

## 1. Contestant profile

▪ Contestant name:	<b>Alessandro Mazzoleni</b>
▪ Contestant occupation:	Biologist
▪ University / Organisation	Freelance
▪ Number of people in your team:	<b>4</b> (Dott. Giorgio Agazzi, Dott. Stefano Aguzzi, Dott. Fausto Leandri)

## 2. Project overview

Title:	Like a stepping stone
Contest: (Research/Community)	Research
Quarry name:	Santa Giustina, Castenedolo BS

## Abstract

The "*Like a stepping stone*" research project was aimed at the ecological characterization of the former Italcementi Santa Giustina quarry area in Castenedolo (BS). Three main target groups were investigated, evaluated as good bioindicators: birds, butterflies and ground beetles; the monitoring of these groups was preceded by a botanical survey in order to best framing the site. The censuses were carried out using consolidated and standardized methods, easily repeatable and functional to the collection of semi-quantitative data, for a total of 20 days in the field.

First of all, the research have made it possible to frame the floristic structure of the site of Santa Giustina, whose grassland and forest habitats are made up of ubiquitous essences typical of the Po valley environment (for a total of 182 species), including the autochthonous species used in the redevelopment phase of the quarry, as well as some exotic invasive ones.

The survey on ground beetles led to a census of 22 species, most of which are well distributed throughout the national territory; of particular interest is the discovery of *Leistus rufomarginatus*, a very rare species in Italy. In addition, three species should be mentioned, the range of which is limited to northern Italy and the Swiss territories.

The butterflies census made it possible to record a total of 26 species, 21 during standard surveys. Most of the detected species can be considered generalist, linked to open areas and ecotones and widely spread in the Po Valley. No butterflies of conservation interest have been recorded.

43 species of birds were observed, 35 detected within the standardized monitoring; 17 species were found to be certain or probable breeding in the area of Santa Giustina and 7 as possible breeding.

The collected data describe a dynamic ecological situation, as expected for a recently redeveloped site, with the finding of wildlife communities that include various species of conservation interest, which are associated with largely widespread ones. The results support the potential of the Santa Giustina site as an ecological connection ganglion within the Brescia plain. To increase this function and increase the ecological value of the site, environmental diversification interventions and specific guidelines for the future management of the habitats are proposed on the basis of what has been observed.

## Final report project “LIKE a STEPPING STONE”

### Introduction

The former Santa Giustina open-pit clay quarry is a wide flatland area located at an altitude between 120 m and 134 m above sea level nearby Castenedolo municipality (Brescia Province). The site is part of the continental biogeographical region and it is surrounded by a mixture of intensive agriculture and anthropized areas, typical of central Po Valley landscapes.

After the closure of the quarry in 2011, an environmental recovery plan started. This plan carried out a compensatory reforestation on a total of 30000 autochthonous trees and shrubs.

The research project was aimed at the opportunity to study a former quarry where the restoration is recently finished. This specific condition could be useful to understand how the zoological communities respond to the redevelopment phase in the short period. First, the researchers carried out a flora census related to surveys on two taxa of insects considered good bioindicators: diurnal butterflies (Lepidoptera Rhopalocera) and ground beetles (Coleoptera Carabidae). Composition and abundance of breeding birds community were also studied to define the status of an important taxon at the top of trophic chains.

The project is carried out using traditional and standardized methods to highlight the role of the field naturalist as a professional researcher who is able to correlate the collected data and the trends at ecosystem or environmental scale.

### Methods

The research was developed by a team of 4 naturalists and biologists, within the former Santa Giustina quarry, on a study area of about 25 hectares (Fig.1). Census were carried out with consolidated and standardized methods, usually used for the wildlife census in Italy, both in the scientific field and within impact assessment programs. This scientific approach led to collect semi-quantitative data, useful both for comparing the current ecological situation with other environmental realities, and for future monitoring of the evolution of the Santa Giustina area.

Census of different target groups was made using the following methods.

**1) Flora and vegetation.** Census of the vascular flora, using parallel linear transects, for the description of the vegetation according to physiognomic criteria.

**2) Butterflies (Lepidoptera Rhopalocera).** Transects counts, with registration of each specimen encountered inside an imaginary box of 5 x 5 x 5 m. The transects were designed to investigate all the types of habitats present in the study area. Individuals were surveyed without collecting specimens (direct observation, temporary capture with entomological net and archiving of photographic documentation).

**3) Ground beetles (Coleoptera Carabidae).** The standardized surveys were carried out by identifying 4 sampling sites, each having its own environmental peculiarities. In each station four pitfall traps were installed (diameter of 5 cm, depth 7 cm). The sampling took place in the months of April, May and June. During this time, the pitfall traps were triggered at the beginning of each month and checked (and defused) after approximately 15 days. All collected ground beetles were examined and determined using a stereoscope and consulting specific manuals (Hurka 1996; Pesarini and Monzini 2010; Pesarini and Monzini 2011).

