



**REGREEN**  
NATURE-BASED SOLUTIONS

Fostering nature-based solutions for smart, green and  
healthy urban transitions in Europe and China

Deliverable **N°5.4**

**EFFECTS AND CONSEQUENCES OF  
IMPLEMENTING CITIZEN-SCIENCE  
PROGRAMMES IN SCHOOLS IN AN  
ENVIRONMENTALLY, ECONOMICALLY AND  
SOCIAALLY-CHALLENGED URBAN DISTRICT**

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**WP N°5** Education on Nature-Based Solutions



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## EXECUTIVE SUMMARY

In an era of over urbanisation and disconnection to living world in Western countries, this report refers to a survey of two-years experiment in fifteen schools in Paris-region, France including students aged 3 to 18. In these schools, volunteering teachers have implemented citizen-science programmes on common biodiversity with their students, and combined these observations with initiatives toward biodiversity in the schoolyards. Citizen-science programmes were part of the French national Vigie-Nature Ecole programme (VNE), developed by the French National Museum of Natural History (MNHN). Teachers were also invited by the research MNHN team to deploy some other pedagogical approaches to enrich the emotional and affective bonds of students with nature.

As shown by the 2-years survey of the involved classes, the implementation of VNE in classes is challenging because it changes many pedagogical and educational routines. The first year is a fundamental stage in the learning process of scientific pedagogy, during which the teacher observes, discovers, seeks out and trains himself and his pupils. It is a moment of transition between the known pedagogical comfort zone and the discovery of new possibilities. During the following years, teachers explore more in-depth the proposed educational tools, and enrich their pedagogical activities, to become innovative in a diversity of initiatives.

Regarding children and young adults, observing common natural species (birds, insects, earthworms, snails, plants) in the schoolyard is the opportunity to discover a new world (for some of them), to increase their awareness toward nature, but also to open new emotional bonds to nature. With these two-year experiments, we highlighted the complementarity of scientific and sensitive approaches to increase the awareness of students from all ages to surrounding nature, in a very urbanised context.



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## 1 INTRODUCTION

### 1.1 Nature disconnection and citizen-sciences

Since its arrival in the media in 1992, the concept of biodiversity has been taken up in many disciplines (ecology, economics, education, sociology, etc.) with various definitions. In this report, in line with scientific ecology, we assigned the following characteristics to biodiversity: biodiversity is composed of a diversity of living beings that are in permanent interaction with each other; biodiversity results from a long-term evolutionary history; biodiversity is dynamics and is subject to regular and often unpredictable disturbances; biodiversity does not need human interventions to exist (see Prévot 2021). We will also use the term “nature” with the same definition.

Nature is deteriorating worldwide, and this crisis has prominent consequences on the quality of life of humans (IPBES 2019), through the deterioration of ecosystem services and nature contributions to people. According to IPBES (2019), including nature in human visions of a good quality of life is a key leverage point to perform transformative changes toward sustainability. Yet, in Western-like countries, people and nature have been progressively disconnecting (Soga and Gaston 2016). According to R. Pyle (1993), The extinction of experience refers to a decrease not only of scientific knowledge of biodiversity, but also of a “wide-spread sense of intimacy with the living world”. Besides adults, children and youth are particularly important to target regarding connection with, awareness to and knowledge of nature. First because individual’s connection with nature and values are deeply rooted and built during childhood (Chawla, 2007). Secondly because nature connection may increase hope in young people and help them cope with the current social and environmental crises (Chawla, 2020). In their review of the 18 categories of personal and social factors that underline pro-environmental behaviours, Gifford and Nilsson (2014) confirmed the importance of childhood nature experiences in the involvement of future adults.

Children can connect to nature in their leisure time, but children living in western-like countries appear to have become indoor children (Chawla, 2020). In this context, schools have an increased responsibility, both to deliver environmental education programmes (UNESCO, 1978) and to deploy pedagogical activities dedicated to nature and biodiversity. These activities can take place in schoolyards. However, relatively little is known about how young people perceive the biodiversity - both in general and in their schoolyards, and about the effect of an environmental education programmes on this perception.

One particular environmental education programme is based on citizen-science. In citizen-science programmes, volunteers (mostly adults) are involved in scientific data collection, and provide scientists with large amounts of data and at large spatial and temporal scales (Devictor et al. 2010). Besides their scientific objective, these programmes provide participants with a strong and practical knowledge on the explored issues (Jordan et al., 2011). Participating to a citizen-science programme on biodiversity generally increases the attention and knowledge of the volunteers toward the surveyed species (Bedessem et al., 2022), and sometimes more widely toward surrounding nature (Cosquer et al., 2012).

Some citizen-science programmes are devoted to children. In France, the national programme Vigie-Nature Ecole (VNE) proposes voluntary schoolteachers to deploy one or several biodiversity citizen-science programmes with their students during the school year.

## 1.2 Scope of the report

As part of the REGREEN project, the MNHN team proposed to fifteen schools in the Paris-region ULL to include VNE in a class or school project dedicated to nature. Three steps were sked to be deployed in each volunteering school: characterisation of the biodiversity present in their school thanks to the implementation of VNE programmes; definition of nature enrichment objectives in the school, and implementation of these green infrastructures.

These 2 years experimentation with 15 French teachers and their scholars (from 3 to 18 years old) belong to the REGREEN Work Package 5 on education to Nature-Based Solutions. Teachers were invited to invent and implement as many different pedagogical activities they wished, in relation to nature. They were helped and surveyed by the research team from the MNHN. On a voluntary basis, some teachers have also tested other pedagogical tools developed in the WP5 (e-books, Greenopolis, Floor maps): these activities are beyond the scope of this report and will not be detailed in here. In parallel, the results of this French 2 years experimentation will help REGREEN programme as a whole to deploy guidelines for school teachers, in the implementation of citizen-science at schools.

This report intends to precise the conditions of implementation of VNE citizen-science programme at schools, in the very urbanized context of the French Paris-region. It also describes how teachers implemented other nature-based activities with their students, and how the combination of different approaches (scientific, artistic, practical or sensitive) can help youth to discover a relation to the ordinary nature in the schoolyard.

This document exposes also the difficulties encountered by the teachers and the students to implement these activities, due to different types of reasons: individual motivations, but also governance of the school, national French curricula and pedagogical agendas of the teachers.

However, this study propose some openness for nature implementation in French schools, not only physically but also in the mind of teachers and students.

## 1.3 Structure of the document

This report is composed of the following sections:

- 1) Presentation of the context of environmental education in France.
- 2) Description of the Vigie-Nature Ecole citizen-science programme, at the French national level
- 3) Description of the stages of implementation of the REGREEN project in the schools concerned: during two years, a post-doc researcher in social-cultural geography and the two VNE coordinators accompanied the participating schools; VNE tool kits were shared and presented; other pedagogical activities on nature were proposed to teachers and their students.
- 4) Some details about the facilities and difficulties of appropriation of the approach by the teachers concerned: starting VNE was somehow difficult for naïve teachers, but some eventually implemented a diversity of pedagogical activities linked to nature in the school.
- 5) Presentation and discussion of the effects of these initiatives for scholars and adults.

## 2 TEACHING ENVIRONMENT, SUSTAINABLE DEVELOPMENT AND NATURE IN FRANCE

### 2.1 How the French school system works

In France, the vast majority of children are educated in state schools or public schools under contract, which operate according to the directives of the French Ministry of Education. This highly centralised system favours a hierarchical and top-down approach to any changes (curricula, learning methods); schools have little autonomy and local initiatives remain marginal.

France is among the highest spenders on education in Europe, but the budget per child in school remains low compared to Scandinavian countries, Germany and the UK. France is the OECD country with the highest number of school holidays (16 weeks per year), but the most concentrated number of hours of instruction. The pace of schooling is therefore particularly intense: pupils currently attend school four or four and a half days a week (Monday, Tuesday, Wednesday morning, Thursday, Friday and Saturday morning depending on the school); each school day (generally 8.30 a.m. to 4.30 p.m.) generally consists of six hours of lessons (three hours in the morning and three hours in the afternoon), interspersed with a 30-minute recess per half-day and a two-hour lunch break.

Schooling is compulsory in France from the age of 3 until the age of 16. Children and young people successively attend the establishments and classes presented in Table 1. Depending on the level, they are accompanied by one or more teachers.

*Table 1: Organisation of public school education in France*

| Type of establishment      | Level            | Average age  | Average number of teachers       |
|----------------------------|------------------|--------------|----------------------------------|
| <b>Kindergarten school</b> | Petite section   | 3 years      | 1 + 1 aid                        |
|                            | Moyenne section  | 4 years      | 1 + 1 aid                        |
|                            | Grande section   | 5 years      | 1 + 1 aid                        |
| <b>Primary school</b>      | CP               | 6 years      | 1                                |
|                            | CE1              | 7 years      | 1                                |
|                            | CE2              | 8 years      | 1                                |
|                            | CM1              | 9 years      | 1                                |
|                            | CM2              | 10 years     | 1                                |
| <b>College</b>             | 6 <sup>ème</sup> | 11 years     | As many as there are disciplines |
|                            | 5 <sup>ème</sup> | 12 years     | As many as there are disciplines |
|                            | 4 <sup>ème</sup> | 13 years     | As many as there are disciplines |
|                            | 3 <sup>ème</sup> | 14 years     | As many as there are disciplines |
| <b>High School</b>         | 2 <sup>nde</sup> | 15 years     | As many as there are disciplines |
|                            | 1 <sup>ère</sup> | 16 years old | As many as there are disciplines |
|                            | Terminale        | 17 years old | As many as there are disciplines |

### 2.2 Nature education in the French education system

As pointed out by Girault and Sauvé (2008) the Haby circular<sup>3</sup> (1977) on the General Instruction on the education of pupils with regard to the environment is the foundation of environment education. This document has been sent to the whole education system administration and stated that instead of creating a new field or discipline, the French Ministry of Education decided to graft the environmental issue onto existing disciplines because it should "permeate". The French Ministry of Education decided to graft the environmental issue onto existing disciplines because *it should "permeate" the whole of education. All disciplines will therefore make their contribution to this educational action.* (Haby

<sup>3</sup> [https://media.eduscol.education.fr/file/EEDD/21/8/circulaire1977\\_115218.pdf](https://media.eduscol.education.fr/file/EEDD/21/8/circulaire1977_115218.pdf) (accessed 14 March 2021)



Circular, 1977). This circular resonates with the Tbilisi Declaration (1977)<sup>4</sup> and states that *"the fundamental objective of Environment Education is to bring individuals and communities to grasp the complexity of the environment, both natural and man-made - complexity due to the interaction of its biological, physical, social, economic and cultural aspects - and to develop a sense of responsibility for the environment, physical, social, economic and cultural aspects - and to acquire the knowledge, values, attitudes and practical skills necessary to participate responsibly and effectively in preventing and solving environmental problems and managing environmental quality."*

A few decades later, however, the report submitted to the Minister of National Education in 2003 emphasised the absence of a genuine national environment education policy. *"While the introduction of environmental issues into our education system dates back to the early 1970s, it must be said that there is no coherent, well-constructed environment education in schools today. Rather, the situation is generally stagnant, if not backward, compared to the mid-1990s. [...] Since the national education system has not included environment education among its priorities and has not "occupied the field", the result is a lack of coherence.* The authors of the report conclude that *"the conditions for generalising environment education to all pupils have not been met"*. (Bonhoure & Hagnerelle, 2003).

The national institution then reacted by issuing a circular in July 2004 which set the conditions for the generalisation of environmental education for sustainable development<sup>5</sup>. This text indicates that this teaching must integrate *"dimensions of health and risk education, citizenship and, more generally, solidarity development. Thus, pupils will be able to measure the consequences of their actions on the environment"*. A second phase of generalisation of education for sustainable development was initiated in March 2007 by a new circular<sup>6</sup>. The objectives assigned to education for sustainable development changed, as the text proposed a shift towards education for choice: *"to enable each citizen to make choices and commitments based on clear and informed reflection"*.

Apart from the differences in terminology, what are the differences between environmental education and education for sustainable development? The objectives assigned to **education for sustainable development (ESD)** are to train citizens to improve the management of natural resources, to prepare them to support the transformations linked to the sustainability of our activities (Hopkins et al., 1996). Even if the democratic and peace objectives are stated, this vision of education is becoming instrumentalized for political purposes and a liberal vision of the world (Leininger-Frézal, 2009). Thus ESD is mainly based on the transmission of knowledge but does not propose critical views on it. For Caroline Leininger-Frézal (2009) on the contrary, **environmental education (EE)** *"is a continuous and comprehensive process by which a person enters into a relationship with the world that respects others, his or her living environment and the biophysical environment"*. The acquisition of knowledge, know-how and interpersonal skills is not the primary goal (even if EE allows, like any activity, to acquire them). EE focuses on the personal development of individuals in order to accompany a profound social change. The object is not the management of the environment but rather the management of our relationship to the environment.

ESD and EE can find their place in the typology of education about the environment proposed by Lucie Sauvé, Yves Girault and Agnès Fortin-Debart (see Coquidé 2017): **"Environmental education** is approached in the form of environmental studies. This form is predominantly used in schools (life science and geography lessons) and in associations, through scientific education and culture or environmental protection structures (national parks, regional nature parks, nature protection centres,

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<sup>4</sup> <http://www.gdrc.org/uem/ee/tbilisi.html> (accessed 13 March 2021)

<sup>5</sup> <https://www.education.gouv.fr/bo/2004/28/MENE0400752C.htm> (accessed 13 March 2021)

<sup>6</sup> <https://www.education.gouv.fr/bo/2007/14/MENE0700821C.htm> (accessed 13 March 2021)



etc.). It most often takes the form of an ecological approach to natural environments. **Environmental education** is a mean of empowering social actors so that they become eco-citizens and human development becomes ecologically sustainable. (...) **Environmental education** is a person-centred education. The activities proposed are, to a large extent, conducted for their own sake and not as simple means for pre-programmed acquisitions. The aim is to promote the harmonious development of the individual in contact with nature, leading to a state of empathy with the environment. The educational approach favoured here is based on direct contact and interaction between the person and his or her natural environment." (Coquidé 2017: 65).

It is within this framework of generalisation of education for sustainable development that biodiversity has appeared in French school curricula (Barroca-Paccard, 2015). In the programmes published between 2010 and 2015 for science and technology and life sciences, biodiversity appears in three major themes (Barroca-Paccard et al. 2018):

- **Scientific study of biodiversity:** biodiversity is largely associated with the notion of diversity at three levels: genetic, population and specific. An evolutionary vision is also addressed. The terms "ecosystem" and "resilience" are absent, which shows that the link between the diversity of living organisms and the functioning of ecosystems is not taken into account.

- **Agricultural practices:** In this theme, the three terms "information", "extract" and "inventory" predominate and correspond to the skills that students should mobilise. In addition, the notion of "natural" is contrasted with agricultural practices.

- **Exploitation of resources:** by including biodiversity in this theme, the school curricula link this notion to that of resources; a vision linked to the exploitation of natural resources by humans seems to emerge. The question of the impact of human activities also emerges from this analysis.

For Barroca-Paccard and colleagues (2018), most scientific knowledge is therefore based on a descriptive view of biodiversity. Biodiversity protection is mainly approached from the perspective of resource exploitation. They also note a disconnection between the scientific and societal dimensions, which suggests that biodiversity protection can be achieved without an evolutionary vision nor intrinsic value (i.e. for its own sake) of biodiversity; on the contrary, the dimensions related to sustainable development have been privileged. Finally, in these programmes, biodiversity education is considered to be interdisciplinary, with social (example: citizen sciences) or economic (example: globalisation) aspects.

All these structuring elements are still present in the new high school curriculum published in 2019. One important addition has been made: teachers are encouraged to participate in participatory science programmes in the second year of secondary school and to process 'information from direct observation in the field'. In the first year of secondary school (as a specialised subject), teachers are invited to "understand the importance of the reproducibility of sampling protocols for monitoring the spatio-temporal dynamics of a system".

## 2.3 Teaching biodiversity and/or educating about biodiversity?

### 2.3.1 The field of "education for"

During schooling, 'educations for' are approached in a multidisciplinary way, with each discipline contributing to broaden the point of view and improve the understanding of the subject of study. But 'education for' also has a critical perspective and aims to build and develop socio-scientific and ethical skills (Sauvé, 2014) around three major axes (Lebeaume, 2012; Diemer & Marquat, 2015) :

- **Empowerment**, which should enable students to take power over their actions (in the case of biodiversity, this could mean increasing acting capabilities for promoting biodiversity, for example at the level of their school),
- **Responsibility**, which aims to make conscious choices that take into account both the individual and the collective (for example, proposing natural infrastructures that satisfy all users of green spaces),
- **Commitment**, which corresponds to the will to transform individual relationships in society (e.g. joining nature associations).

To achieve these objectives, 'education for' deals with **knowledge** but also with **values** in order to enable students to construct a **reasoned opinion** (Lange & Victor, 2006) while developing their **capacity to act** (De Vecchi & Pellegrino, 2008). This notion of reasoned opinion is an intermediary between students' prejudices and scientific knowledge, which should make it possible to form citizens who are intellectually armed to participate in public debates (Fabre, 2014). Thus, the aim of "education for" is not to propose a single solution or even a ready-made method, but rather the development of personal and collective solutions based on a reasoned opinion. Within this framework, pupils must make choices using their own knowledge and values in order to make their own reasoned decisions. In the end, the main challenge of "education for" is therefore to train pupils in citizenship, i.e. to move towards collective and informed responsibility for public affairs (Sauvé, 2014).

The study of biodiversity in the classroom falls within the scope of "education for". For Barroca-Paccard (2015: 56) biodiversity education is based on scientific knowledge and also *"explicitly integrates the values associated with it in a process of scientific emancipation and acculturation to living beings"*. The VNE observatories (see below) include the main characteristics of biodiversity education proposed by Franc, Reynaud and Hasni (2013), namely the association of cognitive (scientific knowledge), affective (the emotional relationship with living beings) and behavioural (the preservation of living beings and their diversity) dimensions.

### 2.3.2 Socio-scientific thinking

Science education can play an important role in citizenship education to help prepare students for active participation in modern democracies. *"What is clear is that ordinary citizens will increasingly be asked to make judgements about matters underpinned by science knowledge or technological capability, but overlaid with much wider considerations. Those without a basic understanding of the ways in which science and technology are impacted by, and impact upon, the physical and the sociopolitical environment will be effectively disempowered and susceptible to being seriously misled in exercising their rights within a democratic, technologically-dependent society."* (Hodson, 2003). As we have just seen, one of the key points of 'education for' is precisely the construction of a reasoned opinion. This is only possible through reasoning that links knowledge with values.

Sadler and colleagues (2007) point out that the construction of citizenship in science lessons is attractive but complex in practice. Socio-scientific reasoning embraces socio-scientific enquiry and serves a citizenship purpose (Sadler et al., 2007, Simonneaux & Simonneaux, 2009). Simonneaux and Simonneaux (2009) propose some consistent frameworks to the socio-scientific reasoning, as following:

- **Understanding the complexity of a situation:** by definition, socio-scientific investigations are complex and cannot be solved simply and directly. It is therefore important to avoid simplifying these problems by focusing on a single factor or by trying to solve them through cause and effect reasoning. Socio-scientific reasoning must take into account multiple and dynamic interactions. To succeed in this stage of thinking, students must perceive the complexity of a situation and adopt strategies to evaluate sometimes contradictory information.

- Encourage situations that lead to the analysis of potential solutions from **different perspectives** (e.g. social, ecological or economic): in the context of a socio-scientific investigation, several argued positions may be adopted due to differences in priorities, principles and personal prejudices. Therefore, no single perspective should initially be favoured. One way of assessing students' ability to consider multiple perspectives is to ask them to evaluate potential solutions from different perspectives while being aware of the limitations of their own position.

- Understand **the need for scientific and social research**: Socio-scientific investigations are necessarily characterised by a degree of uncertainty because students do not know or have all the information they need to make a decision. In addition, many situations raise questions about potential impacts on human behaviour, well-being, economies or social norms. The scientific and social dimensions thus create many open questions that require a research effort. To assess mastery of this step, the authors propose to check whether students propose further research in the area of scientific and/or social inquiry.

- Finally, **remaining sceptical** (in the sense of being vigilant) in the face of potentially biased data: skepticism must be constructive and play a very important role in socio-scientific contexts. In concrete terms, the 'actors' in a socio-scientific situation have interests or biases that may interfere with the way they design their investigations or analyse data. This interference is not necessarily voluntary, as the context may influence one's practice. The scientific literature seems to show that students are not always skeptical in social scientific enquiry and that it is therefore important to guide them through this stage.

This type of reasoning invites students to use their knowledge to construct complex reasoning in order to develop a real scientific-critical approach (Voisin & Lhoste, 2015). Simonneaux & Simonneaux (2009) conclude that the development of critical rationality empowers students to transform society. Both authors link socio-scientific reasoning to students' ability to act (empowerment and engagement).

In the REGREEN programme, the following assumption has been made by the MNHN team that promoted the programme: mobilising socio-scientific reasoning within the framework of environmental and biodiversity education was supposed to create a favourable ground for pupils to implement biodiversity-friendly infrastructures or initiatives. For example, students could investigate in the maintenance of the school's green spaces; they could be confronted with the complexity of biodiversity management with multiple possibilities (regular mowing of lawns versus free evolution, planting of ornamental or local species...) and with varied consequences (letting an overgrown area grow is inexpensive, ecological but can lead to the loss of the gardener's job...). By applying the VNE protocols, students could go beyond the naturalistic aspect (by carrying out simple point-in-time inventories) and could quantify and monitor the evolution of animal and/or plant populations in the schoolyard. They also could acquire knowledge of the biological mechanisms underlying these green infrastructures, knowledge that can be used to reflect on the choice of facilities in the school that are supposed to favour biodiversity. They could also understand that the data collected may be biased (few data collected, poor temporal or spatial coverage in sampling, etc.) and understand the need to remain critical when faced with data.

Encouraging the emergence of genuine socio-scientific reasoning among pupils was finally supposed to enable them to propose locally relevant solutions by having anticipated the implications of these solutions. Indeed, adopting this critical approach is necessary in the face of the ambitions of biodiversity-friendly infrastructures, which, in addition to being inspired by nature and being beneficial on it, must meet cost and benefit criteria in environmental, social and economic terms within a framework that promotes resilience.

### 3 VIGIE-NATURE ECOLE (VNE), A CITIZEN-SCIENCE PROGRAMME

#### 3.1 At the origin of the project

Since 1923, the French national museum of natural history (MNHN, Paris, France) has been mobilising volunteers to participate in scientific biodiversity monitoring programmes. It started with amateur naturalists, first ornithologists for bird monitoring, then specialists of other taxa from the 2000s (butterflies, chiropterans, vascular plants) and the general Vigie-Nature banner was created. In 2006, Vigie Nature's first observatory for non-naturalist volunteers offered to monitor a set of common butterfly species. This observatory was followed by many others: dedicated to snails (Opération Escargots 2009), to pollinating insects (SPIPOLL, 2010), to spontaneous urban plants (Sauvage de ma rue, 2011), to common birds (Oiseaux des Jardins, 2012). The development of observatories aimed at a non-expert audience requires technical adjustments: grouping species that are difficult to distinguish, creating dedicated identification tools, relaxing constraints on survey dates, monitoring site and/or duration of the survey (Conversy, Dozières & Turpin, 2019). All the observatories proposed by Vigie-Nature rely on a compromise between what a non-specialist amateur can do in the field and the need to collect data for scientific ecology.

In 2022, Vigie-Nature is proposing 10 different programmes built on the same principle: to offer anyone who wants to study ordinary biodiversity, using standardised protocols, to help researchers at the MNHN build a spatio-temporal monitoring network of common species throughout metropolitan France, in order to assess and predict changes affecting biodiversity in the long term. The Vigie-Nature programme therefore has three main objectives (Legrand, 2013):

- **Scientific:** to create indicators to understand the dynamics of biodiversity and to feed ecological research. For example, these indicators can be used to monitor trends in bird populations over time<sup>7</sup>.
- **Political:** to make the biodiversity crisis public and concrete. For example, the data collected by Vigie-Nature observers are used to produce indicators highlighting the most biodiversity-friendly practices<sup>8</sup>.
- **Educational:** to encourage individuals, whether or not they are familiar with science, to observe the biodiversity around them in order to strengthen its preservation.

#### 3.2 A system dedicated to schools: Vigie-Nature École

##### 3.2.1 VNE implementation

The Vigie-Nature École programme (VNE, launched in 2010) is aimed at schools and offers volunteer teachers the opportunity to monitor ordinary biodiversity with their pupils, i.e. species that are common and still present in a wide variety of environments occupied by humans. To date, Vigie-Nature École offers ten observatories, accessible from kindergarten to high school, to study various taxonomic groups in metropolitan France: pollinators insects, birds, snails, urban flora, birds, seaweed, brown algae and periwinkles, bats, lichens and earthworms<sup>9</sup>.

Each volunteer teacher can choose the observatory or observatories that he or she wishes to set up with his or her pupils according to his or her educational objectives, his or her possible affinity for a

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<sup>7</sup> See for example the trends for all common birds calculated thanks to the Temporal Monitoring of Common Birds (STOC) proposed to ornithologists by Vigie-Nature: <http://www.vigienature.fr/fr/observatoires/suivi-temporel-oiseaux-communs-stoc/resultats-3413> (consulted on 11 April 2021)

<sup>8</sup> The assessment proposed by the Agricultural Biodiversity Observatory (OAB), which compares different types of agricultural practices, can be consulted here: [http://oab.mnhn.fr/sites/observatoire-agricole-biodiversite.fr/files/upload/attached/bilan\\_oab\\_2018.pdf](http://oab.mnhn.fr/sites/observatoire-agricole-biodiversite.fr/files/upload/attached/bilan_oab_2018.pdf) (accessed 11 April 2021)

<sup>9</sup> <https://www.vigienature-ecole.fr/node/15> (accessed on 20 June 2021)

taxon and the possibilities offered by the green spaces in his or her school. On the Vigie-Nature École website<sup>10</sup>, numerous resources are available for free download to help them set up observatories (field sheets, identification sheets, etc.). Advice is also provided to help them prepare their pupils before going into the field, to learn how to use determination keys, to analyse the data collected, etc.

### **3.2.2 VNE: a nature education and socio-technical reasoning programme?**

As they participate in the biodiversity monitoring observatories, the pupils have the opportunity to enrich their knowledge of the biodiversity around them and to refine their sense of observation. For teachers, VNE is an opportunity to take part in a research programme by becoming involved in a comprehensive scientific approach and in the mechanisms for building scientific knowledge. The observatories and protocols proposed are designed to enable students to act, think and conceptualise and thus better understand the world around them, offering them all the skills to become enlightened citizens. Finally, the link with research is presented as a strong motivating factor for the participating pupils.

