Translated from the original German version

Biodiversity on a biodynamic farm at Fattoria La Vialla, Italy

Results report, focusing on avifauna

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On behalf of
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1 INTRODUCTION

Fattoria La Vialla is a biodynamic-certified family-run farm in Tuscany, Italy. Covering an area of approximately 1,600 hectares, it is the largest Demeter-certified (since 2005) agricultural enterprise in Italy. Fattoria La Vialla produces wine, olive oil, honey, pecorino cheese, antipasti, sauces, pasta, biscuits and other sweet specialities, and vinegar, as well as cosmetics. Biodynamic farming methods have been used at the Fattoria since 1997. Biodynamics exclusively foresees the use of biodynamic preparations.

The decline of biodiversity due to intensive agriculture, monocultures and the use of chemical pesticides is a major problem in many places. Fattoria La Vialla has committed itself to counteracting the extinction of species and enhancing natural cycles, through environmentally friendly and sustainable land management in line with the biodynamic philosophy.

Abb. 1-1 La Vialla Casa Rosa, agricultural land.

BioConsult SH GmbH & CO KG was commissioned to record the biodiversity of fauna, with particular focus on the avifauna, on a biodynamic farm. This report presents the results of mapping and observations in selected sample areas and representative locations.

2 MATERIALS AND METHODS

2.1 Survey area

Fattoria La Vialla's estate covers a total area of 1,715 hectares, including buildings, 900 hectares of which are used for agricultural purposes. The remaining land (just over 800 hectares) is covered with forest, some of which is used for silviculture, but the majority is unused and could even be described as a primeval forest. Of the total land used for agriculture, four representative subplots covering 274 hectares were examined in greater detail, taking into account both the different land uses and the altitudes, providing a basis for conclusions regarding the entire area. The breeding bird survey therefore covered approximately 30% of the area used for agriculture. The following list gives the names and sizes of the four areas:

- Subplot 1: Casa Rosa (41 ha)
- Subplot 2: Spedale (big lake) (35 ha)
- Subplot 3: Fattoria (65 ha)
- Subplot 4: Casa Conforto (133 ha)

The locations of the subplots are shown in Figure 2-1. The four subplots are used as a reference for the entire survey area and as a basis for potential analysis regarding the entire area (see Section 2.3).

2.2 Breeding bird mapping

Survey procedure

The aim of this survey was to record the number of breeding bird species in the area. The breeding bird mapping was carried out according to the methods described by SÜDBECK et al. (2005).

The data was collected by mapping breeding territories. The areas were examined using existing infrastructure (e.g. roads and paths) and boundary lines (e.g. hedges). Some forest areas could not be fully examined because the vegetation was too thick. The peripheral areas were examined, and information on bird species breeding there collected through other sources (e.g. territorial behaviour of birds of prey) was included.

During the surveys, which were carried out in five visits, all the birds acoustically or visually detected and associated with the specific area were carefully recorded daily map using standardised symbols. The characteristics of the territories were also documented for later evaluation. Surveying was carried out in the morning when weather and visibility conditions were suitable. At least one survey was also carried out at night for each subplot, to record nocturnal species. In addition to the night-time surveys, a recording device was used to capture sounds of nigh-time activity. The sound recordings were also analysed to confirm or supplement the species records obtained using the other methods.

The breeding birds sighted were recorded on a map, precisely located using symbols indicating their territory (see Fig. 2-1 and Fig. 2-2). The map contained all the essential information on the location of the survey area, the boundaries and types of habitats.

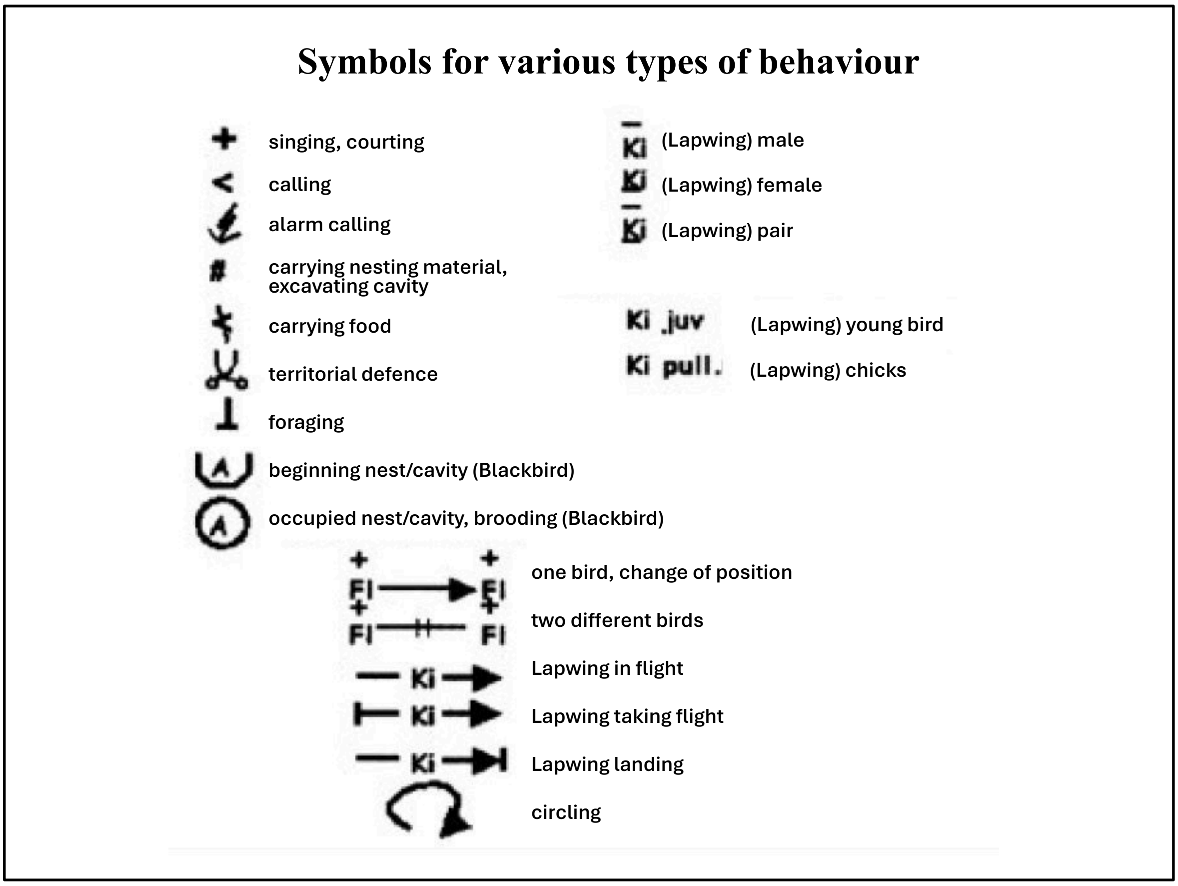

Fig. 2-1 Symbols for bird behaviour recorded in field maps during territory mapping and line mapping (source: Südbeck et al. 2005).

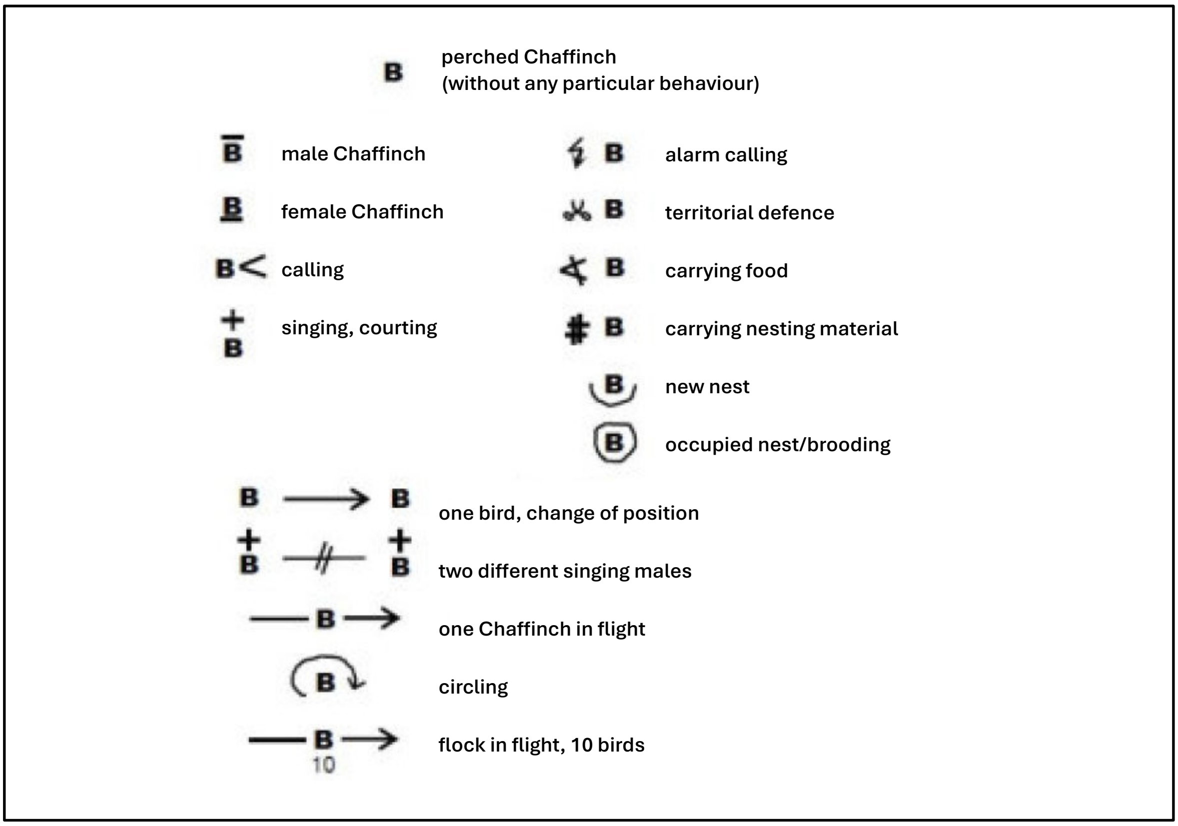

Fig. 2-2 Symbols describing behaviour using the example of the ChaĔinch ("B") (source: Südbeck et al. 2005).

Survey periods and scope

The breeding bird survey was carried out in spring 2024 during March/April and May/June on the agricultural land. A total of 5 five-hour surveys were carried out by two surveyors.

Tab. 2.1 Survey data regarding breeding bird mapping, including details of survey area, date and time period

Number	Date	Time period
Plot 1 – Casa Rosa		
1	29.03.2024	05:00 am – 10:00 am
2	03.04.2024	05:00 am – 10:00 am
3	06.04.2024	05:00 am – 10:00 am
4	16.05.2024	05:00 am – 10:00 am
5	22.05.2024	05:00 am – 10:00 am
Plot 2 – Spedale (Big Lake)		
1	30.03.2024	05:00 am – 10:00 am
2	05.04.2024	05:00 am – 10:00 am
3	12.04.2024	05:00 am – 10:00 am
4	16.05.2024	05:00 am – 10:00 am
5	23.05.2024	05:00 am – 10:00 am
Plot 3 – Fattoria		
1	25.03.2024	05:00 am – 10:00 am
2	02.04.2024	05:00 am – 10:00 am
3	09.04.2024	05:00 am – 10:00 am

Number	Date	Time period
4	15.05.2024	05:00 am – 10:00 am
5	26.05.2024	05:00 am – 10:00 am
Plot 4 – Casa Conforto		
1	26.03.2024	05:00 am – 10:00 am
2	07.04.2024	05:00 am – 10:00 am
3	11.04.2024	04:00 am – 09:00 am
4	14.05.2024	05:00 am – 10:00 am
5	19.05.2024	04:00 am – 22:30 pm

2.3 Land use mapping and potential analysis

2.3.1 Land use mapping

Among other things, the use of agricultural land influences the distribution of flora and fauna. Fattoria La Vialla mainly cultivates permanent crops that are maintained for many years, such as olive groves and vineyards, and the largely unused forest areas are also a stable element of the landscape. This type of land use differs significantly from a landscape dominated by arable farming, where crop rotation and tillage give rise to a very different situation.

According to the results of land use mapping, most of the total area shown in Fig. 2-3 is covered by forest. At just over 600 hectares, this accounts for around half of the total surface area. A good quarter of the total area is characterised by Mediterranean scrub, also known as “macchie". The remaining land is used for a variety of agricultural purposes. Grapes are grown, olive groves and grassland are cultivated, there are vegetable patches, woodlands, bodies of water, special areas such as the solar plant and the composting facility, and a chicken farm.

The four subplots together provide a representative sample of the entire estate and cover a total of 274 hectares, which is a good 22% of the overall surface area.

Subplot 1, Casa Rosa (35 ha), two-thirds of the area is covered by forest and vineyards, followed by olive groves and scrub, which account for one third of the area. A very small part of the area is covered by grassland, a composting area and buildings.

Subplot 2, Spedale (41 ha), almost three-quarters of this subplot is covered by forest and scrub. Olive trees are grown on approximately 10% of the area. The chicken farm, grassland, bodies of water and buildings account for a further 10% of the area.

Subplot 3, Fattoria (65 ha), 40% of the area is covered by forest. One fifth of the area is used for the cultivation of olive groves. Scrub, settlements and vineyards each cover 10% of the area. Managed forest areas and grassland account for approximately 8% of the surface area. The remaining area is occupied by the sola plant and one of the bodies of water.

Subplot 4, Casa Conforto (133 ha). This is the largest of the four subplots. Casa Conforto is situated towards the south, in the predominantly agricultural part of Fattoria La Vialla. Half of the surface area is used for winegrowing and one third consists of grassland. The remaining area is covered by buildings, woodlands, vegetable patches, olive trees, fallow land, a composting facility and some arable land, in percentages that range from 0.5% to 3%.

The maps in Figures 2-4 to 2-8 show the land use within the boundaries of Fattoria La Vialla's estate relevant to this report. The predominance of scrub and wooded areas in the northern and central parts can be clearly seen. Here, the use of the land is particularly extensive, while in the southern part and also in the eastern peripheral areas, land use is more diverse and more focused on agriculture. The farming methods used follow biodynamic principals and can therefore be considered eco sustainable and extensive.

2.3.2 Potential analysis

In order to estimate the total population of breeding birds, the results from the four subplots (see Fig. 2-3) and the land use mapping (see Figs. 2-4 to 2-8) were used to calculate the correlation between the partial results and the total area. The multiplication factor resulting from the distribution of breeding pairs in the subplots and the land use was determined on a species-specific basis, and also takes into account the different expected densities of the breeding territories and the altitude of the land. The results of this analysis are summarised in Table 3.1.

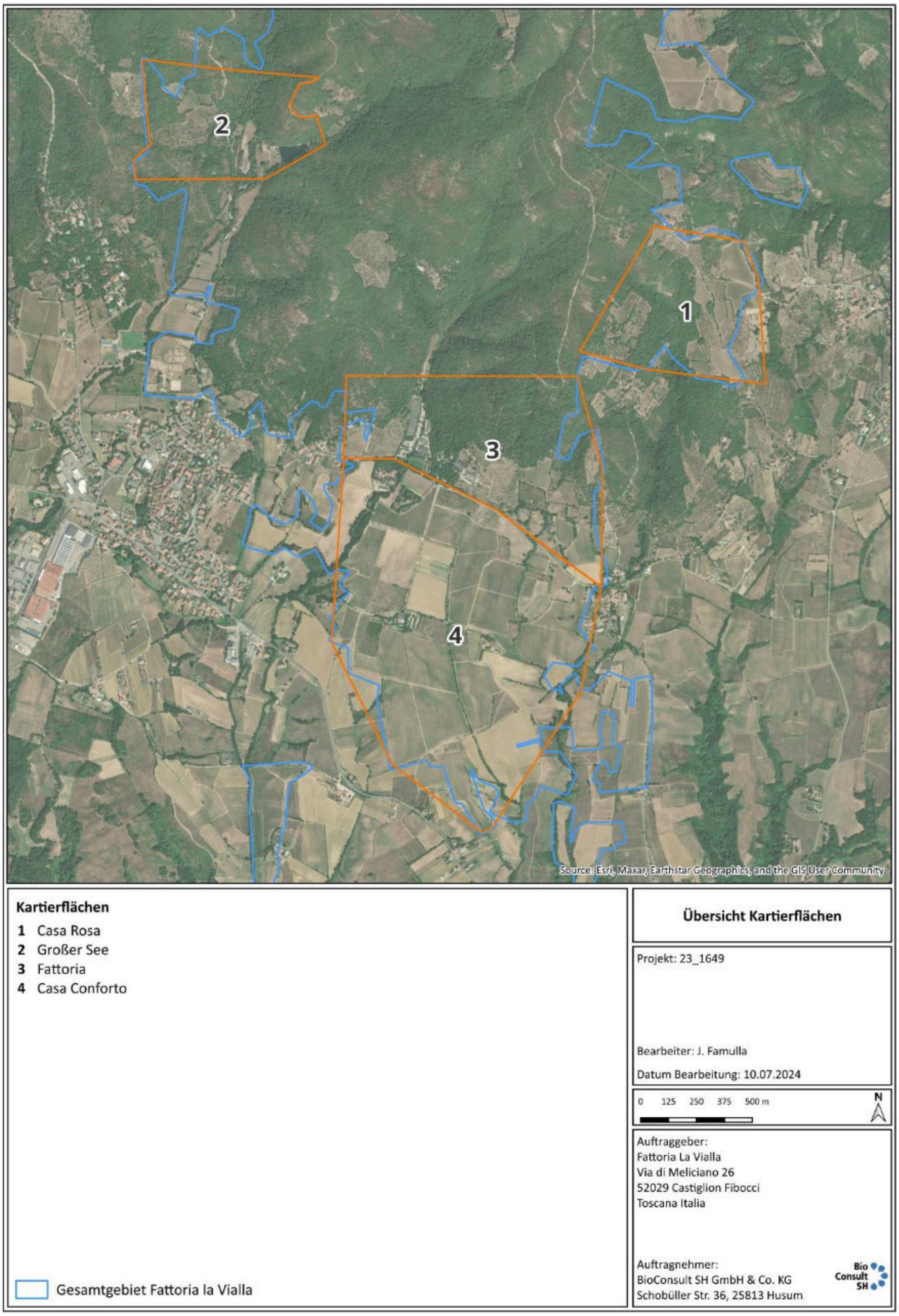

Fig. 2-3 Overview of the four subplots, Casa Rosa (1), Big Lake (2), Fattoria (3) and Casa Conforto (4)