**4) Avifauna.** Bird census was carried out by record all birds identified by sight or sound, with the aid of 10x42 binoculars, along 2 linear transects. Each transect, 500 m length, was defined in order to investigate the main types of habitats present in Santa Giustina. Attention was paid to finding behaviours that proving nesting in progress. The 2 transects were made walking at a slow pace, early in the morning, with 3 repetitions during the spring 2022, in April, May and June. This time schedule made it possible to ensure maximum coverage over early and late breeding species. All the observations of birds present were recorded, within a buffer of 100 meters from the linear transect, or over 100 meters, according to a field protocol taken from MITO 2000 Project (Italian breeding birds monitoring project, Fornasari et al. 2002). Each presence data has been associated with a code relating to the characteristics of the observation, according to the following scheme:

- A: generic observation;
- C: male singing or showing some other territorial behaviour;
- M: male not singing;
- F: female;
- j: juveniles not able to fly or recently fledged;
- r: reproductive activity or nesting site observation;
- V: bird in transfer flight, whose presence is not strictly connected to the site.

The standard data relating to avifauna were then analysed to provide a summary of what was observed. All the field worksheets, useful for more detailed assessments, are attached in Annex III to the project.

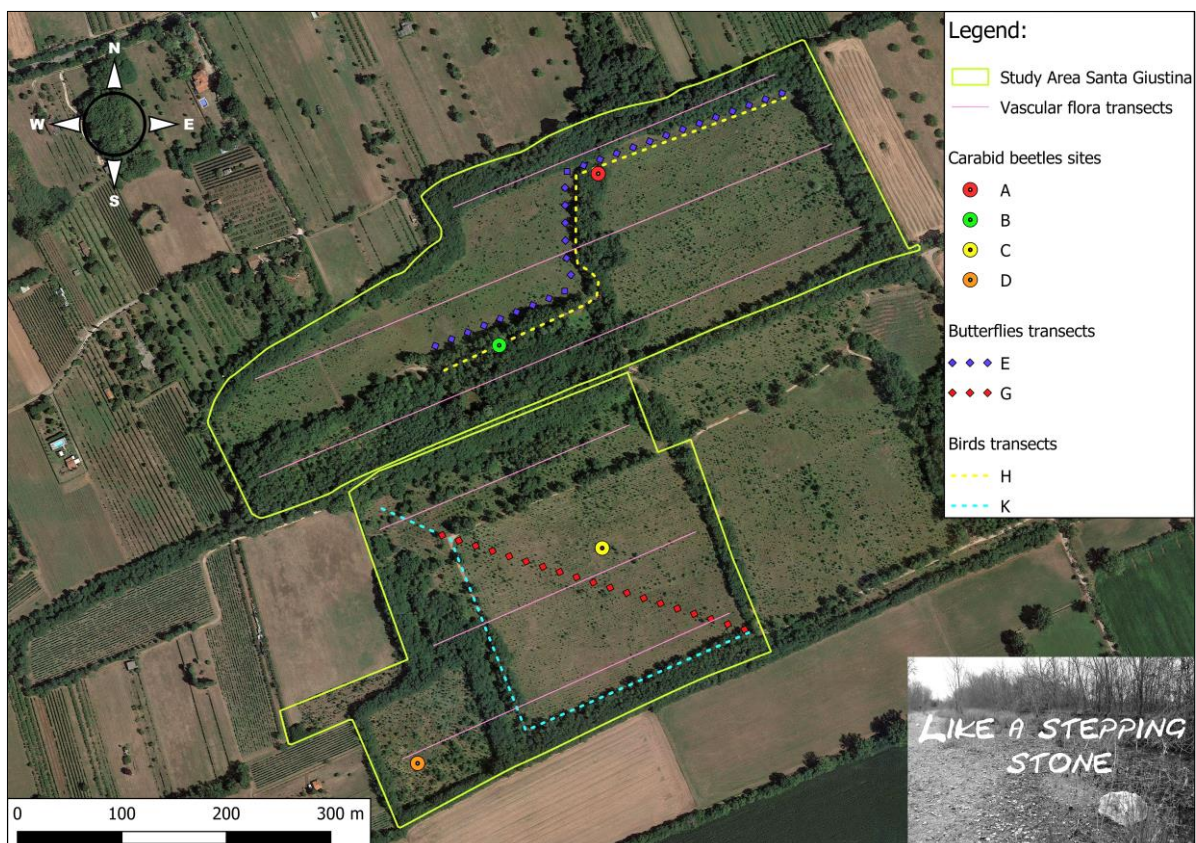


Fig.1: Study area of Santa Giustina, with localization of monitoring sites and standard transects used for the census of vascular flora, carabid beetles, butterflies and birds.

To improve the dissemination of knowledge and offer an educational and informative tool useful to Heidelberg, the local community and schools, within this study, a specific research project related to the Santa Giustina area was created on the Citizen platform. Science iNaturalist.org (link: <https://www.inaturalist.org/projects/like-a-stepping-stone>), on which more than 200 data collected during this research have been uploaded, more than half of which accompanied by photos.

The complete list of species surveyed during the research, 303 species, is instead returned through the appropriate list template, linked to the Quarry Life Award competition, as Annex I to the report.

## Flora and vegetation results

The flora census made it possible to record a total of 182 species of vascular plants, of which 10 are exotic taxa. The vegetation cover is largely made up of grassland areas with sparse shrubs and small trees, while the perimeter bands are characterized by a continuous tree cover. The herbaceous vegetation is composed of ubiquitous essences typical of the lowland environment, for which there is however a limited incidence of exotic or potentially invasive species. The grassy areas are dominated by graminoid species such as *Arrhenatherum elatius*, *Dactylis glomerata*, *Bromopsis erecta*, *Lolium* spp. *Festuca* spp. Among the tree species included in the black list, we note the presence of *Acer negundo* and *Ailanthus altissima*, while among the naturalized species there is an abundance of *Robinia pseudoacacia*.