VNE is built in France in accordance with the school programmes and the official instructions of the French Ministry of National Education, since the VNE observatories respond to different items in the school programmes as well as in the Common Base of Knowledge and Skills.

Finally, by holding classes "outside the classroom", VNE offers teachers the opportunity to adopt an approach of co-construction of knowledge, by letting the pupils discover for themselves. This positioning can stimulate the interest of the pupils and thus contribute to the academic success of all.

In short, this scheme aims to involve teachers and pupils in a research programme, to implement a scientific approach using the proposed protocols, while remaining in conformity with the official curricula.

## **3.3 Other expected effects of participation in VNE**

When implementing the protocols proposed by VNE, students generally discover an unsuspected biodiversity within their school. For Cosquer, Raymond and Prévot-Julliard (2012) for example, repeated observation and direct link with biodiversity can increase not only the knowledge of individuals, but also their interest in biodiversity. More generally, regular observation of the nature around us could modify the representation we have of it: *"Participation seems to reinforce and reconfigure the perception of the presence of living beings in the observers' environment. Observation would tend to give existence to a nature that was previously invisible"*. (Prévot et al., 2016). Kelemen-Finan, Scheuch & Silvia Winter (2018) have shown that participation in a citizen science framework has an impact on pupils' interest in scientific fields and on their knowledge, motivations, behaviour and attitudes. Thus, in addition to discovering species and their living environment, one of the educational challenges of VNE, as stated by some teachers, is also to contribute to developing eco-citizen skills in pupils, particularly with regard to the protection of biodiversity (Bosdeveix et al., 2018) by making them aware of the impact of human activities on the functioning of ecosystems (Girault & Sauvé, 2008).

While some teachers limit themselves to a so-called "naturalist" approach based on species recognition, others choose to go further. From their observations, they can, for example, compare the data collected between different habitats in the school (asphalt, short grass or hedges, for example) or compare food-rich areas with others. Comparisons can also be made between schools, with the help of the VNE website. These inventories and comparisons can then be used to think about possible natural infrastructures to promote biodiversity.

This approach to thinking about biodiversity-friendly actions resonates with one of the goals of nature-based solutions (NBS): following Monte & Reis (2021), the application of nature-based solutions in the

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<sup>10</sup> <https://www.vigienature-ecole.fr/> (accessed on 20 June 2021)

classroom enhances the development of environmental citizenship skills, such as creativity, problem solving, decision making, collaboration, environmental awareness, social justice, respect and responsibility. By working on these issues, students become aware that ecosystems can help cities adapt to climate change, protect biodiversity or reduce the risk of environmental disasters.

### 3.4 An example of VNE observatory: Garden birds watch

*Garden Birds watch* is the most widely implemented VNE observatory at schools<sup>11</sup>. It is quite simple to implement and offers good chances to observe several species<sup>12</sup>. In addition, the threats to birds are scientifically well documented and are widely reported in the media. For example, on 31 May 2021, the MNHN published a press release to review 30 years of bird counts in France<sup>13</sup>; which documents huge decreases of bird abundance in urban and agricultural areas. This hecatomb threaten the numerous ecosystem services provided by birds based on their position in the food chain. For example, by consuming between 400 and 500 million tonnes of insects per year (Nyffeler et al., 2018), birds help to protect crops against insect pests.

The aim of the *Garden Bird Watch* Observatory is to assess the number of birds visiting a well-defined area, which in our case is a schoolyard or a part of a schoolyard. To do this, students are asked to count the maximum number of birds of each species seen at the same time over a period of fifteen minutes. These observations can be carried out throughout the school year, but it is advisable to start in winter by placing feeders to facilitate the observations. Indeed, on the feeders, the birds will stay for a few moments and will be easier to observe and therefore to determine. For the *Garden Bird Watch* as for all the other VNE observatories, respecting the standardised observation protocol is essential to obtain data that can be used for research. Indeed, precise and standardized protocols are easily achievable, reproducible and comparable.

All the resources needed to participate can be downloaded from the VNE website: detailed description of the protocol (Figure 1), answers to frequently asked questions, counting sheet, identification key (Figure 2), video presenting the protocol, suggested educational activities, resources on the biology of the species, determination quiz, etc. Advice is also given on how to prepare pupils before going out into the field: explain each stage of the protocol and the importance of respecting it, and train pupils in the use of the identification documents (with the quizzes available on the website, for example).

Back in the classroom, the teacher or pupils are invited to log on to the VNE website to enter and send the data collected. The website is designed for the teachers to take only five minutes to enter the data. Online help is available, and a form allows the VNE coordinator to be contacted for specific questions. Once the data has been sent in, teachers have access to reports that allow them to compare their observations with those of other schools (top 5 most popular species, graph comparing the abundance and diversity of birds in their school with the national average<sup>14</sup>). A report on participation is sent to each teacher at the end of the school year and allows them to go further in the analysis of their data<sup>15</sup>.

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<sup>11</sup> [https://formation.vigienature-ecole.fr/restits/testjson/Bilan\\_annee\\_newsletter.html](https://formation.vigienature-ecole.fr/restits/testjson/Bilan_annee_newsletter.html) (accessed 23 June 2021)

<sup>12</sup> According to the datasets available on <https://bricks.vigienature-ecole.fr/> (consulted on 23 June 2021), 6% of the observation sessions for this protocol did not result in any birds being observed, compared with 31% of the sessions for the "Operation Snail" protocol

<sup>13</sup> <https://www.mnhn.fr/fr/communiqués-presse-dossiers-presse/bilan-30-années-comptages-oiseaux-france-inquiete-specialistes> (accessed 23 June 2021)

<sup>14</sup> See <https://www.vigienature-ecole.fr/node/440> (accessed on 12/04/2021)

<sup>15</sup> See the review of the 2019/2020 school year:





## Oiseaux des jardins

Fiche protocole

### Quel est le protocole ?

#### 01 Choisissez votre zone d'observation



L'observation doit se faire dans un espace bien délimité, au sein duquel vous êtes sûr(e) de bien voir, et donc de reconnaître, tous les oiseaux. Il peut s'agir d'une partie de la cour, une terrasse de l'établissement, un square ou un espace bien délimité d'un parc public. En hiver, vous pouvez également installer des mangeoires pour faciliter l'observation des oiseaux.

#### 02 Déterminez et comptez les oiseaux pendant 15 min.

Notez tout d'abord la date de votre relevé, l'heure de début et de fin de la période d'observation, sachant que **vous devez observer les oiseaux pendant 15 minutes**. Pendant cette durée, notez le nombre maximal d'oiseaux de chaque espèce vus en même temps.

#### 03 Répétez vos observations aussi souvent que possible

Cet observatoire fonctionne tout au long de l'année, vous pouvez essayer de suivre les populations d'oiseaux de votre établissement en les comptant tous les jours, une fois par mois, ou même ponctuellement ! En répétant vos comptages, vous pourrez par exemple, évaluer l'impact des saisons sur les oiseaux. Sachez enfin que plus vous participerez, plus vos informations seront utiles à nos chercheurs !



#### Quand participer ?

Vous pouvez observer les oiseaux et nous transmettre vos données tout au long de l'année. En hiver, l'observation sera plus facile si vous placez une mangeoire.



Figure 1: Example of the sheet describing the Garden Bird Watch Observatory (VNE)<sup>16</sup>

<sup>16</sup> [https://formation.vigienature-ecole.fr/restits/testjson/Bilan\\_annee\\_newsletter.html](https://formation.vigienature-ecole.fr/restits/testjson/Bilan_annee_newsletter.html) (accessed on 12/04/2021)

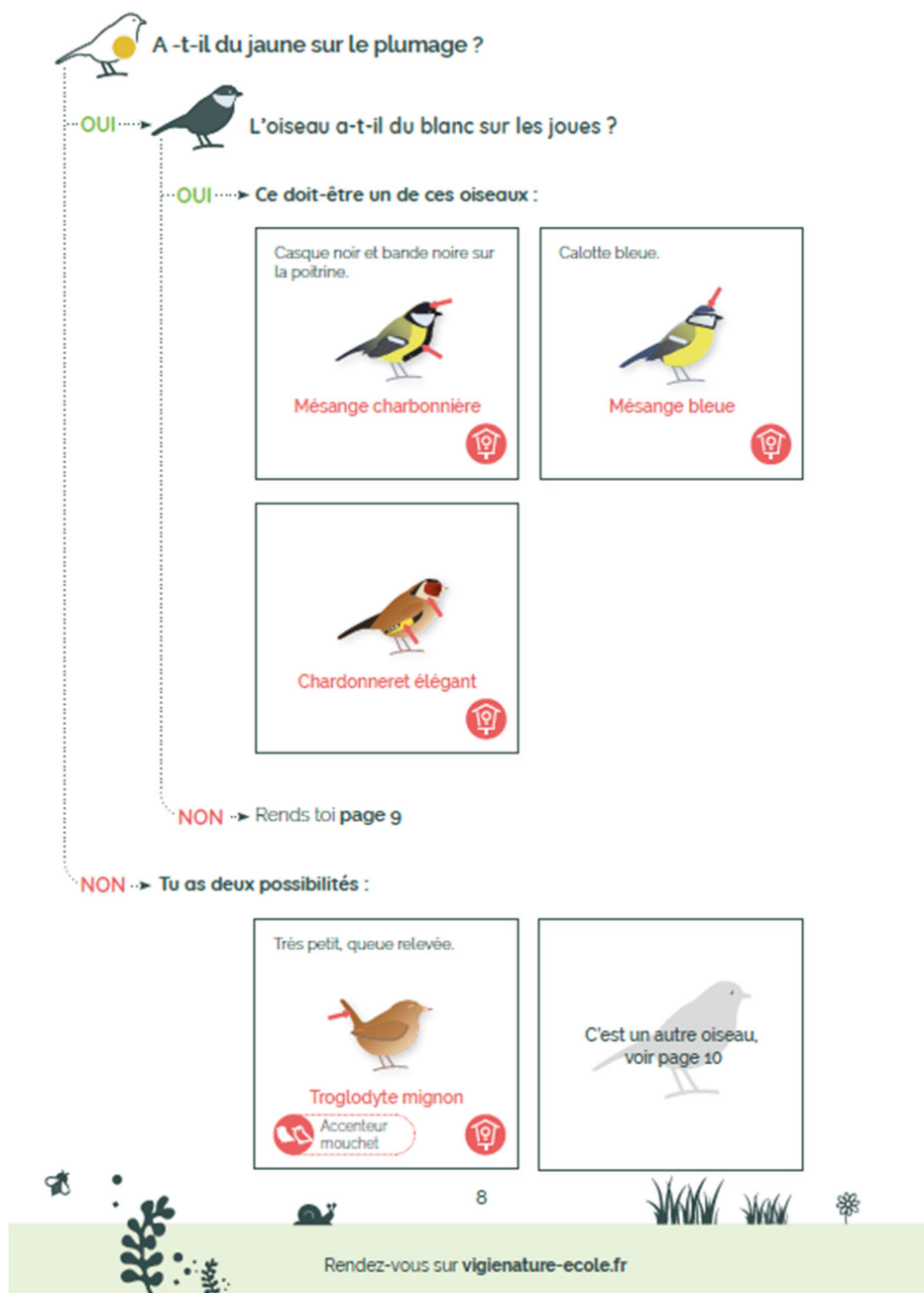


Figure 2: Extract from the bird identification key of the Garden Birds Watch Observatory (VNE)



## 4 THE EUROPEAN REGREEN PROJECT IN FRANCE: SUPPORT FOR THE IMPLEMENTATION OF THE PROJECT IN THE ULL PARIS-REGION

Within the framework of the European REGREEN project, Work Package 5 aims to develop educational programmes and tools to provide children with knowledge, awareness and a sense of individual and collective action. In the ULL Paris-region, the VNE programme has been developing for more than 10 years in this direction. Within the framework of REGREEN, we have studied its pedagogical, educational and participatory impacts on schools, teachers and students.

In this section, we explain the implementation of the REGREEN research project in the ULL Paris-region and the constraints related to the Covid-19 health crisis.

### 4.1 Implementation of the REGREEN WP5 in the ULL Paris-region

In November 2019, the Regional Agency for Biodiversity (ARB-IdF) and the National Museum of Natural History (MNHN) launched a call for schools in the Paris-region network of national education institutions to participate in the European REGREEN project (see the call in Appendix 1). 15 schools were selected in January 2020, from 42 applicants. The selection criteria were mainly the following:

- 1) The schools develop or want to develop a project to promote biodiversity within their school,
- 2) At least two people were responsible for the project within the school,
- 3) The schools had to come from different departments of the Paris-region.

This last point was difficult to achieve because the 42 candidate establishments were not evenly distributed throughout the region (no candidate from Paris downtown, for example). Nevertheless, the applicants were very diverse in terms of geography, socio-cultural background and access to nature. Similarly, in terms of architecture, their possibilities for implementing activities related to biodiversity observation varied greatly. Of the 15 schools selected, 6 are high schools (pupils aged 15-18), 4 are middle schools (pupils aged 11-14), 3 are primary schools (pupils aged 6-10) and 2 are kindergarten schools - grande section (pupils aged 4-5). Of the 15 participating schools, 3 are in a no nature deprivation area (Figure 3, white area), 5 in a nature deprivation area (Figure 3, light blue area) and 7 in a high nature deprivation area (Figure 3, dark blue area). (Deficiency is defined as the lack of large green spaces in the municipality).

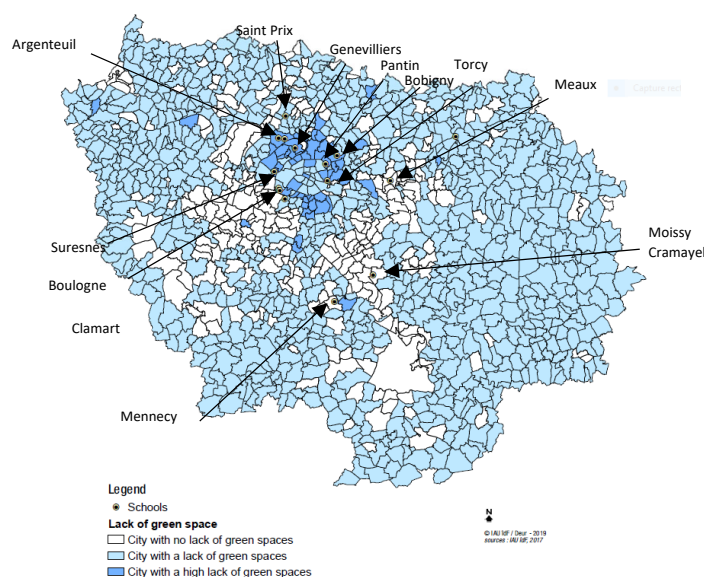


Figure 3. Location of schools participating in the European REGREEN project in the Paris-region.

(Source: IAU, *IdF*, 2017/2019)

Table 2 shows the biodiversity projects that the participating schools had set up before their participation in the REGREEN project. These are mainly clubs for extracurricular activities related to nature and sustainable development: observation of biodiversity in the school grounds in order to identify what exists to protect or improve it; recycling of waste; and implementation of some facilities.

*Table 2. Biodiversity projects of participating institutions (Institutions are identified by their acronym)*

| Type of school | Acronym | Postcode | City                 | Biodiversity-related project before REGREEN  |
|----------------|---------|----------|----------------------|--|
| Primary School | EMBA    | 77       | Torcy                | Installation of a mini farm / breeding in the classrooms / bulb planting / E3D label (level 2) |
| Primary        | EMVH    | 95       | Saint-Prix           | The "little naturalist" project / garden   |
| Primary        | EEMH    | 75       | Paris                | Biodiversity observation / project "oasis schoolyard"  |
| Primary        | EELR    | 92       | Clamart              | Eco-school label / VNE since 2017/ garden  |
| Primary        | EEPB    | 95       | Argenteuil           | Eco-school label / biodiversity project  |
| Middle         | CEZ     | 92       | Suresnes             | Identification and enhancement of college school biodiversity                                  |
| Middle         | ICYC    | 93       | Pantin               | Nature Club / Sustainable Development Club   |
| Middle         | CLP     | 92       | Gennevilliers        | Eco-delegate club / vegetable garden   |
| Middle         | CPS     | 93       | Bobigny              | Club - green / grain library / garden  |
| High           | LHM     | 77       | Meaux                | Worm composting / waste treatment project  |
| High           | LJP     | 92       | Boulogne-Billancourt | Ecology Club   |
| High           | LJVD    | 95       | Argenteuil           | Sustainable Development Club / Eco-delegate Club   |
| High           | LML     | 91       | Menecy               | Ecological pond / swift nesting boxes / naturalization of the yard / fallow area               |
| High           | LSV     | 92       | Boulogne             | Greening of terraces / grain library   |
| High           | LMC     | 77       | Moissy-Cramayel      | Ecological pond / garden   |

Table 3 lists the geographical data of the participating schools (city, size, presence and characteristics of green spaces), as well as the characteristics of the student populations attending them. Figure 4 exemplifies some green spaces present in the participating schools: students can access freely to them (Figure 4) or not (Figure 5). The list of involved teachers in the project is presented in Appendix 2, together with the discipline they teach.

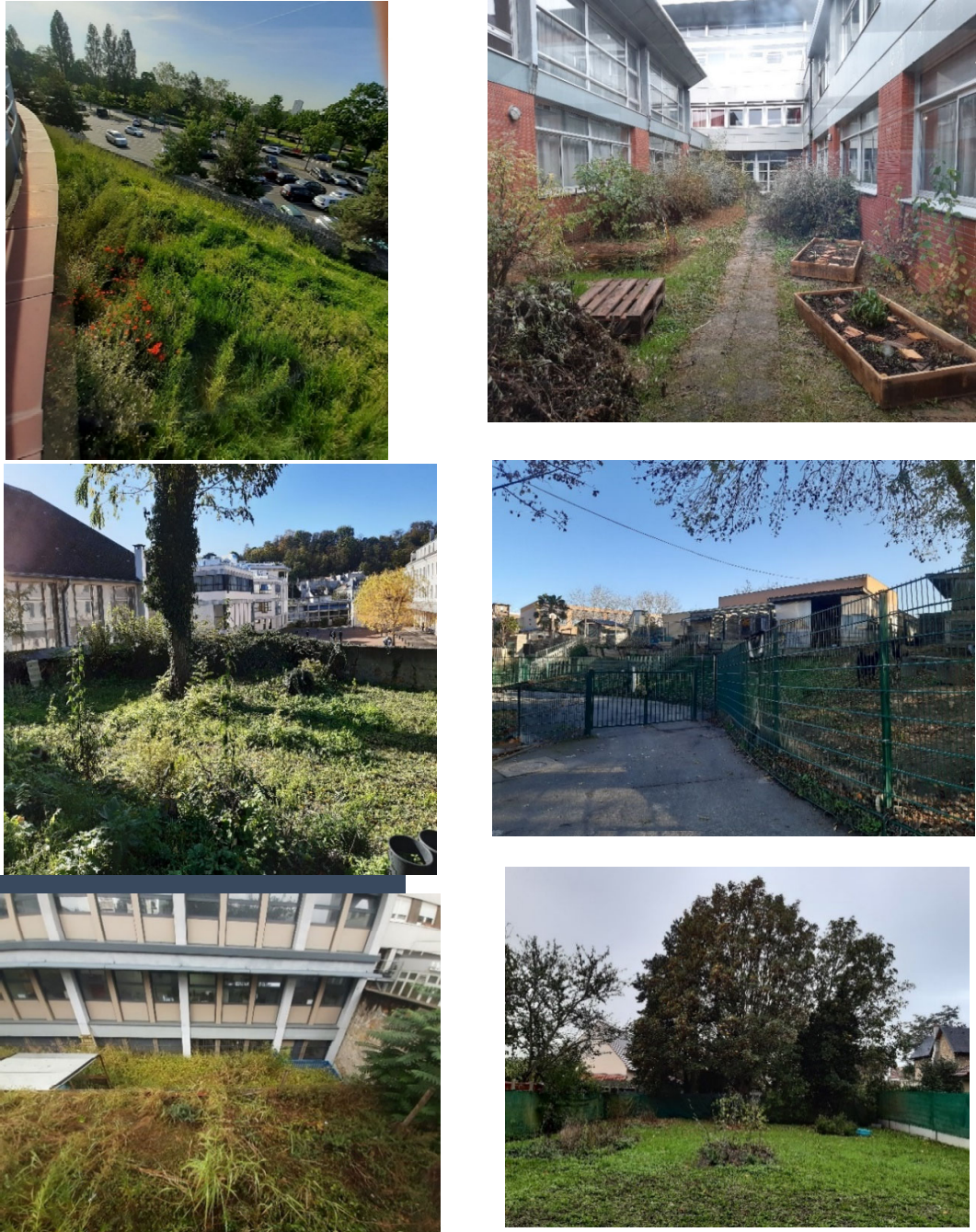
Table 3. Schools participating in the REGREEN project in Paris-region: geographical and social characteristics

| Shool level | Acronym | Postcode | City                 | Geography | Total area of the school (m <sup>2</sup> ) | Green areas (m <sup>2</sup> ) | greenspace feature     | Accessibility of green spaces | Sociology of the pupils |
|-------------|---------|----------|----------------------|-----------|--|-------------------------------|------------------------|-------------------------------|-------------------------|
| Primary     | EMBA    | 77       | Torcy                | Urban     | 8 880                                      | 1 880                         | by patch and connected | Open and closed               | low income              |
| Primary     | EMVH    | 95       | Saint-Prix           | Urban     | 3 000                                      | 770                           | by patch and connected | Open and closed               | medium income           |
| Primary     | EEMH    | 75       | Paris                | Urban     | 4 000                                      | 400                           | by patch               | Open                          | low income              |
| Primary     | EELR    | 92       | Clamart              | Urban     | 4 000                                      | 35                            | by patch               | Open                          | medium income           |
| Primary     | EEPB    | 95       | Argenteuil           | Urban     | 11 570                                     | 2 000                         | by patch               | Open and closed               | low income              |
| Middle      | CEZ     | 92       | Suresnes             | Urban     | 4 071                                      | 581                           | Connected              | Open and closed               | Mixed                   |
| Middle      | ICYC    | 93       | Pantin               | Urban     | 5 085                                      | 300                           | by patch               | Open and closed               | Mixed                   |
| Middle      | CLP     | 92       | Gennevilliers        | Urban     | 11 975                                     | 1 150                         | by patch               | Open and closed               | low income              |
| Middle      | CPS     | 93       | Bobigny              | Urban     | 5 443                                      | 1 000                         | by patch and connected | Open and closed               | low income              |
| High        | LHM     | 77       | Meaux                | Urban     | 17 000                                     | 1 000                         | by patch               | Open and closed               | Mixed                   |
| High        | LJP     | 92       | Boulogne-Billancourt | Urban     | 12 000                                     | 500                           | by patch               | Open                          | Mixed                   |
| High        | LJVD    | 95       | Argenteuil           | Urban     | 12 000                                     | 4 264                         | by patch and connected | Open and closed               | low income              |
| High        | LML     | 91       | Menecy               | Urban     | 11 000                                     | 4 000                         | by patch and connected | Open and closed               | Mixed                   |
| High        | LSV     | 92       | Boulogne             | Urban     | 9 063                                      | 500                           | Connected              | Closed                        | medium income           |
| High        | LMC     | 77       | Moissy-Cramayel      | Urban     | 16 000                                     | 3 000                         | by patch and unified   | Open and closed               | Mixed                   |



*Figure 4. Green spaces in schools where VNE has been carried out - accessible green spaces for students*





*Figure 5. Green spaces in schools where VNE has been carried out - green spaces with limited access for students.*

*Note: These spaces are locked and the key needs to be asked to get access. Allowed students are only those with specific projects (gardening for instance), or during specific times with dedicated teachers.*

## 4.2 Support for participating schools in the period 2020 - 2022

### 4.2.1 Presentation of the project and teachers' involvement in the REGREEN project

The REGREEN project was presented to the participating teachers during a meeting at the MNHN on 5 February 2020 by Léo MARTIN (REGREEN postdoctoral researcher in ecology in 2019-2020) and Sébastien TURPIN (Biology teacher, founder and coordinator of the VNE programme at the MNHN) and Simon BÉNATEAU (VNE programme co-coordinator at the MNHN). The schoolteachers then committed themselves to the following three activities:

- 1) Carry out an inventory of the **biodiversity** present in the school using the Vigie-Nature School protocols and send the data collected with the pupils to the programme's scientists via the website<sup>17</sup>,
- 2) Use the results of the inventories carried out previously to **propose** relevant natural **infrastructures** (*nature based solutions*) to improve the state of the school's biodiversity,
- 3) **Monitor the state of biodiversity using the VNE protocols following the changes made in the school** to assess the impact of these changes on biodiversity, while continuing to send the data collected to the Vigie-Nature Ecole website.

Léo MARTIN then visited all the schools between February and March 2020. The aim was, on the one hand, to discover the schools, their green spaces and development projects, and, on the other hand, to identify with the teachers the VNE observatories best suited to their classes and to their projects: implementation of gardens, fallow lands and nesting boxes, making green spaces safe for pupils or removing concrete from playgrounds. However, the 2020 lockdown and closure of the schools prevented the teachers from implementing these planned activities.

#### French schools during the Covid-19 health crisis

In 2020 with the Covid-19 health crisis, France was confined, schools closed and activities stopped for two months, from 12 March to 12 May 2020. The participating teachers had enthusiastically started the selection of VNE observatories to be carried out but the work was stopped during this first lockdown and did not resume afterwards due to the delay in the curricula.

Throughout the 2020-2021 school year, unlike in other European countries, French schools remained open, which allowed some teachers to start the first VNE observations as early as December 2020. However, the severe restrictions linked to the management of the health crisis and the measures put in place by the State within schools directly affected the work of teachers and the implementation of VNE. For example, the participation of parents or local associations to help with observations was often forbidden. In secondary schools, classes were often divided into two sub-groups and school days were divided into half days. Teachers had to adapt to this new timing, which was very heavy because of the management and organisation of lessons, and which made it very difficult to develop outside activities during school time and extracurricular time. While all the participating teachers tried to work at their own pace to meet the expectations of the REGREEN project and of the pupils, several of them had difficulties in getting actively involved, due to time, motivation or organisational issues. The participating schools are therefore very diverse in their degree of appropriation and implementation of the VNE observation protocols and the various stages of the project.

During the 2021-2022 school year, the management of the Covid-19 health crisis was relaxed in France. Schools remained open throughout the country, but kept heavy constraints in the

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<sup>17</sup> [www.vigienature-ecole.fr](http://www.vigienature-ecole.fr)

management of classes. Four participant schools (2 primary schools, 1 middle school and 1 high school) continued to carry out biodiversity observations and facilities, but others reduced their involvement in the REGREEN project. This concerns one third of the schools initially very involved in the project.