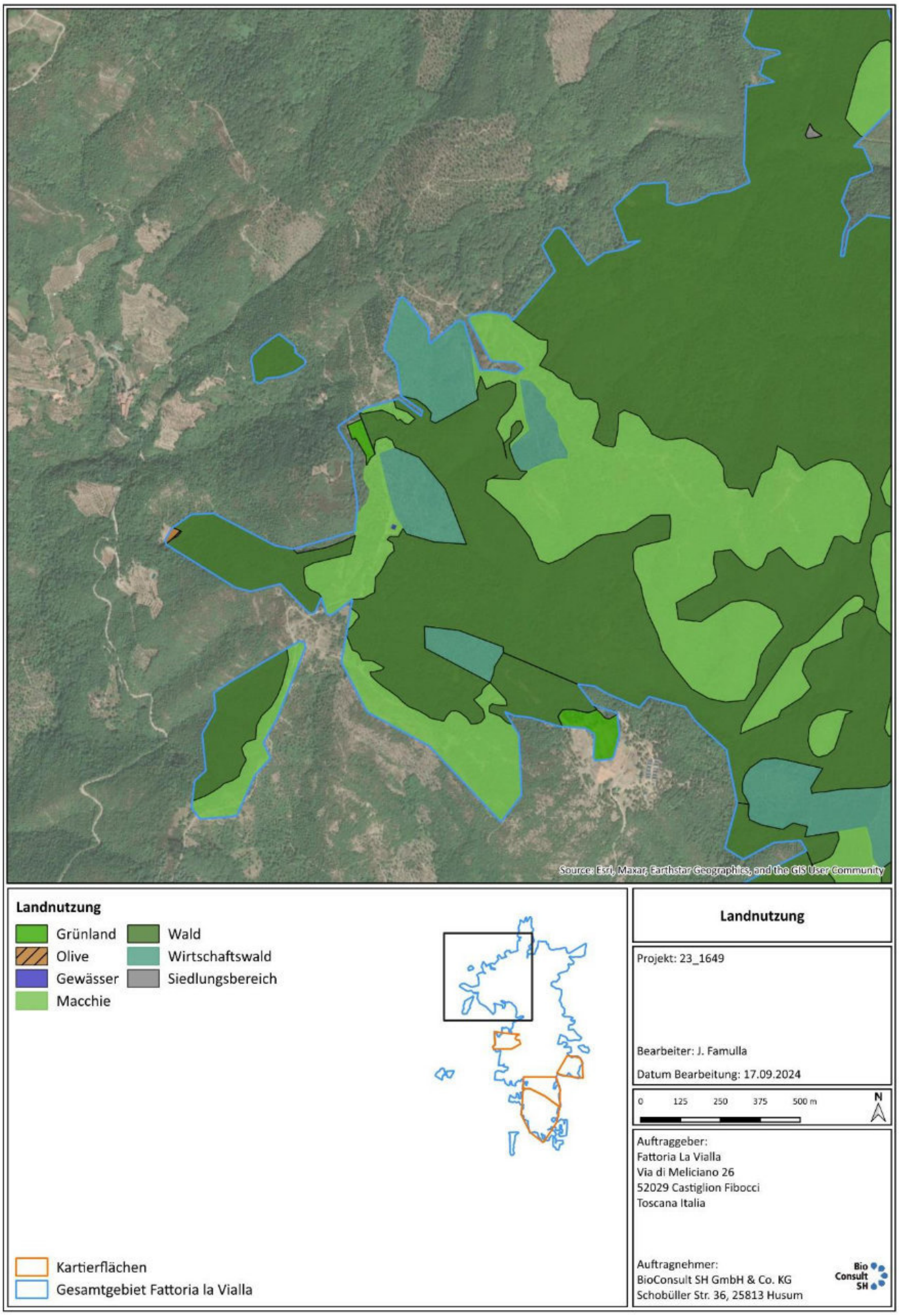

Fig. 2-4 Land use on the estate of Fattoria La Vialla, north-western part

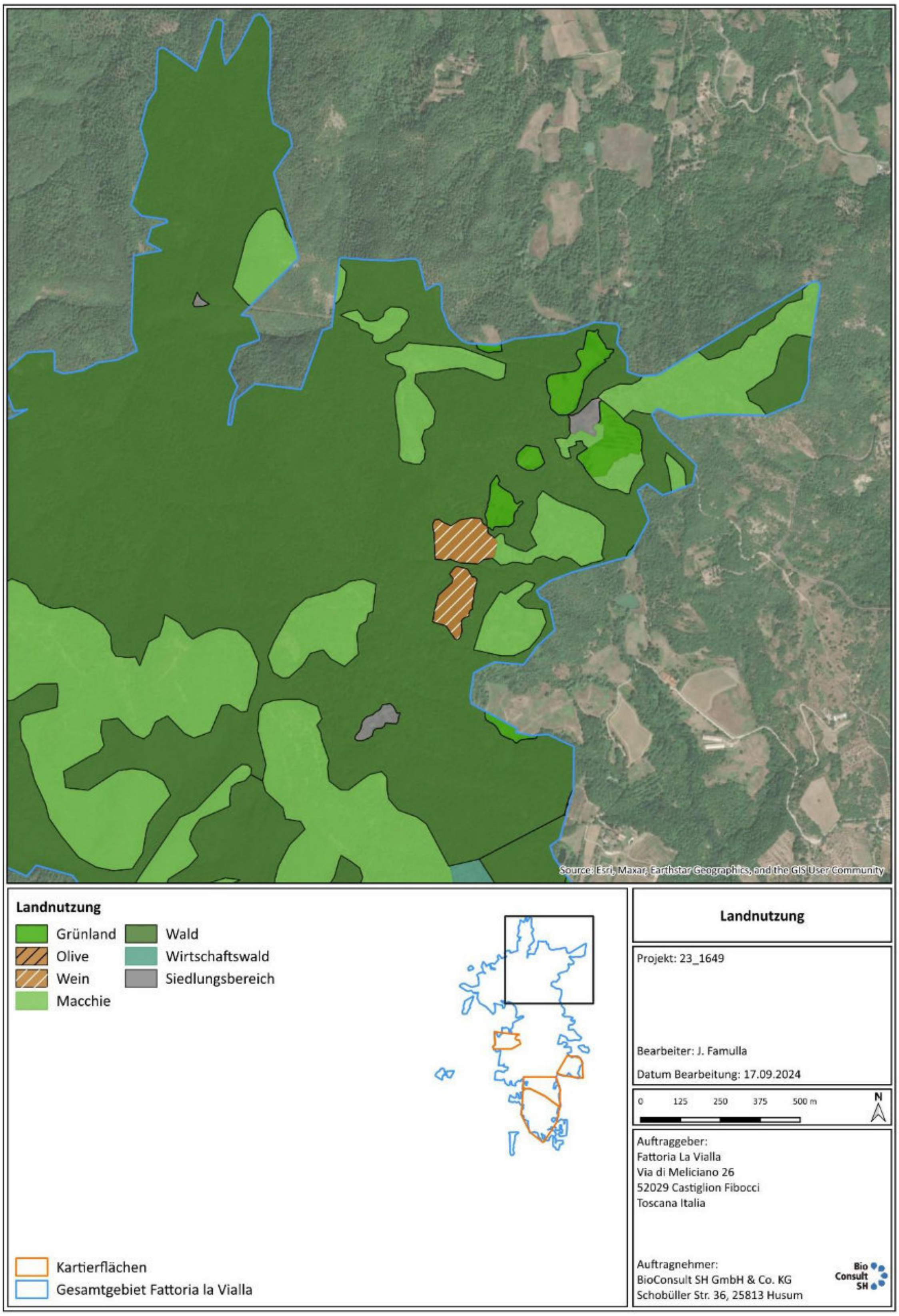

Fig. 2-5 Land use on the estate of Fattoria La Vialla, north-eastern part

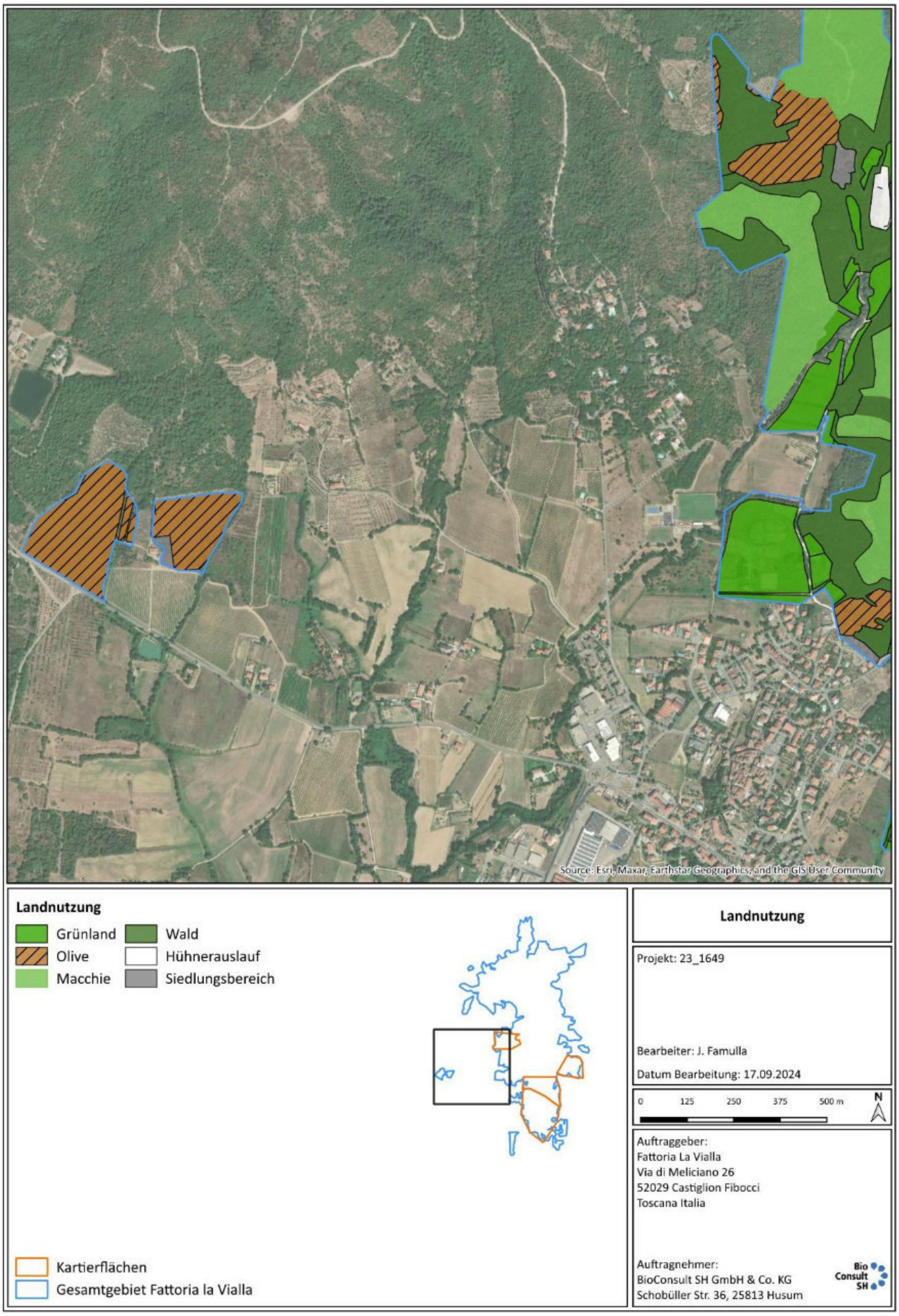

Fig. 2-6 Land use on the estate of Fattoria La Vialla, western part

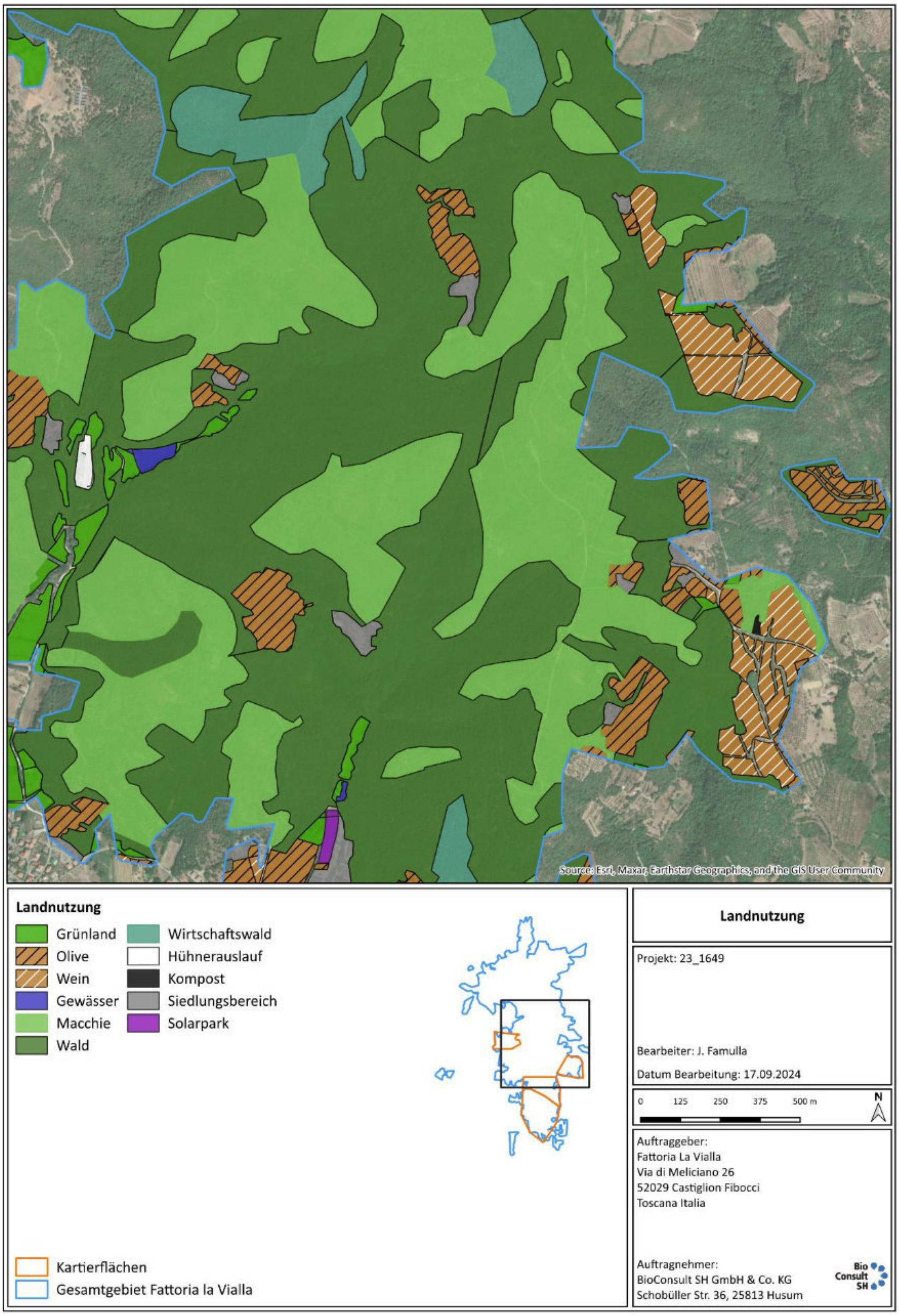

Fig. 2-7 Land use on the estate of Fattoria La Vialla, central part

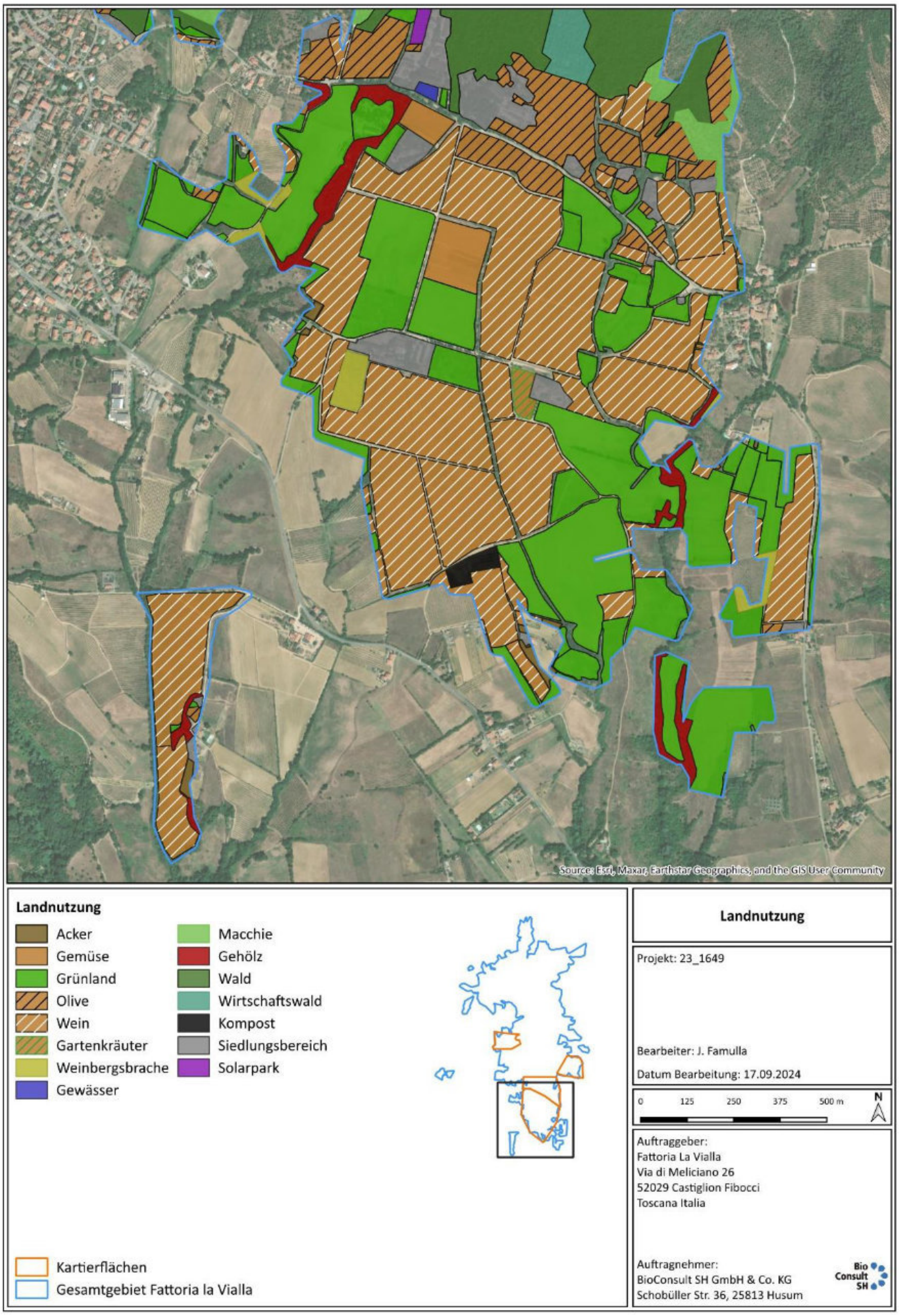

Fig. 2-8 Land use on the estate of Fattoria La Vialla, southern part

2.4 Other species

In May and September 2023 and March, April, May and June 2024, detailed photographic documentation of the insects, reptiles, amphibians and mammals, including bats, found on the estate was carried out. These sightings are only random samples and do not represent a complete survey, however some of them are included in the results report. A complete list of the species identified can be found in the appendix (see Appendix, A.2 to A.7).