## Ground beetles results

During the survey, 100 specimens and 22 species are collected. These species are divided in 5 Subfamilies (Tab.1). No species are inserted in Annexes II or IV of the Habitat Directive (Dir. 92/43/CEE).

The studied communities are mainly represented by generalist species that are common both in woods, both in meadows both in damaged or anthropized environments.

There are also interesting records, like *Leistus rufomarginatus*. This species, represented by a single specimen found in a small grove of *Robinia pseudoacacia* (site A), is a nemoral one, rare throughout the Italian country. In Lombardy, for example, it was known for only one site (Monzini 2008). In Santa Giustina quarry *L. rufomarginatus* seems very rare too.

Another unexpected species is *Nebria brevicollis*. Like *L. rufomarginatus*, it's a Nebriinae ground beetle that prefers woodlands from lowland to medium mountain, becoming rare in agricultural landscapes. In the quarry, it seems to be localized in the small meso-hygrophilous grove (site B).

Finally, three endemic species of Northern Italy and neighbouring Swiss territories are recorded (*Abax contractus*, *Calathus rubripes* and *Pterostichus micans*) (Magistretti 1965).

Subfamily	Species	Sampling Sites			
		A N (DAa)	B N (DAa)	C N (DAa)	D N (DAa)
<b>Brachininae</b>	<i>Brachinus crepitans</i> (Linnaeus, 1758)	0	0	0	2 (0,14)
<b>Harpalinae</b>	<i>Harpalus atratus</i> Latreille, 1804	0	0	0	1 (0,07)
	<i>Harpalus dimidiatus</i> (P. Rossi, 1790)	1 (0,07)	0	13 (0,90)	18 (1,25)

	<i>Harpalus flavicornis</i> Dejan, 1829	0	0	0	1 (0,07)
	<i>Harpalus rubripes</i> (Duftschmid, 1812)	0	0	0	4 (0,28)
	<i>Harpalus serripes</i> (Quensel in Schönherr, 1806)	0	0	0	1 (0,07)
	<i>Harpalus tardus</i> (Panzer, 1797)	0	0	0	9 (0,63)
	<i>Ophonus azureus</i> (Fabricius, 1775)	0	0	0	4 (0,28)
	<i>Ophonus puncticeps</i> Stephens, 1828	0	0	0	1 (0,07)
	<i>Pseudophonus rufipes</i> (De Geer, 1774)	1 (0,07)	0	0	8 (0,56)
<b>Nebriinae</b>	<i>Leistus rufomarginatus</i> (Duftschmidt, 1812)	1 (0,07)	0	0	0
	<i>Nebria brevicollis</i> (Fabricius, 1792)	0	2 (0,14)	0	0
<b>Platyninae</b>	<i>Calathus erratus</i> Sahlberg, 1827	1 (0,07)	0	0	0
	<i>Calathus fuscipes</i> Goeze, 1777	0	0	2 (0,14)	0
	<i>Calathus melanocephalus</i> (Linnaeus, 1758)	0	0	0	1 (0,07)
	<i>Calathus rubripes</i> Dejan, 1831	1 (0,07)	0	4 (0,28)	1 (0,07)
<b>Pterostichinae</b>	<i>Abax contractus</i> (Heer, 1841)	4 (0,28)	2 (0,14)	0	0
	<i>Pterostichus melanarius</i> (Illiger, 1798)	1 (0,07)	0	1 (0,07)	0
	<i>Pterostichus melas</i> (Creutzer, 1799)	1 (0,07)	0	7 (0,49)	3 (0,21)
	<i>Pterostichus micans</i> Heer, 1841	0	0	2 (0,14)	0
	<i>Pterostichus niger</i> (Schaller, 1783)	1 (0,07)	0	0	0
<b>Trechinae</b>	<i>Trechus quadristriatus</i> (Schrank, 1781)	1 (0,07)	0	0	0

Tab. 1: Species list for each sampling site and relative number of individuals collected (N) and annual activity density (DAa).

The analysis of data by the use of Shannon Wiener index and annual activity density (Brandmayr et al. 2005) (Tab. 2) highlights the presence of a community characterized by species that prefer the most recent reforested sites, where the percentage of tree cover is not high (sites C and D).

Site A has an high ecological value too, while the lower number of captures in the last one (Site B) doesn't allow any information about the real structure of the related cenosis.

The factors with a negative influence on the results may be local (like human disturbance) or more global. It's clear, for example, that the last summer was one of the most dry of all time. This particular condition has limited the activity of most of species.

Index	Sampling sites			
	A	B	C	D
<b>DAa Tot: Total annual activity density</b>	0,91	0,28	2,02	3,77
<b>H: Shannon Wiener Index</b>	3,15	1,00	2,10	3,02

Tab. 2: Annual activity density and Shannon Wiener index of ground beetles

## Butterflies results

The butterflies census made it possible to record a total of 26 species, 21 during standard surveys (transects counts E and G). Surveys were regularly performed between April and July, it was not possible to investigate the last generation of butterflies (multivoltine species) in August-September, due the delivery time of the report. The effort does not allow to detect all butterfly species at the site. Further investigations would be needed to

complete a checklist. No species are presented in Habitats Directive. Fifty percent of the detected butterflies are considered generalist species and twenty percent are grassland species (Van Swaay et Al., 2006). The restored quarry site of Santa Giustina hosts many generalist species, some grassland species and few forests species.