#### **4.2.2 Monitoring and support of institutions by MNHN**

To relaunch the REGREEN project, a new meeting was organised on 9 September 2020 at the MNHN, which brought together the 27 volunteer teachers, the VNE MNHN team and the new postdoctoral researcher in socio-cultural geography Mara SIERRA-JIMENEZ (under the scientific supervision of Anne-Caroline PREVOT, CNRS senior scientist in conservation biology and conservation psychology). A letter of agreement to participate in the research was signed by each of the teachers, in which he or she agreed 1) to act as an intermediary between the researcher and the students and 2) to help collect qualitative and quantitative data during the year. An initial free listing exercise was carried out during this meeting, to collect the teachers' representations of biodiversity while making them aware of a qualitative data collection method that they will be encouraged to carry out at the beginning and end of the school year with their students (see below).

In 2020-2021, Mara Sierra-Jimenez made numerous visits to the 15 partner schools to: 1) present the VNE citizen-science programme, 2) present the objectives of the REGREEN project and the research to the pupils and adults in charge (teachers, school headmasters, parents, local councilors, local associations), and 3) start monitoring the implementation of the protocols and natural infrastructure by the participants.

Thereafter, the researcher was regularly in contact with the teachers in each school participating in REGREEN by email and telephone. When several classes and teachers from the same school participated in the project, a referent teacher was identified by school to facilitate exchanges. For schools where only one class or group of pupils carried out observations, contact with the project leader was favoured. The Covid crisis and associated administrative and pedagogical constraints (see above) made teachers less open to demands that were not directly connected to their pedagogical practices. Therefore Mara Sierra-Jimenez preferred to adapt her visits to teachers' willing and not to impose her presence. In the schools where teachers and students were motivated enough, VNE protocols have been implemented and Mara Sierra-Jimenez did visit the groups very regularly with precise questions and survey agenda in 2020-2021. However, some teachers were less motivated, shyer, or experienced more difficulties in their schools. Ongoing exchanges with the researcher helped to support teachers in the process, especially the less experienced ones; in some cases, training (online and face-to-face) in species identification or data entry was offered. These ongoing exchanges also allowed for information sharing and the creation of links between the participating teachers.

In September 2021, the participating teachers were invited to a new follow-up meeting at the MNHN. 18 teachers were present on site, and 1 online. The meeting had five objectives: 1) to present some data collected during the first year and to exchange with the teachers on their experiences; 2) to present the first natural infrastructures implemented in some schools; 3) to propose new activities for the 2021-2022 school year; 4) to introduce Sally Andersson and Jeppe Læssøe, two researchers from the University of Aarhus (respectively in anthropology and education) and participants in the REGREEN WP5; 5) to test with the VNE coordinators a practical mapping exercise in the MNHN's Jardin des plantes. The aim of this exercise was to introduce the teachers to the evaluation process necessary for the implementation of a natural infrastructure. The teachers made 3 maps. The first one listed the uses of the study area. The second was made after a quick inventory of the biodiversity in the area. Finally, the third was a plan listing the possible infrastructures. The choices had to be justified.

During the school year 2021-2022, Mara Sierra-Jimenez kept regular contact with four of the most motivated schools (2 primary schools, 1 middle school and 1 high school) that remained active in the



REGREEN project. The contact with the other schools was continued mainly by e-mail to make progress reports once every 4 months, or more regularly to give relevant information for the project. Five institutions did not respond to requests.

The closing meeting of the REGREEN project in Paris-region took place on Thursday June the 2<sup>nd</sup> 2022 at the MNHN (Figure 5). The classes of the 15 schools that had carried out biodiversity observations and natural infrastructures in their schools were invited to attend. The 6 schools that were most active during the two years of the project came to this day (2 primary schools, 2 middle schools and 2 high schools). Four schools (1 primary school, 1 middle school and 2 high schools) had to cancel their attendance for reasons of timing (baccalaureate exams, busy schedule or lack of resources for class travel). The two kindergarten schools decided not to come to the museum for the following two reasons: the young age of the children (*"as I have 3 year olds, I would not come to the restitution day because it is complicated"*) and the safety of the children (*"the local representation of National Education Ministry told me that outings in Paris are strongly discouraged because of Vigipirate [National French security protocol due to terrorist risk]"*). The MNHN team then offered to visit the schools to listen to and discuss with the children, but the teachers did not follow up this proposal.

This day focused on 5 main objectives: 1) to remind the participants (pupils, adults, parents) of the issues at stake in the biodiversity crisis, the main objectives of the VNE citizen-science programme to respond to this crisis and the approach of the European REGREEN project; 2) the collection of data from the participating classes to identify the impact of the programme on the pupils; 3) the presentation of the pupils about their project (see Appendix 7); 4) the valuation of the pupils' participation in the REGREEN research through a diploma bearing the words *"For their active participation in the project and in research on biodiversity through the implementation of the scientific protocols of Vigie-Nature École and the setting up of solutions to encourage the return of biodiversity in their school"* (see Appendix 6) and 5) A visit to an exhibition at the Jardin des Plantes or to a place of biological interest for the pupils (greenhouses, menagerie, ecological garden). Anne-Caroline Prévot gave a lecture on biodiversity, the VNE coordinators gave a presentation on citizen-sciences and biodiversity observation protocols, and then proposed a ludic survey to collect impressions and knowledge on biodiversity, citizen-sciences or solutions proposed in schools to attract biodiversity. Pupils participated by voting with coloured paper. A short questionnaire on birds was also distributed to the pupils at the beginning of the meeting, in order to collect the pupils' representations of three key words (Nature, Human being, Birds), and to answer two questions, "I like it" and "I know it", based on the proposed images of birds. The aim of this exercise was to assess the impact of bird protocols in the acquisition of students' knowledge and their relationship to various bird species, observed or not. Schools were divided into two different slots: primary and middle schools in the morning; high schools in the afternoon. The students proposed 9-minute PowerPoint presentations of their projects. Mara Sierra-Jimenez, closed the two sessions with the presentation of the diplomas to the students and encouraged the teachers to continue with the VNE protocols in their educational activities after the end of the REGREEN project.





Figure 6: REGREEN project feedback conference

### Internationalisation of the ULL Paris-region citizen-science project

During the REGREEN meeting in Paris in September 2021, four REGREEN researchers (from WP5 and WP6) **visited 3 schools in the ULL Paris-region** (a primary school, a secondary school and a high school). During these visits, they were able to discuss the French educational context and nature-related pedagogical activities with teachers and students, discover the specificities of Paris-region schools, and test a first version of the *Greenopolis* application with a class of 6ème in a middle-school (10-12 year olds) and a class of primary school (7-9 year olds). These exchanges have enriched the collaborative work between the different REGREEN partners: a **podcast** produced by *Intugreen* (Stine Casparij Kondrup and Marie Yvonne Dahlfelt) with three young eco-delegates from a high school in Argenteuil explains how young French men and women represent ecology and get involved in schools around the issues of sustainable development and climate change. In May 2022, during the **REGREEN meeting in Velika Gorica**, Sally Anderson, Jeppe Læssøe, Gertrude Lynge and Mara Sierra-Jimenez, all WP5 researchers, visited three schools and met with teachers, students and other local education stakeholders. The researchers presented what has been achieved in Paris and Aarhus and established contacts to test the transferability of the tools proposed by REGREEN to other educational and socio-cultural contexts. Finally, on 8 June 2022, Sally Anderson, Anne-Caroline Prévot, Mara Sierra-Jimenez, and three **volunteer** primary and secondary school **teachers** from the ULL Paris-region met. The two and a half hour video conference exchange focused on the following five points: 1) the place of nature education in France, 2) the difficulties and blockages of the French education system in developing nature education and outdoor education approaches, 3) feedback from the teachers on the difficulties experienced in setting up VNE in their schools, 4) identification of solutions or avenues for improvement by the teachers based on their teaching experience, and 5) the proposal to write a collective paper on nature education in France. Following this meeting, a plan for a paper was proposed to the volunteer teachers to continue the writing work in 2022 (this paper is currently in progress).

#### 4.2.3 Tools proposed to teachers by the MNHN team

Participating teachers received education and support tools produced by the MNHN VNE team for all volunteer teachers and students.

1) **VNE participation booklets.** These booklets guide and accompany teachers and students during the observations. Each protocol is described in detail and tools for identifying the different species (birds, snails, wild plants, insects, bats, lichens, etc. ....) are provided. The booklets also make it easier to collect and send quantitative data to the MNHN, thanks to a field sheet.

2) The **VNE website** (<https://www.vigienature-ecole.fr/>) gives teachers access to all the resources they need to participate in the programme. The protocols are detailed there, with simple videos adapted to pupils, the participation booklets are available for download, and quizzes to be taken before going into the field allow for practice in species recognition. Data entry is also carried out via specific forms for each protocol. The programme coordinators also provide simple results.

3) **Training on biodiversity observation.** Online training courses are offered on a regular basis and, when possible, in person in schools, to explain how to identify the species observed while respecting the chosen scientific protocols. The training courses cover the preparation of the protocol in the classroom, the conduct of the activity in the field, the identification of species through the use of determination keys, and the collection and submission of data to the VNE website.

4) **A VNE communication kit for pupils.** This kit aims to encourage the involvement of pupils in their schools. It consists of posters to help pupils communicate, raise awareness and explain to adults and other pupils what projects are being implemented at school and their importance for biodiversity

(Figure 6). It also includes guides to facilitate the administrative procedures necessary to implement biodiversity-friendly projects: learning how to ask something to the school management team, learning how to apply for funding outside the school, etc.

5) **A personal REGREEN logbook** was offered to each student in all grades. This logbook encouraged students to express their opinions and experiences about the biodiversity observation process in a free and personal way. In fact, apart from a few isolated cases of middle school pupils, only the kindergarten and primary school classes used this tool (see below).



Figure 7. Posters from the VNE Communication Kit

## 4.3 Implementation of activities in participating schools

### 4.3.1 Implemented VNE Observatories

The VNE observatories most frequently used by teachers concerned birds (Garden Bird Watch), earthworms (Earthworm plots) and snails (Operation snail) (Table 4). Some teachers suggested monitoring common plants (Sauvages de ma rue), and others pollinating insects (SPIPOLL).

*Table 4. Protocols carried out in schools and working format*

| school       | Working format                        | VNE protocols carried out          | Places of observation         |
|--------------|---------------------------------------|------------------------------------|-------------------------------|
| MBA, primary | Whole class                           | Birds, earthworms, snails          | schoolyard                    |
| MVH, primary | Whole class                           | Snails, earthworms, birds          | schoolyard                    |
| EMH, primary | Whole class                           | Birds                              | schoolyard                    |
| ELR, primary | Whole class                           | Birds, earthworms                  | schoolyard- out of the school |
| EPB, primary | Whole class                           | Birds, earthworms, snails, insects | schoolyard                    |
| EZ, middle   | Nature workshop                       | Birds, lichen, snails              | schoolyard- out of the school |
| IJC, middle  | Sustainable Development Club          | Snails, earthworms                 | schoolyard                    |
| LP, middle   | Club Jardin                           | Snails                             | schoolyard                    |
| PS, middle   | Nature Club                           | Birds, plants, snails              | schoolyard                    |
| HM, high     | Eco-delegates club                    | Birds, earthworms, plants          | schoolyard                    |
| JP, High     | Whole class -autonomy                 | Plants, birds, insects             | schoolyard- out of the school |
| JVD, High    | Whole class - ecodelegates (autonomy) | Birds, insects, plants             | schoolyard- out of the school |
| ML, high     | Ecology Club                          | Birds, earthworms, snails          | schoolyard                    |
| SV, high     | Whole class                           | Plants, insects                    | schoolyard                    |
| high         | Ecology Club                          | Plants                             | schoolyard                    |

### 4.3.2 Natural infrastructures

One of the objectives of the REGREEN project in the ULL Paris-region was to encourage the implementation of simple measures to promote the return of biodiversity in schools, accompanied by biodiversity monitoring carried out thanks to the VNE programmes. Beyond the biodiversity objective, the implementation of these natural infrastructures depends strongly on variables specific to each school, including the following:

- The available budget and the steps to be taken
- The location(s) available for these infrastructures (visibility, accessibility, relevance, effectiveness)
- The aesthetic and safety of the infrastructures
- Maintenance issues for these infrastructures
- The necessary authorisations\_(school management team, town hall when owner of the schoolyards, etc.) for the installation of these infrastructures

It is also important to know that, as in any public space, the greening of schools is often a divisive issue, which brings up fears and negative representations of a dirty and disorganised nature; maintenance issues are often the first obstacles identified to starting such transformative projects<sup>18</sup>.

Despite the pitfalls and constraints, several of the participating schools set up simple natural infrastructures (see Table 5). Most of them are nesting boxes and feeders (Figure 8), which are directly linked to the VNE observatory chosen by the teacher and which respond positively to the variables mentioned above: low cost, easy to install, multiple aesthetic possibilities, no danger, relatively simple maintenance and easy to obtain authorisations within the school. In the same vein, plant pots, which are simple to install and inexpensive, have been used in some schools (Figures 9 and 10). The third possible arrangement was to use fallow areas around schools or in areas with restricted access for pupils. The other implemented projects were in response to teachers' projects prior to REGREEN: vegetable garden and medieval garden, mini-farm for children and local residents in the neighbourhood, planting of sunflower seeds to feed the birds.

Very few schools have started tree replanting or demineralisation projects: the cumbersome administrative procedures for finding funding and support from local authorities very often delayed the implementation of these projects and greatly reduced the motivation and commitment of teachers.

The implementation of biodiversity facilities remains rather low in the participating schools, despite the interest shown by some directors in the REGREEN project. Moreover, some of these facilities do not correspond to the initial expectations of the VNE coordinators in terms of biodiversity. However, for the teachers, these natural infrastructures have a positive effect (aesthetics, quality of life) for the school, the pupils and the school staff. They can be a first step towards the establishment of more "wild" or spontaneous nature areas.

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<sup>18</sup> <https://www.cerema.fr/fr/actualites/pourquoi-comment-vegetaliser-cours-ecole> (2022)



Table 5. Facilities implemented in schools during the REGREEN project

| School       | Initial project  | VNE protocols carried out          | natural infrastructures implemented, relating to VNE | Other infrastructures              |
|--------------|--|------------------------------------|--|------------------------------------|
| MBA, primary | Installation of a mini-farm                                  | Birds, earthworms, snails          | Nest boxes, feeders                                  | Mini-farm                          |
| MVH, primary | The Little Naturalist" project garden                        | Birds, earthworms, snails          | Flower meadow, dead wood                             | Vegetable garden                   |
| EMH, primary | Biodiversity observation courtyard oasis                     | Birds                              | Nest boxes, feeders, oasis courtyard                 | Planting sunflower seeds           |
| ELR, primary | Eco-school lab garden  | Birds, earthworms                  | Nest boxes, feeders, plant plots                     | Tree planting and garden (project) |
| EPB, primary | Eco-school lab Biodiversity project in the school            | Birds, earthworms, snails, insects | Bird feeders   |                                    |
| EZ, middle   | Identification and enhancement of the college's biodiversity | Birds, lichens, snails             | Nest boxes, bird feeders                             |                                    |
| IJC, middle  | Nature Club Sustainable Development Club                     | Earthworms, snails                 | Plant pots   | Tree planting and garden (project) |
| LP, middle   | Eco delegates Shared educational garden                      | Snails                             |  | Vegetable garden                   |
| PS, middle   | Ecology Club Grain library, Garden                           | Birds, snails, plants              | Nest boxes, fallow land, plant pots                  |                                    |
| HM, high     | worm composting waste treatment                              | Birds, earthworms, plants          | Nest boxes, bird feeders                             |                                    |
| JP, high     | Ecology Club   | Birds, insects, plants             | Fallow land (unoccupied)                             | Herb garden                        |
| JVD, high    | Sustainable Development Club Eco-delegates club              | Birds, insects, plants             | Fallow land (unoccupied)                             |                                    |
| ML, high     | Ecological pond*. Naturalization of the court                | Birds, earthworms, snails          | Nest boxes, fallow land, plant pots                  | Tree planting (project)            |
| SV, high     | Greening of terraces Grain Library                           | Plants, insects                    | Plant pots   |                                    |
| LMC, high    | Ecological pond*. Garden                                     | Plants                             |  | Herb garden                        |

\* Ecological ponds were created in both schools before the REGREEN project started



With an ecologist, students built up nest boxes and decided where they will be implemented. By doing that, they discovered the diversity of nest boxes, according to bird species

*Figure 8. Nest boxes assembled and installed by high school students in 2021*



*Figure 9. Plant pots made and set up by students in a secondary school*

The school's sustainable development club is involved in a courtyard renovation project. A first project of flower boxes and aromatic plants has been set up in 2021-2022. The second stage of the project is the planting of trees and the greening of a terrace.

According to the teacher, the absence of green space in this school is linked to the architectural project of the building (which forbids any change in the design of the building). The plant pots and trees in the inner courtyard are the only possible spaces and elements of nature for natural infrastructures.



*Figure 10: Installation of plant pots to introduce some greenery in a high school.*

### **4.3.3 Another school project, a mosaic mural**

Beyond the discovery of biodiversity, some teachers gave a multidisciplinary dimension to their project. For example, a primary school in Argenteuil implemented a mosaic art project on biodiversity during the two years of the project (Figure 11). Parents, teachers and pupils from three classes of CM1, accompanied by an artist, carried out this project, which aimed to discover the school's biodiversity thanks to the VNE observatories; but also to bring more biodiversity into the playground walls through art to make them more attractive and welcoming. A final objective of this project was to make the school more appropriated by the pupils, their parents and teachers. The creative process was divided into five main steps: 1) scientific observation of biodiversity; 2) children's drawings around the observed species, 3) selection and artistic transcription of the children's drawings by the artist, 4) collective creation of the mosaic, 5) installation of the mosaic in the school. During the second year of the mosaic project, the primary school's referent teacher and Mara Sierra-Jimenez invited students from the neighbour high school to visit and discover the artistic work of the primary school and to make a report on this process. Following this experience, the high school teacher wants to propose a similar artistic work in the high school in 2023. This biodiversity mosaic project has thus encouraged the meeting of two schools participating in the REGREEN project to continue working together around nature, art and scientific research.





Figure 11. Mosaic project around biodiversity in a primary school in Argenteuil (School year 2020-2022)

#### 4.3.4 Appropriation of the projects of natural infrastructures

We identified **three levels of** appropriation and implementation of facilities to restore biodiversity in schools. These stages develop over time and according to local possibilities, in an order that varies according to the projects, the teachers and the institutional timeframe.

An **introductory** level, where the natural infrastructure most often meet aesthetic (decoration, visibility), practical (easy to set up) and educational (awareness of living beings) interests, but without necessarily taking into account the issues related to biodiversity. These include gardening areas or plant pots installed in the corridors and classrooms (affective and empowerment dimension):

*"I love plants. So if we could put some in each classroom and make the students a little more responsible, for example, just taking care of them, adopting them during the summer, watering them and so on, that would be good enough. (High school, girl, 16 years old).*

A **discovery** level, following the implementation of the VNE protocols, where the natural infrastructures meet scientific (protocols), ecological (biodiversity) and emotional (new relationship with the species observed) interests. These include nest boxes and bird feeders, but also wasteland and insect houses:

*"I made the feeders. I took big 5 litre plastic bottles. I put seeds in them, made holes, cut them out so the birds could get in. I tied them up. By the way, I even saw European green woodpeckers and I learned to recognise the birds, including robins, sparrows and European green woodpeckers. It was great" (High school girl, 17 years old).*

In general, the construction of simple infrastructures gives meaning to the achievements of the VNE biodiversity observation protocols:

*"It was interesting to take the protocol much further and make it a real projec , for me, more interesting than the protocol. Because the protocol is just a list, whereas here, we have really taken action to improve biodiversity. Because here, we are providing shelter for the birds, to enable them to survive if needed. I find that really incredible and much more interesting than just doing the protocol. (High school, girl, 18 years old)*

In the same vein, this student proposes to do the same exercise for each protocol proposed in the VNE programme:

*"In the future, we should do fewer protocols, but push them much further, without forcing the students to do: "If you do the protocol, you can do the layout afterwards". As with the birds, continue the bird project, but then do another protocol and push it by doing a concrete action. See the earthworms, they've been inventoried, but that's all. I never understood why we did that. So, even though it was an incredible experience, I didn't see the point of listing the earthworms and then doing nothing to help them. (High school girl, 18 years old).*

A level of **awareness**, which seems to stem from various experiences and projects around nature and biodiversity before and during the REGREEN project (VNE protocols, theatre, arts, sustainable development, etc.). The interests are focused here on the improvement of the living environment for the pupils and the staff, the return of biodiversity and green spaces within the school, as well as on the educational projects to be developed. These include the demineralisation of courtyards, the creation of oasis courtyards or the planting of trees:

*"We thought about a demineralization project, but it's very complicated to propose a project like that. So we didn't propose anything to the headmaster. We just thought about this idea for the future.... But for all the bushes, the grass that we had, a project would be to avoid cutting them often so that berries and the bushes could grow and the birds could eat them.*

*And for the grass, the same thing, leave room for nature rather than domesticate it as we have always done (High school, boy, 18 years old)*

*"Afterwards, given that we have a completely tarmacked high school, we could say that natural infrastructures could be implemented. But this would mean, for example, breaking up the asphalt in some places. But then, it may be a little less accepted within the school because it will involve work that will not have the same cost, it will involve the regional administration, which will give orders. (SVT teacher, high school)*

As in other contexts of engagement or participation around ecological, climate or environmental projects (Pleyers 2016 a and b), young people need to feel "useful to the cause", to be "witnesses of their actions", or to feel "actors of change", among others. In the REGREEN project, natural infrastructure becomes the tool and the process that allows the student to feel like an actor of change in their school and to take ownership of the process of observing nature:

*"What I really liked was when we made the nest boxes. Because everything that is manual, I like. That's the part I really liked. And also choosing where to place the nest boxes. It's making them, really. I like manual activities. Making, I liked having to put each piece together, nail it and again, I learned things" (High school, girl, 16 years old).*

The infrastructure thus makes it possible to make one's commitment to helping biodiversity visible, and in some cases, promotes validation and recognition of this action within one's school, teachers and peers. The primary school mosaic had the same objective for teachers, pupils, the artist and parents, namely *"to leave a trace of their work to observe biodiversity in the school and make [nature] visible"*. The mosaic allowed the participants to give their own meaning to their participation in VNE and to nature observation. But the construction of this mosaic also reinforced the pedagogical dimension of the observation:

*"We drew the birds, which allowed us to observe the shape of the beak, the size of the tail or the colours. I think this is maybe the thing that helped them the most to recognise the birds in the end. To do it themselves and to know that it will remain in the school in the future" (Primary school teacher)*

In some schools, it was the reflection around the natural infrastructures that encouraged the participation and interest of students:

*"Where they expressed the most desire, or in any case, where they took a stand, was when we were thinking about the natural infrastructures. They said: "Well yes, in this area in the courtyard, there is nothing growing because everyone is trampling everything, we must make it grow", others expressed their desire to build the infrastructures themselves.... The opinions really came in the phase of reflection and choice for these" (Teacher, middle school).*

To sum up, we can identify three levels of expectations and meanings given to the natural infrastructures according to the different actors, whose cross-knowledge could allow each one to give meaning to these activities:

- For the VNE coordinators, the natural infrastructures should promote nature observation, data collection for science and have a positive impact on biodiversity.
- For the teachers, the meaning given to the natural infrastructures seems to be linked mainly to their educational project: training in reflection, collective realisation of an action or a concrete project (for biodiversity) by the pupils. This process involves an ecological and eco-citizen dimension.
- For some students, especially at middle school level, the quest for meaning seems to lie in carrying out visible and concrete actions to help biodiversity, more particularly the species observed in the framework of VNE; it is also a question of being an actor who decides, chooses and does.

All the participants are aware of the possibilities of development and more extensive work to promote biodiversity. It is the financial and administrative issues that limit and slow down the realisation of these projects.



## 5 NATURE EDUCATION THROUGH CITIZEN-SCIENCE: RESEARCH ON THE IMPLEMENTATION OF REGREEN IN THE ULL PARIS-REGION

### 5.1 Research framework and questions

Outdoor learning can be defined as "educational practice that takes place in near or distant outdoor and/or out-of-school environments, whether natural or man-made, where students have the opportunity to engage in a variety of learning activities" (Dabaja 2022: 3). Natural environments where children can interact, play and be surrounded by plants, animals, insects, stones and other biological components, have already been identified by various international researchers as being conducive to children's development on several levels (Dabaja, 2021): 1) knowledge inputs in different curriculum subjects (Avci & Gümüş, 2020; Becker et al, 2017); 2) increased physical skills and improved mental health (Finn et al., 2018; Heras et al., 2020; Marchant et al., 2019); 3) increased social and collaborative skills (Waite et al., 2016).

VNE does not promote play with or in nature, but it proposes to observe and monitor biodiversity, based on standardised scientific protocols. Two studies have been recently carried out to study how VNE is perceived and implemented at school by the teachers, one on the declared teaching practices (Bosdeveix et al. 2019) and the other on the knowledge, perceptions and reasoning of high school students (Turpin 2022). This work confirmed that the 'programme [VNE], initially focused on a quasi-exclusive objective of collecting standardised data, has been enriched with objectives relating to awareness-raising, naturalistic education and the adoption of dynamic pedagogical approaches'. (Conversy et al., 2019). These two studies have also highlighted a certain discrepancy between the initial intentions of the VNE designers at the MNHN (to collect scientific data) and the motivations and methods of effective appropriation of the protocols by teachers in the field, for whom "the contribution to research is not so important for some, even though it is stated as an objective" (Bosdeveix et al., 2019). Despite this apparent discrepancy, the main benefit of the system for teachers lies in the partnership with MNHN researchers around citizen-science and the scientific approach. With regard to students' knowledge and socio-scientific reasoning, "occasional participation in a citizen-science scheme, such as Vigie-Nature École, only marginally modifies pupils' knowledge and perception of biodiversity" (Turpin, 2022).

Yet, this previous research, which was mainly quantitative and based on questionnaires, has difficulty in grasping the diversity and complexity of a participatory system carried out in extremely diverse territories and with extremely diverse young people. These survey methods do not make it possible to take account of specific information on the realities of the field: the precise way in which the observation sessions are implemented, the choices made by the teachers according to the contexts and the school and human constraints, or the usual practices of the teachers, for example.

In order to complete the knowledge, a qualitative research was set up at the Museum, by Mara Sierra-Jimenez, postdoctoral researcher in socio-cultural geography.

At the beginning of the REGREEN programme (2019), the following questions were asked: What relationships do pupils have with nature? How are these relationships linked to the acquisition of knowledge about biodiversity? How does the implementation of natural infrastructures or activities dedicated to nature in schools allow for changes in: 1) the biodiversity present in schoolyards; 2) the ways in which pupils appropriate these spaces; 3) the teachers' educational activities; 4) the governance of the schools, both internally and with local stakeholders?