A so-called bat box was installed to automatically record bat song (Section 2.4.1). In addition, a wildlife camera was installed (Section 2.4.2).

2.4.1 Bat box

During the breeding bird surveys, a Wildlife Acoustics SM4Bat song meter (see Fig. 2-9) was used in three different locations in turn. Location no. 1 was near a building (see Fig. 2-11), location no. 2 was near a lake (see Fig. 2-12) and location no. 3 was in the forest (see Fig. 2-13). The choice of these different types of habitat provides a good general overview of the entire range of bat species present. The data collected obviously only provides a rough indication of the diversity of bat species and is not intended as a complete list. The data does not reflect the number of individuals of each species.

Fig. 2-9 The Wildlife Acoustics SM4Bat bat song meter used (https://www.wildlifeacoustics.com/products/song-meter-sm4bat)

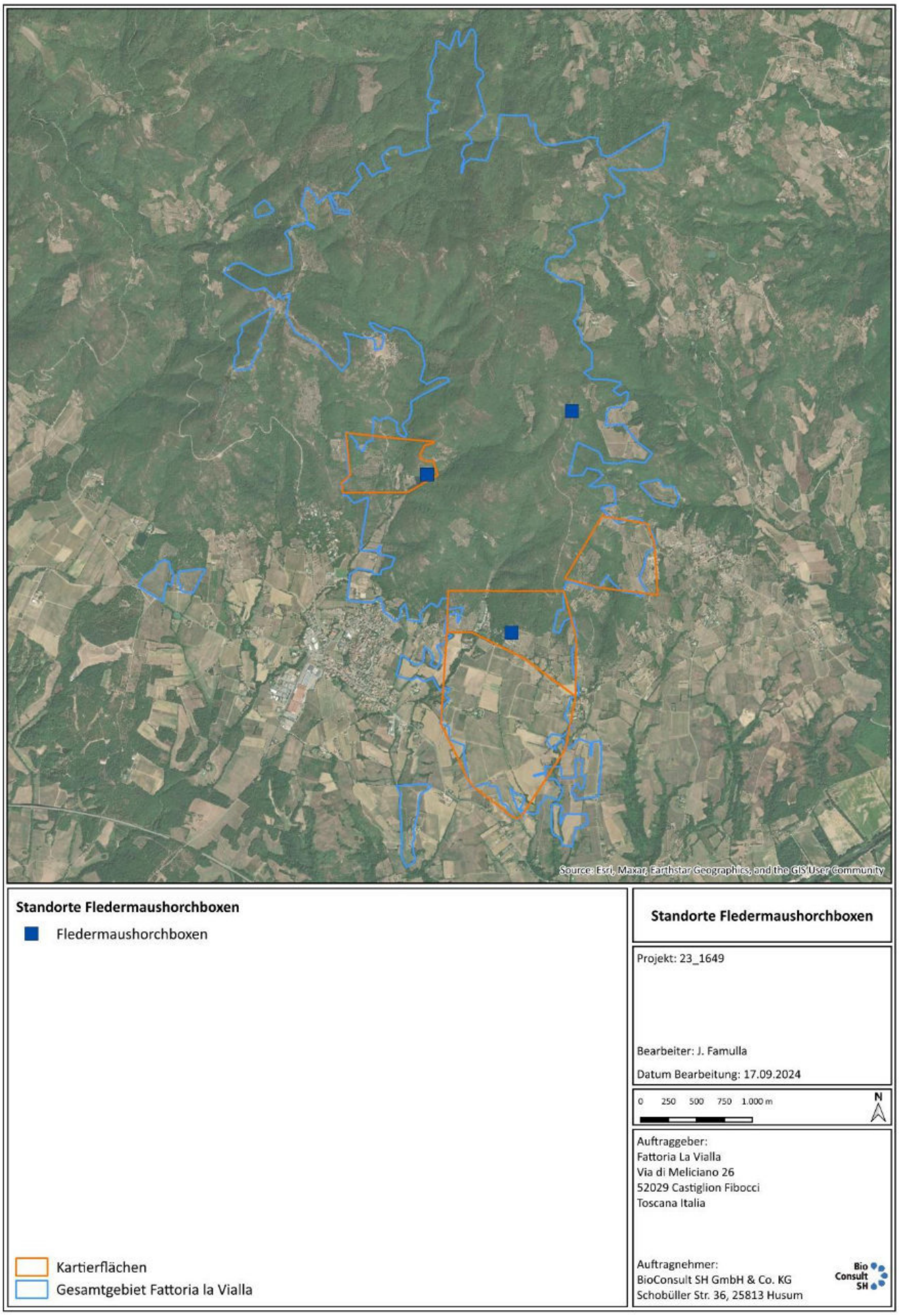

Fig. 2-10 Overview of the three locations of the bat boxes

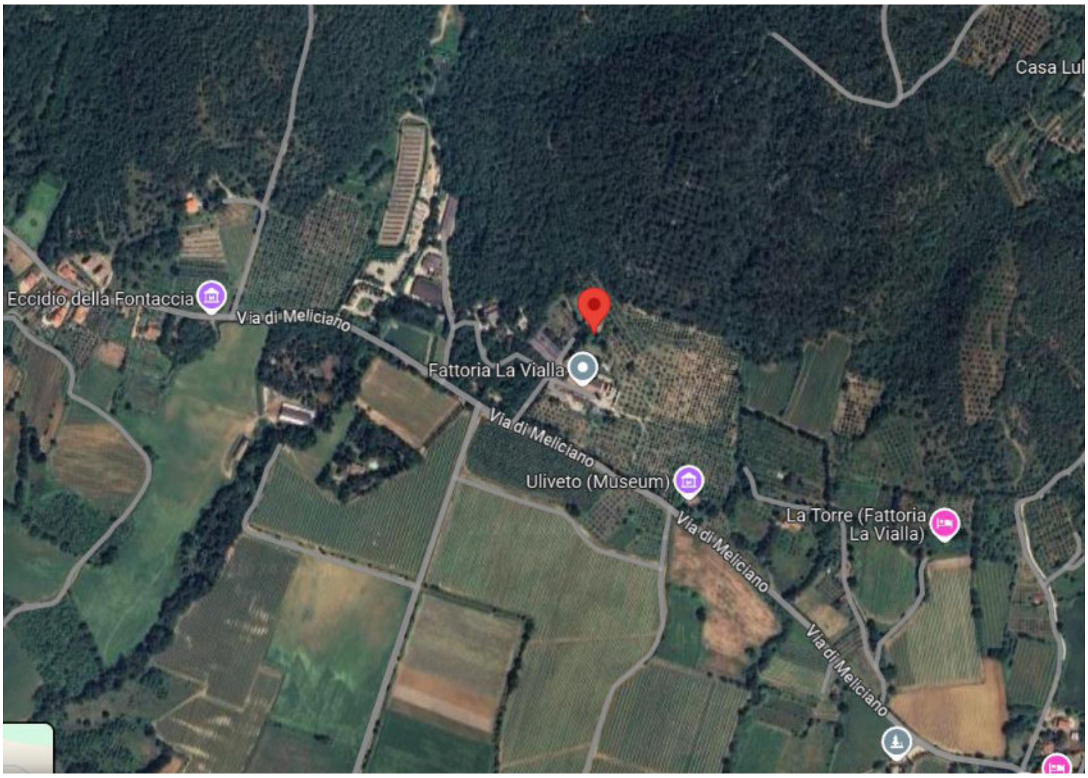

Fig. 2-11 Detailed view: Location no. 1 bat box in March, April and May (mapped using Google Maps)

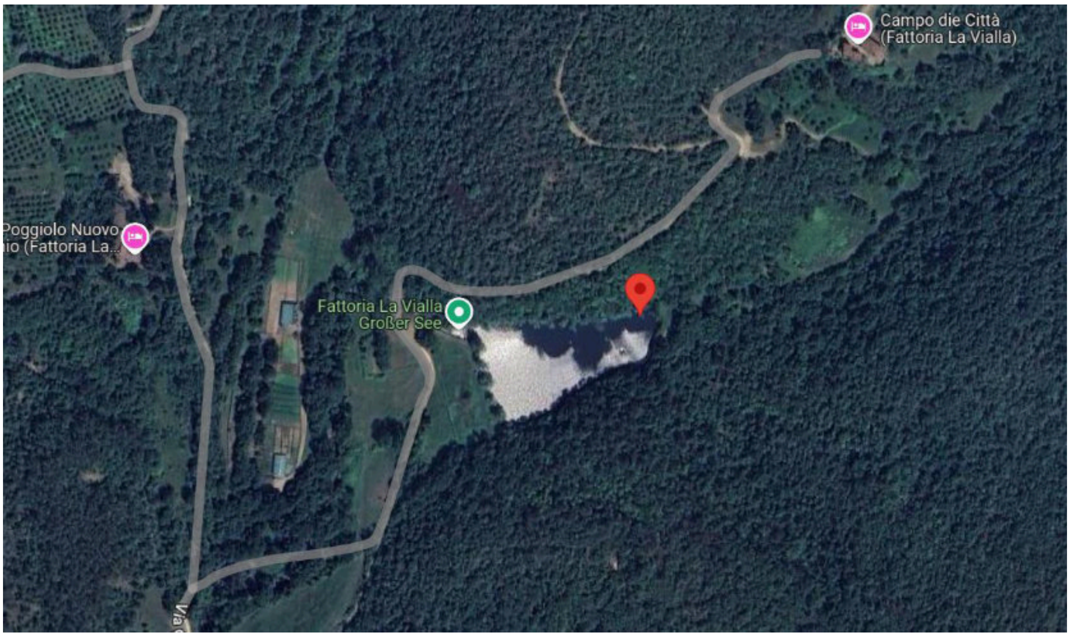

Fig. 2-12 Detailed view: Location no. 2 bat box in March and April (mapped using Google Maps)

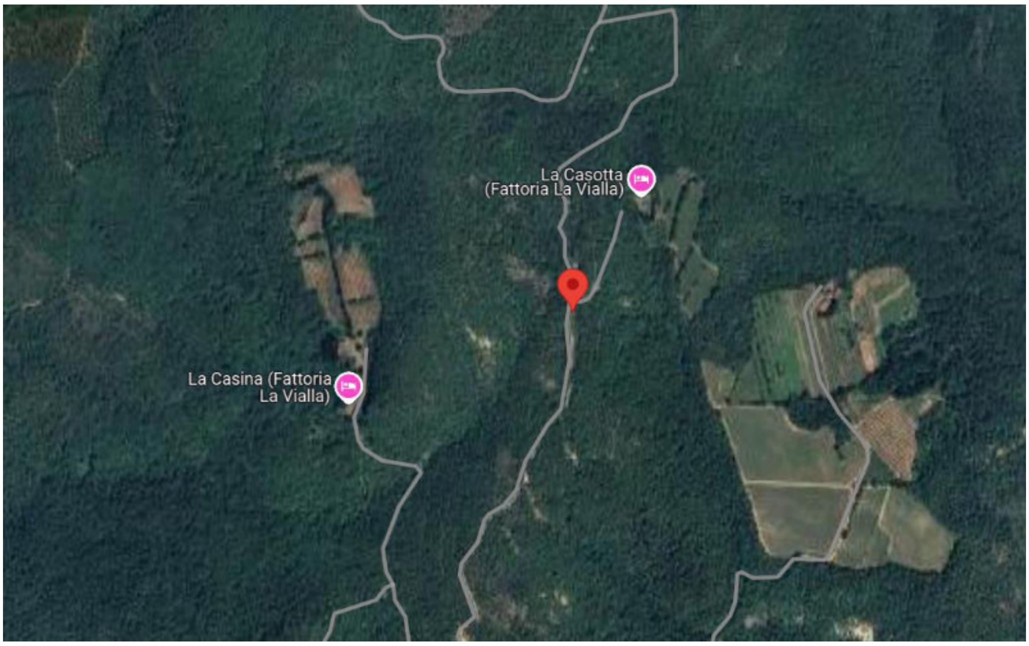

Fig. 2-13 Detailed view: Location no. 3 bat box in March, April and May (mapped using Google Maps)

2.4.2. Wildlife camera

In order to get a rough idea of what other animal species are present on the Fattoria's land other than those recorded by visual and location-based surveys, a wildlife camera was also used. It was set up in five different locations in rotation (see Figs. 2-15 to 2-19). The images provide some insight into the other fauna present.

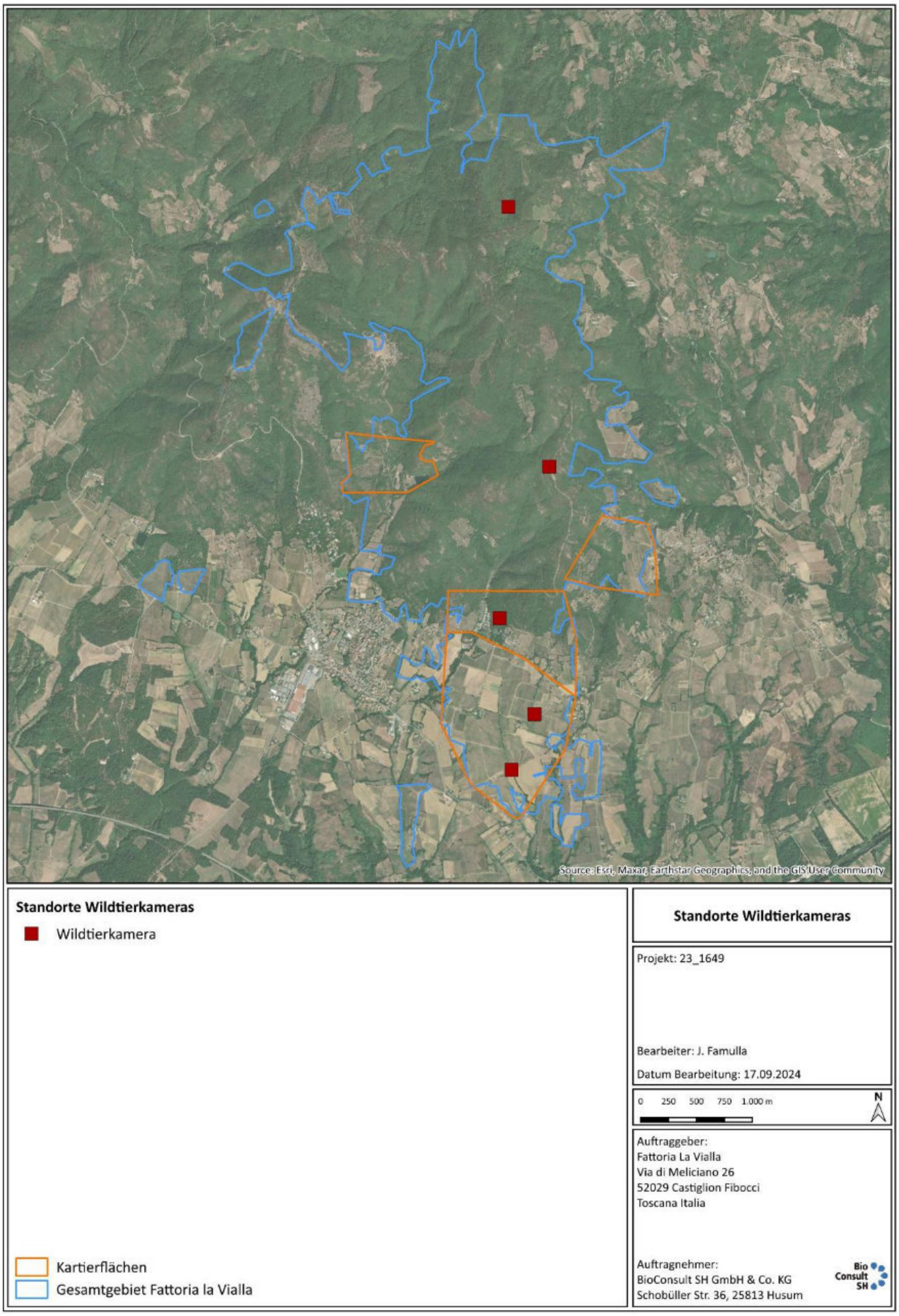

Fig. 2-14 Overview of the wildlife camera locations

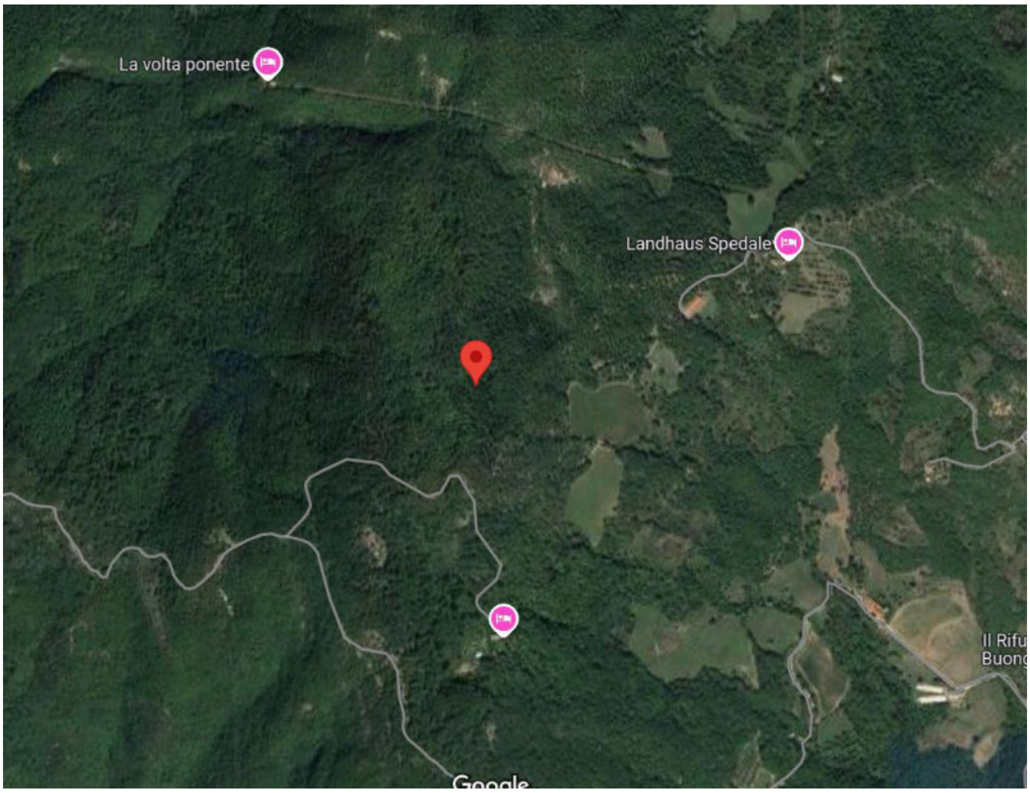

Fig. 2-15 Detailed view: Location no. 1 wildlife camera in March, April and May (mapped using Google Maps)