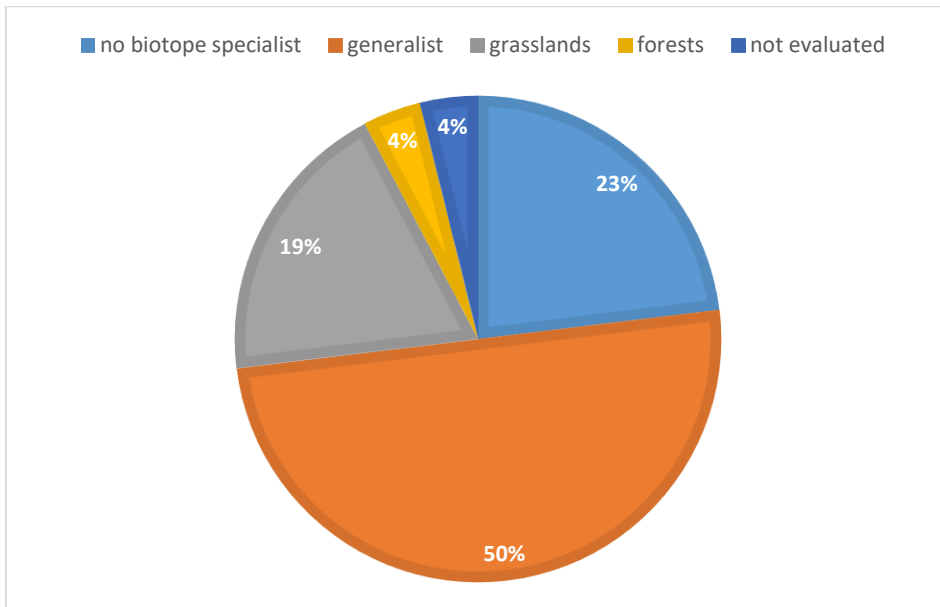


Fig.2: Ecology of butterflies species in Santa Giustina quarry

Thanks to the contemporary census of the Flora of Santa Giustina Quarry is possible to argue that more than 90 percent of the species likely reproduce in the site, more than 70 percent of the detected species are “quite stationary”, according to ecological classification of Italian butterflies , based upon their ecological preferences (Balletto & Kudrna, 1985).

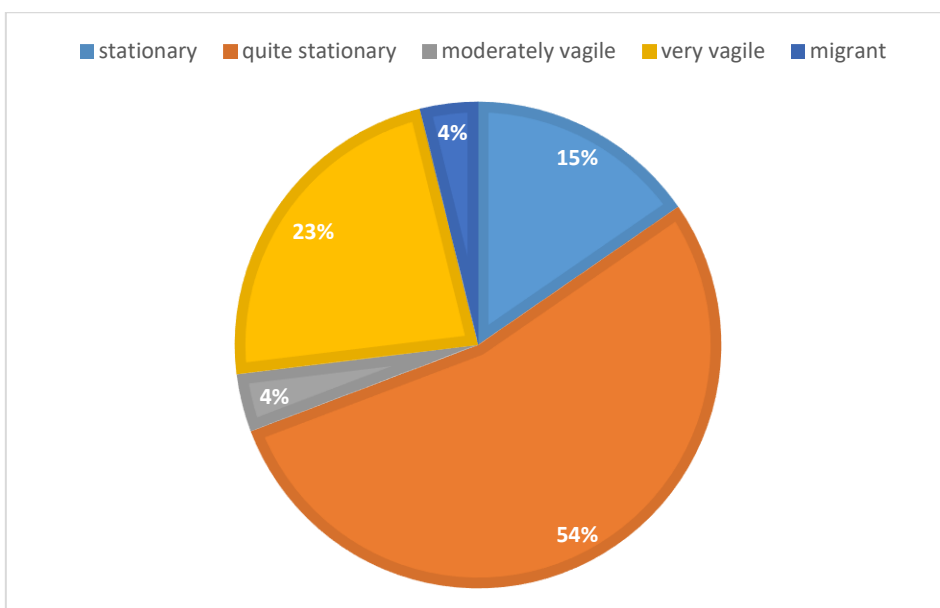


Fig.3: Vagility of the butterflies of Santa Giustina Quarry.

In the graphs species and number of specimens recorded during transects counts. *Leptidea sinapis* complex, *Aricia agestis*, *Erynnis tages* and *Thymelicus lineola* are the more frequent species. *Leptidea sinapis* and *Thymelicus lineola* are almost absent from the Po Plain and became more frequent in hills and prealpine habitats (Ruffo & Stoch, 2004).