A reformulation of the objectives in September 2020 refocused the research on three main questions:

- How do teachers and students appropriate the tools offered by VNE?



- What are the educational, environmental and social effects of implementing VNE in schools?
- How do teachers include VNE in their own practices?

To answer these questions, we combined the following methodological frameworks:

- The dimensions of education proposed by Franc et al (2013): the **cognitive dimension**, i.e. reference knowledge on biodiversity and on the relationship between humans and biodiversity; the **affective dimension**, i.e. the emotional relationships maintained with living beings (Braun et al, 2010; Chawla, 2021; Lindemann-Matthies, 2005); the **behavioural dimension**, i.e. citizen, eco-citizen and responsible positions and intentions to act (Chawla and Cushing, 2007; Sauvé et al., 2017); and the **social dimension**.

- The indicators proposed by Rey-Valette et al (2018), Mazeaud et al. (2012) and Beuret and Cadoret (2015) around the effects of participatory approaches, in order to understand the effects of the VNE framework on the communities of actors in the school, including: 1) **the types of beneficiaries** (VNE facilitators, teachers, students, local actors); 2) **the levels and forms of school governance**; 3) **the places and times** of programme implementation, the contextual factors, such as the institutional scale of programme implementation (city, town hall, municipality, school) and the levels of conflict at this scale; 4) the **intentionality** of participants and the impact on the intended effects (by programme implementers or participants), and unintended or rebound effects in the programme.

- The processes of appropriation by the participants of VNE have been approached according to the three dimensions identified by Capdevila et al. (2020) as determining the success of a citizen-science project: (i) **attributes of citizens** (knowledge and experience in collecting data, awareness of environmental problems, motivation, and socio-economic background of citizens); (ii) **attributes of institutions** (motivation, type of organization, consistent and adequate funding); (iii) **interactions between citizens and institutions** (supporting structure, communication and feedback).

We made the following assumptions:

- 1) The appropriation of the VNE citizen-science programme varies according to the educational level of the participating classes, but also according to the motivations of the teachers and the issues specific to each school;
- 2) The effects of implementing VNE in schools depend on the intensity and recurrence of the VNE observatories in the school;
- 3) Teachers of subjects other than biology (Sciences de la Vie et de la Terre, SVT) have more difficulty implementing VNE because of their lack of knowledge of biodiversity.

## 5.2 Research methods and tools

The qualitative approach was favoured, more specifically ethnographic methods (Morrissette et al., 2014) including direct observation (Arborio and Fournier, 2010), semi-directed interviews (Becker, 2002) and the inductive approach for data analysis (Glaser and Strauss, 1967).

A variety of methods was used to collect qualitative data from teachers and pupils in kindergarten schools, primary, middle and high schools between September 2020 and June. Most of them are classical social science methods and were implemented by Mara Sierra-Jimenez: semi-directed interviews, on-site observations, focus groups (Table 6).

Table 6. Summary of monitoring and support actions between 2020 and 2022

| Type of support   | Number of establishments | Means of interaction    | year      |
|---|--------------------------|-------------------------|-----------|
| <b>Contact with the project leaders and the referent teachers for each school</b> | 2 kindergarten schools   | Mail                    | 2020-2021 |
|   | 3 primary schools        | Telephone               |           |
|   | 4 middle schools         |                         |           |
|   | 6 high schools           |                         |           |
| <b>Presentation of the project and visit to the schools</b>                       | 2 kindergarten schools   | Meeting                 | 2020-2021 |
|   | 3 primary schools        | Face to face            |           |
|   | 4 middle schools         |                         |           |
|   | 6 high schools           |                         |           |
| <b>On-site monitoring of the implementation of the first VNE protocols</b>        | 1 kindergarten school    | On-site observation     | 2021      |
|   | 3 primary schools        |                         |           |
|   | 2 middle schools         |                         |           |
|   | 1 high school            |                         |           |
| <b>Remote monitoring of the implementation of the first protocols</b>             | 1 kindergarten school    | Mail                    | 2021      |
|   | 2 middle schools         | Telephone               |           |
|   | 5 high schools           | WhatsApp                |           |
|   |                          |                         |           |
| <b>Monitoring of artistic initiatives related to biodiversity</b>                 | 1 primary school         | On-site observation     | 2021-2022 |
| <b>Follow-up on the implementation of the first VNE protocols</b>                 | 1 primary school         | On-site observation     | 2022      |
|   | 2 middle schools         |                         |           |
|   | 1 high school            |                         |           |
| <b>Ad hoc monitoring of the implementation of protocols in schools</b>            | 1 primary school         | On-site observation     | 2022      |
|   | 1 middle schools         |                         |           |
|   | 1 high school            |                         |           |
| <b>Monitoring the implementation of the protocols</b>                             | 2 kindergarten schools   | Mail                    | 2022      |
|   | 3 primary schools        | Telephone               |           |
|   | 4 middle schools         | WhatsApp                |           |
|   | 6 high schools           | Meeting at MNHN         |           |
| <b>Follow-up - meeting Teachers / students / WP5 and WP6</b>                      | 1 primary school         | Face to face meeting    | 2022      |
|   | 1 middle schools         |                         |           |
|   | 1 high school            |                         |           |
| <b>Follow-up - training for VNE eco-delegates</b>                                 | 1 high school            | 2 face-to-face meetings | 2022      |
| <b>Follow-up - focus group WP5 and teachers</b>                                   | 1 primary school         | Visio                   | 2022      |
|   | 2 high schools           |                         |           |

Others activities were set up in collaboration with a research team in sociocultural and sociolinguistic psychology at the University of Neuchâtel (Laure KLOETZER and Thierry DESHAYES), Switzerland, to explore young people's sensitive and sensory relationship with nature; these were most often set up by the teachers, with or without Mara Sierra-Jimenez: free-listings, accounts of nature experiences, logbook of nature observations, "relationship to" questioning, sensitive activities carried out in class. The data from the so-called "sensitive" protocols were not all analysed, but we present here how and why the adults appropriated these sensitive tools in their practices. We also point out some preliminary intuitions that allow us to ask complementary questions to grasp in a more ambitious way the roles that sensitive activities can play in transformative education about nature and the world.

### 5.2.1 Semi-structured interviews

Semi-structured interviews lasting an average of 1.5 hours were conducted with 23 teachers (at least one per school). Due to the constraints of the health crisis, all interviews were conducted by telephone and video conference between April and May 2021. The interview grid (see Appendix 3) dealt with various themes that allowed for a better understanding of: 1) teachers' motivations for participating in the REGREEN project, 2) strategies for appropriating the various VNE, 3) difficulties identified by teachers in setting up the project and carrying out the VNE protocols, and 4) the impact observed by teachers on students and other partners following VNE.

A second series of 30-minute face-to-face individual interviews was conducted with four pupils aged 9-10 years (2 boys, 2 girls). These pupils were identified by their teacher for their interest or disinterest in the biodiversity observation protocols. The aim of these exchanges was to better understand how the students behave with these protocols and the moments that marked them the most (positively or negatively). We also asked if the students could tell us what the word "nature" and "biodiversity" meant to them. Finally, a last series of one-hour individual interviews with 7 high school students (6 girls and 1 boy), aged 17 and belonging to three different schools, was conducted by telephone. The students were identified by their teachers or volunteered. Among these students, 3 were eco-delegates<sup>19</sup> at the time (ecological leader of the class) and were participating in the project within the framework of the nature club or the ecology club, which enabled the students to carry out extracurricular activities proposed by the teachers in charge of the REGREEN project in their school. The interview grid was adapted from the grid constructed for the teachers. Additional questions were asked about the status of the eco-delegate in their school.

### 5.2.2 Direct observations

The choice of direct observation (see Arborio and Fournier 2010) meets three objectives: 1) data collection during the training stage before the execution of the VNE protocols; 2) observation in the field during the execution of the VNE protocol, and 3) observation during the final stage of the protocol, after the data collection. As for semi-structured interviews, and according to Ioanna Guikas, Diane Morin and Marc Bigras (2016), *'although direct observation is subject to social desirability it empowers the researcher to build a comprehensive picture of a situation in a natural setting and is particularly advisable when social interactions are the subject of interest'* (Guikas et al. 2016: 164). Indeed, this method helps the researcher to more or less realistically describe the behaviour of actors and to understand the complex interactions between them. The observations were mainly carried out in two types of spaces: classrooms (before and after the protocols were carried out, or during trainings) and at the places where the VNE protocols were carried out (schoolyards and green spaces, public gardens and parks). An observation grid allowed us to collect information according to the following five criteria: temporality, place, interactions, discourses, corporality (see Appendix 4). These

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<sup>19</sup> From 2020, eco-delegates are elected as representative of the students in every class in middle and high schools, to represent environmental issues in the school and to act for nature and climate change mitigation. Besides these national recommendations, the exact missions of ecodelegates are not precisely defined and vary according to schools.

data allow us to better understand the appropriation of the tool by the teachers and their pupils, as well as the behaviour of the latter in nature.

### 5.2.3 Focus groups

The classes chosen to participate in the focus group had all carried out one or two protocols several times during the year. We divided the classes into two groups (boys and girls) in order to collect data on the relationship to nature according to gender, and to respect a number of participants ranging from 4 to 8 students per group (See Appendix 5)

Before starting the activity, we explained the scientific approach of the meeting and the fact that the exchanges would be recorded with a tape recorder that was placed in the center of the group. Then, in order to keep the anonymity of the participants, we asked each child to choose a nickname, to mark it on a sheet of paper and to put it in front of them. Finally, in order to make the activity more social and welcoming, we explained that each child would be responsible for leading the discussion. The facilitator should give the floor by naming the nickname that was in front of each participant. This facilitation strategy allowed us to identify who was talking about what to facilitate data analysis. To facilitate the discussion in a fun and educational way, three discussion sessions were proposed. The first one was a free discussion on all the activities related to nature carried out during the year, then the children chose the ones they liked the most and the least, and we asked them to argue these choices. The second time of exchange was organized around the photos taken during the realization of the protocols by their class. The children had to agree to classify, name, organize and reconstruct chronologically the steps of the protocol. Then, they had to choose the image that corresponded to the moment that had most marked them and tell us why. The third and last moment of exchange was focused on the sensitive and emotional dimension of their relationship to the different stages of the protocol and to the animal observed. For this we showed them pictures representing emotions or adjectives (joy, anger, fear, sadness, boredom, disgust, interest, dynamic, curious, and a Joker to express another feeling or adjective if it was not in the pictures).

As an example, 'Little Butterfly' tells us:

*"At the first protocol, I was a bit bored and scared. At the second one, I was angry and disappointed, because I was in the pink team, I was doing one by one, so I was in the pink team, so I was angry, I was not happy and I was a bit sad because there were really not many earthworms. The third time, I was happy and I was also active, because I did a lot of things, I sorted them in the right boxes and all that."*

The focus groups allowed us to get the students to discuss their views on the protocols and the research, to debate and agree on the positive and negative aspects of the observations, to remind the scientific process and to share their emotions during the scientific observation process.

### 5.2.4 Free listings

To study whether and how the implementation of biodiversity observation protocols transforms the students' social representations of the species observed, we asked volunteer teachers to carry out a series of free listings (Abrie, 1994) at the beginning and end of the school year.

Volunteer teachers were asked to present the exercise to students as follows:

*"We are going to do an exercise to understand what you think about your environment. So I'm going to tell you five very simple words and you have to write down the first five words that come into your head, without thinking. It's important to do it quickly, without thinking too much about it."*

The five leading words we asked to say were as follows:

1: cat - first word, to help students start the exercise

2: earthworm - a nature word

3: nature - a word of interest for research, to be able to evaluate an evolution of social representations of nature during the year

4: human being - word of interest for research, for the same reasons

5: the name of the taxonomic group monitored during the year (bird, insect, snail, plant)

Most of the teachers carried out this activity as requested. However, several teachers, at all levels, also used it to introduce a lesson or an activity related to nature, biodiversity or sustainable development:

*"There are things that are part of the protocol that I have integrated into my work. For example, what is it called again? We give the students five words...the free listing" (Elementary).*

Indeed, this activity favours a context of communication and benevolent exchange between pupils and adults to question, become aware of and have fun with the words spoken: *"The free-listing, they found it funny. It was quick and it was collective because they were there in person. No, they found it fun and joyful. They were quite willing to do it"* (High school)

In the kindergarten and primary schools, some teachers adapted the protocol with students who could not yet write:

*"The free-listing, I didn't do it quite like that because it was in first grade, it seemed complicated to me... I asked them to draw what the word evoked in them (Figure 12). They could write a little sentence, those who could manage it. And those who couldn't, they did an adult dictation and I wrote what they told me" (Elementary).*



Figure 12. Example of the appropriation of the free listing in an elementary school class.

This appropriation has allowed the integration of the youngest children into the project, but above all, it has promoted a new pedagogical activity to teach pupils to write and talk about nature, in urban contexts and with children who sometimes come from very disadvantaged neighbourhoods:

*"There was something that struck me during the free-listing session. It was their relationship to nature. The poverty of the words that came to mind when we said cat, earthworm, nature, all that. In particular for "nature", what struck me was a student who had drawn, you know, the sports structures in the parks. For him, nature made him think of a park. A park... the park behind the school where there are structures for doing sit-ups, things like that. And that's it, I thought it was a very urban representation. (Teacher - elementary school)*

In one middle school, another type of appropriation was achieved during the second year of the project. The aim was twofold: to promote communication and awareness of the REGREEN project among classes that did not participate, and to reinforce the role of "young researcher" that the



participating students had acquired thanks to the teachers by concretely implementing a qualitative scientific approach. In this context, 10 students from the 6ème nature workshop carried out the free listing with all the school's 6ème classes: they went to the classes, explained the initial project, the protocol and its purpose, and led a session to collect the data correctly. Then, with the help of Mara Sierra-Jimenez, they carried out an exercise to analyse the words spoken around "snail" with 50 free-listing: in pairs, the pupils identified the order of the words spoken on 10 protocols, and then the three words that came up most often (shell, ugly, slobbering). At the end, they debated together about the positive and negative representations that the pupils in their school might have of the snail and how to raise their awareness of this animal. A comic strip was produced by the pupils following this sensitive animation.

It is therefore interesting to see the pedagogical possibilities that the free listing method can bring to teachers of several levels in order to favour an alternative pedagogy, which works from the diversity of ways of seeing or imagining the world, and not from an already structured definition of the notion of nature which would limit the pedagogical possibilities of exchanges.

### 5.2.5 Writing an experience of nature

The activity consists of asking students (middle and high school) to answer the following question:

*"Tell us in a few sentences about an experience in nature (good or bad) that struck you. Try to describe what happened. (15-20 lines)"*

The nature experiences referred to here refer to the definition of S. Clayton et al. (2017), i.e. all forms of encounters between human beings and (other) elements of nature that are potentially transformative for the human subjects who live them - through knowledge, emotions, bodily sensations, etc. The nature narratives collected from 134 secondary school students in Paris-region have joined other narratives collected in the South of France and are being analysed, following the conceptual framework of sociolinguistics.

The account of a nature experience revealed the diversity of students' emotional relationships (positive and negative) with nature. In the same way as with the free associations, some teachers were challenged by the diversity of the stories, especially the negative experiences of nature:

*"When they were asked to give nature stories, what came out a lot were negative experiences: 'I got bitten by a spider'. That kind of thing" (middle school).*

But being able to talk about these experiences also seems to encourage new exchanges between students:

*"When asked for nature stories, he only told us about dead animals. He actually continued. Every time he told us an anecdote. But this provokes debate with the others. Because every time, they say: 'But why are you talking about that? Don't you have live animals? So, these are perhaps the two things that have most impressed me in the debates between students'" (middle school).*

In this particular context, the nature story and the work carried out by the teacher allow students to speak freely and to become aware of his or her relationship with the non-human world, as well as of his or her fears and/or traumas.

More generally, in a middle school, the scientific (VNE protocols) and sensitive approaches were integrated in an interesting way by the two teachers in charge: an SVT teacher for the VNE scientific protocols and a librarian. Following a sensitive animation carried out in the first year by Mara Sierra-Jimenez, the librarian decided in the second year to appropriate the sensitive dimension of the project by animating a workshop around the experiences, representations and sensitive reports of the pupils who carry out the VNE protocols:

*"I thought it was good that it existed as a subject in itself, an interesting one, that we could talk about. And that, as a result, schoolyard conversations are not always limited to video games or to the main subjects of the schoolyard. It introduced a bit of diversity and it's important to give them this space to talk about their relationship with nature as well."*

In this school, the REGREEN project was thus able to benefit from two clearly identified and organised, but complementary spaces in an integrated educational approach: one for the scientific observation of nature; the other for reflection and sensitive observation of nature.

As an example, here is an extract from the exchanges between the pupils following an activity based on nature experiences in 2020, which enables them to understand the diversity of reactions that a young person can have when faced with the death of an animal. The "nature story" activity and the associated debates can help to free students' talk in the face of negative events, some of them traumatic, experienced or observed in nature. It is on the basis of these negative experiences and the resulting emotions of the student that the teacher can subsequently take a transformative approach to his or her relationship with the world.

**Presenter: *What was the experience in the wild that made the biggest impression on you?***

**Student 1 - G:** I was walking with my grandmother and I saw a dead squirrel on a footpath. It was all broken up. My grandmother told me that it was probably a fox that had attacked it.

**Student 2 - F:** oh that's horrible!

**Student 3 - G:** Why horrible? That's life!

**Student 2 - F:** to die like that!

**Presenter: *So what specifically stood out for you in this experience?***

**Student 1 - G:** well, to see him on the ground like that, with everything coming out of his body...

**Student 3 - G:** It wasn't a fox that killed him! He must have been hit by a car!

**Host: *Can you try to tell me what emotion you felt when you saw him like that?***

**Student 1 - G:** well, sadness, it made me a bit disgusted too... I don't know.

**Host: *And what did you do next?***

**Student 1 - G:** Nothing, we kept walking with my grandmother.

**Student 3 - G:** What? You didn't do anything?! I would have taken it to bury it!

**Host: *And why would you want to bury it?***

**Student 3 - G:** because he doesn't deserve to stay like that! He deserves a proper burial. We bury him and give him a name.

**Host: *A name? And why would you want to name it if it's an animal and you don't know it?***

**Student 3 - G:** But it doesn't matter! We have to bury him and give him a name so that he has a dignified death. We can't leave him like that! That's what I would have done!

**Host: *Okay. Have you ever told anyone else about this experience?***

**Student 1 - G:** No, it's the first time I've mentioned it...

**Host: *And how old were you when you had this experience?***

**Student 1 - G:** 7 years

For high school students, **the implementation of the Nature Story** activity was more complicated, for several reasons: difficulty in carrying out this activity at a distance, finding time slots for it or, according to some teachers, lack of interest of teenagers in these issues:

*"I think age is a factor because in 6ème you would have had kids who were more attached to nature. I have the impression that the older you get, the further away they get from that ideal";*

*"At the time of the nature story, we were really distanced. I don't know, if it's because of their age group, it didn't speak to them. I didn't feel they were motivated at all by it (high school).*

However, for the two students who produced the nature stories, the view is very positive:

*"[The nature stories] were very interesting. It's a bit like the observation book if we had continued it. To give our opinion on an experience and to look into it and explain why it made us feel good and why we want to do it again. So that was very interesting. (Girl, 20 years old)*

*"I think that putting words to our feelings is always good" (Girl, 16 years old)*

The appropriation of the sensitive protocol "writing an experience of nature" by the middle school teacher and the testimonies of these two high school students, allow us to show the interest of the tool to reflect and work in an individual and collective way on the theme of the relationship with nature in a transformative approach to nature education.

### 5.2.6 Nature observation notebook

A personal observation booklet has been distributed to each student in all grades during the 2020-2021 school year (Figure 13). This notebook was proposed to note, draw, or paste, like a diary, all the thoughts, anecdotes, knowledge or impressions that might have emerged during the school year around their experience with / in nature. In fact, apart from a few isolated cases of middle and high school students, only kindergarten and primary school teachers have used this tool. Three elementary school classes have asked us for other notebooks for the year 2021-2022.



Figure 13. Observation notebook of a primary school student carrying out the earthworm protocol.

The notebook contains the names of the species studied and a commentary on the TV documentary "Ce n'est pas sorcier", where the pupil learned how earthworms live

For the youngest pupils, this tool favours the process of naturalist learning, while giving an important place to the sensory and emotional dimension during observation. Here are some examples of how pupils in a primary school have used the notebook. (Focus group notes, 2020):

*"Sometimes the teacher tells us: go to your house and if you see, for example, a ladybird, whatever I say, a ladybird on a tree or a squirrel on a tree, you can write it down in your VNE notebook, draw a little picture and show it to everyone at the class council meeting. (Girl\_1, 7 years old)*

*"And also, we noted everything in our VNE notebook. So, in our VNE notebook, we noted during the three protocols how many earthworms we had each time, or we drew pictures of the zones". (Girl, 8 years old)*

*"In my VNE notebook, I presented several plants, for example, an olive tree or several trees, I stuck leaves in my notebook" (Girl\_2, 7 years old)*

*"And we also wrote in the VNE notebook what we like and what we don't like about earthworms" (Girl\_3, 7 years)*

The observation booklet seems to us to be a key tool to accompany scientific, artistic, literary or sensitive activities related to nature. The appropriation of the tool by middle and high school pupils nevertheless remains to be developed, to feed more clearly with these institutional contexts and to allow students to give a personal meaning to the use of this tool, with an objective well defined between the teacher and the students.

### **5.2.7 Activity "Relationship to"**

It is very common to talk about 'relationships' between friends, relatives or family in Western societies. On the other hand, it is much less common to use this term to talk about nature. We wanted to take a quick look at how young people in high school think about "relationships with non-human living things" by asking them three simple questions:

*Have you ever had a special relationship with a tree? a plant? an animal?*

*Which one?*

*Why?*

Of the 140 students who responded to the questions, we obtained the following answers:

For trees: Yes 27 / No 111 / no answer 2

For plants : Yes 36 / No 102 / no answer 2

For animals: Yes 90 / No 47 / no answer 3

In general, these results show us two things. Firstly, the representation of a 'relationship' is much more rooted in the dynamism and expressiveness that characterises some species of animals, and much less attached to the static and passive nature of the plant world. Interaction and exchange, as perceived by Western cultures, are often stated as criteria for a good relationship:

*"Since a tree doesn't talk, doesn't move and doesn't feel emotion, I find it complicated to have a relationship with a tree" (Girl, high school).*

The sentimental dimension also seems to be a criterion:

*"I don't see the tree as something that can be close to me emotionally" (Girl, high school);*

*"When I start to tie up, they get cut."*

But other young people were surprised by the questions: *"I've never asked myself that question", "it's weird", "I'm not interested"* were the most common answers.

The second result that stands out is a criterion of proxemics, where the relationship exists because there is regular contact, a high spatial proximity and a feeling of *"caring for"*. Here are some testimonials for the particular relationship with a plant:

*"An apple tree shoot that I didn't manage to make survive. Because I took care of it every day and put a lot of energy into it"* (Girl, High School)

*"I used to look after cacti, they were beings in their own right, like a pet"* (Girl, High School)

*"A plant that I adopted in high school. Because I feel responsible for it"* (Girl, High School)

For animals, the special relationship is often one of benefit, sharing and mutual understanding between the two beings:

*"My cat, because I adopted him when he was born and I was also very small so he is a member of the family"* (Girl, High School)

*"Now, I have a cat with whom I have a good relationship because we get along well and I have already looked after his paw by myself, which I consider a personal pride"* (Girl, High School)

*"It allows me to calm down after various life events"* (Girl, High School)

The special relationship with trees is more of a symbolic nature:

*"When my father, my uncles and myself were born, trees have been planted, I have always known them, they grow up with me and accompany me. The tree that was planted for me has a reassuring side for me"* (Girl, High School)

*"A tree under which all the animals in my family are buried for a very long time and a giant cherry tree that is very old. It is filled with 20 nest boxes"* (Boy, High School)

According to the teachers' testimonies, this series of questions provoked a lot of reactions and questions from the pupils, such as: *"but you can't have a relationship with a tree", "what kind of questions are these", "it's weird to ask these questions"*. For the teachers, these reactions show to what extent young people have lost the link with nature and how important it can be to work on this at school:

*"Afterwards, for the pupils, obviously there are some who have theoretical knowledge but who don't have the link with nature. And I think that despite everything, questions like the relationship to the tree and all that, it opens their minds to what the relationship to nature is, that's it. Things that they don't necessarily have. So it doesn't necessarily lead them to scientific knowledge, but maybe that's not the main thing. It's the fact that nature can create emotions"* (Teacher, secondary school).

We do not have data on the appropriation of these issues by high school teachers during the year 2021-2022. But taking into account the results obtained and the testimonies, it seems obvious to us that this type of sensitive activity can contribute a lot to the pedagogical framework of nature education from a very young age.

### **5.2.8 Affective representations around the species observed with VNE protocols**

Three different sensitive activities were proposed in primary schools classes, during the animations carried out by Mara Sierra-Jimenez and a master student. We propose here an illustration of one of them, based on the *earthworm* observatory.



Students were shown photos of the four earthworm species studied in the earthworm plot scientific protocol (Figure 14) and were asked to note in their VNE notebook which earthworm species they liked best and least, and why.



Figure 14. Sensitive animation about earthworms in a primary school in 2021.

The discussions that followed this activity allowed the students to become aware of the transformation of their own relationship with earthworms between the first and the last protocol carried out.

*"At first I was afraid of the earthworm and I didn't want to touch it because it was slimy and I found it a bit ... not very pleasant. But now I hold them in my hand and I am not afraid of them anymore. They are nice"* (Girl, 8 years old)

*"Yes, I think I've improved a bit with the earthworms. In the first protocol I was a bit afraid, but to hurt them, I didn't know how to pick them up and get them out of the ground. Now I know how to do it and I pay more attention to them"* (Boy, 7 years old)

To the question, what do you like most and least about earthworms:

*"There are things that I like about earthworms and things that I don't like so much. For example, what I like is that earthworms are soft, sometimes they're gentle, it's not because they're slimy that they can bother me, and what's more, they're gentle and don't bite. And what I don't like is that they are really a little bit, sometimes, slimy, but they are also not very pretty, sometimes, and I especially don't like the endogenic, because the endogenic, sometimes, they are green.* (Girl, 7 years old).

*"I really like the red-headed anecic and the epigenic because the colour is very pretty, I like the red colour. And I don't like the endogenic as much because the colour is ugly"* (Boy, 7 years old)

The sensation with the touch (soft, squishy, slimy) and the aesthetics (colour) of the earthworm are very present in the pupils' answers to qualify their representations, positive or negative, towards the animal.

To the question "If you could, what question would you like to ask earthworms?":

*"I would ask them where they meet each other. Because they are not at the same level of the earth, I would like to know where they see each other and what they talk about"* (Girl, 8 years old).