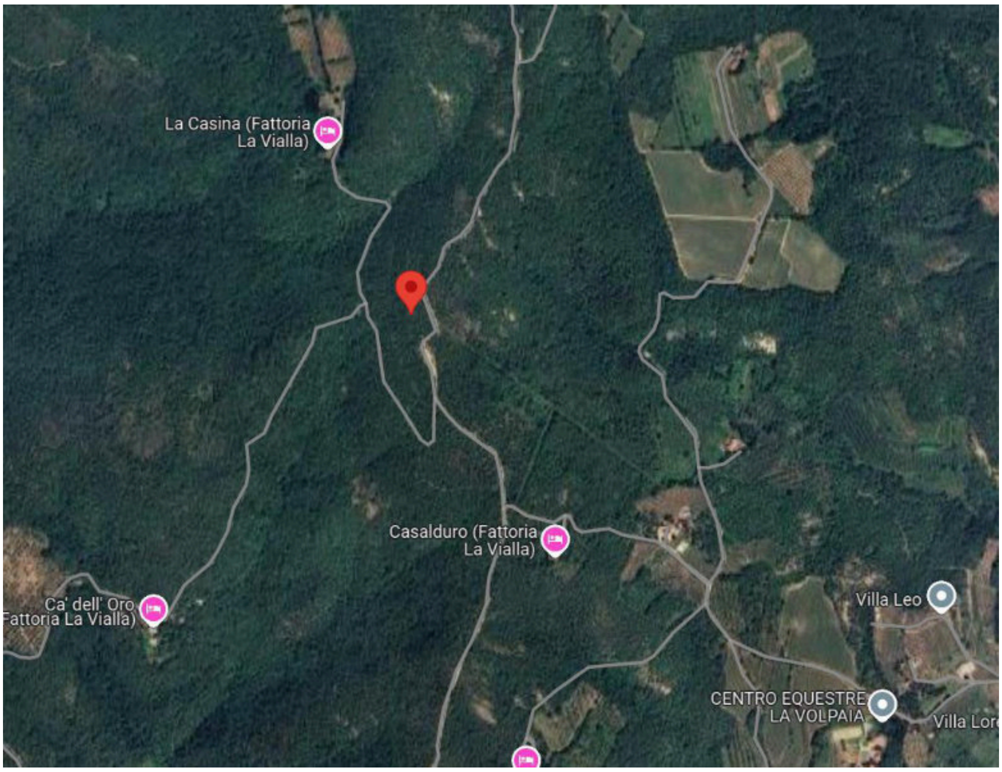

Fig. 2-16 Detailed view: Location no. 2 wildlife camera in March, April and May (mapped using Google Maps)

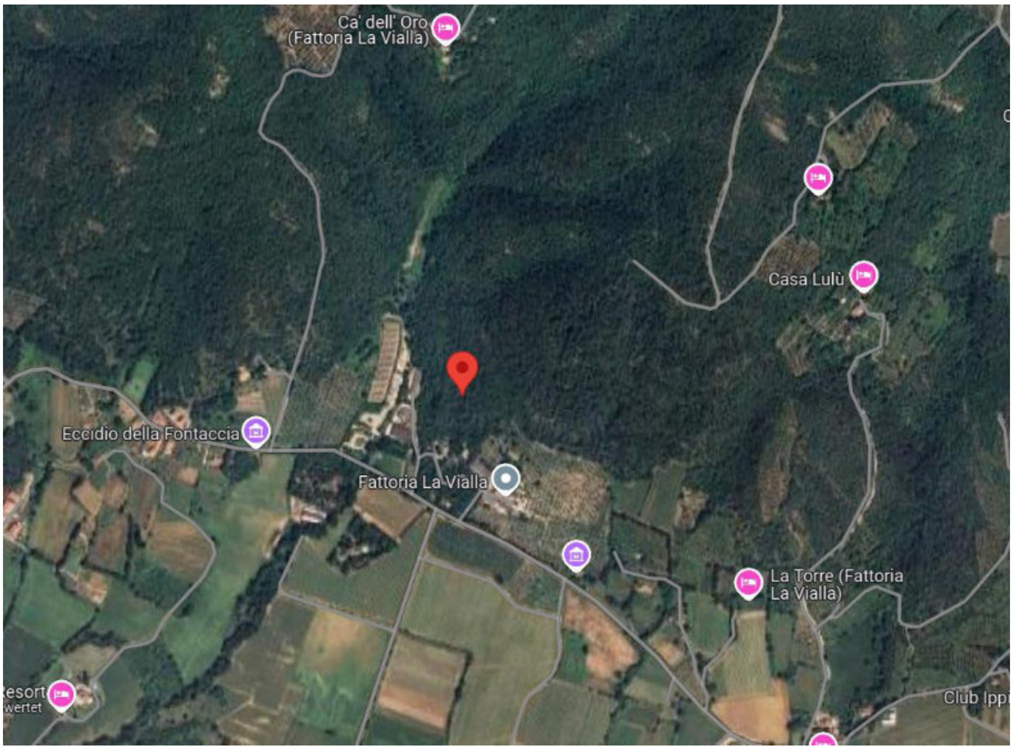

Fig. 2-17 Detailed view: Location no. 3 wildlife camera in March, April and May (mapped using Google Maps)

Fig. 2-18 Detailed view: Location no. 4 wildlife camera in March, April and May (mapped using Google Maps)

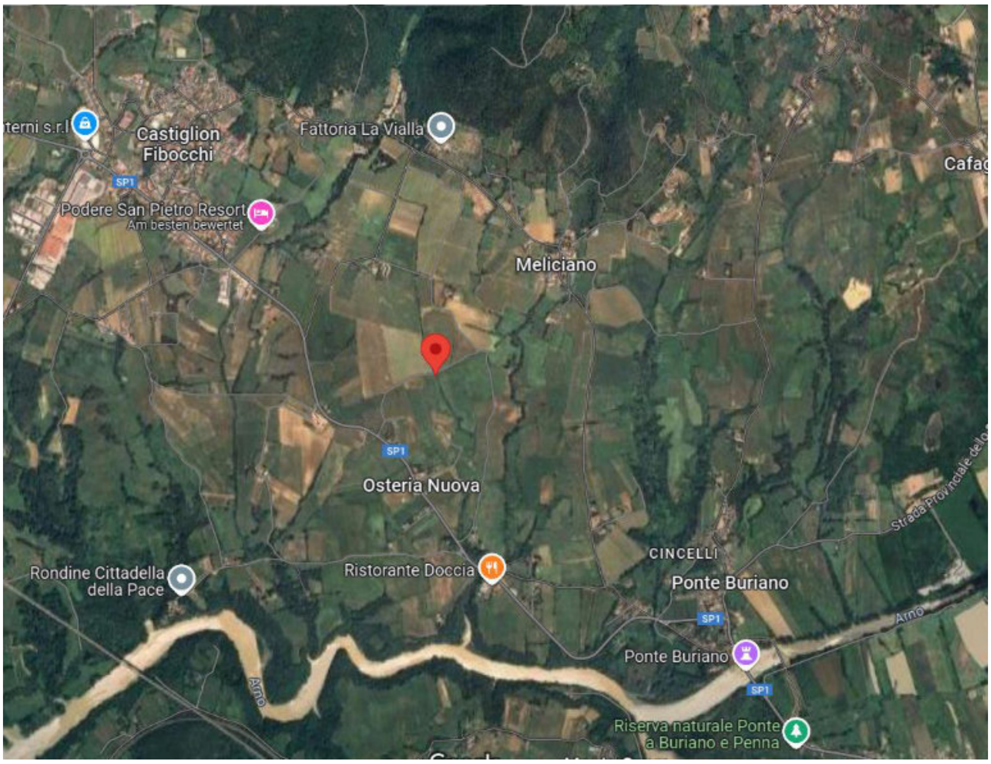

Fig. 2-19 Detailed view: Location no. 5 wildlife camera in March, April and May (mapped using Google Maps)

3 RESULTS

3.1 Overview of the spectrum of species

The range of species recorded in the four mapping areas comprised 72 different species, with a total of 1,253 breeding pairs. Calculations based on the potential analysis indicate that a total of 2,160 breeding pairs can be estimated for the Fattoria's entire estate (see Table 3.1 and Table 3.2). The spectrum of species mapped is dominated by species from the tit family (14.3%, 309 breeding pairs), followed by the old world warbler family (14.0%, 303 breeding pairs). The finch family accounts for 9% with 195 breeding pairs, the thrush family for 6.9% with 149 breeding pairs, and the sparrow family for 5.1% with 110 breeding pairs (see Fig. 3-1 and Table 3.1). All the other families account for less than 5%.

The breakdown of species grouped by families with a share of at least 5% can be found in Table 3.1, while Table 3.2 provides an overview of species grouped by families with a share of less than 5%.

The most common bird species are the Eurasian Blackcap with 2015 breeding pairs, followed by the Eurasian Robin with 197 breeding pairs and the Blackbird with 140 breeding pairs.

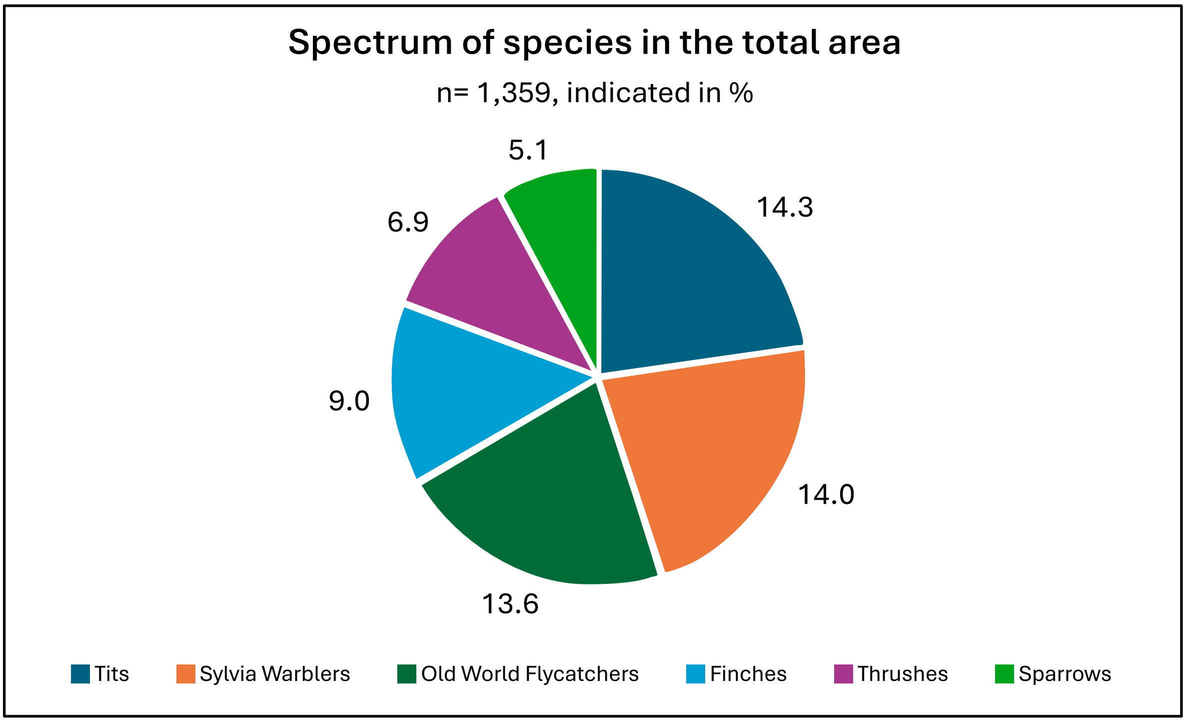

Abb. 3-1 Diagram showing the spectrum of species on the entire estate of the Fattoria, grouped by families with a share >5%

Tab. 3.1 List of breeding bird species by family, with details of the percentage of family/bird species, suspected breeding (BV), confirmed breeding (BN), total breeding pairs in subplots (BP), Red List status for Italy and EU, listing in Annex I of the Birds Directive, multiplication factor based on the potential analysis and number of breeding pairs in the total area. Listed according of the total percentage of breeding pairs from the four subplots with a share >5%.

Species	Percentage [%]	BV	BN	BP	RL IT	RL	VSchR	Potential analysis factor	Total number of territories
Tit family	**14.3**								
Eurasian Blue Tit	6.9	71	4	**75**				2	150
Great Tit	7.2	99	4	**103**				1.5	155
Marsh Tit	0.2	2		**2**				2	4
Old World Warbler family	**14.0**								
Eurasian Blackcap	9.5	137		**137**				1.5	206
Sardinian warbler	2.3	32	1	**33**				1.5	50
Moltoni’s Warbler	1.4	15		**15**				2	30
Eastern Subalpine Warbler	0.4	5		**5**				1.5	8
Dartford warbler	0.3	2		**2**		NT	I	3	6
Common Whitethroat	0.1	1		**1**				3	3
Old World Flycatcher family	**13.6**								
Eurasian Robin	9.1	129	2	**131**				1.5	197
Nightingale	2.1	23		**23**				2	46
Redstart	1.4	12	3	**15**				2	30
Whinchat	0.2	2		**2**	X	VU		2	4

Stonechat	0.7	7	1	**8**			2	16
Finch family	**9.0**							
Common Chaffinch	3.8	41		**41**			2	82
European Serin	2.8	40	7	**47**			1.3	61
European Goldfinch	1.4	13	2	**15**			2	30
European Greenfinch	1.0	9	2	**11**	x		2	22
Thrush family	**6.9**							
Blackbird	6.5	78	15	**93**			1.5	140
Song Thrush	0.3	3		**3**			2	6
Mistle Thrush	0.1	1		**1**			3	3
Sparrow family	**5.1**							
Italian Sparrow	4.0	37	6	**43**	x	VU	2	86
Tree Sparrow	1.1	8	4	**12**			2	24

Tab. 3.2 List of breeding bird species by family, with details of the percentage of family/bird species, suspected breeding (BV), confirmed breeding (BN), total breeding pairs in subplots (BP), Red List status for Italy and EU, listing in Annex I of the Birds Directive, multiplication factor based on the potential analysis and number of breeding pairs in the total area. Listed according of the total percentage of breeding pairs from the four subplots with a share >5%.

Species	Percentage [%]	BV	BN	BP	RL IT	RL EU	VSchRL	Potential analysis factor	Total number of territories
Pigeon and Dove family	4.0								
Common Wood Pigeon	1.8	25	1	**26**				1.5	39
Eurasian Turtle Dove	1.1	16		**16**				1.5	24
Eurasian Collared Dove	0.8	9		**9**				2	16
Feral Pigeon	0.3		2	**2**				3	6
Bunting family	**2.8**								
Cirl Bunting	1.7	23	1	**24**				1.5	36
Corn Bunting	1.1	11	1	**12**				2	24
Nuthatch family	**2.7**								
Eurasian Nuthatch	2.7	27	2	**29**				2	58
Corvidae family	**2.6**								
Eurasian Jay	1.1	11	1	**12**				2	24
Magpie	0.8	2	4	**6**				3	18
Hooded Crow	0.7	10		**10**				1.5	15
Kinglet family	**2.6**								

Common Firecrest	2.6	27	1	**28**			2	56
Treecreeper family	**1.9**							
Short-toed Treecreeper	1.9	21		**21**			2	42
Wren family	**1.5**							
Eurasian Wren	1.5	25		**25**			1.3	33
Long-tailed Tit family	**2.2**							
Long-tailed Tit	2.2	16	12	**28**			2	56
Cisticolidae family	**1.6**							
Zitting Cisticola	1.6	17		**17**			2	34
Woodpecker family	**1.6**							
Green Woodpecker	0.7	12		**12**		I	1.3	16
Great Spotted Woodpecker	0.5	4	1	**5**			2	10
Lesser Spotted Woodpecker	0.3	2		**2**			3	6
White-backed Woodpecker	0.1	1		**1**	x	I	2	2
Owl family	**1.4**							
Eurasian Scops Owl	0.6	9		**9**			1.5	14
Little Owl	0.4	5		**5**			1.5	8
Tawny Owl	0.3	4		**4**			1.5	6
Long-eared Owl	0.1		1	**1**			3	3
Leaf Warbler family	**1.3**							

Chiffchaff	1.2	17	1	**18**			1.5	27
Western Bonelli's Warbler	0.1		1	**1**			3	3
Lark family	**1.2**							
Woodlark	1.0	14	2	**16**	x	I	1.3	21
Crested Lark	0.3	3		**3**			2	6
Swallow family	**1.2**							
Barn Swallow	1.2	6	3	**9**			3	27
Hoopoe family	**1.2**							
Eurasian Hoopoe	1.2	4	6	**10**			2.5	25
Starling family	**1.0**							
Common Starling	1.0	7	6	**13**			13	39
Phasianidae family	**1.0**							
Common Pheasant	0.6	9		**9**			1.3	12
Red-legged Partridge	0.2	2		**2**			2	4
Common Quail	0.2	2		**2**			2	4
Nightjar family	**0.6**							
European Nightjar	0.6	6		**6**	x	I	2	12
Swift family	**0.6**							
Common Swift	0.6	3		**3**			4	12
Wagtail family	**0.6**							

White Wagtail	0.4		4	**4**			2	8
Grey Wagtail	0.2	2		**2**			2	4
Cuckoo family	**0.5**							
Common Cuckoo	0.5	7		**7**			1.5	11
Oriolidae family	**0.5**							
Golden Oriole	0.5	7		**7**			1.5	11
Od World Flycatcher family	**0.4**							
Spotted Flycatcher	0.4	3		**3**			3	9
Acrocephalidae family	**0.3**							
Melodious Warbler	0.3	5		**5**			1.5	8
Falconidae family	**0.2**							
Common Kestrel	0.2	2	1	**3**			1.3	4
Accipitridae family	**0.3**							
Eurasian Sparrow Hawk	0.1	2		**2**			1.5	3
Common Buzzard	0.1	1	1	**2**			1.5	3
Black Kite	0.05	1		**1**	x	I		1
Laniidae family	**0.2**							
Red-backed Shrike	0.2	2		**2**			1.5	3
Grebe family	**0.1**							

Anatidae family	**0.1**				
Mallard	0.05		1	**1**	1
Rallidae family	**0.1**				
Common Moorhen	0.09	2		**2**	2

Key: BV: Suspected breeding, BN: confirmed breeding, BP: breeding pairs, RL IT: Status according to the Italian Red List of Breeding Birds (NICOLA BACCETTI1*, GIANCARLO FRACASSO2* & COMMISSIONE ORNITOLOGICA ITALIANA (COI) 2020), RL EU: Status according to the European Red List of Birds (BIRDLIFE INTERNATIONAL 2021), Threat level: EX = extinct, CR = critically endangered, EN = endangered, VU = vulnerable, NT = near threatened, VSchRL: Species listed in Annexes I, II or III of the European Birds Directive.