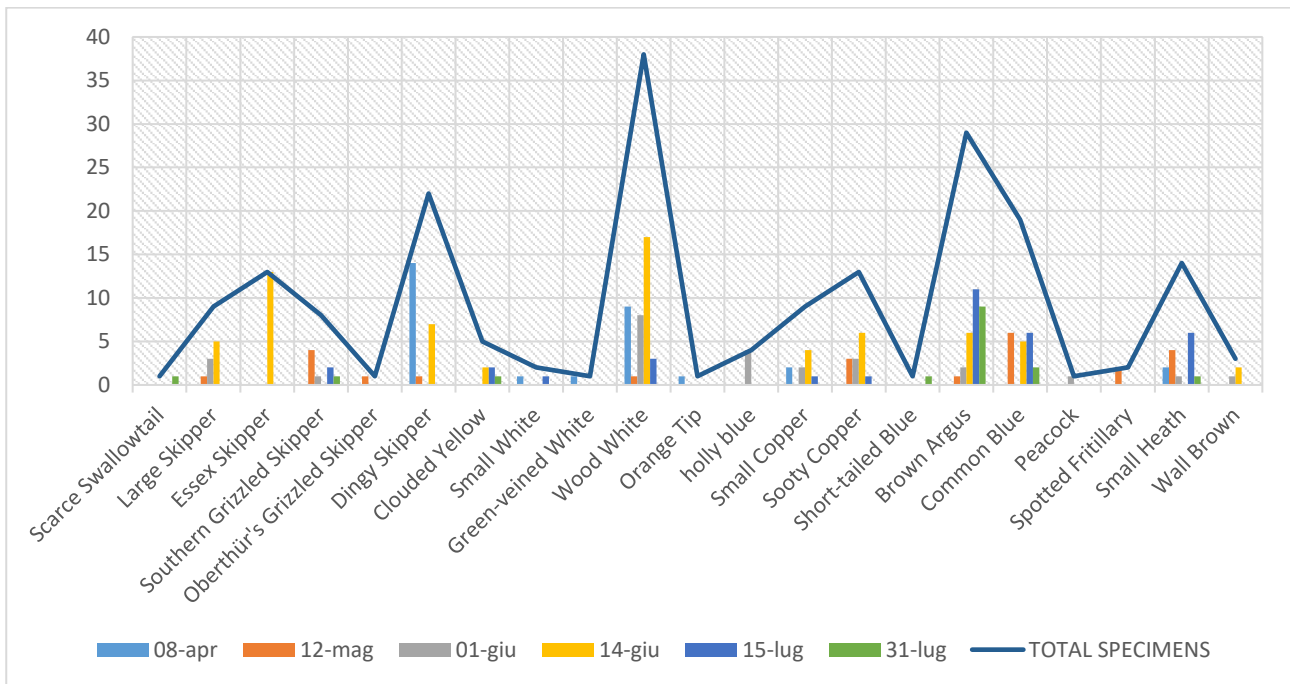


Fig. 4: Transect counts: total number of specimens/species, Butterflies transect E.

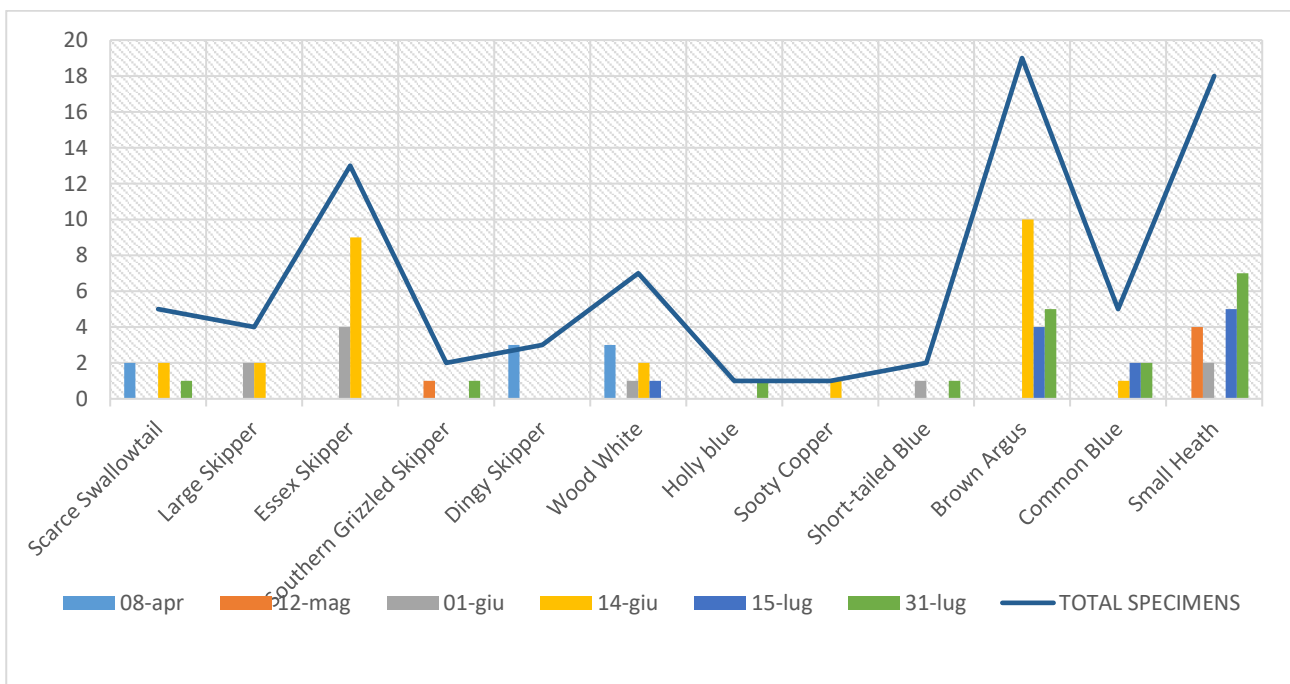


Fig.5: Transect counts: total number of specimens/species, Butterflies transect F.