This sensitive activity allows students to take an interest in the animal by creating a close relationship with it. It is also an exercise in reflexivity for the pupils, allowing them to ask themselves questions about their representations of and relationships to the animal studied, and then to become aware of

what has improved in their own relationship with earthworms during the school year. Sensitive questions such as *"What question would you like to ask the earthworms?"* also allowed the teacher to propose a pedagogical framework around the imaginations of possible interactions with living beings. This type of activity favours a change of attitude and interest in the pupil thanks to the proximity effect that this formulation proposes.

### 5.3 Research question 1: How do teachers and students appropriate the tools proposed by the Vigie-Nature Ecole citizen-science programme?

Only three of the 23 teachers interviewed in 2021 stated that they had received the call for applications from their school management team. The others stated that they had received the information by chance or through a contact (colleague, town hall official, parent or member of an association). Some participants regretted not having had access to this information through their superiors: *"What we regretted was that our superiors were not the ones who sent us the project, who told us about it, in fact... It's a bit of a shame that in terms of projects like this, the national education institution is not more involved"* (Teacher, kindergarten school).

#### 5.3.1 Initial motivations to participate

The analysis of the interviews reveals five types of initial motivation for teachers to participate in the REGREEN project (see Table 7). They are presented here in decreasing order of importance (in terms of the number of people identifying with the same motivation):

**Motivation 1: To feed and enrich a novel class or school project:** almost half of the teachers interviewed stated that they made a direct link between the theme underlying their class or school project (ecology, development, sustainability, nature club, vegetable garden) and the possibilities of REGREEN to improve it, particularly in terms of biodiversity. The VNE observatories are seen as possible new activities to be carried out with the students within the framework of the existing project, which can also provide new knowledge about the biodiversity of their school.

**Motivation 2: To revitalise or bring to life an old project:** for some teachers, REGREEN was an opportunity to revive a dormant project (waste, recycling, vegetable garden, eco-school label, biodiversity), or even to enrich it around biodiversity. Some teachers also wanted to use a European project as a label to apply for grants for their school or class project.

**Motivation 3: Taking advantage of the opportunity and the right timing of the project:** several teachers said that they "jumped at the opportunity" of a "very interesting" project for their students, which corresponded to the pedagogical dynamics they had already started with them. Moreover, among these teachers, some only used the observation part of VNE and did not enter the data in the website:

*"The aim was to raise children's awareness of pollinators and insects in general, and the spipoll protocol fitted in perfectly with our class project, which is how we tried to participate... But we stopped our participation because we couldn't adapt the protocol for the children. So we decided to continue the awareness-raising work on our side with the insects using the protocol, but not for the science project"* (Primary school).

The VNE observatories are considered here as tools to help observe and raise awareness among students, not as tools for collecting scientific data.

**Motivation 4: Pedagogical interest of the project and of the observation protocols:** some teachers wanted to have tools to accompany the pupils in their learning:

*"I found the dimension of pedagogical support [with the protocols] particularly interesting; to work more with the pupils on knowledge, so that it is not just superficial actions such as sorting and recycling [...]"* (middle school).

Many of them expected teachers and students to be accompanied by MNHN scientists:

*"The aim of participating was to have a partner to be more solid on the biodiversity aspect of the eco-school because we didn't really know how to go about it". "I said to myself, this is great! There are researchers from the museum who are going to come and talk to the pupils about biodiversity, they are going to learn a lot of interesting things, it's great!" (high school)*

Generally speaking, the MNHN was perceived by most teachers as a privileged partner, which was rewarding for the schools.

**Motivation 5: Interest in the scientific method:** Only three teachers mentioned this motivation, for three reasons: the first is a strict and structuring scientific framework in the observation process, consistent with the teaching mode developed by this kindergarten school teacher; the second is linked to the process of questioning and scientific thinking, which is in line with the pedagogical objectives of certain disciplines such as biology sciences; the third is the reproducibility and comparability of the scientific protocol, as well as the associated possibilities of being able to evaluate the effects of possible transformations of space.

Table 7. Initial motivations declared by teachers in 2021

| Institution level                            | Declared categories of motivation  |
|--|--|
| <b>Kindergartens (2)<br/>3 respondents</b>   | <ul style="list-style-type: none"> <li>• Pedagogical interest in the project and protocols (3)</li> <li>• Interest in the scientific method (1)</li> <li>• Nurturing and energising the new class or institution (1)</li> <li>• Taking advantage of the opportunity - good timing (1)</li> </ul>   |
| <b>Primary Schools (3)<br/>8 respondents</b> | <ul style="list-style-type: none"> <li>• Revive or revive an old project (5)</li> <li>• Taking advantage of the opportunity - good timing (4)</li> <li>• Nurturing and energising the new class or school (3)</li> <li>• Pedagogical interest in the project and the protocols (1)</li> <li>• Interest in the scientific method (1)</li> </ul> |
| <b>Colleges (4)<br/>6 respondents</b>        | <ul style="list-style-type: none"> <li>• Taking advantage of the opportunity - good timing (5)</li> <li>• Nurturing and energising the new class or school (5)</li> <li>• Pedagogical interest in the project and protocols (5)</li> <li>• Reviving or reviving an old project (4)</li> <li>• Interest in the scientific method (2)</li> </ul> |
| <b>High schools (6)<br/>6 respondents</b>    | <ul style="list-style-type: none"> <li>• Nurturing and energising the new class or school (5)</li> <li>• Taking advantage of the opportunity - good timing (4)</li> <li>• Pedagogical interest in the project and protocols (3)</li> </ul>   |

In their diversity, the teachers' motivations for starting the project are linked to their own educational objectives (class or school). Interest in citizen- science, particularly in the collection and transmission of biodiversity data, was not declared as a central motivation for the teachers at the start of the project, even though interest in the scientific method was emphasised as being very structuring and interesting.

### 5.3.2 Strategies for implementing the project in schools

The analysis of the interviews revealed four main types of strategies for implementing the project.

**Creating alliances in the school:** The call for participation required that projects be led by at least two teachers. In general, the middle and high schools complied with this request, with the formation of a pair of teachers between a biology science teacher and a teacher of another discipline (language, history-geography). In 1 middle school and 1 high school, the pairing was composed of a biology teacher and a member of the staff, for example a librarian. In the 3 primary schools and the 2 kindergarten schools, the pairs were composed of teachers who were aware of nature and sustainable development, but had no training or only occasional knowledge of biodiversity. Whatever their composition, these alliances had an effect on the working methods of the people involved:

- They encouraged working in teams (between 3 and 5 people) and with other disciplines. Working in groups can allow for better time management and convivial moments:

*"There are three of us, a science and technology teacher, a history and geography teacher and me, a German and French teacher... When there are three of us, it's the most fun because for us too, it's important to have fun together, to exchange. And we can manage multiple activities better" (high school).*

This may also allow for better synchronisation between the participating classes and the setting up of observatories:

*"With my colleagues, I will take the protocol on earthworms for example, with my other colleagues who also do it, there are several of us doing it in the school, even colleagues from the elementary school, so the earthworm plots we installed together for example" (kindergarten school).*

For some teachers, the creation of alliances is built over time and according to the possibilities:

*"... at the beginning, what we had imagined was to work with the art teacher as well (...) But for the moment... There, the question has not been asked again. Maybe next year" (middle school).*

For others, the configuration of classes does not facilitate exchanges and work between different levels:

*"What we did last year was that my pupils came for a session on birds. Well, afterwards it was the idea that he would come with his pupils to attend a session on plants, but that was not possible... So unfortunately, the interclass, the exchanges are complicated" (primary school).*

- They have sometimes made it possible to integrate members of staff or parents, by enhancing their knowledge or know-how, and sometimes by promoting new modes of internal collaboration and cross-ownership of the REGREEN project. In one school, for example, *"the school manager is very interested in biodiversity issues, so she is basically our contact person whenever we need to identify a plant, we go and see her"*. In other schools, the technical staff sometimes provided technical assistance for the creation and maintenance of the facilities set up:

*"The caretaker is very involved because we make the observations in front of her lodge and she is very interested in the birds. She will help us to fill the feeder or to do things like that" (primary school);*

*"[The person in charge of the DIY workshop] has been involved in all the projects for the last 5-6 years, he is a real partner in everything we do" (middle school);*

*"The technical department... they are very motivated guys! And so the other time they said to me, "Is that OK with you? We can do this, we can do that". So there is a partnership between us" (kindergarten school, elementary school).*

The creation of alliances between the REGREEN project teachers and different staff profiles was reported by half of the teachers as a way to enrich the project and the life of the school.

The integration of parents has been encouraged in some schools: *"We are in a very working-class neighbourhood, so our project is a neighbourhood project. We set out to do two workshops so that parents could see how a protocol is set up, to raise their awareness and then go to the site and see that anyone can do science with their child, and this is something very accessible and very rich" (Kindergarten school).* However, the Covid crisis limited the participation of parents at the beginning of the project because of the sanitary restrictions.

*- Finally, they encouraged collaboration between classes: in one primary school, for example, the team of six teachers decided to mix an "ordinary" class and a ULIS class<sup>20</sup>: "We organise things together, so it's also a question of working with colleagues. And that's not bad, really. In addition, by working with a ULIS class for the pupils, I think it's great too. That my pupils are mixed with ULIS pupils... You see, in the mutual aid, in the collaboration, it's very important (...) Normally we should do it but it's very complicated (...) So there, with REGREEN, it's done and it's quite simple in fact. And it's very beneficial both for the ULIS class and for my class".*

**Creation of partnerships outside the school:** Existing partnerships can be mobilised to support these new biodiversity-related projects, but new partnerships can be created to enrich the project, create links between the school and local stakeholders, benefit from close support from experts, or simply be reassured by a naturalist expert. In most cases, these new partners belong to sustainable development structures, naturalist associations, natural spaces or local associations for the protection of fauna and flora:

*"We preferred to choose a local association, an association which looks after a nature reserve. They really know the immediate environment of the school locally to set up something, which can in fact be quite sustainable in the future, which allowed us to include a local partner, in the end, in the reflection on the facilities to be set up... So the person who came is a biologist, an ecologist" (High school).*

Only one partnership has been established with the MNHN: *"Here, it is clearly REGREEN, it is Florence from the Museum, who is coming to help us with the wild plant protocol and also to think about the tree species that can be put in the school yard" (middle school).* The objective of this partnership is to prepare the rewilding of the courtyard following the assessment carried out by a member of the museum.

Other partnerships have also been set up with public actors, here from a local authority:

*"There is something to do with plant biodiversity to plant wild flowers on a plot where there is nothing. And we would like to feed it with compost, so we are in contact with the department to get this compost" (middle school).*

Two partnerships have been set up around artistic projects: an artist in a primary school: *"In relation to the mosaic, the idea was to have an artistic component if you like to consolidate, to approach nature differently and to leave a trace. I had already worked with Anne a long time ago in a middle school to make a mosaic on the theme of a nature park, and I really like the way she relates to children, the way she listens to them and makes room for them";* in a high school, a teacher took advantage of an

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<sup>20</sup> In France, ULIS are special classes for the education of pupils with disabilities. These are pupils who need adapted teaching in specific groupings.



international partnership to work on an art project about birds: *"For the REGREEN project, we created an art exhibition around the birds we could observe in each city, us with the bird protocols and them too, but I think they adapted it"* (High school).

Sometimes, however, no partnership is entered into, often due to lack of time:

*"At the association level, for a very long time, we would like to work with a local association that would agree to help us create a vegetable garden. But we haven't taken the step, we don't have the time. The will is there, but I can't do it any more... I'm too overwhelmed"*. (High school).

For others, the health crisis has limited the search for new partners

*"This year, it was so complicated, honestly, that we limited ourselves to what was planned and did not go looking for additional partnerships"* (middle school).

**Identification of the working format:** In general, two working formats were favoured to integrate REGREEN in schools: the whole class and the 'club' or 'workshop' format, with voluntary pupils.

Whole-class format was especially adopted in primary schools, where the children's curiosity and the possibility of working with the same teacher throughout the year favoured the implementation of the activities requested: *"For us, it's much easier than for our colleagues in middle and high school, because we work with the same class all the time. They are curious, they like that, observing, touching things, as soon as you propose something new, they are up for it"* (primary school). The whole-class format was also tested in high school, in connection with the educational possibilities of integrating scientific protocols for studying biodiversity into the compulsory curricula: *"I'm going to try to include a little more citizen-science in my curricula, which I didn't do before... for example, when we study the soil and the importance of earthworms. Now that I'm doing it in citizen-science, I realise a bit more what I can do in the classroom and how I can include it in the curriculum"* (High school). However, working with a whole class has not always been easy for these grades, *"the students are not [always] willing to participate in the project"*.

Thematic clubs or workshops (nature, ecology, sustainable development, garden, eco-delegates) were favoured in middle schools and in four high schools. This format enabled some teachers who were committed to the environment but whose teaching disciplines were not concerned with biodiversity to become involved in the approach. The testimony of this teacher clearly explains the creation of the nature club as a means of operation and an institutional strategy for working on nature: *"I am a German teacher, so I am not a biology teacher. I've been interested in the environment for 20 years, but I've never been able to get into the swing of things (...) That's why I had to go through a club because I couldn't offer the activities I wanted to do to a class, since they have German with me, I'm not allowed to do that"* (high school).

The 'club' or 'workshop' format engages volunteer students of all levels, often interested in environmental issues, but not always. As the testimony of this secondary school teacher indicates, the motivations of volunteer pupils can be very diverse: *"[this pupil] told me that she actually 'didn't like nature'. I was surprised that she came to this workshop, she explained that it was the only place where she could express herself because there were too many of them in the classroom (...) The other pupils confirmed this view, only two of them felt really concerned by ecological issues. This seems to me to be an interesting way of addressing the question of the audience we can potentially reach with these workshops, I thought that by doing it on a voluntary basis we would only have students who were already aware, whereas this was clearly not the majority in reality. The more intimate setting of the workshop is therefore to be considered in itself as a lever for raising awareness even before addressing the details of its content"* (middle school). For these pupils, this format provides access to a "transitional space" between two ages, with close support and listening.

However, two limitations of this working format were noted: the unpredictable fluctuations in the number of participants at each session (linked to volunteering), and the time given to these clubs by the school management (often one hour during the lunch break).

**Communication:** The interviews indicated the implementation of five different ways of communicating about the project:

- by a steering committee, e.g. composed of representatives of the management, teachers and pupils, eco-delegates and the teachers responsible for the project. However, very few schools have set up a steering committee for the REGREEN project. The reasons cited are multiple: difficulties in meeting due to the health crisis, lack of time, lack of motivation and support from colleagues or the school, etc. Some teachers have also joined the steering committee. Some teachers have also included the REGREEN project on the agenda of existing steering committees.

- through the use of networks such as WhatsApp and Instagram, often developed by the pupils themselves. The teacher then communicates with a relay student, who passes on information to the group.

- by communication campaigns from the pupils of the clubs or the eco-delegates to the other pupils and adults of the school. The development of communication tools around the observation and management areas soon became necessary to complete the project, limiting interventions on the lawns, snail beds, feeders or nesting boxes. These communications are aimed at the town or school maintenance staff, the school staff and the classes that were not involved in the project. Without communication, tensions often arise about the mowing of lawns by municipal maintenance workers (*"Every time we start to let the lawn grow they come and cut everything, they move the boards, everything is cut flush with the ground, it's painful"* – Kindergarten school); with non-participating pupils (*"the 6eme classes who did the project last year are not participating this year because it's only open to the 6eme grade... and so they were always moving the boards, taking down the posters etc... and in fact we realised that they were jealous because they could no longer take part in the project and that's why they were destroying everything... Now we've explained it to them, they've understood and next year we're going to try to include the 5eme grades"* (middle school).

- a blog maintained by pupils and teachers, for the use of parents, but also for the animation of the project during periods of confinement.

- through the work of the librarians, for all students in the school.

### 5.3.3 Appropriation of VNE tools

The teachers participating in the project had at their disposal a set of accompanying tools for biodiversity observations (see above). The interviews describe the ease and difficulty of using these tools.

**Appropriation of e-learning sessions:** Only four of the 22 teachers interviewed said that they had participated in online training. These four teachers unanimously noted the interesting and necessary nature of the training:

*"It was very good in fact, they presented the site to us, and it was very good frankly, to see how it worked. And I thought it was interesting and necessary"* (primary school); *"At the beginning of the year we did on... on a snail protocol... it was super interesting. Compared to what we can have as training, it was great"* (kindergarten school).

Some of the teachers who did not attend these courses regretted a lack of information about their existence, partly due to a lack of internal communication among teachers. Others lacked time or had other priorities.

Others do not feel concerned because they already have naturalist knowledge, think that the protocols are already very well explained on the site, or even prefer to learn with their pupils. But for many, the theoretical online training sessions are sometimes too far away from the times when they carry out these observations with their students, times when they do not find answers to their practical questions (sometimes intimidated by the MNHN institution, several teachers testified that they had never contacted VNE on their own initiative, even though they were invited to do so). A certain discrepancy is felt between the assumption of teacher autonomy on the part of the MNHN team and the lived reality of certain novice teachers who do not dare to make contact.

And indeed, many teachers prefer face-to-face training. In the opinion of several people, face-to-face training that includes the implementation and experimentation of several observation protocols would reassure and motivate teachers, especially those who have no scientific knowledge. The VNE team at MNHN offers very little face-to-face training in schools, due to a lack of trainer resources.

During the REGREEN project, five training sessions were held in a middle school (2 sessions for the *lichen* protocol, in 2020 and 2021) and in a primary school (3 sessions for the *garden bird watch* protocol). The aim was to discover biodiversity and citizen-science, to learn how to use the species identification key, and to practise recognition using images, quizzes or samples (for lichens). There was also time for discussion, allowing students to ask questions. In the first case, the trainer stayed to carry out the observation protocol and to give a report at the end of the session in class. Other questions could then be asked. The feedback on these training sessions was very positive, on several points: the motivation of the pupils; the contribution of naturalist knowledge; the empowerment of the pupils with regard to data collection: *"When they see the people from the museum and we explain to them what they are going to use the data they are going to collect, well, immediately there is more interest, they find a meaning in what they are being asked to do... we can tell them, but it's not the same"* (middle school). A student: *"For me, it would be important for a researcher to present the project because that would immediately make it much more lively and it would anchor it more in research. Here, there is someone who is a specialist, who comes to see us and tells us that this is it. So it shows that it's something serious to take into account"* (Girl, high school, 17 years old).

**Appropriation of the VNE website:** Fifteen of the 22 teachers interviewed said they had visited the VNE website. More than half of them had only visited it to download the participation booklet. However, the interviews and field observations give some indication of how the site was appropriated:

- Presentation of protocols? The videos that present the protocols are appreciated for their clarity and simplicity, and are the central tool for reaching students. Moreover, in the field, teachers focus on the short videos presenting the protocols, without detailing the broader citizen-science project in which the students participate by collecting and sending data. In fact, the notions of citizen-science and scientific protocol were not understood by most of the students we met.

- Scientific support for pupils? Several teachers stated that they had asked their students to carry out observation protocols independently (alone or in groups) using the resources on the VNE website, without always accompanying them. This potential transfer of responsibility to the VNE website was never conclusive.

- Scientific support for teachers? The teachers who used the website to prepare and carry out the protocols all acknowledged the quality of the resources and the site: the clarity of the presentations, the information given, the quality of the determination keys, the pedagogical proposals, etc. The quality of the site favours its appropriation and encourages the teachers to develop new pedagogical practices to carry out the observation protocols. The quality of the site favours its appropriation and encourages teachers to develop new pedagogical practices to carry out observation protocols.

- Self-training for teachers? Only one teacher has used the site to train himself in new biodiversity observation protocols.

- Training students in species recognition? The quizzes on the VNE website have often been used in class or in clubs: *"We practice with the recognition quizzes. I leave a time... we work in teams, I make it like a competition between groups, so that when we are really outside, we are a little more reactive"* (middle school). However, several primary and kindergarten school teachers regretted that the tools on the VNE website were not adapted to the young age of their pupils, and often went looking for alternative resources.

- More in-depth content? The VNE site has many resources that are not used by teachers: newsletters, training videos, results reports, scientific information on species, etc. Perhaps due to a lack of encouragement from the VNE team at MNHN, teachers seem to use the site only at specific times and for specific reasons, and do not browse the site for new information.

- Focus on data entry. In addition to providing resources, the VNE website also provides an interface for entering and sending observation data to MNHN scientists. On this point, several teachers found the data entry platform very complex and stated that they had difficulties with data entry. Faced with a data entry platform that is much more complex than most of the current sites, a large proportion of teachers are discouraged and do not enter the observation data.

**Appropriation of the participation booklet and scientific protocols:** The perceived ease or difficulty of VNE observation protocols seems to be related to the teachers' motivations, the space available to carry them out, and the time devoted to the observation activity.

- Because of the spatial organisation of French schools, observation areas within the school are often very limited and sometimes very restricted in access (see Part 2). The small size of the green spaces in schools and the limited biodiversity present led some teachers to carry out observations during outings outside the schools. These were the city's urban parks (Figure 15), or when possible, more wooded areas such as the Bois de Vincennes or the Bois de Clamart. These urban public parks offered a more suitable context for observation, but, as a place of passage, they presented constraints in terms of noise and distraction, which conditioned the teachers' choice of place, time and conduct of the activity.



Figure 15. Garden Bird Watch Observatory in a public park of the city of Clamart (2021)

- The observation process proposed by the VNE protocols includes several stages: 1) a preparation phase: presentation of the activity, the steps of the protocol, reminder of the determination key and explanation of the scientific stakes; 2) observation and data collection in the field, where the students are in direct contact with the species studied; 3) a conclusion and an assessment of the observation practice, with the sharing and pooling of observations, the experience and the resulting ideas; 4) the inputting and sending of the collected data on the VNE platform by the teachers and/or the pupils, to participate in the scientific research conducted by the MNHN.

The first three stages were always carried out in kindergarten and primary schools, where the teacher always worked with the same class. In clubs or high school classes, the assessment stage (stage 3) was generally absent, and the presentation (stage 1) was carried out in a very variable way, depending on the teachers' constraints. The methods used to carry out the observation (step 2) varied according to the specificities of each observation protocol (time of year, duration, tools, observation location and distance, species monitored, etc.) and contextual factors (green spaces inside or outside the school, number of volunteers, etc.). But the implementation of the observation depends on the choices made by the teacher, which depend on his or her motivations, naturalist knowledge, management of the group, difficulties encountered on the day of the session, the teacher's character and emotional state, etc. In the field, the observation process is therefore fluid, uncertain and heterogeneous, not fixed and determined as recommended by the VNE programme. Despite the difficulties encountered by some novice teachers in identifying and entering data on the VNE platform (step 4), 210 observation data were entered, by 13 schools (3 middle schools, 6 high schools, 3 primary schools and 1 kindergarten school), which seems to represent only one third of the total data collected. The difficulties expressed by the teachers in entering the data included difficulties in getting the participants to use the data entry platform and time constraints.

## 5.4 Research Question 2: What are the effects of implementing the Vigie-Nature School citizen-science programme in schools?

Several responses have already been highlighted in the previous section in detail. In this section, we come back to the most visible and relevant effects identified in all the schools. It should be remembered, however, that these effects are heterogeneous and vary according to a number of important criteria: the specific features of each school, the context of participation for the pupils (whole class, nature club, extracurricular activity), the motivations of the teachers and the intensity of investment of each class and pupil in the project. It is therefore trends and not assertions that we wish to propose here.

The effects identified in this report correspond to three main dimensions: 1) the environmental dimension, 2) the educational dimension and 3) the social dimension. Within these three dimensions, VNE can have effects on one or more of the three dimensions of education proposed by Franc et al. (2013): cognitive, affective or behavioural. We propose a three-level intensity scale based on observations and interviews conducted in the field:

**Weak:** less than half of the schools and teachers adhere to the change, they are not very responsive to the transformations that emerge and do not appropriate the VNE tools or other proposed protocols.

**Medium:** Half of the schools and teachers adhere to the change, they are rather reactive to the transformations that emerge and show an interest in appropriating VNE tools or other proposed protocols.

**Strong:** More than half or all of the schools and teachers are committed to the change, are responsive and supportive of the emerging transformations with their actions, and show great interest in appropriating VNE tools or other proposed protocols.

### 5.4.1 Environmental and partnership dimension

In the context of the educational institutions studied in Paris-region, the environmental dimension was studied according to two concepts: **the environment**, understood as '*the set of biophysical and social realities external to a (social) system conditioning its existence and interacting with it*' (Lussau and Levy 2003: 342); **governance**, defined here as '*the set of processes, actors and institutions involved in the political management of a society*' (ibid: 457), and in our case, of an educational institution.

Participation in the European REGREEN project and the implementation of the Vigie-Nature Ecole citizen-science programme has strengthened and promoted various types of inter- and extra-



curricular relationships and partnerships between environmental stakeholders in most schools. It has also led to transformations of the physical space (green spaces) of schools by these actors, notably through developments.

#### 5.4.1.1. Collaboration within the institution

**Low: Development of interdisciplinary partnerships within schools.** In four schools (middle and high schools), some teachers from different disciplines worked together on the REGREEN project from the beginning of the project: *"There are three of us, a biology teacher, a history-geography teacher and me, a German and French teacher"* (high school); for others, the integration of new teachers started during the second year of the project: *"We started the work, me, the librarian, and my biology colleague; then we managed to work with the English teacher during the second year of REGREEN"* (middle school). For the other schools, several attempts at integration were made, but without success (scheduling problems or lack of interest). In all cases, interdisciplinary work remains to be developed: the teachers collaborate in carrying out the protocols, but there is no appropriation of the project or of the biodiversity theme within the discipline (e.g. learning about biodiversity in English, German, or working on biodiversity in geography, literature, etc.).

**Medium: integration of school staff in the project.** The REGREEN project promoted the participation of new actors in educational activities: half of the schools directly and indirectly integrated different school staff (manager, secretary, caretaker, maintenance staff) in the implementation of protocols, the setting up of natural infrastructures or the preparation of materials or identification tasks. School headmasters accept and support teachers in their actions, but we did not observe any active participation in activities.

#### 5.4.1.2. Collaborations outside the institution

**Strong: development and strengthening of partnerships with local actors in the city.** Almost all the schools have strengthened or created collaborations with external actors, in particular because of the need for concrete support in the field to carry out the VNE protocols. These are mainly environmental education associations or the city's nature coordinator:

*"We work with an ecologist who works in an association that looks after a nature reserve... she helps us with the garden bird watch protocol... this enabled us to include a local partner, in the end, in the reflection on the natural infrastructures to implement"* (high school).

*"We have been working for some time with the nature coordinator of the city of Argenteuil who is there for all the issues related to nature. Each middle school tried to apply to the nature workshops in relation to the protocol they had to follow, except perhaps for bats, because they told us that they had no knowledge"* (Primary school).