3.2 Distribution of breeding bird territories in the four subplots

The following figures show the distribution of breeding pairs in the four subplots. The text also indicates the multiplication factors from the potential analysis and the total number of bird territories calculated as a result in the entire estate of Fattoria La Vialla, as shown in Fig. 2-3.

3.2.1 Blackbird (*Turdus merula*)

Blackbirds were found to have a total of 93 territories in the four subplots (274 ha, see Fig 3-2). The blackbird territories are spread across the entire area, with a lower density in the southern subplot no. 4 than in other areas (see Fig 3-2). In order to draw a conclusion for the entire survey area, the blackbird breeding territories were multiplied by a factor of 1.5 based on the potential analysis (Table 3.1), resulting in an estimated total of 140 territories.

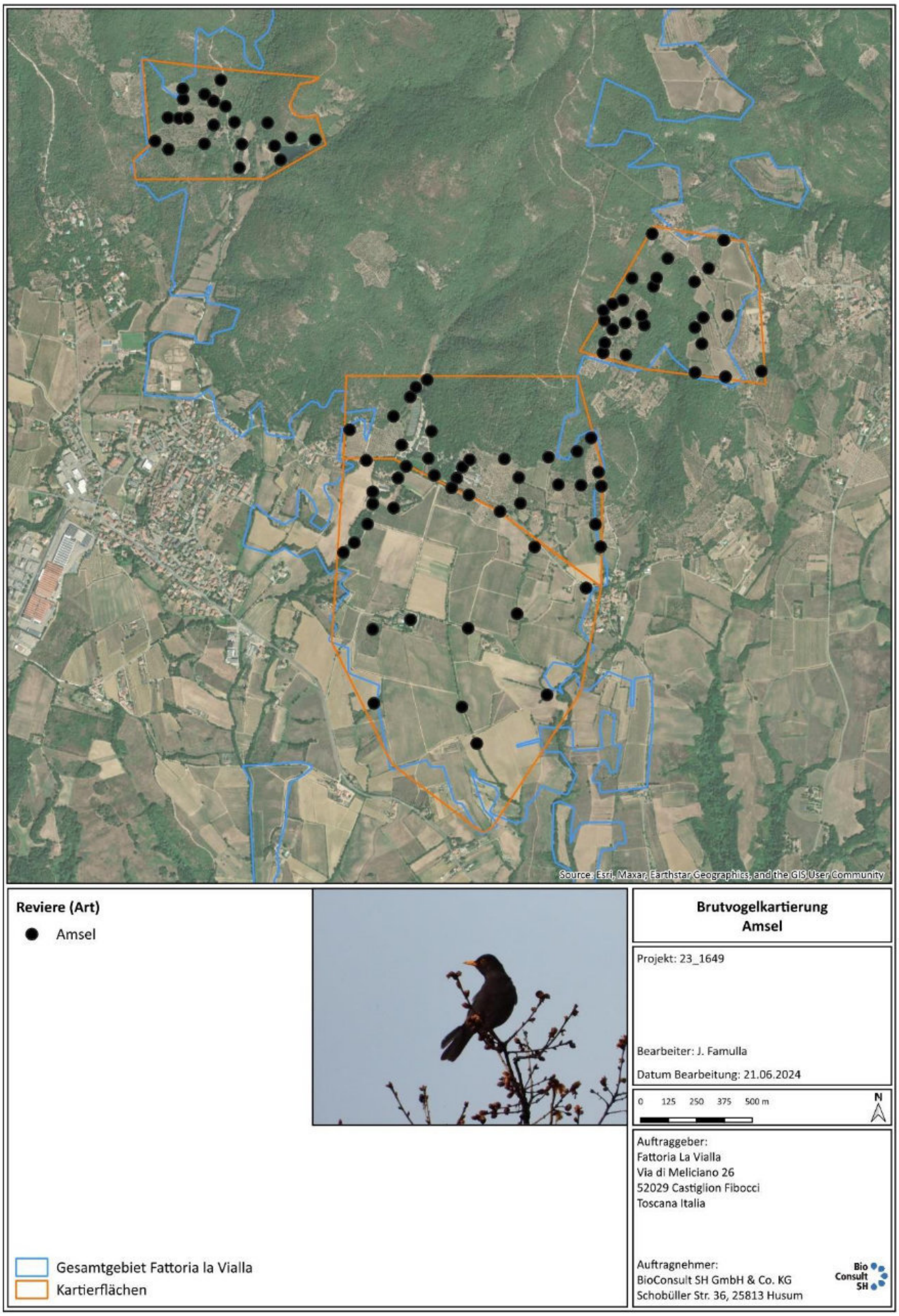

Fig. 3-2 Distribution of Blackbirds in the four subplots

3.2.2 White Wagtail (*Motacilla alba*) and Grey Wagtail (*Motacilla cinerea*)

In subplot no. 1 one breeding territory each was recorded for the White Wagtail and the Grey Wagtail. Another Grey Wagtail territory was recorded in plot no. 3. Four more White Wagtail territories were recorded in plots no. 3 and no. 4 (see Fig. 3-3). To calculate the potential total number of territories, the number of White Wagtail and Grey Wagtail breeding territories was multiplied by a factor of 2 based on the potential analysis. A total of 8 White Wagtail territories and 4 Grey Wagtail territories is estimated for the total area.

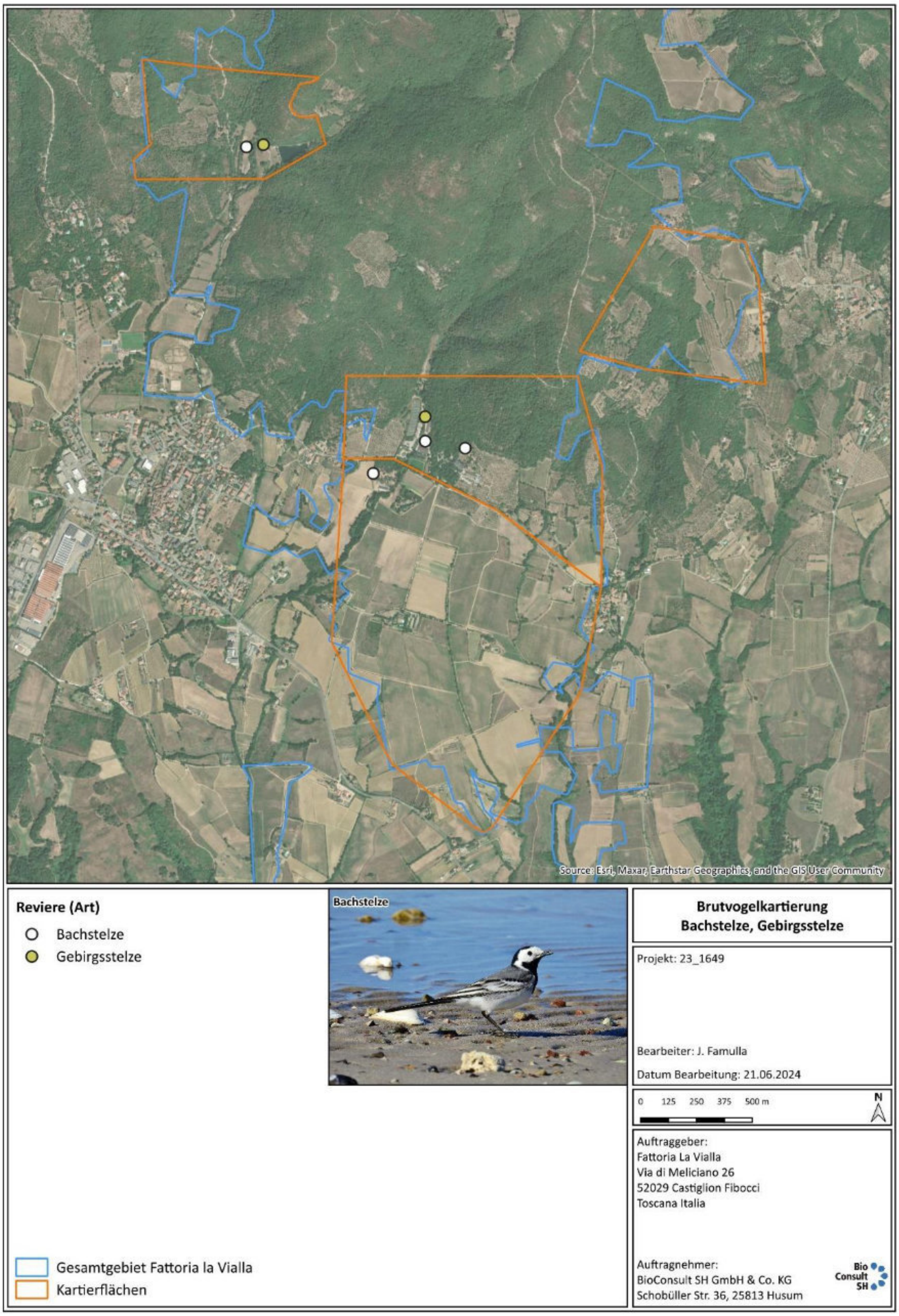

Fig. 3-3 Distribution of White Wagtails and Grey Wagtails in the four subplots

3.2.3 *Eastern Subalpine Warbler (Curruca cantillans), Common Whitethroat (Sylvia communis), Moltoni's Warbler (Curruca subalpina), Dartford Warbler (Curruca undata) and Sardinian Warbler (Curruca melanocephala)*

Of the Sylvia Warbler species shown on the map (see Fig. 3-4), the Sardinian Warbler was found in all four subplots, with a total of 33 breeding territories recorded and, based on the potential analysis, 50 breeding territories in the total area (factor 1.5; Table 3.1). Moltoni's Warbler was recorded with 15 breeding territories in all the subplots except number 4. Based on the potential analysis, there are 30 Moltoni's Warbler territories in the entire area (factor 2; Table 3.1). The Easter Subalpine Warbler was recorded in five breeding territories (factor 1.5; Table 3.1, 8 in the total area based on the potential analysis) in subplots 1, 2 and 3. The Common Whitethroat was only recorded with one breeding pair in subplot 1, Casa Rosa. Based on the potential analysis, three breeding pairs of Common Whitethroats are estimated to exist in the total area (factor 3; Table 3.1).

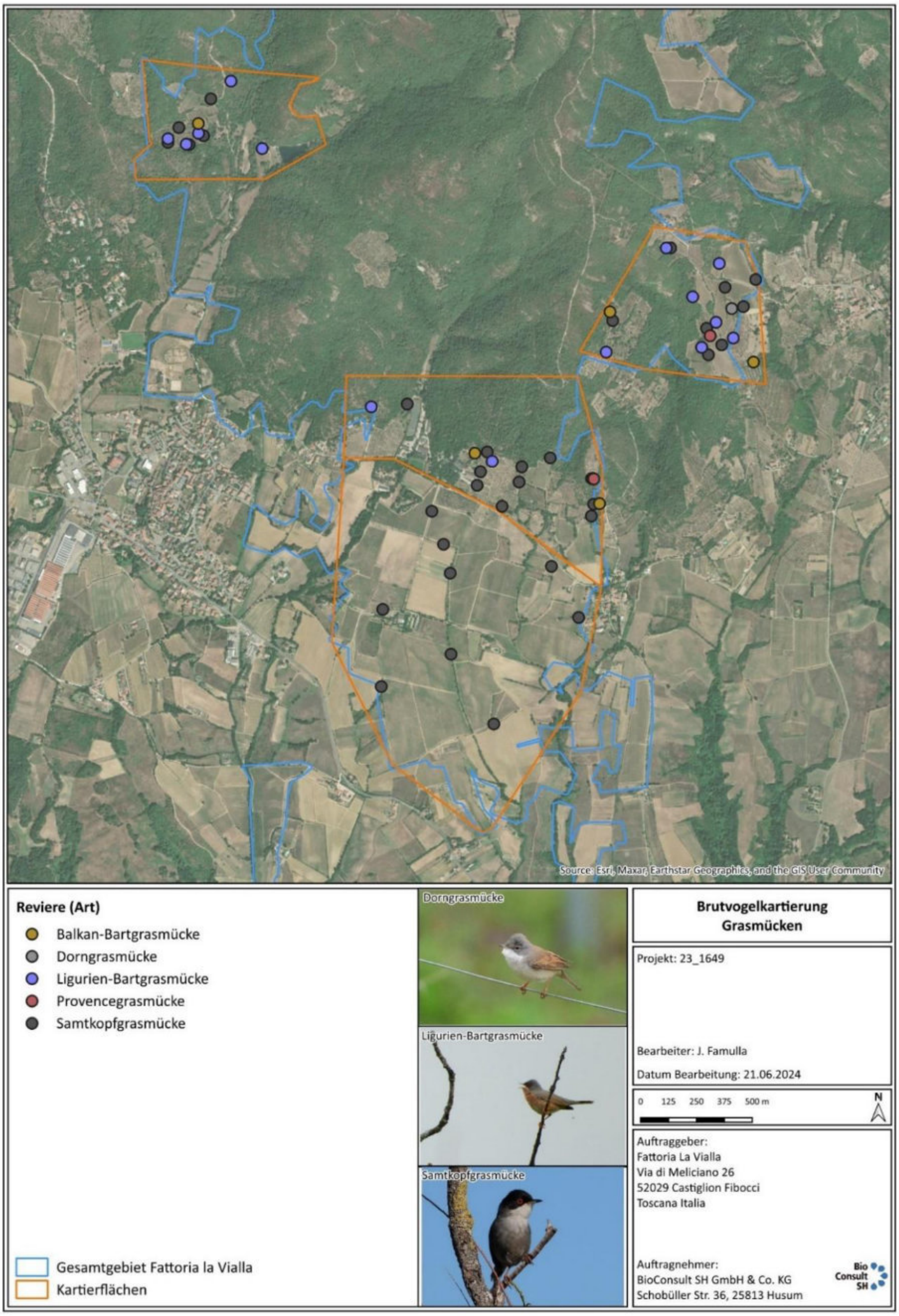

Fig. 3-4 Distribution of different Old World Warbler species in the four subplots

3.2.4 Western Bonelli's Warbler (*Phylloscopus bonelli*) and Zitting Cisticola (*Cisticola juncidis*)

Western Bonelli's Warbler were only recorded in subplot 1 Casa Rosa. For the potential analysis this figure was multiplied by a factor of 3, resulting in an estimated total number of breeding territories in the entire area (see Fig. 3-5 and Table 3.2). A total of 17 breeding pairs of Zitting Cisticolas were recorded in subplot 4 Casa Conforto (see Fig 3-5). In order to draw a conclusion for the entire area, the Zitting Cisticola breeding territories were multiplied by a factor of 2 based on the potential analysis, resulting in an estimate of 34 territories in the total area (see Table 3.1).

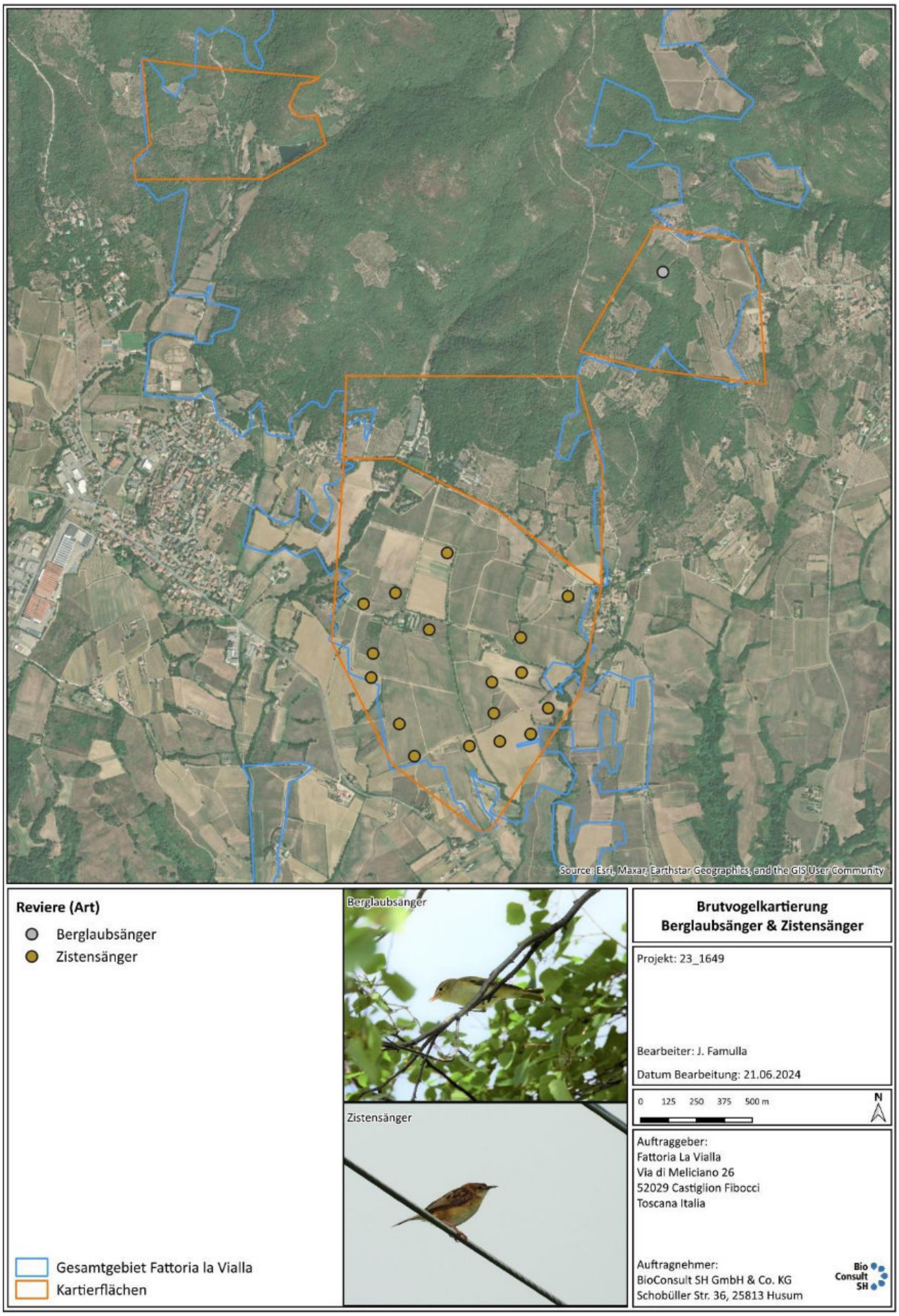

Fig. 3-5 Distribution of Western Bonelli's Warblers and Zitting Cisticolas in the four subplots

3.2.5 Eurasian Blue Tit (*Cyanistes caeruleus*)

Eurasian Blue Tits were recorded throughout all four subplots, with a total of 75 breeding territories, however only four of the territories were recorded in the Casa Conforto subplot (see Fig 3-6). In order to make an estimate for the entire area, the Eurasian Blue Tit breeding territories were multiplied by a factor of 2 based on the potential analysis. A total of 150 breeding territories are estimated for the entire area (see Table 3.1).