## Birds results

The research on avifauna allowed the census 43 species of birds (25 passerines and 18 non-passerines) in the area of Santa Giustina. 35 species were detected during the surveys conducted using the standardized methodology, along H and K transects (Table 3). The standardized surveys made it possible to define the local status of the observed species and to offer an estimate of the minimum number of breeding pairs; 17 species were found to be confirmed/probable breeding, while 6 species were possible breeding. For a further 7 species, the area represents a roosting/foraging site during the nesting period, although the absence of suitable ecological conditions and habitats does not support direct nesting within the study area. The remaining 5 species detected are attributable to the presence of late wintering or migratory birds.

Species	Scientific name	Date & Standard transect						Status	Breeding pairs
		08/04/22		14/05/22		12/06/22			
		H	K	H	K	H	K		
Long-tailed Tit	<i>Aegithalos caudatus</i>	2	-	-	-	4	2	BC	1 - 3
Common Swift	<i>Apus apus</i>	-	-	-	1	24	15	P	-
Grey Heron	<i>Ardea cinerea</i>	-	-	1	-	-	-	P	-
Cattle Egret	<i>Bubulcus ibis</i>	-	-	-	1	1	-	P	-
European Goldfinch	<i>Carduelis carduelis</i>	2	-	-	-	-	-	BX	1
Common Wood-Pigeon	<i>Columba palumbus</i>	6	7	3	5	9	5	BC	2 - 4
Hooded Crow	<i>Corvus cornix</i>	2	2	4	3	5	-	BC	1 - 3
Eurasian Jackdaw	<i>Corvus monedula</i>	1	-	-	-	1	-	P	-
Common Cuckoo	<i>Cuculus canorus</i>	-	1	1	-	-	-	BC	1
Common Whitethroat	<i>Curruca communis</i>	1	-	-	-	-	-	MW	-
Common House Martin	<i>Delichon urbicum</i>	-	-	-	-	2	-	P	-
Great Spotted Woodpecker	<i>Dendrocopos major</i>	2	1	1	1	4	3	BC	1 - 3
Common Chaffinch	<i>Fringilla coelebs</i>	5	1	-	2	-	1	BC	1 - 3
Brambling	<i>Fringilla montifringilla</i>	4	-	-	-	-	-	MW	-
Melodious Warbler	<i>Hippolais polyglotta</i>	-	-	-	1	-	1	BX	1
Barn Swallow	<i>Hirundo rustica</i>	1	-	-	3	4	8	P	-
Common Nightingale	<i>Luscinia megarhynchos</i>	2	1	3	2	3	3	BC	3 - 5
European Bee-eater	<i>Merops apiaster</i>	-	-	1	8	-	-	P	-
Spotted Flycatcher	<i>Muscicapa striata</i>	-	-	-	2	-	-	BC	1
Eurasian Golden Oriole	<i>Oriolus oriolus</i>	1	-	6	3	2	3	BC	3 - 6
Eurasian Scops Owl	<i>Otus scops</i>	-	-	1	-	-	-	BX	1
Great Tit	<i>Parus major</i>	4	5	3	2	5	1	BC	4 - 8
Ring-necked Pheasant	<i>Phasianus colchicus</i>	-	1	-	-	-	-	BX	1
Common Redstart	<i>Phoenicurus phoenicurus</i>	-	1	-	-	-	-	BX	1
Eurasian Magpie	<i>Pica pica</i>	3	2	3	1	6	4	BC	1 - 3
Green Woodpecker	<i>Picus viridis</i>	2	1	-	1	2	3	BC	1 - 3
Dunnock	<i>Prunella modularis</i>	-	1	-	-	-	-	MW	-
European Serin	<i>Serinus serinus</i>	-	1	-	1	-	2	BC	1
Eurasian Collared-Dove	<i>Streptopelia decaocto</i>	1	-	1	-	-	-	BX	1
European Turtle Dove	<i>Streptopelia turtur</i>	-	-	1	-	-	3	BC	1 - 3
European Starling	<i>Sturnus vulgaris</i>	2	-	-	5	9	-	BC	1 - 3
Eurasian Blackcap	<i>Sylvia atricapilla</i>	7	2	5	2	7	6	BC	6 - 10
Eurasian Wren	<i>Troglodytes troglodytes</i>	1	-	-	-	-	-	MW	-
Eurasian Blackbird	<i>Turdus merula</i>	4	1	4	1	6	1	BC	2 - 4
Song Thrush	<i>Turdus philomelos</i>	3	-	-	-	-	-	MW	-
	<b>Total</b>	<b>56</b>	<b>28</b>	<b>38</b>	<b>45</b>	<b>94</b>	<b>61</b>		
	<b>Daily total</b>	<b>84</b>		<b>83</b>		<b>155</b>			

Tab. 3: List of species, n. of individuals, nesting status and number of estimated breeding pairs, detected during the 3 standardized monitoring survey along the standard transects H and K. Nesting status in the study area is classified according to the following codes: **MW** = presence as migratory/wintering bird; **P** = presence during breeding season in the area, used as a roost or foraging site; **BX** = possible breeding; **BC** = **confirmed/probable** breeding.