Other types of collaboration exist, such as with actors from the Department and the municipality. However, these remain marginal and correspond to financial or administrative requests for ambitious projects that preceded REGREEN:

*"We have started to create links with the region to be able to finance the courtyard renovation project, which has made absolutely no progress, so I am going to contact the person in charge of finances again to find out what is going on"* (high school).

**Weak: integration of parents.** Only one school (a primary school) involved parents in the work carried out during REGREEN, through the creation of a mosaic with an artist:

*"I find this project magnificent and it allows us, the parents, to share with the teachers and the children everything they have done during the year around nature, and so it is really beautiful...we lived the protocol through the children, every time they came back, they told us about their observations"* (Mother).

Other kindergarten and primary schools have tried to link up, but they were soon stopped because of Covid-19. But in some cases, work with parents will be able to develop in the coming years:

*"We have decided to hold two workshops in the coming years so that parents can see how a protocol is set up, to raise their awareness, and so that they can go to the site and see that everyone can do science with their child and that it is very affordable and very rich" (Kindergarten school).*

In middle and high schools, no work has been done with parents.

#### **5.4.1.3. International collaborations**

**Weak: international collaborations.** Only one teacher (biology) has strengthened a partnership with a German high school thanks to the REGREEN project. The French teacher proposed to the German teacher to work on the birds observed in their schools and to carry out a French-German art project:

*"For the REGREEN project, we created an art exhibition around the birds we could observe in each city, us with the bird protocols and them too, but I think they adapted it" (High school).*

**However, all these effects are sometimes fragile and dependent on contextual changes:**

- The health crisis and its lockdown affected the development and going-on of some interdisciplinary partnerships between teachers, the smooth running of observation sessions with pupils, the integration of parents into school activities and the close collaboration with external actors within the school.
- The management of the institutional temporality and the time devoted to extracurricular activities (club and nature workshop) had important impacts on the level of commitment of the young people and the teachers in the project, the training of the determination key or the good progress of the VNE observation protocols; the needed standardisation of the observation conditions is not always in adequacy with the time and the realities perceived by the teachers in the school context
- The voluntary nature of the nature clubs and workshops does not encourage the structuring of projects by the same pupils in the long term, as the composition of the groups may vary from one session to another.
- Health, time and administrative constraints affect the teachers' motivation and commitment in carrying out long-term observation protocols. Some of them find it difficult and tiring to repeat the protocols every year. Others continue to carry them out but in a more detached way with respect to the scientific criteria to be respected (steps, temporality, identification, data sending).
- The status of eco-delegate remains abstract for students and is not well promoted in schools. Eco-delegates who wish to get involved in ecological projects do not have dedicated time. This lack of institutional recognition strongly limits the appropriation and development of projects by young eco-delegates within their school.

#### **5.4.2 Pedagogical dimension**

With the exception of two people, none of the teachers participating in REGREEN had ever carried out the scientific protocols for observing biodiversity proposed by VNE. Moreover, fifteen of the 23 teachers interviewed do not teach biology and have very limited knowledge of biodiversity.

The interviews with the teachers were conducted mainly at the end of the first year of the REGREEN project. The results presented here are therefore partial and only represent the impressions of beginning teachers after only one year of practice. Nevertheless, they allow us to suggest some avenues of reflection to be explored in greater depth in the future.

#### 5.4.2.1. Effects on teachers' teaching practices

**Strong: structuring a formal framework for nature observation.** Teachers agree on the positive effects of carrying out scientific protocols on their way of working with pupils. The first point concerns the standardised time devoted to observation:

*"For the birds, if we had just said to them: "Let's go to the yard and look at the birds", I think it wouldn't have given the same result. The fact that there is a protocol and that there are 15 minutes and that we have the watch and that during these 15 minutes, we know that we can't really talk, so there is no negotiation with a scientific protocol. It allows us to give a common framework and I think it's interesting from that point of view" (middle school).*

The second point concerns the demand for students' prolonged attention, for a given time, to observe:

*"I don't think they're used to taking time to observe, no, that's for sure. I sit for fifteen minutes and wait to see if a bird comes and lands in front of me. No, they never land for fifteen minutes like that. This was an opportunity to see that something was happening around me. Because in the end, this time is imposed on them: "You have fifteen minutes and during this fifteen minutes, you'll have to pay attention". And then they realise that there are indeed things going on" (high school).*

Finally, carrying out the scientific protocol is an opportunity to develop reflection and curiosity in the students:

*"You have to build bridges between the different things you see. If you were doing observation for observation's sake, there's no point. If they've seen but don't get anything more out of it... But if you get them to think that well... seeing a bird is interesting, but asking questions about what you see is even more interesting, then you've won everything, I think. Make them curious ... I don't worry about the future of a child who is curious" (Kindergarten school)*

**Medium: setting up educational activities to complement VNE observations.** Participating in VNE has enabled some teachers to develop nature-related educational activities: watching films or animal documentaries, reading stories, drawing, writing and vocabulary work, art projects, creating blogs on the Internet, etc.

This also encouraged some specific activities to discover the species observed:

*"We set up a vivarium with snails to see how they live and what they eat. At least to make them aware, not to be afraid to handle them, etc." (kindergarten school)*

*"We drew the earthworms, then we made them out of clay, then we have the worm composting tool to go and observe them" (Boy, 7 years old, primary school)*

*"We found many butterflies in the school, including the red admiral and the Pieris. And we had the challenge of drawing them, so that we could make the mosaic, so that it would always remain, that there were these butterflies in the school. We also brought cocoons, chrysalises and caterpillars back to school" (Girl, 10 years old, primary school).*

In secondary schools, we can mention: 1) the creation of a comic strip following the nature workshop on snails in a secondary school; 2) an attempt to create a blog mixing a photo of the species observed with an account of the observation experience; 3) the creation of collaborative blogs during the containment to advance the management of the project and 4) the creation of workshops for the construction of nest boxes, bird feeders and plant containers.

**Low: development of educational tools to identify species.** A primary school teacher created a game to facilitate the identification of observed species (snails and birds):

*"I made a game of "Who is this? You slip your pictures in. I used the little pictures from Vigie-nature School, of birds. So in fact, they play "Who is this? with birds. That's something they're still learning about and they love it. As soon as it's free, they jump on it. I've made some sort of vocabulary cards too, on the vocabulary of birds, the parts of the body of birds, the specificities. All the vocabulary we're going to use in the context of bird recognition, but also food, habitat" (Figure 16).*



Figure 16. The "What-Is-It" game created by a primary school teacher as part of Vigie-Nature Ecole for the implementation of the "garden birds" protocol (2020)

In other schools (mainly kindergarten and primary schools), teachers have used new technologies (video, large interactive screens) to amplify the experience of observing snails, earthworms and insects. This large-scale observation experience feeds the children's interest and fosters a more proxemic relationship with it.

**Low: change in teachers' professional practices.** For some teachers, carrying out the observation protocols led to the following reflections:

- a reflection on their pedagogical practices in biology sciences on enrichment through citizen-science:

*"I'm going to try to include a bit more citizen-science in my curriculum, which I wasn't doing... include at least one protocol in the second or first year. Now that I'm doing citizen-science, I realise a bit more what I can do in the classroom and how I can include it in the curriculum" (high school, biology teacher).*

- a reflection on the ways of working in their discipline:

*"It changed my professional practices...it made me want to tackle these issues more in my subjects, especially in geography. When we have to deal with issues of nature protection, perhaps we should deal with the protection of this relationship in relation to the actors... That's it. I tell myself that we can tackle this type of question" (middle school, geography teacher).*

- confirmation of the importance of awakening curiosity and a relationship with nature in students:

*"It simply reinforces my view that the concrete aspect and the relationship with the environment - with biodiversity in particular - is absolutely fundamental in the curiosity that people can develop; I have been able to integrate it into my biology lessons. The concrete aspect that will develop curiosity" (High school, Biology teacher)*

- reflection on new ideas and projects to be integrated into teaching practice:

*"The fact that environmental and nature awareness is included in the curricula makes me feel better because we can see how the children are developing. And as a result, it gives us more ideas for projects. Because if it hadn't been for that, I wouldn't have had the idea, as a teacher, of counting earthworms. We would have observed them eventually, we would have talked about it, but we wouldn't have gone so far as to count them and so on. And now I'll do it, even outside REGREEN, I'll do it" (kindergarten school, teacher)*

Apart from these few examples, most teachers do not feel that they have changed their teaching practices. However, even for these teachers, having participated in a citizen-science project has changed some things at the margin:

- The project adds value to existing practices:

*"I can't say that it's the project that made us change our way of working, the project brings something extra. My class functioning is really oriented on everything we observe around us. It really happened in a very natural way. The plus, I would say, compared to my usual classroom practice, is that it has a structuring effect" (Teacher, Kindergarten School)*

- The project allows for educational development:

*"I think that we come to citizen-science if we already have a mindset that is to look for a very clean and square framework to observe, to experiment, a desire to seek partners, because it is always better with several people; in this case, REGREEN enriches.... I don't think that teaching practice has changed, but I think that with you it finds the right framework to flourish" (Teacher, Primary School)*

- The project makes it possible to become aware of the contribution of citizen-science for pupils, but without necessarily perceiving the scientific dimension:

*"Let's just say that the citizen-science aspect, I am increasingly aware of what it can bring and how important it is, yes. Now, the contribution of Vigie-nature and the protocols with the students, I have the impression that I am more involved in raising awareness than in a real scientific project" (high school, teacher)*

- The project allows the school's pedagogical practices to be nourished:

*"In fact, we often work on projects, so I was used to that. After that, it's not necessarily in science and even less so in birds. So we are used to working on projects. If we do it, we try to do something in science and we also try to do it in visual arts and reading. The protocols allow us to feed our work and the approach we are already developing" (Primary school, teacher)*

**Medium: appropriation of the VNE protocols in the personal setting.** For a handful of teachers, it is interesting to note that the effects of the citizen-science programme in the pedagogical and professional context are transposed to their personal context.

*"Personally, yes, it changed a lot for me. Because I knew the protocols, I knew they existed, but personally, I had never been involved in them. And now, at home, with my children, we look at birds. I show them two or three, because they are small, but identifying birds, when you hear a bird ... personally, these are things that I didn't do before and that make me want to do it. I think that the earthworm protocol, I will do it with my children because it is interesting to show them that there is life under the ground. It's something I didn't necessarily think about before and I think I'm going to do it" (Teacher, high school).*



*"What has changed for me is perhaps also the scientific side, to become more scientific in my personal observations, to better respect the protocols, since I do a lot of protocols to observe birds. Until now, I didn't want to do that, but now I do" (Teacher, High School)*

*"Before doing the protocol, I already knew nothing about birds and I wasn't really interested. Now, it's true that I often stop in the street because now I'm interested and because, yeah, I'm starting to recognise a little bit and to have some knowledge about it. It's true that I see things a little differently... I think I'm more receptive to questions that didn't necessarily interest me before" (Teacher, primary school)*

#### **5.4.2.2. Effects on the cognitive dimension of teaching**

**Strong: acquisition of knowledge in the short term (the year of participation).** The REGREEN project favoured the acquisition of several levels of knowledge: (1) scientific and naturalist knowledge: the scientific approach, how to carry out an observation protocol, discovering species (names of species, physiology, behaviour, environment of the species), development of language (vocabulary, foreign language, writing); (2) practical knowledge: how to build a natural infrastructure, in particular a nest box (materials, adaptation according to the species of birds, maintenance), where to place it (at what time of the year, at what height, where)

The type and level of knowledge acquired depend on the level of involvement of teachers and pupils in the project; for example, one primary school class carried out the earthworm protocol 4 times during the year 2020-2021. At the end of the year, all pupils could recognise the 4 species of earthworms and name them with their scientific name:

*"We learned about the species of earthworms: endogenous, epigeous, red-headed and black-headed. We dealt with earthworms and we really, really, really learned everything about earthworms. We learned how to recognize whether earthworms are old or young. In fact, if they have a clitellum, they're old, and if they don't have a clitellum, it means it's a baby. (Focus group, 2020).*

Beginning teachers seem to learn at the same pace as their students:

*"Now that we've made good progress during the year, it's made them evolve on many things, but now we've moved on to earthworms and yeah, yeah they've learned a lot and so have I" (Teacher, kindergarten school).*

*"I'd like to work on plants too. Yeah, I'm thinking next year, maybe change a bit and do the birds again. Because I don't hide it from you, it also allows me to learn a lot of things [laughs]. And that's what's interesting about this job" (Teacher, elementary school)*

For some high school students, carrying out the observation protocols has been very rich not only for the knowledge acquired, but also for the preparation of their future university curriculum:

*"We carried out quite a few protocols with the bird counts and I learned quite a lot because I am not someone who knew much about bird species, etc. Since I am currently studying science to become a scientist in biology, I know that by dint of my information, I quickly realised that a biologist works well, but alone, he doesn't get very far. He needs help, he needs data, he can't do everything at once. He can't go and collect data, analyse it and then go and collect it somewhere else" (Boy, 17 years old).*

Making the observations also allowed some students to question themselves on studied species:

*"It was quite funny because sometimes the species of snail, there was always a debate about "Is it this species or that species". It's true that it was interesting to observe it because usually,*

*when you see a snail, you think: "It's a snail". But in fact, there are many snails that look alike, but they are not necessarily the same species of snail"* (Girl, 17 years old)

**Medium: long-term knowledge acquisition.** We asked the following question to the teachers and students interviewed: *Do you think the VNE protocols have, or will have, an impact on your students? On you?* Here are some answers:

- The long-term effect will probably depend on the children, which raises the question of the permeability between the school career and activities outside school:

*"It's a bit complicated to say because they're children and there's a lot going on in their lives. In the short term, I think that it has already had an impact. That's what I was telling you earlier about their ability to look at what's going on and to pay attention. In the long term, I don't know, it depends on what they themselves will do with it"* (Teacher, middle school).

- The long-term effect depends on the degree of engagement of the student:

*"They are all willing, but what will change the most will be when they carry out the protocols in an active way, when they will be active, when they will not think they are in school doing something academic"* (Teacher, middle School).

- The long-term effect will undoubtedly depend on the degree of monitoring by parents, which is in line with general questions about the integration of families in participatory science monitoring:

*"I hope so. I'd like to. But you see, it's hard to answer the question. I think it also depends a lot on whether this process is supported at home or not. That is to say, if at home it is not followed up at all, if there is no link made, it will inevitably have less impact in the long term"* (Teacher, primary school).

- Knowledge fades over time in young people who are under great pressure from the intensity of their high school classes:

*"Afterwards, it was at the beginning of the year, so the knowledge in the meantime had flown out the window a bit, for me at least. It's true that there was so much time and so many courses that it's a shame I didn't retain more"* (Girl, 17 years old).

From a qualitative point of view, it can be concluded that there is a strong acquisition of knowledge. This is not limited to naturalist knowledge, but is extended to other fields depending on the activities carried out. Naturalist knowledge is likely to remain temporal and partial, which is in line with the results of S. Turpin (2022); it can be said to be synchronous learning (short-term, one-off) because it depends on several contextual, pedagogical and personal factors. We cannot say anything about a potentially diachronic (medium and long term) appropriation of knowledge by pupils after the school year. Complementary activities within the school and the family could allow consolidating the scientific and naturalistic knowledge acquired thanks to the protocols throughout the student's school career (from kindergarten to high school)

#### **5.4.3 Insert: Citizen-science observatories of nature can change cognitive models of students**

During the REGREEN programme in ULL Paris-region, teachers were invited to propose free listing activities to their students. Free-listing tasks are considered to tap into the implicit meanings people attach to the stimulus term (e.g., Abric 1994). This method is used to unravel people's cognitive models or social representations of different social groups (e.g. Buijs & Elands 2013). This method is not devoted to assess individual changes; it is more powerful to assess collective representations or cognitions in a quantitative way.

In volunteer classes, students were asked to write the five first words coming in their mind when the teacher pronounced a stimulus term. One of these stimuli was the name of the taxonomic group surveyed by the students through VNE during the year. Teachers were invited to implement this activity at the beginning of the school year and after having done VNE observations. We collected XX free-listings from 10 classes and 3 stimulus terms (Table 8). Few classes did the task before and after their participation to VNE observatories. We decided therefore to merge the classes according to their level (i.e., primary schools and high schools), to the stimulus terms (bird, insect, earthworm), and to the time in the year where free listing were full-filled (before or after VNE). For each data set, we selected the words written by at least 10% of the respondents.

*Table 8: number of data used in the analyses of social representations*

| Stimulus term    | Class level    | Nb of respondents / nb of selected words |          |
|------------------|----------------|--|----------|
|                  |                | Pre VNE                                  | Post VNE |
| <b>Bird</b>      | Primary school | 67 / 11                                  | 57 / 8   |
| <b>Bird</b>      | High school    | 54 / 9                                   | 72 / 12  |
| <b>Insect</b>    | High school    | 16 / 18                                  | 20 / 17  |
| <b>Earthworm</b> | Primary school | 23 / 9                                   | 16 / 7   |

For each word, we computed its salience, i.e. is a statistic accounting for its rank (written in first, second or later position) and frequency (i.e. the number of respondents that wrote it: Quinan 2005). Words with higher saliences describe the most accurately the cognitive models or social representations of the group. More precisely, salience (S) of each word is calculated as following:

$S_{ind}$  = inversed rank / number of words written by the individual

$S$  = Sum of  $S_{ind}$  / number of respondents that wrote this word (frequency)

Saliences of each word for primary and high schools before and after VNE are presented below (Tables 9-11). Based on these raw results, observing biodiversity following citizen-science VNE could change the cognitive models of students, differently according to observed species and/or class levels:

- young children (aged 6-10, primary schools) learn scientific names of the observed species and mention less often words linked to negative aesthetic representations. This is particularly visible for earthworms, but also for birds.
- older students (aged 14-18, high school) did not seem to increase their scientific knowledge of scientific names of the species. However, negative feelings tend to decrease in salience, and nature seems to be considered more as living.

All these preliminary results are promising in the effect of citizen-science observatories on changing representation and knowledge of ordinary nature, they open research questions to be continued.

*Table 9: Salience of the words before and after exposition to the VNE protocols – Earthworm – primary school*

| Word [in French]                            | Word [in French] |           |
|---|------------------|-----------|
|   | Before VNE       | After VNE |
| Endogenic [endogé]                          |                  |           |
| Epigenetic [épigé]                          |                  | 9.85      |
| Black-headed anecic [anécique à tête noire] |                  | 8.35      |
| Red-headed anecic [anécique à tête rouge]   |                  | 7         |
| Clitellum [clitellum]                       |                  | 5.5       |
| Anecic [anécique]                           |                  | 3.2       |
| Earth [terre]                               |                  | 2.2       |
| Slimy [gluant]                              | 21.45            | 1.8       |
| Big [long]                                  | 5.97             |           |
| Small [petit]                               | 3.82             |           |
| Slow [lent]                                 | 2.55             |           |
| Worm   Ver]                                 | 2.45             |           |
| Pink [rose]                                 | 2.17             |           |
| Slim [bave]                                 | 1.85             |           |
| Light pink [rose pâle]                      | 1.75             |           |

*Table 10: Salience of the words before and after exposition to the VNE protocols – insect – high school*

| Word [in French]           | Before VNE | After VNE |
|----------------------------|------------|-----------|
| Ant [fourmi]               | 3.4        | 2.9       |
| Small [petit]              | 2.95       | 5.6       |
| Bee [abeille]              | 2.4        | 3.8       |
| Spider [araignée]          | 2.35       |           |
| Ugly [moche]               | 2.2        | 1         |
| To bite [piquer]           | 2.2        |           |
| Ladybug [coccinelle]       | 2          | 2.4       |
| Disgusting [dégoutant]     | 1.8        |           |
| Butterfly [papillon]       | 1.8        | 2.4       |
| Mosquito [moustique]       | 1.8        | 1.8       |
| Fear [Peur]                | 1.55       |           |
| Fly [Mouche]               | 1.4        | 2         |
| Grasshopper [Sauterelle]   | 1.2        |           |
| To fly [voler]             | 1.2        | 2         |
| Nature [nature]            | 1          | 3.85      |
| Colony [colonie]           | 0.8        |           |
| Wing [aile]                | 0.7        |           |
| Wasp [guêpe]               | 0.65       |           |
| To live [vivre]            |            | 2.6       |
| Fauna [faune]              |            | 2         |
| Protocol [protocole]       |            | 2         |
| Living being [être vivant] |            | 1.7       |
| Earth [Terre]              |            | 1         |

| Word [in French]         | Before VNE | After VNE |
|--------------------------|------------|-----------|
| Earthworm [ver de terre] |            | 1         |
| Useful [utile]           |            | 0.95      |

Table 11: Salience of the words before and after exposition to the VNE protocols – Bird – primary school & high school

« Bird » - primary school

| Word [in French]                         | Before VNE | After VNE |
|--|------------|-----------|
| Red-necked parakeet [perruche à collier] |            | 7.15      |
| Blue tit [mésange bleue]                 |            | 6.3       |
| Beak [bec]                               | 11.18      | 16.92     |
| Feather [plume]                          | 6.95       | 13.6      |
| Wing [aile]                              | 23.3       | 12.4      |
| To fly [voler]                           | 13.77      | 6.73      |
| Leg [patte]                              | 6.9        | 6.5       |
| Nest [nid]                               | 5.02       | 2.2       |
| Pigeon [pigeon]                          | 6.85       |           |
| Sky [ciel]                               | 6.4        |           |
| Seed [graine]                            | 5.4        |           |
| Tree [Arbre]                             | 4.25       |           |
| To eat [Manger]                          | 2.45       |           |

« Bird » - high school

| Word [in French] | Before VNE | After VNE |
|------------------|------------|-----------|
| Beautiful [beau] |            | 6.4       |
| Nature [nature]  |            | 5.65      |
| Colour [couleur] |            | 5.6       |
| Seed [graine]    |            | 5         |
| Pigeon [pigeon]  | 8.65       | 14.5      |
| To fly [voler]   | 23.5       | 25.85     |
| Wing [aile]      | 15.9       | 15.9      |
| Feather [plume]  | 13.9       | 14.45     |
| Nest [nid]       | 6.15       | 5         |
| Tree [arbre]     | 5.75       | 5.8       |
| Beak [bec]       | 5.25       | 4.4       |
| Sky [ciel]       | 8.1        | 4.6       |
| Fauna [faune]    | 4.1        |           |

#### 5.4.4 Emotional and behavioural dimensions, relationship to nature

**Strong: impact on the emotional relationship with living beings.** Teachers, pupils and parents all agree on the positive effects of nature observation on the emotional level of the participants. The observation experience made them aware of the fragility of species, their beauty, diversity, colours or textures, among others. In the short term, most of the participants transformed their relationship with wild animals: less fear, desire to protect and care for them, desire to observe them, desire to touch them, etc.

- Observation time helps to manage emotions and to become aware of the outside world:



*"It was good, at least this silent observation phase. Because they find it very difficult to be silent. Usually, it's something that makes them anxious quite easily. And there, as we were watching, it was possible. It's true that I really appreciated when we carried out these protocols, we could feel them... and also to contain their emotions... And there, as we didn't want to frighten the birds, they were obliged to hold back. So they were very, very enthusiastic, but they were very, very restrained. It teaches them that. This work with emotions. It really does something and we felt they were really calmed down after these sessions. We had really been in nature, in silence, we had observed together, we were happy to have seen birds, and I think we were also calmed by having really observed them. Few birds, but convincing results from an emotional point of view" (Teacher, middle School)*

*"I thought it was fun to take the time too, most of the time it was sunny. We really took the time to sit and observe. We take less and less time to sit down and watch the birds in particular. It's true that I found it interesting to see how the birds behaved according to the different species. We could see a crow trying to steal one of our fat balls. The ball was so heavy that it couldn't do it, so it tried several times. It's true that it's quite funny to watch. We know that if we hadn't stood still or watched, we wouldn't have seen that moment which was quite funny and which we remember. It's true that these are nice little memories. Even if for some people it's futile, for us it was interesting" (Girl, 17 years old)*

- Observation and touch encourage a sensitive and emotional approach:

*"Yes, there is a personal and emotional attachment to snails. That is to say, they find them cute and they want to see them again and they laugh. Yes, yes, yes, this is a very important thing. Maybe more so with snails than with birds. We take the snails in our hands and look at them from all sides, we touch them, it creates a bond. (Teacher, high school)*

*"I wanted to make the earthworms feel they are loved a little bit. Even if it's very childish what I'm saying. Because no one likes earthworms and everyone finds them disgusting. I really wanted to work with them, to observe them, to touch them. It's very interesting to work on that and it's stupid not to work on that because it's disgusting or whatever. Yeah, that's why I wanted to work with earthworms. Afterwards, I give them a conscience and maybe that's not the right thing to do" (Girl, 18 years old)*

- Observation promotes awareness of living things and sharpens attention to nature:

Kindergarten school:

*"There has been a change in the children's attitude towards insects. Well, not yet with trees, I haven't managed to get them not to tear off the leaves, but... before the firebug, it was 'I'll take some, I'll put some in my pockets, I'll do this, I'll do that'. Now they look at them and they make houses for them. So sometimes they move them to the yard, but it's to put them in a house that they've made with grass, little pieces of wood, leaves. It's no longer 'I'll do anything with it', so it's this side that I find successful" (Teacher, kindergarten school)*

Primary school:

*"There, as soon as they hear a bird, they look up and most of the time, they manage to recognise it, when it is not too far away and when it has remarkable characteristics. And then they say: 'Hey, I hear a ring-necked parakeet', 'I hear a crow'. They pay attention. They are interested in things that maybe they were not interested in before" (Teacher, primary school)*

*"What is interesting is that, as is often the case in the first grade, we categorise what is alive and what is not. As a plant doesn't move, they tend to think that a plant isn't alive. And so they respect it less than the animal world. And well, I think that with the 'wild on my street' protocol,*

*plus the oasis courtyard, they have become aware of things and they have as much respect for plants as for animals" (Teacher, primary school)*

Middle school:

*"There are pupils who come to tell me about the birds they have seen in the courtyard, when and where. In any case, it has made them aware of a question of observation and they come to tell us about it. Then they are interested in what it is used for, why it is there. When we went to look at the birds, to realise the diversity of the birds there were" (Teacher, middle school).*

High school:

*"I pay more attention to bird song, even if I can't recognise it, I'm more sensitive to it. Before, birds were: 'Yes, okay, there are birds, they fly, it's pretty', now I pay more attention. I try to listen to their song, to look at them better, to observe them. Even pigeons, I try to be more interested" (Girl, 17 years old)*

**Strong: impact on changing students' behaviour towards the species observed.** The change in behaviour is often linked to an attitude of "well-being" of the animal and protection. It is very present in kindergarten and primary school students. Young adolescents in middle and high school talk less about it, but are aware of their change in behaviour.