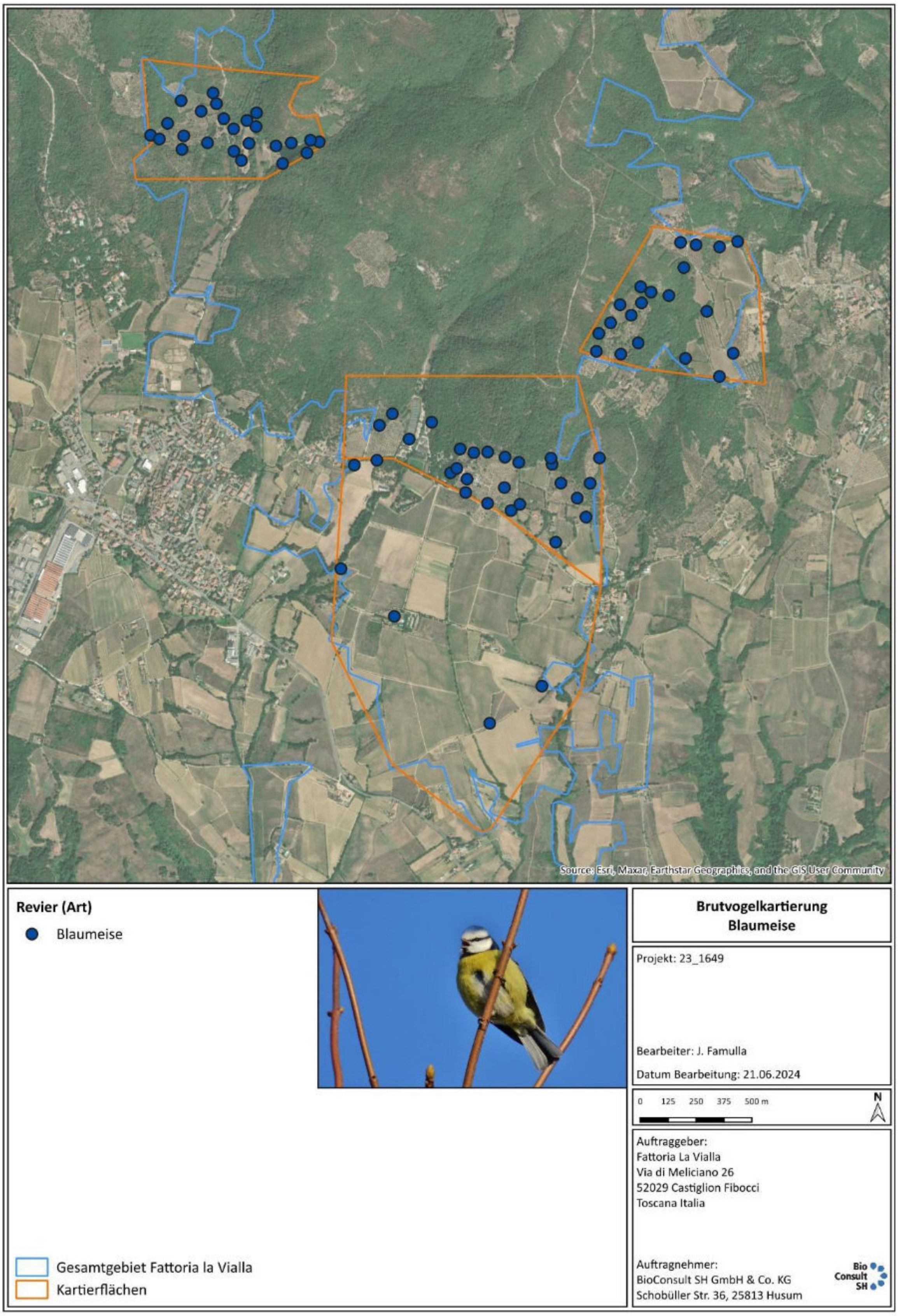

Fig. 3-6 Distribution of Eurasian Blue Tits in the four subplots

3.2.6 Whinchat (*Saxicola rubetra*) and Stonechat (*Saxicola rubicola*)

Amongst these two species, the number of Stonechat territories predominates, Whinchats and Stonechats were only recorded in subplot 4 Casa Conforto (see Fig 3-7). There were eight Stonechat breeding territories and two Whinchat breeding pairs. Both species were multiplied by a factor of 2, resulting in an estimated total of 16 Stonechat and 4 Whinchat breeding pairs in the entire area (see Table 3.1).

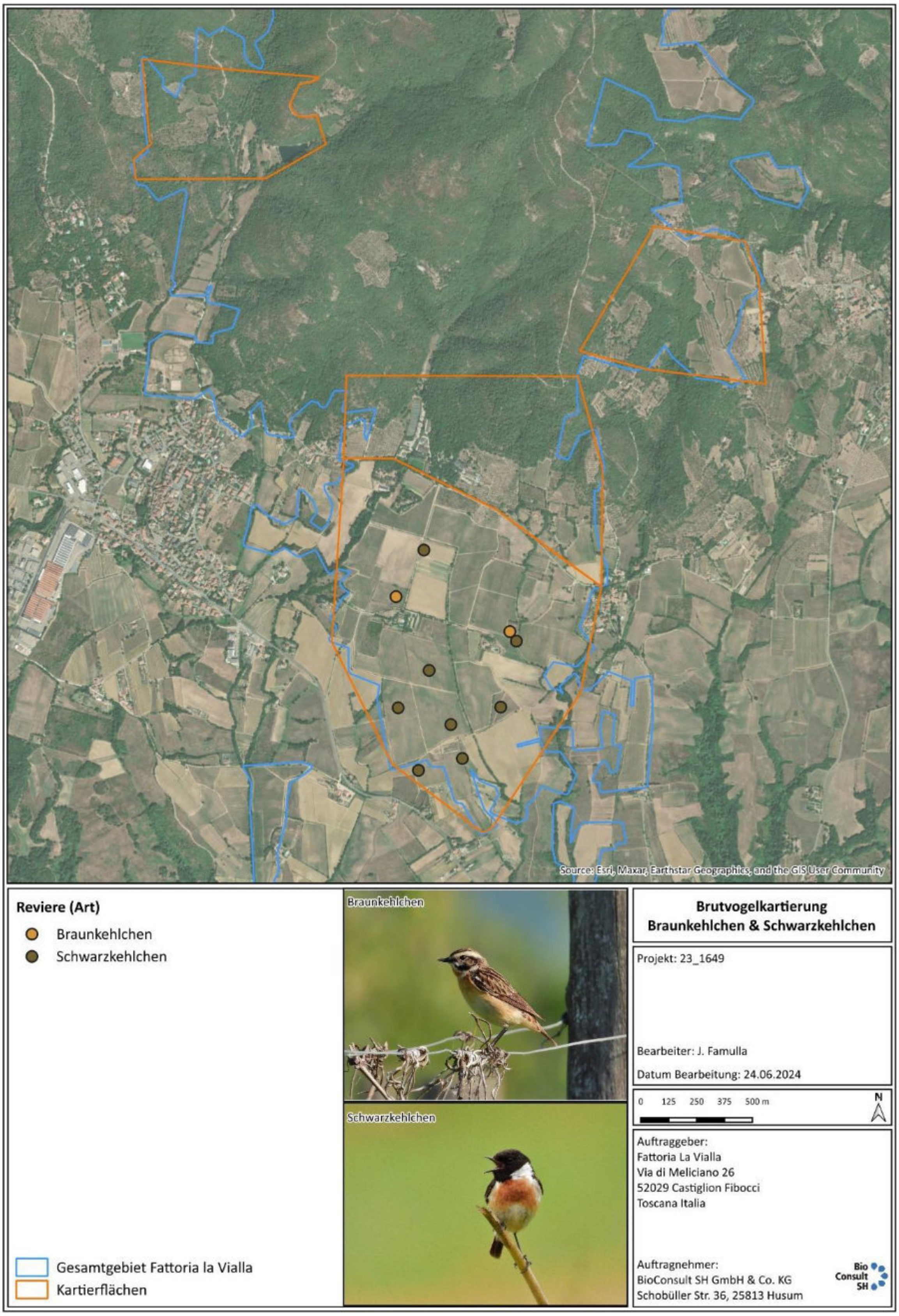

Fig. 3-7 Distribution of Whinchats and Stonechats in the four subplots

3.2.7 Common Chaffinch (*Fringilla coelebs*) and European Greenfinch (*Carduelis chloris*)

Common Chaffinches were recorded in all four subplots with a total of 41 breeding territories. European Greenfinches were recorded with 11 territories in subplot 4, Casa Conforto, and subplot 3, Fattoria (see Fig 3-8). In order to draw a conclusion for the entire area, the Finch breeding territories were multiplied by a factor of 2 based on the potential analysis. The entire area is estimated to have 82 Common Chaffinch territories and 22 Greenfinch territories (see Table 3.1).

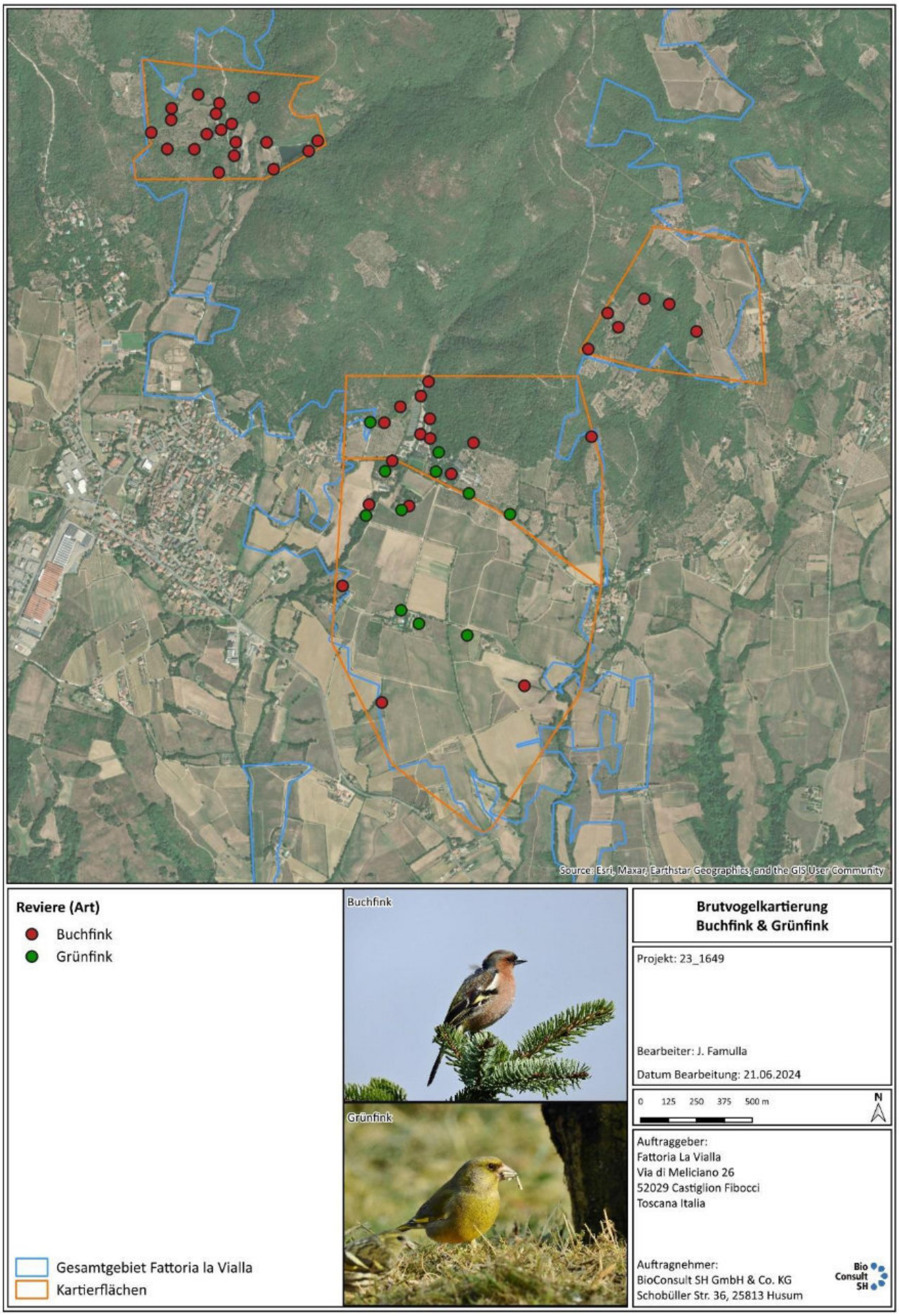

Fig. 3-8 Distribution of Common Chaffinches and European Greenfinches in the four subplots

3.2.8 Great Spotted Woodpecker (*Dendrocopos major*), Green Woodpecker (*Picus viridis*), Lesser Spotted Woodpecker (*Picus* minor) and White-backed Woodpecker (*Dendrocopos leucotos*)

Four species of woodpecker were recorded. Green Woodpeckers showed the largest population with 12 breeding pairs and a potential number of 16 territories (factor 1.3; Table 3.2), followed by Great Spotted Woodpeckers with five breeding pairs and a potential number of 10 territories in the entire area (factor 2; Table 3.2). Two breeding pairs of Lesser Spotter Woodpeckers were recorded, with a potential total of six breeding pairs in the entire area (factor 3; Table 3.2). One breeding pair of White- backed Woodpeckers was recorded in the south-western subplot, number 2, it is estimated that there are a total of two pairs breeding in the entire area (factor 2; Table 3.2 and Fig 3-9).

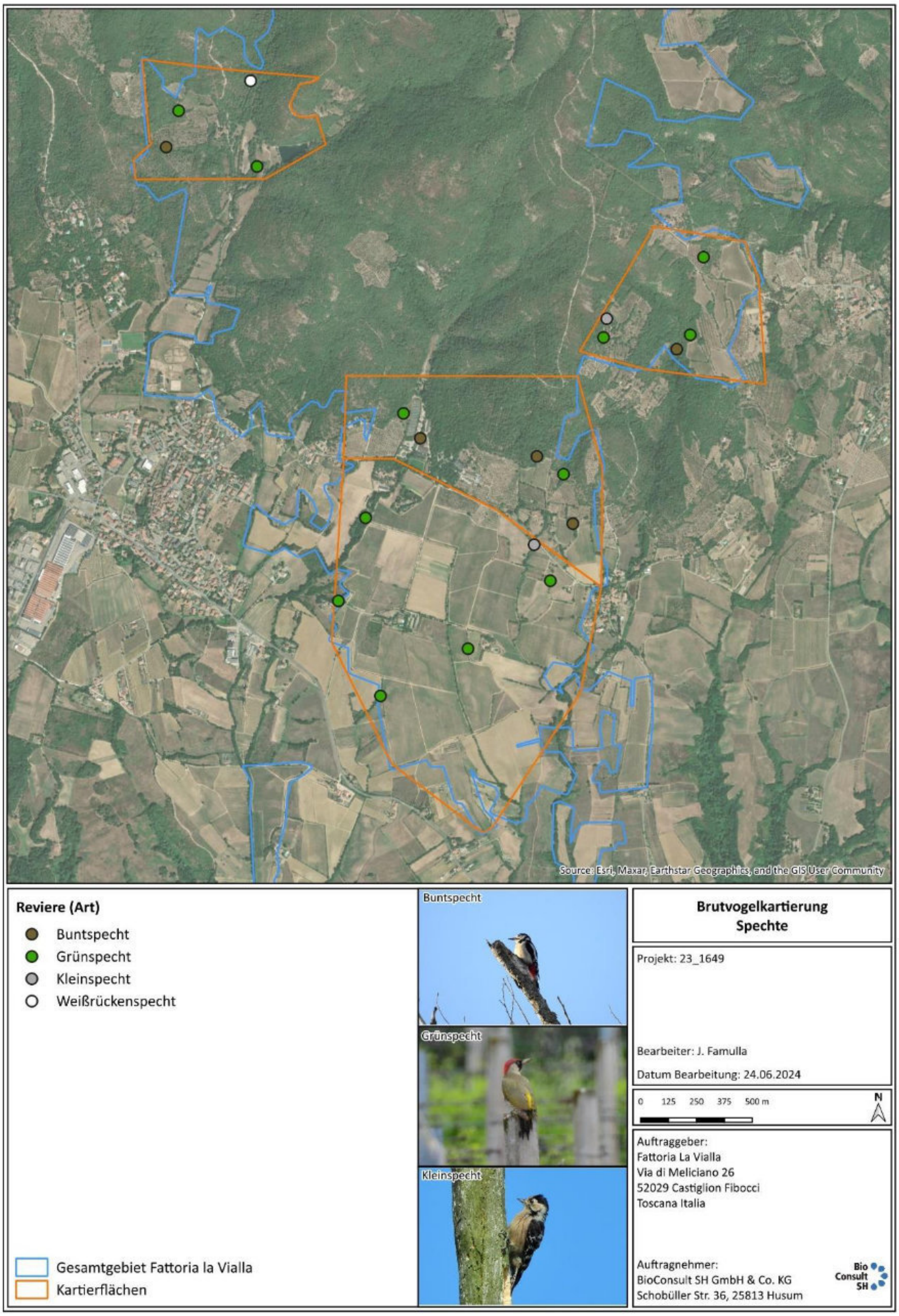

Fig. 3-9 Distribution of Great Spotted, Green, Lesser Spotted and White-backed Woodpeckers in the four subplots

3.2.9 Eurasian Jay (*Garrulus glandarius*), Magpie (*Pica pica*) and Hooded Crow (*Corvus* cornix)

Eurasian Jays were recorded in a total of 12 breeding territories scattered across all four subplots; it is estimated that there are 24 breeding territories in the entire area (factor 2; Table 3.2). Magpies were recorded in 6 territories in subplots 1, 3 and 4; a total of 18 breeding territories are estimated for the entire area (factor 3; Table 3.2). Hooded Crows, like Eurasian Jays, were recorded in all four subplots, with a total of 10 territories; in the entire area, the number of territories is estimated to be 15 (factor 1.5; Table 3.2).