Species	Scientific name	Observation data
Hen Harrier	<i>Circus cyaneus</i>	11/02/22
Eurasian Woodcock	<i>Scolopax rusticola</i>	08/04/22
Common Chiffchaff	<i>Phylloscopus collybita</i>	08/04/22
Black Kite	<i>Milvus migrans</i>	14/05/22
European Robin	<i>Erithacus rubecula</i>	08/04/22
Common Buzzard	<i>Buteo buteo</i>	31/07/22
Common Quail	<i>Coturnix coturnix</i>	14/06/22
Eurasian Wryneck	<i>Jynx torquilla</i>	14/06/22

Tab. 4: List of species, with indication of observation's date, found in the Santa Giustina area only outside of standardized monitoring transects.

The indices, used for the analysis of the bird community surveyed (Tab. 5), show a peak of species richness and diversity in the month of April, linked to the overlap between the presence of nesting and migratory/wintering birds; in June the number of total individuals detected increase, with a substantially stable specific diversity, but with a reduction in the parameters of diversity and equipartition; this evidence is related to the differential numerical increase between the different species, which depends on their variable reproductive success.

The space-time abundance data collected, which can also be calculated for single species, represent useful indices that can be used for comparisons with other research carried out in similar environments in the Po Valley.

Index	Data & Standard transect							
	08/04/2022		14/05/2022		12/06/2022			
	H	K	H	K	H	K		
<b>S: richness of species</b>	21	15	15	19	17	16		
<b>H: Shannon Wiener index</b>	2,86	2,52	2,50	2,71	2,51	2,46		
<b>J: Lloyd Ghelardi index</b>	0,94	0,93	0,92	0,92	0,89	0,89		
<b>A: abundance</b>	<b>- number of individuals / 1 h</b>		56	28	38	45	94	61
	<b>- number of individuals / km</b>		112	56	76	90	188	122

Tab. 5: Summary indices obtained from the analysis of standard data collected.

S = richness of species, total number of species detected; H = diversity calculated using the Shannon & Wiener index; J = Lloyd & Ghelardi equipartition index, that return the degree of distribution of the frequencies of the different species in the community; A: abundance - number of individuals / 1h = number of individuals observed in 1 hour; - number of individuals / km; = number of individuals observed in 1 kilometre of linear transect.

Among the certain/possible nesting species detected in Santa Giustina, there are several birds of conservation interest, linked to woodland and ecotone habitats in good state of conservation. These species have discontinuous distributions in the Po plain area, often with population trends declining in the last decade, such as the Great spotted woodpecker, Green woodpecker, Eurasian Scops Owl and, among the trans-Saharan migrants, Common Cuckoo, Common Redstart, Melodious Warbler, European Turtle Dove, Eurasian Golden Oriole (which has a pair density close to the *Favorable Reference Value* of the species, according to Gustin et al. 2016), Common Nightingale and Spotted Flycatcher.

The number of species directly linked to the presence of open, grassland and farmland habitats is more reduced: only Barn Swallow and Common Quail are present, while other species, such as Red-backed Shrike, Eurasian Skylark, European Stonechat and Common Hoopoe are actually absent.

Some species detected in the early seasonal surveys are only migratory birds for the area, such as the Common Whitethroat, or even potentially wintering ones, such as Hen Harrier, Dunnock, Brambling, Eurasian Wren, Common Chiffchaff, Song Trush and Eurasian Woodcock. This data supports the evident role of the Santa Giustina area as a stop-over site for these migratory and / or wintering birds.

3 bird species surveyed are included in Annex II of Dir. 147/2009/CE: Black kite, Eurasian Scops Owl and Hen Harrier.

## Discussion

The survey gave back important informations on the communities of the area and on the status of evolution of the habitats.

The vegetation cover is largely made up of grassland areas with sparse shrubs and small trees, while the perimeter bands are characterized by a continuous tree cover. Despite the agricultural landscape of Po valley is mostly modified, homogeneous and often banalized, the flora census highlights a limited incidence of exotic or potentially invasive species. Santa Giustina quarry, therefore, could be considered an important patch for a future recovery of the native lowland vegetation.

The ground beetles community is apparently simplified and characterized by generalist species. However, the finding of rare and exigent species shows that microhabitats linked to a traditional agriculture are still present. The maintenance of these microhabitats and the creation of additional ones could preserve this particular community, increase the species richness and favour the recolonization of surrounding territories.

Most of the detected butterfly species can be considered generalist, linked to open areas and ecotones and widely spread in the Po Valley except for two entities more localized in lowland than in hilly areas. To preserve these species and to favour all the butterflies' community, the management of the quarry must provide the maintenance of open meadows avoiding the replacement of dead or suffering trees and the planning of a rotation of mowings.

Avian community is characterized by a good diversity; there are several birds of conservation interest, linked to woodland and ecotone habitats in good state of conservation. The maintenance of disetaneous wooded belt and meadows could increase the richness, favouring both woodland both open areas species.

More complex is the recolonization by species that are decreasing in the whole Po valley. However, Santa Giustina quarry could be an important stopover site for their migratory contingent.

The collected data describe a dynamic ecological situation, as expected for a recently redeveloped site and support the potential of the Santa Giustina site as an ecological connection ganglion within the Brescia plain.