- Taking care of the animal:

*"So, if there's an earthworm in distress: "Mistress, quickly, he's near the earthworm, it's going to be crushed, we have to go and put it in the vegetable garden"... The snails, well, they arrive with the snail in their hand, I say to them "What do we do? I said, "We'll put it in the vegetable garden! So, they put it in the grass so that it doesn't get crushed" (Teacher, kindergarten school)*

*"They look at the earthworm, they won't pass by it, they will react so that the earthworm is put back in the earth and that it is not damaged by the other classes that pass by, they will try to identify it, to know what it's called, that interests them, and somewhere they also feel a little responsible for the fact that nothing happens to them, which was not at all the case at the beginning of the year. That I see, and then touching, which they didn't do at all at the beginning of the year... the first times when it was a question of touching, everyone screamed, so there you go, the change in behaviour I see" (Teacher, primary school)*

- Even those who disliked or were afraid of a species reported a positive change in their behaviour:

*"I had a classmate who didn't do the earthworm protocol, but in the end, she came to help at the end. She seemed to like it, whereas at the beginning, when we were talking about the protocols we had chosen, she said that she didn't like earthworms at all, that it disgusted her. And in the end, she worked with them with a smile. So yes, some of the relationships between the eco-delegates and the earthworms have indeed improved" (Girl, 18 years old)*

*"I don't kill insects when I come across them. I don't kill them when I come across them, and I don't kill earthworms either, because when it rains there are a lot of them on the ground and I don't want to touch them, not even with my shoes. If I see an earthworm on the ground, I go around it. I make sure I don't run into them, but I don't kill them, I don't crush them" (Girl, 16 years old)*

- Behaviour change towards a more eco-citizen attitude:

*"Before, it was more me that had to be convinced about nature and that one should really pay attention to it. But now, what has changed is that I try to tell others about it. I really try to share with others what I feel about nature, about biodiversity. I'm trying more and more to set*

*up things that would show that it's important and to make more and more people aware of it"* (Girl, 17 years old)

*"I have realised, more than usually, that nature brings me a lot in my daily life. It's really a breath of fresh air where you are with nature and you forget all the problems of everyday life. It allows us to find ourselves a little bit, to reflect, to put ourselves in our place a little bit, to remind ourselves that we are just humans, we are not the gods of the world and that we can do things to change things"* (Boy, 17 years old)

*"It's very hard to convince your parents and grandparents, who already have their own ideas about nature, which is not the same relationship to nature as our generations have. Before, everything about sustainable development and climate change didn't affect them very much. Now, I know that it affects us, but also nature. For me, it is important to develop this with people. That's what has changed for me, at least since this year and the end of the year before that."* (Girl, 16 years old)

- Questioning and reflecting on the experience with the animal: Taking the time to ask questions about the observation experience encourages a change in the relationship and self-perception of living things. In this case, it is relevant to encourage scientific observation accompanied by questioning about the experience with the animal during the observation and identification period.

*"What I see in the workshop is that each time, it is an opportunity to have discussions about their relationship with nature...for example, we found a snail, but not under the boards. It was a pupil who found it near a tree. He took it and put it on his hand, etc. So, the others come to see and obviously, you have very, very different reactions. Some start screaming, some find it disgusting, others discuss it. Some people have never thought of putting a snail on their hand, but they are still interested. So you see them observing, asking what it does. They start to touch the mucus a little to see if it's really disgusting or if it's okay before taking it anyway. So between them, it leads to quite a lot of discussion each time... Yeah, to discuss, is it disgusting? Is it not disgusting? But in fact, in the end, what is the problem?"* (teacher, middle school).

#### **5.4.5 Social dimension - sharing and valuing among participants**

Pedagogical activities contribute to the social construction of pupils, in particular by encouraging teamwork, mutual aid, the sharing of knowledge and experience or collective reflection. Through the REGREEN project, teachers had the opportunity to foster new contexts of networking between pupils around biodiversity and science. The following effects were identified by the associated research:

##### **5.4.5.1. Observation promotes sharing between teachers and students, as well as teamwork between students**

During the naturalist observations, the participants (teachers or students) with more environmental sensitivity and naturalist knowledge naturally took the lead in the activity or group in order to guide, reassure, accompany and share with those who had no experience or knowledge of the environment and the species observed:

*"It's true that with the teacher and other students who knew more than I did, it also allowed us to share our knowledge. I think that this is also the sharing between us within eco-citizens, eco-delegates and teachers who are involved. I think that there is also the sharing of information that makes everyone learn in the end. So in addition to the protocols, it allows us to get more involved and to have an impact behind it"* (Boy, 17 years old)

Several teachers remarked on the importance and quality of the teamwork developed during the observations:

*"The day of the protocol, to see them all with their hands in the earth and then, they were super autonomous and really interested and involved, it's not a great year but it impressed me to see them all passing the earthworms around, discussing, laughing, I really liked that moment" (Teacher, kindergarten school)*

*"They were excited to be all together, counting worms, getting them out, finding them, identifying them, gathering them. In fact, I felt like they were five-year-olds. They were no longer teenagers who could hide behind certain things. And a lot of them didn't know each other because they come from different backgrounds. Often they come in pairs, but the whole group didn't know each other. And there, the fact that we were all around the earthworms, it was unifying" (Teacher, high school)*

*"It's all the students who are invested in taking time. Really all of them. And those who were faster than the others, they didn't get bored despite everything because they did other things [...]. That's what they did, they tried things and it was great! Afterwards they showed the others and yeah, that's how we should teach and that's how the pupils would learn better and that everyone would learn better above all" (Teacher, high school)*

#### **5.4.5.2. The participation in the REGREEN project and the realisation of the VNE protocols have valorised students**

Teachers have noticed a feeling of pride among the pupils and classes most active in the VNE observations, as well as a valorisation in the school or in their families.

##### **- Valorisation within the school:**

*"It allows the students who participate and invest themselves, and who are part of the small group that comes often and who have missions with a bit of responsibility, to have a slightly different position in the school because they are in charge of disseminating information to the others" (Teacher, middle school)*

*"As we are in the courtyard sometimes at lunchtime on Fridays, those who are there on lunch break come to see, they ask questions and we ask the pupils who are part of the workshop to explain what is going on, what they are doing and why" (Teacher, middle school)*

*"We set up the steering committee. The eco-delegates took responsibility for organising everything. We asked them to prepare a support to explain the project. To explain why they did it, what they wanted to do. The committee took place on video before the holidays. It went very well, they expressed themselves well and the committee members told them that what they wanted to do was great. They were very happy" (Teacher, high school)*

##### **- Sense of pride:**

*"So at first they thought it was impossible for us to participate in something really scientific for real [...] And then they were very proud, happy to do it. Too happy that we needed them. They understood that they could participate as little researchers in the project" (Teacher, primary school)*

*"There was a certain pride. They were a bit impressed to be part of something bigger" (Teacher, primary school)*

##### **- Valuation with families:**

*"They talk a lot at home about protocols. I have parents who had to go collecting earthworms or snails to observe them and so on. Children, often, when they leave the classroom, don't talk to their parents about what they did at school. But here, I have quite a lot of feedback from parents, so I think that it has really motivated them. And so, parents also learn things through*

*their children. There is a transmission that takes place between children and parents that is very rewarding for them"* (Teacher, kindergarten school)

*"I have learned a lot about birds this year thanks to my son. He shows me, he explains to me, and now we share it together, we observe the birds more when we go for a walk"* (Mother).

**- Helping peers to overcome fears.**

We observed several times a phenomenon of encouragement between pupils. Despite some mockery, in most cases children and young people encouraged each other in difficult moments. Fear is very present in the relationships that some urban children socially reproduce with nature, and more particularly with insects, earthworms or snails. Carrying out the protocols favours a time of thinking which, for some, makes it easier to confront preconceived ideas and their own fears.

As an example: A primary school class performed the earthworm protocol several times. Despite her enthusiasm and willingness, during the first two observations, a girl who wanted to touch an earthworm started crying and could not keep her hand in place so that one of her classmates could put the worm on it. During the third and fourth observation, the pupils in the group encouraged her tenderly: *"Go ahead, it doesn't do anything, it's all soft"; "I'll take it with you, you'll see that it's all soft"; "Go ahead, I'll take it and you touch it"*. The encouragement paid off. During the fourth observation, the girl (trembling and a little afraid), left her hand open and held the worm for a few seconds. Everyone else congratulated her and she was pleased with her achievement: *"ah, it's all soft, it's cute"*. (Field observations).

In some cases, some pupils themselves played a moral role with other pupils who behaved inappropriately with a pupil or with the earthworm: *"you mustn't throw it away like that, you'll hurt it!"; "let it touch the worm, it's not yours!"; "no, you have to wash them first otherwise they'll burn with mustard"*.

**- Taking care of the living in order to take care of the other:** For this teacher, raising awareness of the positive and peaceful relationship between pupils and living beings is very important because it will be translated later into the social context:

*"If they manage to take care of their environment, children will take care of themselves... Well, taking care of oneself sometimes starts with being well in one's environment and taking care of nature and all that. And taking care of others, that's it, that follows on naturally from that. And that's what interests us with these children who live in social contexts that are not very easy"* (Teacher, kindergarten school).

**- Erasing social inequalities in terms of access to nature.** In schools present in deprived neighbourhoods, the implementation of the protocols and activities related to the biodiversity project enabled the pupils to go to natural areas, to take the time to observe nature that remained inaccessible and strange, to make new experiences with animals, to carry out artistic projects, to learn about biodiversity and to confront their fears. These experiences foster a different relationship between young people and their school, their peers, their city and nature. They enable them to become aware of the living world around them and of the possible activities to be carried out in green spaces outside the school and their home.

In conclusion, several positive effects stem from the students' nature observation experience. As we have shown, during the first year of participation in the protocols, the effects of the programme on the pedagogical practices of beginning teachers seem to start taking shape slowly. On the other hand, taking into account the scientific timing could have positive pedagogical effects. The effects of these protocols on naturalist knowledge can be important, but seem to depend on the intensity of involvement of teachers and students in the preparation and execution of these protocols. However, there is a risk that they will remain limited to time of school participation, if complementary actions



are not promoted throughout the student's school career, or if families are not more involved in pursuing nature-related activities at home. Remarkable changes were observed on representations and relationships to nature among the participants, especially at the emotional and behavioural levels. Pupils can develop greater attention and sympathy towards the living world, take care of animals and plants and better understand the importance of their actions on the environment. Finally, positive social aspects are also identified: naturalist observations favour sharing and mutual aid, but also the valorisation of the pupils at school, by their peers and in their families. However, the effects on the development of biodiversity and the greening of school are weak, due to administrative, political or economic constraints. Important changes are needed in social representations of nature among school staffs, to make nature become an opportunity rather than a constraint for improving school environments

## **5.5 Research question 3: How do teachers appropriate VNE programme?**

The process of appropriating and mastering VNE protocols is a medium- to long-term process, and the first few years can generate difficulties, even blockages. We have identified three levels of potential difficulties, which we describe below.

### **5.5.1 Institutional difficulties**

#### **5.5.1.1. Covid 19 health crisis**

The management of the health crisis within the schools limited the amount of time spent working with pupils, as well as the possibilities to involve parents and partners during the first year of the project:

*"It was difficult to manage with the health context. Students are there every other day, it's not always the same ones. It doesn't always coincide with me, my schedule. It makes it a little bit more difficult to implement" (high school)*

*"In addition, with the Covid, it's really complicated. At the beginning, we wanted to involve parents, in particular because there are quite a few parents who may have knowledge or, because of their background, may be able to contribute. But that requires a lot of work and now it's really too complicated to welcome parents into the school" (middle school)*

#### **5.5.1.2. Time issue**

The institutional time organization does not favour adequate (extracurricular) spaces and slots to work properly on scientific observations of nature, especially for middle and high schools.

*"Ideally, we want the students to do everything. But to do that, they would have to go to the lodge and ask for the watering can, go to the tap, measure the quantities of water, measure the quantities of mustard, etc. But you have to wait 15 minutes before the earthworms come out to count them and then you have to repeat the protocol with intervals, and it takes more than an hour. Yet we never have more than one hour in school timing, we have 50-55 minutes, we don't have 1 hour and 20 minutes" (middle school).*

*"Since it's a club, it's at lunchtime, sometimes they just have trouble getting through the canteen, or they have a test and they're completely stressed out and they tell us at the last minute: 'I can't, I have to revise'. It's in their free time, so we're a bit subject to these fluctuations. (High school)*

*"They do it during their free time, during breaks, when there is a break... Some protocols last a quarter of an hour, so they can them during the lunch break or when they have an hour gap. But we don't have a specific time slot to work on that" (high school).*

### 5.5.1.3. Difficulties of engagement for eco-delegates

There are no slots or meeting spaces in schools for eco-delegates to get involved:

*"We don't have any set times in the school to run the eco-delegates group, we do what we can. We offer a time slot, often on Wednesdays after school. So that everyone can have relative access to it because they come from different classes. So, obviously from a logistical point of view, it's complicated"* (high school)

*"The school didn't really know how to find a use for the ecodelegates. I think there should have been an obligation for all the ecodelegates to meet at least once, in the afternoon, the morning, whenever. But this year, the ecodelegates were never obliged or called to meet all together at least once. It didn't give the impression that we had responsibilities"* (Boy, 17 years old)

### 5.5.1.4. internal institutional problems (governance, administration, etc.)

Internal conflicts within the institution may make it difficult to implement protocols or natural infrastructures:

*"Overall, there is a really bad understanding between the administrative and technical staff. It's going very, very badly. It's a human management problem which, likewise, is untenable. So... it complicates things considerably"* (high school)

A change in the organisation of the teachers or partners who initially supported the project may reduce the motivation of the participants and the commitment of some schools during the project:

*"The municipality did not renew my partner's contract, so it is more difficult to work with the pupils alone; then, the activities planned by my colleague could not take place to launch the project with the pupils"* (kindergarten school)

*"The concern is not about the protocols or the natural infrastructures to implement, but more about a change of organisation between my colleague and me, which has somewhat upset the dynamics of the REGREEN project and it is complicated to get back into it on my own"* (middle school)

Sometimes volunteer teachers suffer from the lack of commitment of their colleagues in several disciplines:

*"No one is hooked because I think that people are not necessarily focused on this personally, in fact, in their private lives. And because they feel that it's going to be a lot of work and, of course, it takes up personal time as well. I think that if it's not something that you like or that you know a bit in advance, people don't get into it. Clearly"* (kindergarten school)

*"In the school we are really just the two of us. Although we have tried to open up as much as possible, there are not really any colleagues who have joined"* (middle school)

*"It is much more difficult to mobilise colleagues. At the beginning of the school year, things were still going well, but I think that this year has exhausted everyone from that point of view because we have changed the health protocol so often, that is, we don't know what we can do this week, next week, in a fortnight' time... People don't have the courage to get involved anymore"* (middle school)

Sometimes, it is the cumbersome administrative procedures for purchasing equipment, offering outings outside the school or promoting schoolyard depaving projects that limit teachers' long-term commitment:

*"For us, buying equipment is always complicated; we have money, but spending money is a major difficulty, it's an obstacle course. You can't go to a supermarket and buy 10 pots of mustard, because you can't get reimbursed for cash expenses anymore. So you have to order, to open an account... That's horrible for us" (High school, nature club)*

*"We got 7000 euros funding... but, I can't take it anymore and I'm exhausted by it all, because afterwards, we have had to manage the expense and it's not easy. We had to get pro-format invoices, discuss with all school staff, choose and above all take into account what is ecologically interesting... it's too much to manage for us, the teachers" (high school)*

*"They worked alone because there is nothing to see in the school and so you have to go out to see something. If we want to go out with them, we also have to do a lot of administrative work to get agreements to go out and it's not easy with the management team... In France, students are considered as not well-behaved, doing something stupid, they are seen as a problem" (high school)*

#### **5.5.1.5. Student motivation issues**

The workload may seem too heavy for students, especially in the final year of high school:

*"In any case, with my final year class, I couldn't do it. As they are taking the competitive exams, I couldn't impose this extra thing on them... They already have difficulty carrying out everything that is asked of them, so if I added something, I wouldn't have much of a favourable response" (Teacher, high school).*

#### **5.5.2 Pedagogical difficulties**

##### **5.5.2.1. Little naturalist knowledge**

The lack of naturalist knowledge and the difficulties felt in identifying species or groups of species limited the appropriation of the VNE protocols by some teachers, especially those in kindergarten and primary schools, but also middle school teachers without scientific training:

*"Quite honestly, I would love to have an expert there to help for accurate identifications... at least the children would see what it means to set up a protocol, that it's very well defined. It's very interesting, but for the identifications, if I don't want to answer anything, I would need to have someone from the museum to help because I don't have the knowledge" (primary school)*

*"There is a lack of knowledge in terms of species identification and knowledge of their biology and properties: I will find it difficult to feel "up to the task" of supervising the class" (middle school)*

*"We realise that sometimes it's a bit complicated in terms of identification. Even for us, SVT teachers, it's not that simple. We say to ourselves, for teachers who have primary school children, it must not be that simple" (high school)*

##### **5.5.2.2. Difficulties in obtaining the necessary materials**

Some observation protocols require the acquisition of specific material, which is sometimes difficult to obtain. This is the case, for example, for the mustard in the *earthworm* protocol:

*"Ah yes, the galley! The mustard jar! We were dying laughing with Amora mustard. I think I went to four or five shops, she also went to four or five, saying "No, it doesn't exist" [laughs]! [...] we managed to find it but I think there are series, and between two series there are gaps, I think, in the supply" (kindergarten school)*

In another primary school, two teachers wishing to carry out the earthworm protocol did not find any "Amora fine and strong" mustard. Despite this, they decided to carry out the observation with their pupils, which had been planned for a month. They added more mustard than planned in the protocol

to make up for the fact that the mustard chosen was not strong. One and three earthworms came out respectively for the two classes. The teachers took pictures without trying to identify them with their students and the activity ended there.

For the snail protocol, one difficulty may be related to snail boards:

*"There is a difficulty, for example, in the nature of the protocols. We have to use rough wooden boards. But in fact, we didn't have any. Here too, we made a call for donations to our colleagues: "Who has raw wooden boards?" Nobody. Out of 120 teachers, nobody. In the end, it was me who found a board up in the attic. And somehow it hurt my heart when it was cut up. But there it was, we cut it up, we put it in place. And the snails, they don't go under the board. You see lots of them going on the walls. So it's frustrating. We found a few, but we can't note the others. It's frustrating. Maybe the protocol should have just said: "You mark out an area of one square meter on the ground and one square meter on a wall without a board", for example. Or, you can put a piece of wood, whatever the dimensions are. For example, what you can find very easily, and I would have had it right away, is bark. You can find it everywhere in the forest. It would have been easier. Because we hung out with these pieces of wood" (High school).*

#### **5.5.2.3. Too high initial ambitions on the part of teachers**

During the first year of the project, 2 kindergarten schools, 1 primary school, 2 middle schools and 3 high schools wanted to carry out a large number of VNE protocols. Several teachers realised that it was impossible to carry out all the projects and quickly lowered their expectations:

*"The first time we did all the inventories, we had quite a few students... And we realised that it was a lot. In fact, we were starting with too many aspects and each one was going to require a colossal amount of work. That's why, afterwards, we concentrated solely on the birds" (high school)*

Others have realised the need to go more slowly and to take the time to better prepare for the acquisition of knowledge:

*"I had the impression that at the beginning I went a little bit in all directions, I wanted to do everything at once and I think that if I did it again, on this protocol or on another one, I would go more slowly... And bring knowledge to my students little by little. Not about bird watching itself, but about anatomy, lifestyle, etc. I try to take things one step at a time. I try to take things a little more slowly" (Primary school)*

For other teachers, raising awareness and discovering the various protocols were their priority from a pedagogical point of view.

*"I'm happy. It's good that they participated at least once. That they know that it exists and that they ask themselves questions about nature, what surrounds them, what's around them. And you see, I think that is the most important thing for them" (primary school)*

#### **5.5.2.4. Inadequacy of the chosen protocol in relation to the level of the class**

Some teachers of kindergarten or primary schools chose to carry out protocols that were not recommended by the VNE coordinators for these school levels (*plants, insects or bats* protocols). These teachers wanted to use these protocols to carry out nature awareness sessions: discovering pollinating insects, discovering the plant cycle or working on negative representations of bats. They took part in the REGREEN project with a pedagogical approach focused less on scientific approach and more on changing relationships with nature (to be less afraid of insects, to understand that plants are alive, to change the representations of bats, especially after the covid-19).

#### 5.5.2.5. Lack of parental involvement

The health crisis severely limited parental participation in class activities in kindergarten and primary schools, which impacted the implementation of VNE programmes:

*"We had managed to do an observation before the national instructions were tightened up, and the parents came. But afterwards, we were not able to keep bringing them in... And then this winter, well, it all fell through because this winter we were normally supposed to count the birds. Except that for counting the birds, you really need to be in a small group so that it's calm, but they had tightened up the instructions so I couldn't get the parents involved any more. So the bird count fell through this year" (kindergarten school)*

*"Every time we try to organise something, there's a new (health) protocol that tells us we're not allowed to bring parents in anymore. So yeah, it's a bit complicated to integrate them. Otherwise it's something that would have interested us" (primary school)*

#### 5.5.3 Partnership difficulties

Several teachers would have needed to rely on partnerships to implement the VNE observation protocols. However, for some, their usual partners do not have the necessary naturalist skills to implement these protocols. It is complicated for other teachers to find adequate partners on their territory.

Some teachers and pupils felt frustrated by the lack of support and exchanges with the Museum's researchers and the VNE coordinators in their school. Others would have liked to have more exchanges with classes and pupils from other countries participating in REGREEN, and did not understand why participating in a European project could not allow them to create exchanges between French and Danish classes.

Other teachers regretted that the project did not promote more exchanges with their educational partners on the experiences of implementing VNE protocols.

*"But, in the end, what's a pity is that I don't really know what the other schools and classes are doing. Maybe that's what's missing, more exchanges... Maybe a kind of platform that would list each other's research, their achievements. Because there are probably things, there must be other classes that work on birds, and that could give me ideas, or maybe there are things that we do that could interest them. Maybe that, something where we could exchange with the others. So, I don't know what kind of thing it could be, but it's true that it's missing" (primary school).*

Despite these limitations and difficulties, the teachers were happy to have participated in the REGREEN project and to have experimented and discovered the VNE protocols. For example, two teachers from a middle school listed the strong points of their participation in the project: the pure pleasure of discovery through nature observation, learning to manage emotions (so as not to scare the animals away), nature as a subject of conversation, and the pride of the students in participating in a scientific protocol.

Interest in the VNE citizen -science programme remains high even among some teachers who have reduced their level of involvement in the project:

*"Apparently, the vast majority of colleagues want to renew or actually do the protocols next year" (kindergarten school);*

*"We learn by doing, next year it will be better" (middle school).*

Some teachers have started to value the protocols in other educational contexts:



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*"The protocols are really well done! I have already used them in a simplified way with a class of non-native speakers."*

Generally speaking, the participants in the REGREEN project were actively involved in the project and were able to test, for some, or appropriate, for others, the protocols for scientific observation of biodiversity.

## 6 CONCLUSIONS: VIGIE-NATURE ECOLE, A CITIZEN-SCIENCE PROGRAMME THAT CAN BE GRADUALLY ADOPTED

Implementing citizen-science on biodiversity in schools is not a simple and linear process. Understanding the different stages of implementation can allow better accompanying the participants in the learning stages of a scientific pedagogy, but also better responding to the needs of teachers and students and reinforce and enhance their knowledge and skills. Beyond individual variability, we have distinguished three or four different stages (Table 12):

*Table 12. Trends and timeframes in the process of appropriating the scientific nature observation protocols of the Vigie-Nature Ecole citizen-science programme*

|  | <b>Year 1<br/>Discovery time</b> | <b>Year 2<br/>Maturation time</b> | <b>Year 3<br/>Mastery time</b> | <b>Year 4<br/>Time for Change</b> |
|--|----------------------------------|-----------------------------------|--------------------------------|-----------------------------------|
| <b>Carrying out the protocol(s)</b>              | Experimentation                  | Refining                          | Mastery                        | Mastery and experimentation       |
| <b>Use of the VNE website</b>                    | One-off                          | In-depth                          | One-off                        | One-off                           |
| <b>Biodiversity Discourse / Participatory Sc</b> | Low control                      | Refining                          | Mastery                        | Mastery                           |
| <b>Knowledge acquisition naturalists</b>         | Low                              | Average                           | Mastery                        | Mastery and low                   |
| <b>Scientific timeframes</b>                     | Low control                      | Average mastery                   | Mastery                        | Mastery                           |
| <b>Determination key</b>                         | Low control                      | Average mastery                   | Mastery                        | Mastery                           |
| <b>Data entry On the VNE website</b>             | Low                              | Average                           | Mastery                        | Mastery and low                   |
| <b>Setting up facilities</b>                     | Low                              | Average Strong                    | Average Strong                 | Average Strong                    |
| <b>Partnerships</b>                              | Low Average                      | Average Strong                    | Average Strong                 | Average Strong                    |
| <b>Need for VNE support</b>                      | Strong                           | Medium and occasional             | One-off                        | One-off                           |

### **Year 1 - the time of discovery:**

This is the moment of discovery of the scientific protocol and the citizen-science programme. This discovery can be encouraged by the school context (institution, colleagues, partners), but also by the personal context (acquaintances, parents of pupils, personal discovery). The motivated teacher tries to understand what it is all about and tries to use this tool in his or her teaching activities according to the possibilities (discipline, curriculum, extracurricular activities, teaching cycle, etc.). During this stage, the teacher browses the VNE website looking for useful information, namely the videos presenting the observatories, the participation booklet and the determination keys. Some on them

find the time and interest to do an online training course, others start experimenting independently. During this first year, teachers often test the implementation of observations in class and do not pay particular attention to entering and sending data on the dedicated VNE platform. They discover and learn by doing and by making mistakes. This is a time of uncertainty, doubt and lack of confidence in the ability to carry out identification according to the scientific rules.

The first year is also a time of awareness. The experiments carried out allow the teacher to take stock of his or her knowledge, shortcomings and weaknesses, and then of his or her needs in terms of collaboration inside and outside the school, particularly with naturalist partners. The teacher also discovers the expectations and scientific constraints of the protocol (timing, preparation, material, behaviour, knowledge, identification, place of observation, data sending). They test and adapt the scientific time of the protocol to their teaching and school time according to their possibilities and their discipline. At the same time, he/she discovers the communication and awareness strategies needed to motivate and mobilise his/her pupils, without which the objective of participation cannot be achieved; this is done according to his/her educational framework (school cycle, discipline, work area).