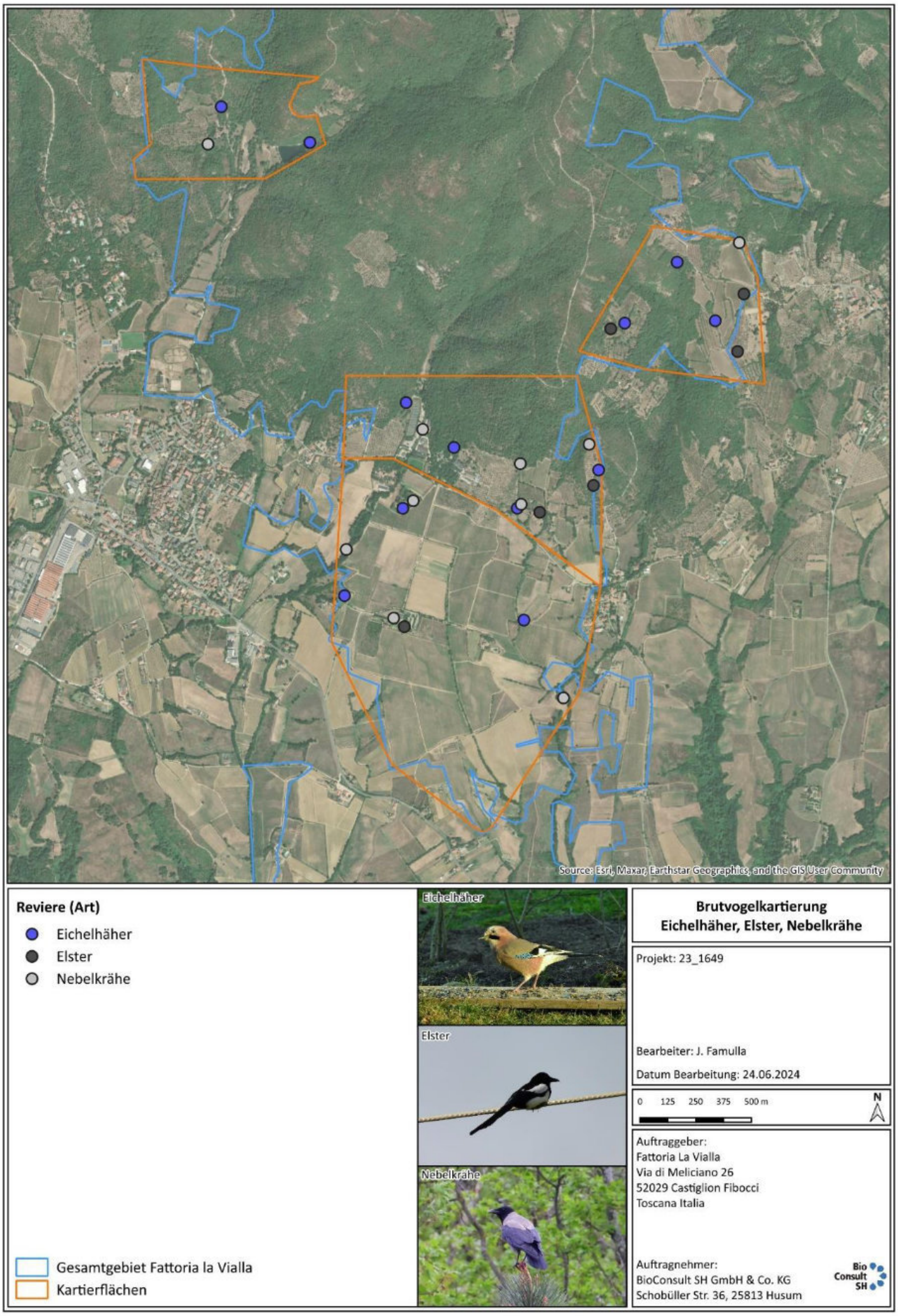

Fig. 3-10 Distribution of Eurasian Jays, Magpies and Hooded Crows in the four subplots

3.2.10 Common Pheasant (*Phasianus colchicus*) and Common Quail (*Coturnix corturnix*)

A potential number of 12 breeding territories is estimated (factor 1.3; Table 3.2, see Fig 3-1). Common Pheasants were found in subplots 3 and 4, with a total of 9 territories. Two breeding pairs of Common Quail were recorded in subplot 4; potentially there are four breeding pairs in the entire area (factor 2; Table 3.2; Fig 3-11).

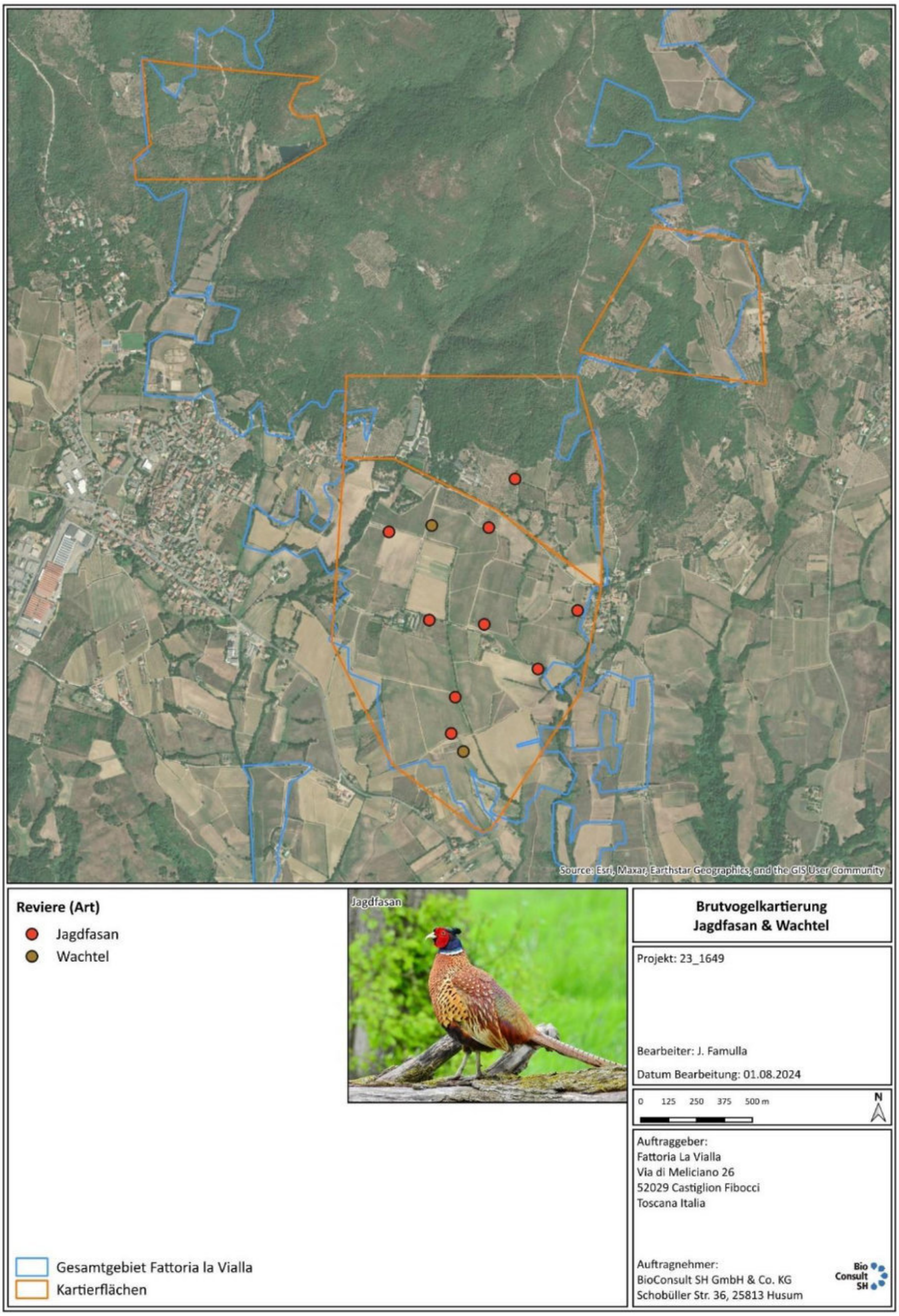

Fig. 3-11 Distribution of Pheasants and Common Quails in the four subplots

3.2.11 Tree Sparrow (*Passer montanus*) and Italian Sparrow (*Passer italiae*)

Both species of sparrow were found in all four subplots, with a total of 12 breeding pairs of Tree Sparrows and 23 pairs of Italian Sparrows recorded. To calculate the number of territories in the entire area, the sparrow breeding territories were multiplied by a factor of 2, based on the potential analysis. For the entire area, a total of 24 territories for Tree Sparrows and 86 territories for Italian Sparrows were estimated (see Table 3.1).

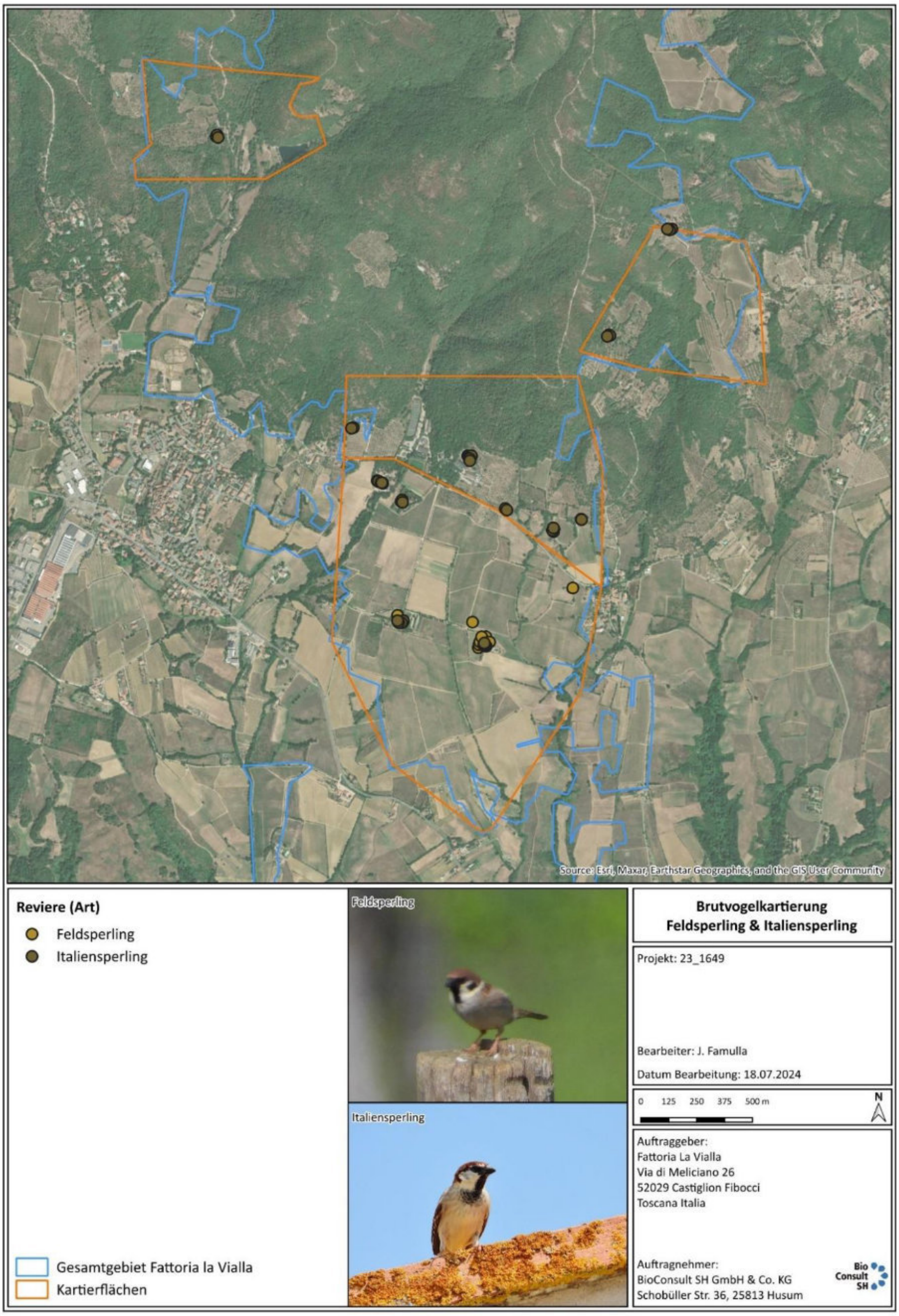

Fig. 3-12 Distribution of Tree Sparrows and Italian Sparrows in the four subplots

3.2.12 Short-toed Treecreeper (*Certhia brachydactyla*) and Eurasian Nuthatch (*Sitta europaea*)

Short-toed Treecreeper and Eurasian Nuthatch breeding territories were found scattered across all four subplots (see Fig. 3-13). There were 21 Short-toed Treecreeper breeding territories and 29 Eurasian Nuthatch ones. Based on the potential analysis, the number of breeding territories for each species was multiplied by a factor of 2, resulting in an estimated total in the entire area of 42 Short- toed Treecreeper and 58 Eurasian Nuthatch territories.

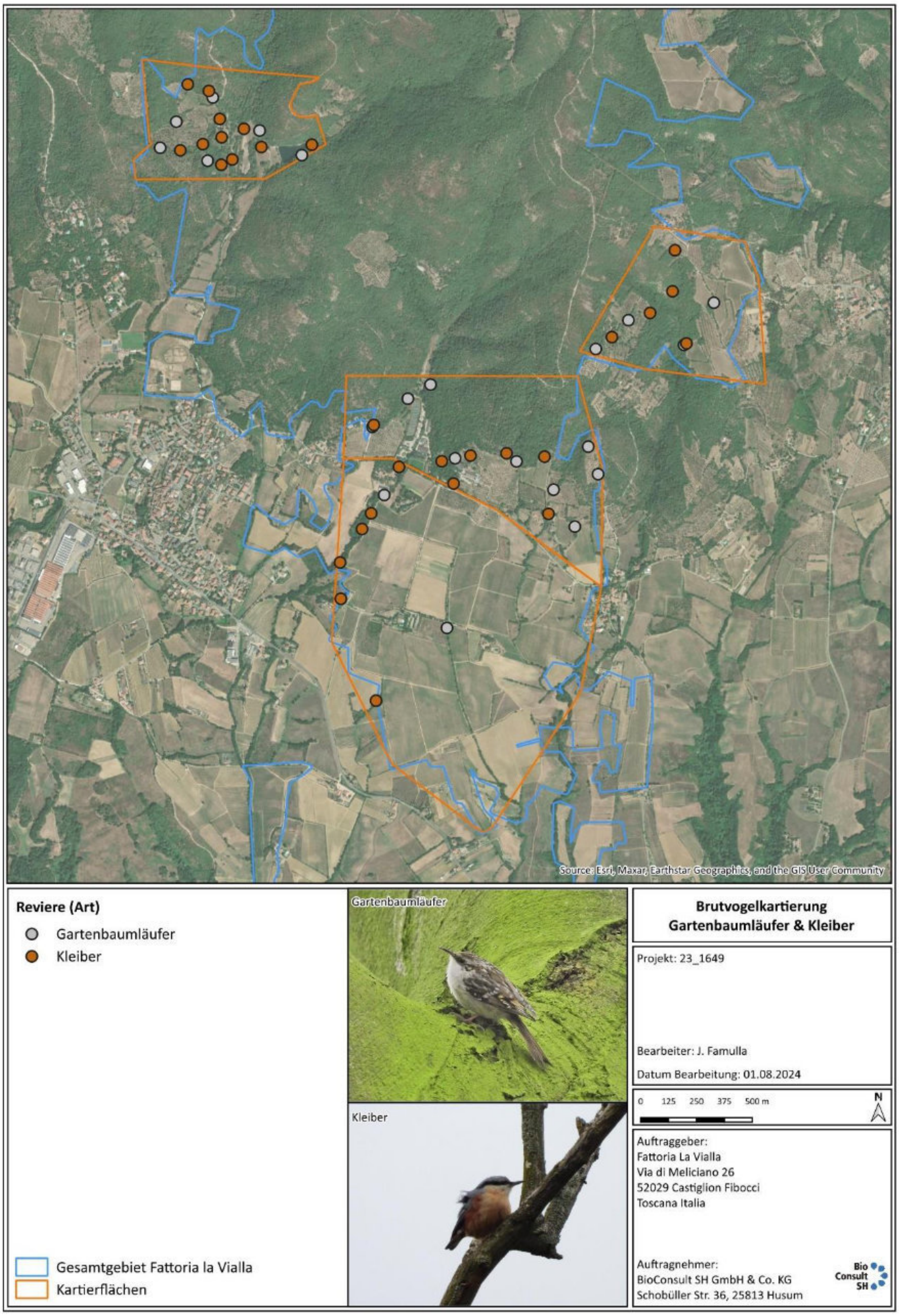

Fig. 3-13 Distribution of Short-toed Treecreepers and Eurasian Nuthatches in the four subplots

3.2.13 Common Redstart (*Phoenicurus phonicurus*) and Spotted Flycatcher (*Muscicapa* striata)

Spotted Flycatchers were found exclusively in subplot 3, Fattoria, with three territories. Common Redstarts were recorded in all four subplots with 15 breeding pairs (Fig 3-14). On the basis of the potential analysis, the number of Redstart breeding territories was multiplied by a factor of 2, resulting in an estimated total of 30 territories for this species in the entire area. For the Spotted Flycatchers a factor of 3 was used, resulting in an estimated total of 9 (see Table 3.1).