To increase this function and increase its ecological value, specific actions are below proposed:

- preserve an environmental mosaic with diversified habitats, not focusing solely on the creation of continuous forest formation;
- improve the vegetation of the wooded belts, by reducing the presence of alien species and the maintenance of the shrubby mantle at the edge;

- monitor throughout the area, and where necessary limit, the abundance of non-native plant species in the black list, herbaceous and arboreal;
- identify and maintain areas to lead to stable grass with naturalistic management (on a minimum surface of 0.5 ha, for at least 5 plots), with indication of execution of a maximum of 1-2 cuts per year, in shifts, using vehicles equipped with a cutting system at a height of more than 5 cm from the ground, and with subsequent accumulation on site in sheaves of at least 30% of the cut plant material, to be used for the natural decomposition process; single trees and/or small groups of shrubs can be kept in these plots. These areas should be identified in the driest portions of the site and/or where the recently completed plantings are stunted in growth or decaying;
- replace only in wooded patches the tree plantations that show limited or no growth and pathologies, after an adequate preparatory soil processing and identifying the species to be replanted among the autochthonous ones already used, which have shown greater vigor of growth on site. The maintenance of these areas must be realized with a naturalistic approach that includes the preservation of spontaneous growing of trees and shrubs and the preservation of dead wood *in situ*.
- to maintain and, where possible, increase elements that create microhabitats, such as bushes, dead trees (standing or crashed), stony ground, escarpments and other areas with sparse vegetation;
- create new permanent or ephemeral wetlands (also using natural geocomposite waterproofing) making depressions and exploiting the clayey nature of the soil. The site would also benefit from the presence of minor ditches with running water (evaluating the possible connection with the irrigation network for agricultural use), also to be used to ensure the minimum flow of water to minor wetlands;
- regulate anthropogenic use, limiting it to existing bike lane and pedestrian paths, identifying and equipping specific areas to be used for recreational or educational use; characterize the remaining areas as totally protected "no access" sites - to be delimited with natural elements such as ditches and hedges;
- to propose the entire area and a safeguard buffer around its borders as a no hunting area, in any form, when updating the regional and local Wildlife Hunting Planning;
- promote renaturalization interventions in the areas outside the quarry, on a medium-wide range, which favor the connection with the elements of the Regional Ecological Network, with the aim of supporting permeability lines that favor the recolonization of Santa Giustina, by the more localized or valuable elements.

*To be free as a flower child, called by fauna "home"  
Like an island of wild, like a stepping stone*

## Annex list

Annex I: Species list template.

Annex II: Photographic report.

Annex III: Birds filed data.

Annex IV: Bibliography

**To be kept and filled in at the end of your report**

<p><b>Project tags (select all appropriate):</b></p> <p>This will be use to classify your project in the project archive (that is also available online)</p>	
<p>Project focus:</p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Beyond quarry borders</li> <li><input checked="" type="checkbox"/> Biodiversity management</li> <li><input type="checkbox"/> Cooperation programmes</li> <li><input type="checkbox"/> Connecting with local communities</li> <li><input type="checkbox"/> Education and Raising awareness</li> <li><input type="checkbox"/> Invasive species</li> <li><input checked="" type="checkbox"/> Landscape management</li> <li><input type="checkbox"/> Pollination</li> <li><input checked="" type="checkbox"/> Rehabilitation &amp; habitat research</li> <li><input type="checkbox"/> Scientific research</li> <li><input type="checkbox"/> Soil management</li> <li><input checked="" type="checkbox"/> Species research</li> <li><input type="checkbox"/> Student class project</li> <li><input type="checkbox"/> Urban ecology</li> <li><input type="checkbox"/> Water management</li> </ul> <p>Flora:</p> <ul style="list-style-type: none"> <li><input checked="" type="checkbox"/> Trees &amp; shrubs</li> <li><input checked="" type="checkbox"/> Ferns</li> <li><input checked="" type="checkbox"/> Flowering plants</li> <li><input type="checkbox"/> Fungi</li> <li><input type="checkbox"/> Mosses and liverworts</li> </ul> <p>Fauna:</p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Amphibians</li> <li><input checked="" type="checkbox"/> Birds</li> <li><input checked="" type="checkbox"/> Insects</li> <li><input type="checkbox"/> Fish</li> <li><input type="checkbox"/> Mammals</li> <li><input type="checkbox"/> Reptiles</li> <li><input type="checkbox"/> Other invertebrates</li> <li><input type="checkbox"/> Other insects</li> <li><input type="checkbox"/> Other species</li> </ul>	<p>Habitat:</p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Artificial / cultivated land</li> <li><input type="checkbox"/> Cave</li> <li><input type="checkbox"/> Coastal</li> <li><input checked="" type="checkbox"/> Grassland</li> <li><input type="checkbox"/> Human settlement</li> <li><input type="checkbox"/> Open areas of rocky grounds</li> <li><input type="checkbox"/> Recreational areas</li> <li><input type="checkbox"/> Sandy and rocky habitat</li> <li><input type="checkbox"/> Screes</li> <li><input checked="" type="checkbox"/> Shrub &amp; groves</li> <li><input type="checkbox"/> Soil</li> <li><input type="checkbox"/> Wander biotopes</li> <li><input type="checkbox"/> Water bodies (flowing, standing)</li> <li><input type="checkbox"/> Wetland</li> <li><input checked="" type="checkbox"/> Woodland</li> </ul> <p>Stakeholders:</p> <ul style="list-style-type: none"> <li><input checked="" type="checkbox"/> Authorities</li> <li><input checked="" type="checkbox"/> Local community</li> <li><input type="checkbox"/> NGOs</li> <li><input type="checkbox"/> Schools</li> <li><input checked="" type="checkbox"/> Universities</li> </ul>