The first year is therefore a fundamental stage in the learning process of scientific pedagogy, during which the teacher observes, discovers, seeks out and trains himself and his pupils. It is a moment of transition between the known pedagogical comfort zone and the discovery of new possibilities. During this first year, the accompaniment and assiduous follow-up of the beginning teachers by the VNE coordinators is a key parameter for the adherence to the participative and scientific approach.

### **Year 2 - the maturation period:**

This is the time to refine the scientific and pedagogical approach. The teacher could be helped by an assessment form to make a reflective evaluation of his or her experiences during the first year, become aware of the improvements to be made in his or her pedagogical practices, and defines new scientific challenges to accomplish for the second year. He or she makes a more relevant choice of protocols to be carried out, according to his or her interests and motivations, but also according to the real possibilities in the school area (identification of the observation site(s) - inside or outside the school, possibilities of accompaniment and naturalist support in the field, material possibilities for the construction of infrastructures such as nest boxes, feeding troughs, cameras; support from the management and integration of teachers, staff or parents in the project, etc.). The pedagogical work also takes shape. Depending on the school cycle and the work format (whole class, club or workshop), the teacher develops more conscientiously the tools and activities necessary for raising awareness, training and learning the keys to identifying the species studied. He or she can better visualise the organisation of an observation calendar and the acquisition of the necessary material during the year. Complementary educational actions in collaboration with other actors can also be developed around the species (conferences, nature outings, artistic work, etc.). Then, most often, during this second year, there is a more in-depth exploration of the educational tools proposed on the VNE website and the platform for entering the collected data. Some teachers are doing online training, or are starting to train independently. A sensitivity to observation emerges or increases in the teacher, thus feeding his or her motivation with the scientific protocols.

In the field, the experiences of the first year allow a better appropriation of the scientific approach and temporality: preparation and management of the group before and during the observation, more rigorous respect of the steps of the protocol, of the observation time and of the identification key. Some teachers are more familiar with the species observed, are more confident and can better guide the pupils in the crucial and complex identification stage, even if occasional identification problems may remain (particularly for earthworms, plants, lichens and insects). In some contexts, the hesitant teacher can take photos and send them to the scientists, to avoid giving wrong information. Data entry on the platform tends to become more regular thanks to a better mastery and understanding of the site, as well as greater confidence in the quality of the data collected for simple protocols (birds or

snails). With the pupils, the teacher has a more elaborate discourse on biodiversity, the objectives and the expectations of the citizen-science programme as regards the interest of contributing to science. They are also more aware of the pupils' possibilities for proposing actions and concrete solutions to encourage the return of biodiversity in the school or in their living environment.

During this second year, support for teachers and pupils by the VNE coordinators can be concentrated at the beginning and end of the year, around a review of what has been achieved or needs to be improved in scientific practice and the implementation of facilities. Scheduled emails can also be sent every three months to the network of participants to maintain symbolic contact with them, to send news about species, to publicise tools or new products, etc. One-off work on communication, construction, implementation and promotion of facilities in schools can be developed with pupils and eco-delegates (communication kit). The feedback to the pupils on their data is highly expected by the participating classes.

### **Year 3: Time to master / Year 4: Time for change**

This is a time for gaining confidence in the scientific approach. The teacher has a better understanding of the scientific, contextual and institutional issues with which he/she must juggle during the school year to successfully complete the observations of nature, while contributing to research on biodiversity. Partnerships are better identified and collaborations are more regular, new actors can be integrated into the scientific approach and the implementation of facilities (staff, parents, teachers, town hall). The teachers' mastery of scientific protocols reassures them; the material, educational and observation sessions are better organised; identification becomes easier for some. The VNE website is mostly used for data entry and much less for searching for information or pedagogical activities related to the protocols (with the exception of a change of observatory by the teacher during the year, which would lead him/her to use the site to find information specific to his/her needs). The integration of new activities or training around the implementation of student accommodation can be a plus for the VNE site. This new information can revitalise its use.

Two trends were nevertheless identified in the third year thanks to the testimonies of two teachers who have been participating in VNE for four years. For the first, the third (or even fourth) year was a stage of expansion of the educational project with his class. In this context, the teacher introduced new VNE protocols to his project and thus new complementary activities (construction of natural infrastructures, inter-class work, other projects related to biodiversity, etc.). Within the framework of the REGREEN project, the teacher valued the introduction of activities allowing him to work on the pupils' relationship with nature, their representations and their emotions. Similarly, he set up another citizen-science observatory than those proposed by VNE. For the second teacher, the third and fourth years were too much, she was bored. During this year, she was more interested in passing on the torch to her colleagues and passing on the knowledge and teaching skills acquired during the previous years. She is no longer as assiduous with the scientific approach and does not devote as much importance to entering data on the platform as she did at the beginning of her participation.

The third and fourth years seem to represent a time of change in the way teachers think about and invest in the VNE programme, as they need a renewal of their pedagogical practices and personal motivations. The support of VNE coordinators during these years can be focused on this change, for example by helping teachers to feed their pedagogical practices with different activities or protocols, before they fall into a logic of monotony and gradual abandonment of the programme.

The following testimonial shows the evolution of a teacher's involvement in nature observation and participatory science over the last 4 years:

*"I worked in the private sector for 15 years before. I was working in a computer engineering services company. I was doing something that had nothing to do with teaching or nature... Today I have been a school teacher for 8 years [...] I am working with Vigie-nature École, this is the third year for me (2020-2021). I had already been participating in the protocols for two*

*years [...] Before doing the protocol, I didn't know anything about birds and I wasn't really interested. Now, it's true that I often stop in the street because now I'm interested and I'm starting to recognise them a little and have some knowledge about them. It's true that I see things a bit differently, I think I'm more receptive to issues that didn't necessarily interest me before [...] I've never been someone... I'm not committed to the defence of the environment, any more than anyone else, if you like. But now it's true that it changes a little, it changes the game, it's interesting [...] With the bird protocol, it's wonderful. That is to say, the first time I conducted it, we set up the photographic trap, but I expected to see a pigeon, a blackbird and that's all. And in fact, we noticed that there were a lot of different species of birds passing by [...] When we went back to the classroom, we debriefed our observation. We all discuss together to agree on how many birds of a given species we have seen. We reach a consensus. On the other hand, I'm in charge of recording. It's not them who enter the data on the website [...] This year (2021-2022) we're going to work on mammals that come at night. We have bought a kind of device that takes the prints of mammals when they pass through a kind of tunnel. We're going to put the food in this tunnel and the camera at the end of the tunnel to see what happens at night. Knowing that you never know. I would like to see a hedgehog or a fox". (Teacher, primary school)*

This testimony allows us to clearly see the stages that characterise the process of transformation of the relationship with nature and the pedagogical practices that result from the observation of biodiversity on this teacher. It is a long process that develops over time. Observation awakens a feeling of curiosity, discovery and wonder that subsequently fosters interest in going further in knowledge (through scientific protocols), in educational activities (installation of a camera, scientific approach) and in setting up new facilities (to promote discovery). It is therefore a process combining awareness of what surrounds us (observation), understanding of this living thing (scientific protocols), the desire to contribute to research (sending data) and the curiosity to continue discovering one's immediate environment (facilities).



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## 8 APPENDIX

### 8.1 Appendix 1: Call to participate to the REGREEN programme



We are looking for schools wishing to work on biodiversity and the relationship we have with it. Our objective is to set up concrete actions to promote (directly or indirectly) ordinary biodiversity. Within the framework of the European project REGREEN (see below), we will be able to propose to some voluntary establishments an accompaniment in the implementation of these projects.

#### Context of the call:

REGREEN is a European research programme led by the University of Aarhus in Denmark. This programme brings together more than 60 partners from universities, planning and urban development institutes from Europe and China (the two French partners are the Ile-de-France Regional Biodiversity Agency (ARB-IdF) and the National Museum of Natural History). Based on the observation that urban systems face major socio-environmental challenges and that the degradation of natural ecosystems makes cities vulnerable, the REGREEN project supports work that seeks to encourage the implementation of solutions based on the functioning of ecosystems (in English Nature-Based Solutions). More generally, it aims to understand and promote the renaturation of cities in a concerted approach that takes into account biodiversity, city dwellers and the governance of urban spaces.

Paris and the Ile-de-France region are one of the three study sites planned for this project, alongside Aarhus (Denmark) and Velica Gorica (Croatia).

#### Objectives of the call

Within REGREEN, the Museum and the ARB-IdF, wish to develop a collaborative work with schools (from primary to high school) in Île-de-France, to answer the following questions:

What relationships do students have with nature? How do they relate to their activities in nature, and/or to the acquisition of knowledge about biodiversity?

Does the implementation of facilities or activities dedicated to nature in schools make it possible to modify 1) the biodiversity present on school grounds; 2) the appropriation of these spaces by students; 3) the teachers' educational activities; 4) the governance of schools, both internally and with local actors (municipalities, departments, etc.)?

#### Participation process:

Initially, 1) an inventory of the state of biodiversity in the school will be carried out, following the protocols of Vigie-Nature Ecole (<https://www.vigienature-ecole.fr/>). These protocols will be carried out by the students and their teachers with, if possible, administrative staff, maintenance agents and/or parents. 2) In parallel, an inventory of the relationship between the students and the adults will be proposed, in the form of a quiz or short survey. The analysis of these data will be implemented in partnership with the MNHN team.

Students, teachers, staff and potentially parents, accompanied by the MNHN team, will use this diagnosis of the state of health of biodiversity to propose facilities and activities that promote the



biodiversity present in the school and that encourage relationships with nature. These activities could be linked to the arts (visual arts or technology, participation in and study of literary works or shows, etc.)

These activities and arrangements will be implemented throughout the year. Regular monitoring of biodiversity with the Vigie-Nature School protocols will make it possible to evaluate the effectiveness of these installations.

**Resources and support:**

All the establishments that participate in this project can be accompanied by people from the Museum or the ARB-IdF. Other structures, such as the CAUE (council for architecture, urban planning and the environment), may be mobilized.

Two activities have been identified by the Museum and the ARB-IdF teams: the implementation of participative sciences in schools (Vigie-Nature Ecole), Etienne Saglio's new magic show, Le bruit des loups (<http://www.ay-roop.com/le-bruit-des-loups-etienne-saglio/>). [Due to Covid crisis, the magic show was delayed and this activity was not included in this report]

**Condition of engagement:**

This project will span two school years (2019-2020 and 2020-2021). Teams wishing to participate in this project must have a minimum of two teachers, at least one of whom must be a life and earth sciences teacher. They will then join the collective of this project, which will bring together scientists, naturalists, artists, etc. in addition to teachers and students.

**Resource persons for this call for proposals:**

Léo MARTIN: Project manager at CESCO (Museum) for this project

Sébastien TURPIN : Coordinator of Vigie-Nature Ecole

Simon BENATEAU : Deputy coordinator of Vigie-Nature Ecole

Anne-Caroline PREVOT : CNRS researcher at CESCO (Muséum)

Gwendoline GRANDIN : correspondent of this project at ARB-IdF

## 8.2 Appendix 2: Sociology of the teachers involved in the programme

| Teacher    | Age | Gender | School level | Disciplines/profession | Classes                             |
|------------|-----|--------|--------------|------------------------|-------------------------------------|
| Teacher 1  | 48  | M      | Kindergarten | All disciplines        | Petite section                      |
| Teacher 2  | 44  | F      | Kindergarten | All disciplines        | Moyenne et grande section           |
| Teacher 3  | 36  | F      | Kindergarten | All disciplines        | Petite section                      |
| Teacher 4  | 39  | F      | Primary      | History                | CE1-CE2                             |
| Teacher 5  | 50  | F      | Primary      | All disciplines        | CP                                  |
| Teacher 6  | 36  | F      | Primary      | All disciplines        | CE1                                 |
| Teacher 7  | 44  | F      | Primary      | All disciplines        | CE2                                 |
| Teacher 8  | 43  | F      | Primary      | All disciplines        | CP                                  |
| Teacher 9  | 41  | F      | Primary      | All disciplines        | CP                                  |
| Teacher 10 | 36  | F      | Primary      | All disciplines        | CE1                                 |
| Teacher 11 | 40  | F      | Primary      | All disciplines        | CPA2                                |
| Teacher 12 | 45  | M      | Primary      | All disciplines        | CP                                  |
| Teacher 13 | 39  | F      | Middle       | Librarian              | 6ème, 5ème, 4ème                    |
| Teacher 14 | 33  | M      | Middle       | History/geography      | 6ème, 5ème, 3ème                    |
| Teacher 15 | 26  | F      | Middle       | Biology                | 6ème à 3ème + UPE2A (allophones)    |
| Teacher 16 | 37  | M      | Middle       | Biology                | Club nature                         |
| Teacher 17 | 31  | HM     | Middle       | Biology                | 6ème, 4ème                          |
| Teacher 18 | 58  | F      | High         | Biology                | 2nde, 1ère, terminale               |
| Teacher 19 | 50  | F      | High         | Economy and sociology  | 2nde, 1ère, terminale               |
| Teacher 20 | 37  | F      | High         | Biology                | 2nde, 1ère, terminale               |
| Teacher 21 | 52  | F      | High         | Biology                | 2nde, 1ère, terminale               |
| Teacher 22 | 46  | F      | High         | Biology                | Terminal, classes post-baccalauréat |
| Teacher 23 | 41  | F      | Medium       | French                 | 5ème, 3ème                          |

### **8.3 Appendix 3: Guideline for the semi-structured interviews of the teachers**

**Personal information:** First name / Age / Gender / Civil status / Place of birth / Living place / School / Profession / Classes

#### **8.3.1 Part 1 - Opening Questions**

How long have you been teaching at this school?

What do you think is unique about this school compared to others geographically? Environmental? Socio-cultural?

According to you, what are the major difficulties for teachers and students in this school?

#### **A) Awareness and acceptance of the REGREEN project**

Can you explain to me how you joined the European project REGREEN? Why did you join this project?

How was the project received by your management? By your colleagues? By the pupils and their families?

Can you tell me if the objectives of the REGREEN project are clear to you and your school?

Have you been involved in citizen-science projects before REGREEN? What do you think about citizen-science? about data collection?

#### **B) Personal and collective educational appropriation of the REGREEN project**

How did you integrate the REGREEN project in your educational activities?

Did you have any difficulties integrating the VNE protocols into your educational activities? Can you give me an example of a difficulty encountered?

What relationships or collaborations have you developed with other members of your school for the REGREEN project (other teachers, staff, administrators)? Can you give me an example of a collaboration you developed for the REGREEN project with one of these people? What did this collaboration add to the project and the students?

Have you developed relationships or collaborations with partners outside the school (scientists, parents, professionals, associations, other)? Can you give me an example of collaboration with a partner for the REGREEN project? What did this partnership collaboration bring to the project and to the students?

Is there a steering committee for the REGREEN project in your school? If yes, who is on it? If not, why not?

How can we help you to set up this committee next year?

#### **C) Participation and presentation of the project to students**

Who is involved in the REGREEN project in your school?

How was the REGREEN project presented to the students? Parents (for kindergarten and elementary schools)?

How did the students react to the REGREEN project / protocols? How did the parents react to the project? (for kindergarten and elementary schools)

What means did you use to make your students aware of the VNE protocols? (none, VNE videos, scientific sources, documentaries, etc.) Did the students take initiatives to carry out the VNE protocols within the school? For example?

How was this received by other students and the administration?

Have you observed any changes in behavior following the realization of the protocols among the students in relation to the species observed? Among parents? Among your colleagues? For example?

Did you observe any differences between students (boys and girls) during the execution of the VNE protocols? Which ones?

Did you have any difficulties to mobilize students in the project? For example?

Did you have any difficulties in involving parents in the project? For example?

How do you think we can improve student participation in the project for next year? What about the involvement of other adults?

What role do the eco-delegates currently play in the project? In your opinion, could they be given a more important place? How could this be done?

#### **D) Activities carried out - protocols**

What VNE protocols do you carry out in your classes?

Can you tell me how the protocols are carried out with your students in class and outside?

What activities do you promote to accompany the realization of the protocols? Why do you do this?

Where did the VNE protocols take place? Why did you choose this space?

Did you need to adapt the protocols? Why did you need to adapt the protocols? How did you adapt the protocols?

How is data collection and entry done during student observations? Who does the data entry on the VNE site? Why or why not?

Do you ever not perform data entry on the VNE site? Why or why not?

Do you use the resources offered on the VNE site to carry out the protocols? If so, which ones? What do you think of these resources? If not, why not?

Would you like to have other resources on the VNE site to help you implement protocols? Which ones? What type of protocols?

What do you think of the other protocols proposed in this project (free listing, nature stories, exploratory activities)?

Did you participate in the training offered by the School Vigilance Programme to help you implement the protocols? If so, what did you think of these trainings? If not, why?

Would you like to take (another) course by the end of the year? Which one?

#### **Conclusion part 1**

Do you have a memorable anecdote to tell me about the protocols?

What activities would you like to develop in your school next year around the VNE protocols?

### **8.3.2 Part 2 : reflective questions**

#### **A) Your relationship with nature**

How would you define your personal relationship with nature today?

Do you think that your personal relationship with nature influences your teaching practices? For what?  
Can you give me an example?

Do you think that conducting the VNE protocols will change anything in your relationship to nature?  
Like what for example?

#### **B) Reflective approach**

Do you think the VNE protocols have, or will have, an impact on your students? Like what, for example? (knowledge, relationship to others, research, other)

And on the school?

Would you like to continue this project next year? Why or why not? What would you change?

After this first year of participation in the project, what aspects could be improved for next year?

What would you need to do differently?

#### **Conclusion Part 2**

Would you like to add a comment on something we overlooked?

Thank you very much for your participation



## 8.4 Appendix 4: Observation grid for VNE Protocols

Date / Site / interactions / body posture / discours

|                               |                      |                                |
|-------------------------------|----------------------|--------------------------------|
| Implemented activity          |                      |                                |
| Objective of the activity     |                      |                                |
| Starting time of the activity |                      | Total duration of the activity |
| Ending time of the activity   |                      |                                |
| Class                         |                      |                                |
| Number of students            | Boys :               | Girls :                        |
| Adults                        |                      |                                |
| Activity context              | VNE protocol / Other |                                |
| Sites for the activity        | Inside :             |                                |
|                               | Outside :            |                                |
| Weather                       |                      |                                |

### BEFORE THE PROTOCOL :

|  |  |                         |         |
|--|--|-------------------------|---------|
| TIME   | Length of the presentation                               |                         |         |
| SPACE<br>Spatial organization of people<br><br>To draw   | Students :   |                         |         |
|  | teachers   |                         |         |
|  | Other animator   |                         |         |
|  | Parents / others :                                       |                         |         |
| TALKS  | Who talks (function)?                                    |                         |         |
|  | Content / Theme  |                         |         |
|  | Media used to present information                        |                         |         |
|  | Language used (scientific, adapted, complex...)          |                         |         |
|  | Vision given of the observed species (terms, vocabulary) |                         |         |
| BODY POSTURE<br>(non verbal language)                    | Students   |                         |         |
|  | Teachers   |                         |         |
|  | Other animators:   |                         |         |
|  | Parents / others :                                       |                         |         |
| INTERACTIONS   | What   | When                    | Content |
| Teachers interventions                                   |  |                         |         |
| Parents interventions                                    |  |                         |         |
| Students oral interventions<br><br>Write in the notebook | Who (M / F)  | What (content / action) |         |
|  |  |                         |         |
|  |  |                         |         |
|  |  |                         |         |
|  |  |                         |         |

Drawing of the situation / spatial context of the activity Before the protocol

### DURING THE PROTOCOL / activity

|   |  |  |                |
|---|--|--|----------------|
| <b>TIMING</b>   | Duration of the activity :                                   |  |                |
| <b>Course of the activity</b><br><b>Movements</b>   | Where ? :  |  |                |
|   | How the trip goes (who accompanies, duration, atmosphere)    |  |                |
| <b>SPACE</b><br><b>Spatial organisation of actors</b><br><b>Sketch/ photo</b><br><b>Movements (indicate movements in the sketch)</b>                    | Students : organisation/reorganisation/ movements (who, how) |  |                |
|   | Teachers   |  |                |
|   | Other animators  |  |                |
|   | Parents /others :  |  |                |
| <b>TALKS</b>  | Who talks? (function)  |  |                |
|   | Content/theme  |  |                |
|   | Media used to present the information                        |  |                |
|   | Language used (scientific, adapted, complex...)              |  |                |
|   | Vision given of the observed species (terms, vocabulary)     |  |                |
| <b>BODY POSTURE</b><br>(non verbal language)<br><i>Changes during the observation</i>   | Students   |  |                |
|   | Teachers   |  |                |
|   | Other animators  |  |                |
|   | Parents / others :   |  |                |
| <b>INTERACTIONS</b>   | <b>What</b>  | <b>Whent</b>   | <b>Content</b> |
| Teachers interventions  |  |  |                |
| Parents interventions   |  |  |                |
| Interactions of students with each other / with others<br>Language/vocabulary<br>Expressions<br>Objectives of the action<br><i>Note in the notebook</i> | Who (M /F)   | What (content / action)  |                |
|   |  |  |                |
|   |  |  |                |
|   |  |  |                |
| Interactions of students with <b>Nature</b><br><b>Attention to SENSES mobilized</b>   | Who (M /F)   | What (interaction with what / type of action / purpose / speech / attitude -aggressive-soft-etc. / interaction alone or other) |                |
|   |  |  |                |
|   |  |  |                |
|   |  |  |                |

**Sketch spatial organization: Attention to movement - spatial reorganization**

## AFTER VNE PROTOCOL:

|   |  |                         |                |
|---|--|-------------------------|----------------|
| <b>TIMING</b>   | Duration   |                         |                |
| <b>New proposed activity ? What? How ?</b>  |  |                         |                |
| <b>SPACE</b><br>Spatial organization of actors<br><i>If needed, take sketch 1 and modify</i>  | Where ?  |                         |                |
|   | Students :   |                         |                |
|   | Teachers   |                         |                |
|   | Other animators :  |                         |                |
|   | Parents / others :                                       |                         |                |
| <b>TALKS</b>  | Who talks? (function)                                    |                         |                |
|   | Content/theme  |                         |                |
|   | Media used to present information                        |                         |                |
|   | Language used (scientific, adapted, complex...)          |                         |                |
|   | Vision given of the observed species (terms, vocabulary) |                         |                |
| <b>BODY POSTURE</b><br>(non verbal language)<br><b>Behaviors</b><br><b>Gestures, Grimaces</b> | Students :   |                         |                |
|   | Teachers   |                         |                |
|   | Other animators :  |                         |                |
|   | Parents / others :                                       |                         |                |
| <b>INTERACTIONS</b>   | <b>What</b>  | <b>When</b>             | <b>Content</b> |
| Teachers' Interventions   |  |                         |                |
| Parents' Interventions  |  |                         |                |
| Animators' Intervention   |  |                         |                |
| <b>Students' oran Interventions</b><br><br><b>Note in the notebook</b>                        | Who (M /F)   | What (content / action) |                |
|   |  |                         |                |
|   |  |                         |                |
|   |  |                         |                |
|   |  |                         |                |
|   |  |                         |                |
|   |  |                         |                |

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## COMMENTS

\* Recording of exchanges is recommended to have access to the verbatims

## 8.5 Appendix 5. Focus groups implemented in 2021

| Theme / gender                   | School level | Number of participants         |
|----------------------------------|--------------|--------------------------------|
| Birds / Boys                     | primary      | 8 students + Mara SJ           |
| Birds / Boys                     | primary      | 8 students + Mara SJ           |
| Birds / Boys                     | primary      | 8 students + Mara SJ + teacher |
| Birds / Girls                    | primary      | 7 students + Mara SJ + teacher |
| Birds / Girls                    | primary      | 8 students + Mara SJ           |
| Birds / Girls                    | primary      | 8 students + Mara SJ           |
| Earthworms / Boys                | primary      | 7 students + Mara SJ           |
| Earthworms / Girls               | primary      | 7 students + Mara SJ           |
| Several species / Boys and Girls | primary      | 6 students + Mara SJ           |
| Several species / Boys and Girls | primary      | 6 students + Mara SJ           |
| Several species / Girls          | middle       | 6 students + Mara SJ           |

## 8.6 Appendix 6: Diploma for participation to REGREEN



**Vigie-Nature**  
DÉCOUVRIR & PARTAGER *école*



# Diplôme de participation au projet européen REGREEN



Ce diplôme est décerné à .....

Pour sa participation active au projet et à la recherche sur la biodiversité à travers la réalisation des protocoles scientifiques de Vigie-Nature-école et la mise en place de solutions pour favoriser le retour de la biodiversité dans leur école

Paris, Muséum National d'Histoire Naturelle, le 2 juin 2022

Le coordinateur de Vigie-Nature École  
Sébastien Turpin



La coordinatrice scientifique  
Anne-Caroline Prévot



La coordinatrice du projet REGREEN  
Mara Sierra Jimenez



## 8.7 Appendix 7: Presentation of school participations to the REGREEN project

### 8.7.1 Primary school



Protocole Vigie-Nature École « oiseaux des jardins »

- \* Identification des oiseaux de leur école
- \* Mise en place des mangeoires et des nichoirs
- \* Mise en place d'un appareil photo pour observer les oiseaux de l'école
- \* Apprendre à reconnaître et identifier les oiseaux de l'école
- \* Plantation des graines à l'école pour nourrir les oiseaux
- \* Production d'une fresque artistique sur les oiseaux de leur école





## 8.7.2 Middle school



Collège Emile Zola

MUSEUM NATIONAL D'HISTOIRE NATURELLE  
AGENCE RÉGIONALE POUR LA BIODIVERSITÉ

**ATELIER**  **REGREEN**  
NATURE-BASED SOLUTIONS

Une présentation de Riyad Benkanoun, Ghalia Chalhoun, Léo Chauchis Xifra, Tommy Dequi Seckler, Mahé Gueret, Manel Hemouga, Massylia Iklef, Anyes-Zahia Moudache, Ritag Othman, Maëlys Tamoud et Hadjila Zaouali.

### Protocole Vigie-Nature École « Lichens »

- \* Test avec les protocoles oiseaux, vers de terre et escargots
- \* Identification des zones pour faire le protocole – Adaptation au terrain
- \* Réalisation des protocoles à l'extérieur de l'établissement
- \* Apprendre à reconnaître et identifier les lichens
- \* Valorisation du projet par le club nature à d'autres classes
- \* Atelier « la nature et nous »

**L'ATELIER AU COLLÈGE**

OBJECTIF 1 : OBSERVER ET COMPTABILISER LA BIODIVERSITÉ AU COLLÈGE



Oiseaux des jardins



Opération escargots



Placettes à vers de terres



Lichens Go !

**LE PROTOCOLE LICHENS :**

**LES RÉSULTATS**

Sur les trois arbres : toutes les faces sauf sud



*Physcia adscendens / tenella*

- Présence de soriales au bout des lobes
- Présence de cils (1 à 3 mm) et de quelques rhizines
- Lobes étroits de 0,3 à 1,5 mm de large