Fig. 3-14 Distribution of Common Redstarts and Spotted Flycatchers in the four subplots

3.2.14 European Serin (*Serinus serinus*) and European Goldfinch (*Carduelis carduelis*)

Altogether, 43 breeding pairs of European Serins were recorded, and a total of 61territories was estimated for the entire area (factor1.3; Table 3.2). European Goldfinches were mainly found in mapping areas 3 and 4, with a total of 15 breeding pairs; a total of 30 territories can therefore be estimated (factor 2; Table 3.2).

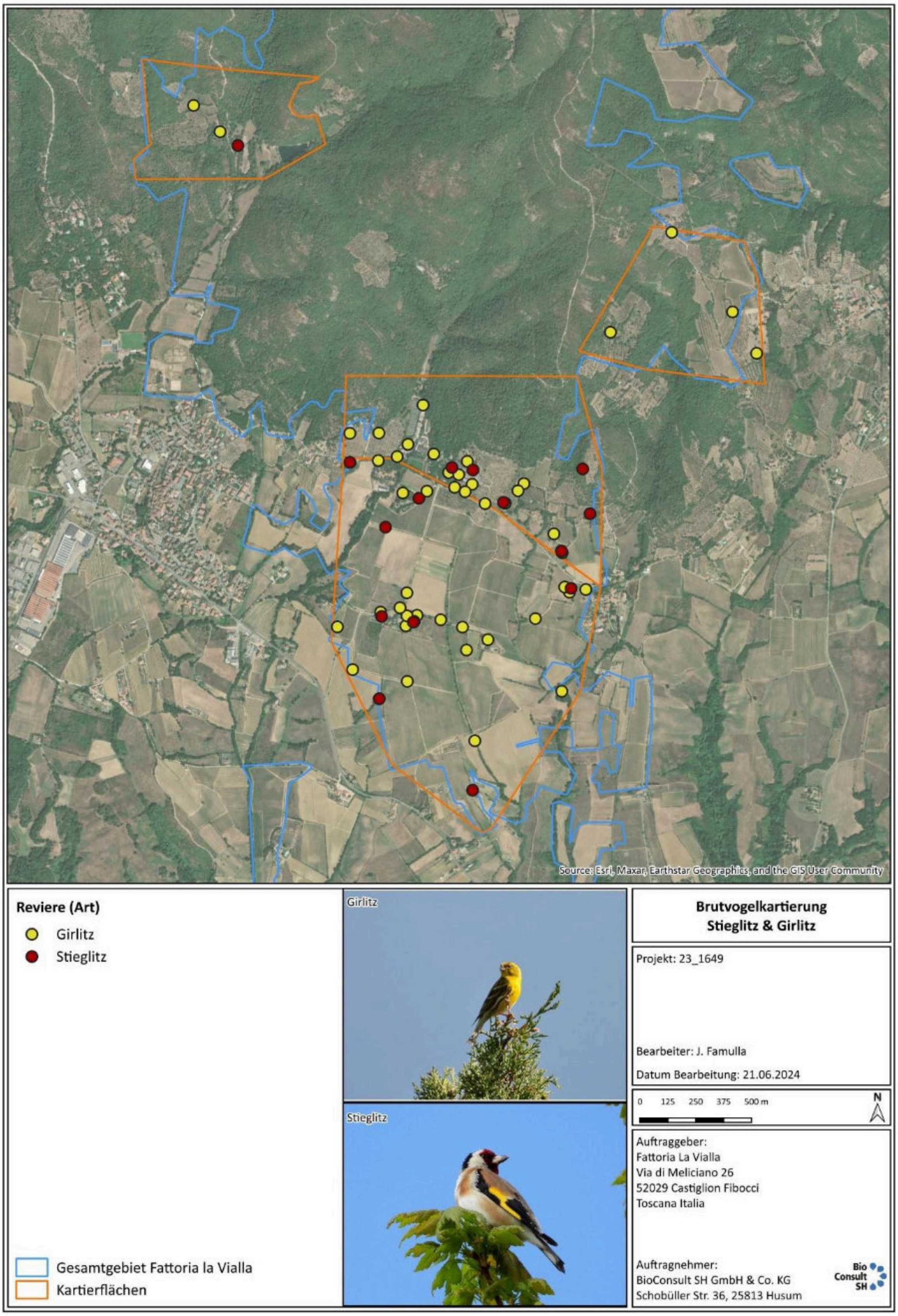

Fig. 3-15 Distribution of European Goldfinches and European Serins in the four subplots

3.2.15 Corn Bunting (*Emberiza calandra*) and Cirl Bunting (*Emberiza cirlus*)

Corn Buntings were only recorded in the southern part of subplot 4, Casa Conforto, with a total of 12 breeding pairs. A total of 24 breeding territories can be estimated (factor 2; Table 3.2). Cirl Buntings, on the other hand, were distributed across all four subplots with 24 breeding pairs. Based on the potential analysis, a total of 36 territories are estimated (factor 1.5) for the entire area (Table 3.2 and Fig. 3-16).

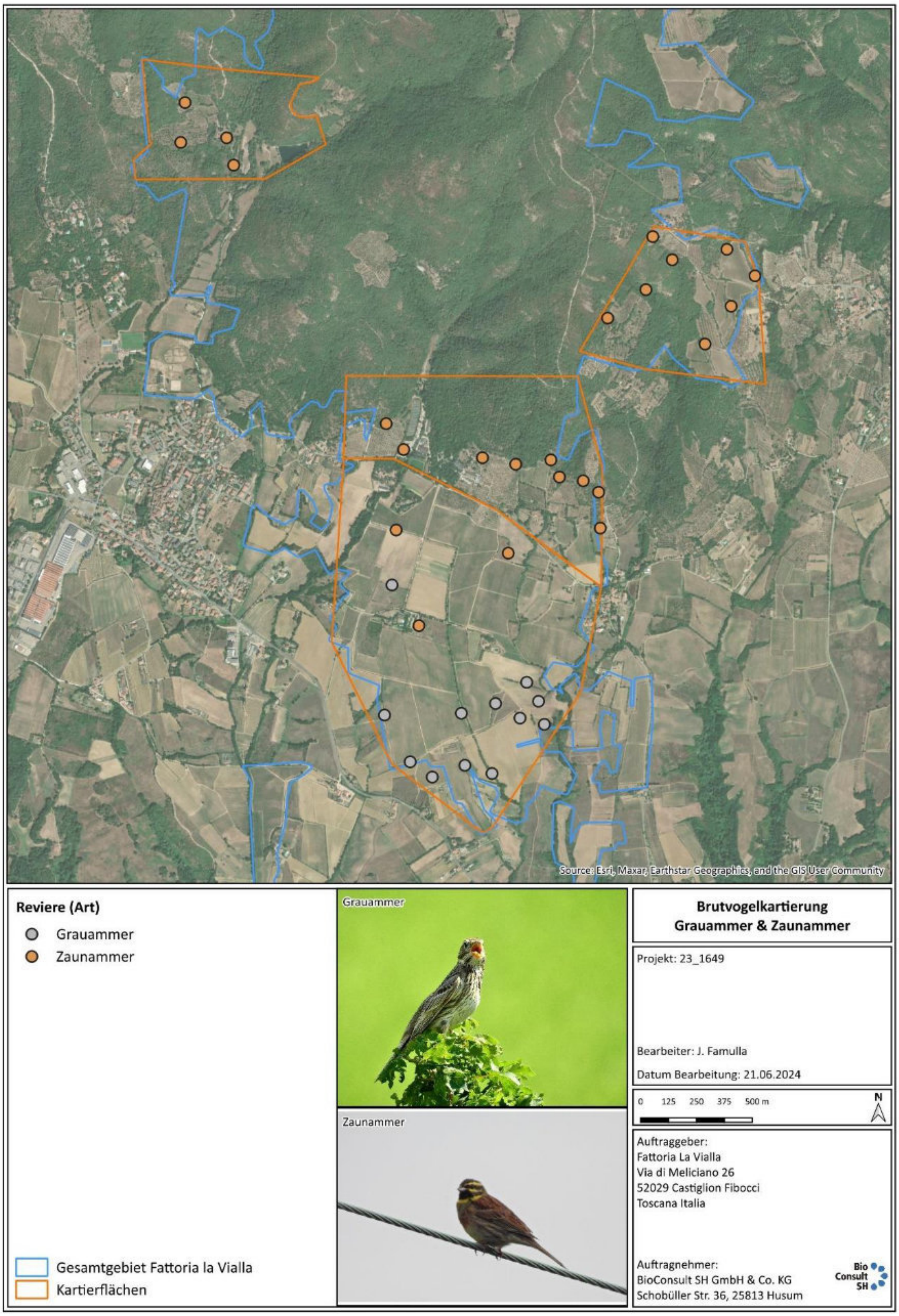

Fig. 3-16 Distribution of Corn Buntings and Cirl Buntings in the four subplots

3.2.16 Woodlark (*Lullula arborea*) and Crested Lark (*Galerida cristata*)

The lark species was represented by Crested Larks and Woodlarks. 16 breeding pairs of Woodlarks were recorded in subplots 1, 3 and 4, with a potential number of 21 territories across the total area (factor 1.3; Table 3.2). Crested Larks were recorded with three breeding territories in subplot 4, meaning that a total of six breeding pairs can be estimated (factor 2; Table 3.2). No Eurasian Skylarks were recorded during the entire mapping period.

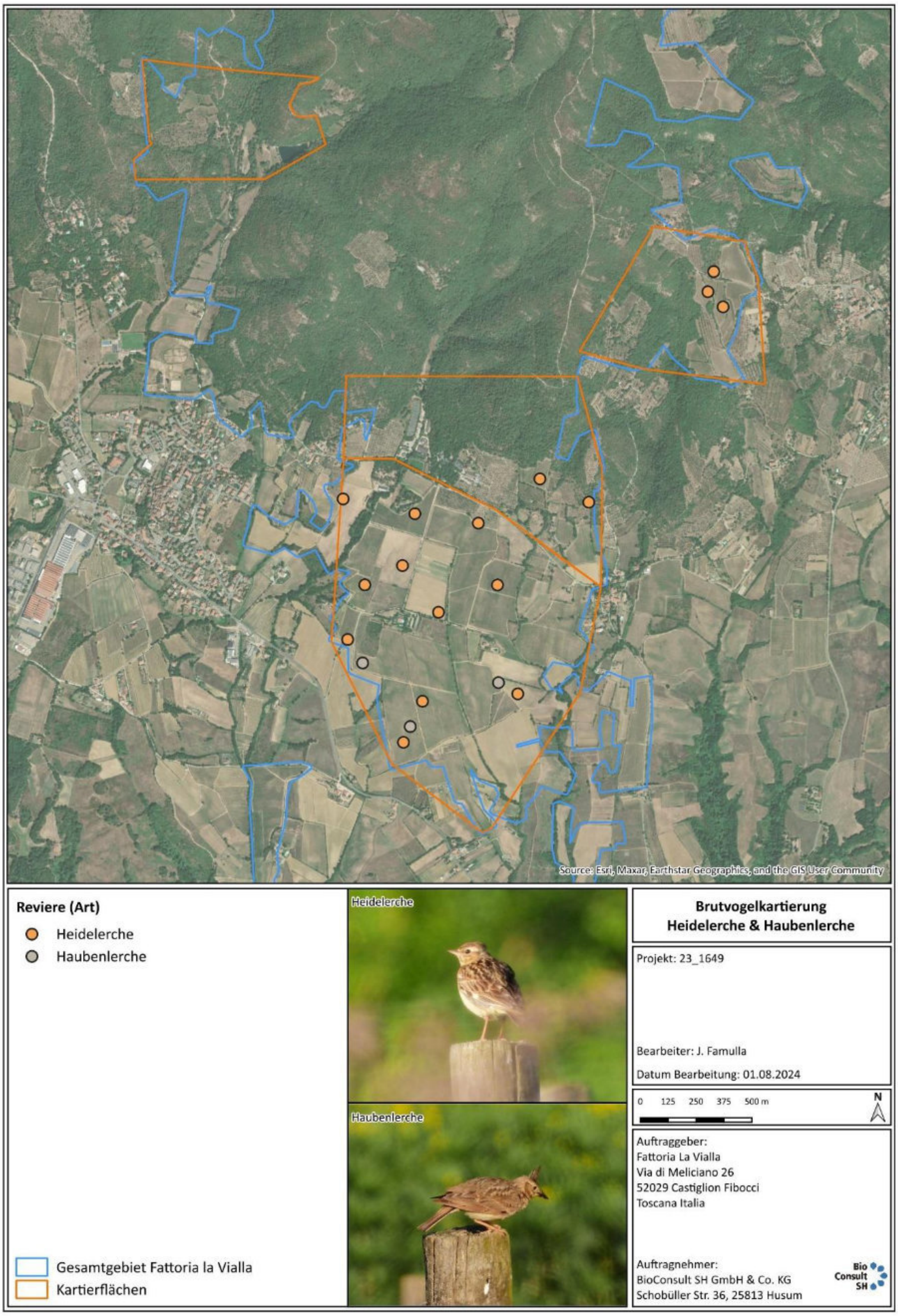

Fig. 3-17 Distribution of Woodlarks and Crested Larks in the four subplots

3.2.17 Great Tit (*Parus major*)

Great Tits are among the most common breeding birds in the subplots studied. They were evenly distributed throughout all four plots with 103 breeding pairs recorded. Based on the potential analysis, a total of 150 territories (factor 1.5; Table 3.1) are estimated for the entire area (Table 3.1 and Fig. 3-18).

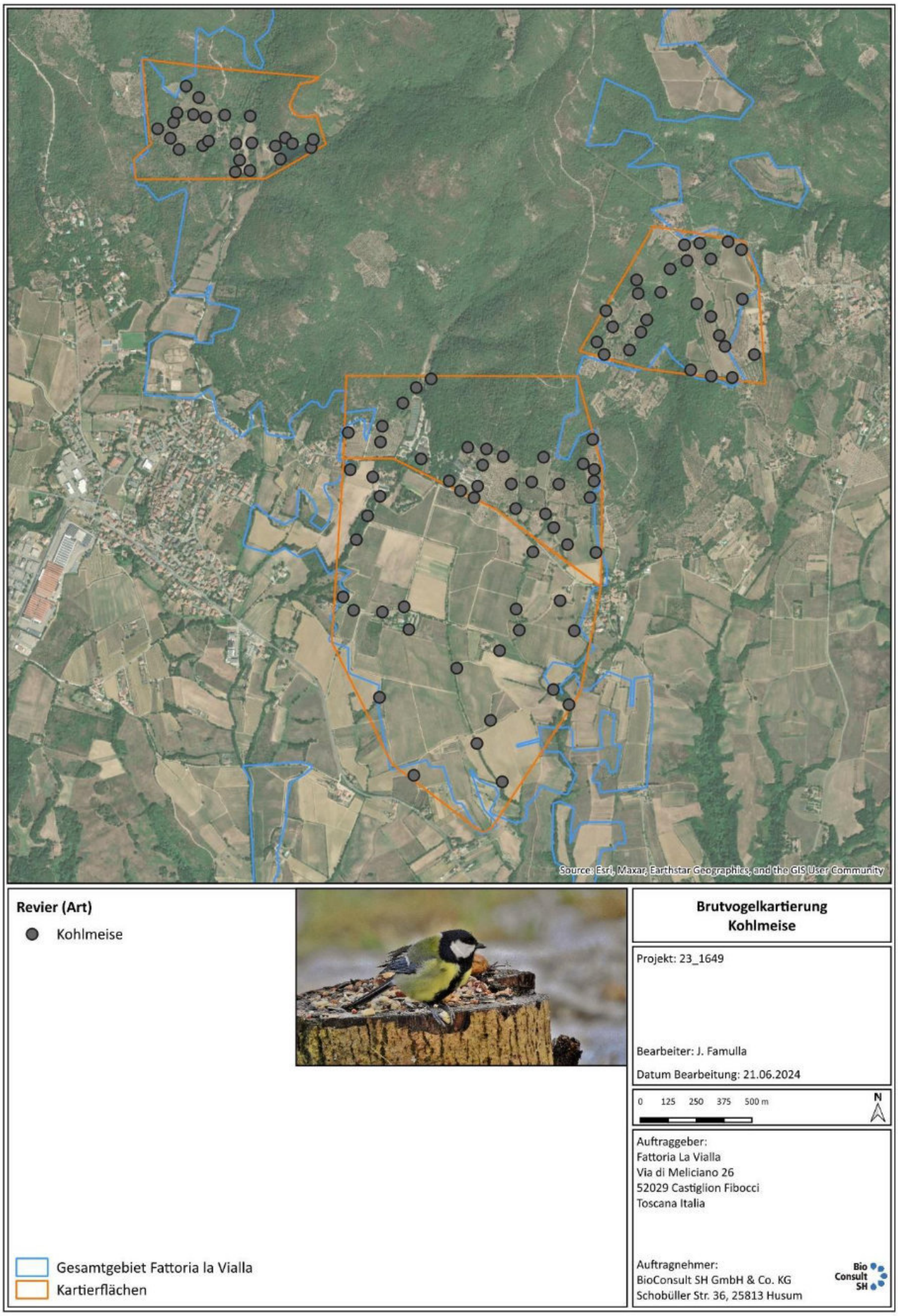

Fig. 3-18 Distribution of Great Tits in the four subplots

3.2.18 Common Buzzard (*Buteo buteo*), Black Kite (*Milvus migrans*), Eurasian Sparrow Hawk (*Accipiter nisus*) and Common Kestrel (*Falco tinnunculus*)

Among the birds of prey, the most frequently observed were Common Kestrels, with three breeding territories in subplots 3 and 4 (see Fig. 3-19). It was estimated that there were a total of four territories in the entire area (factor 1.3; Table 3.1). Common Buzzards and Eurasian Sparrow Hawks were recorded with two territories each in subplots 1, 2 and 3. A total of three breeding territories each can be estimated for both species (factor 1.5; Table 3.1).

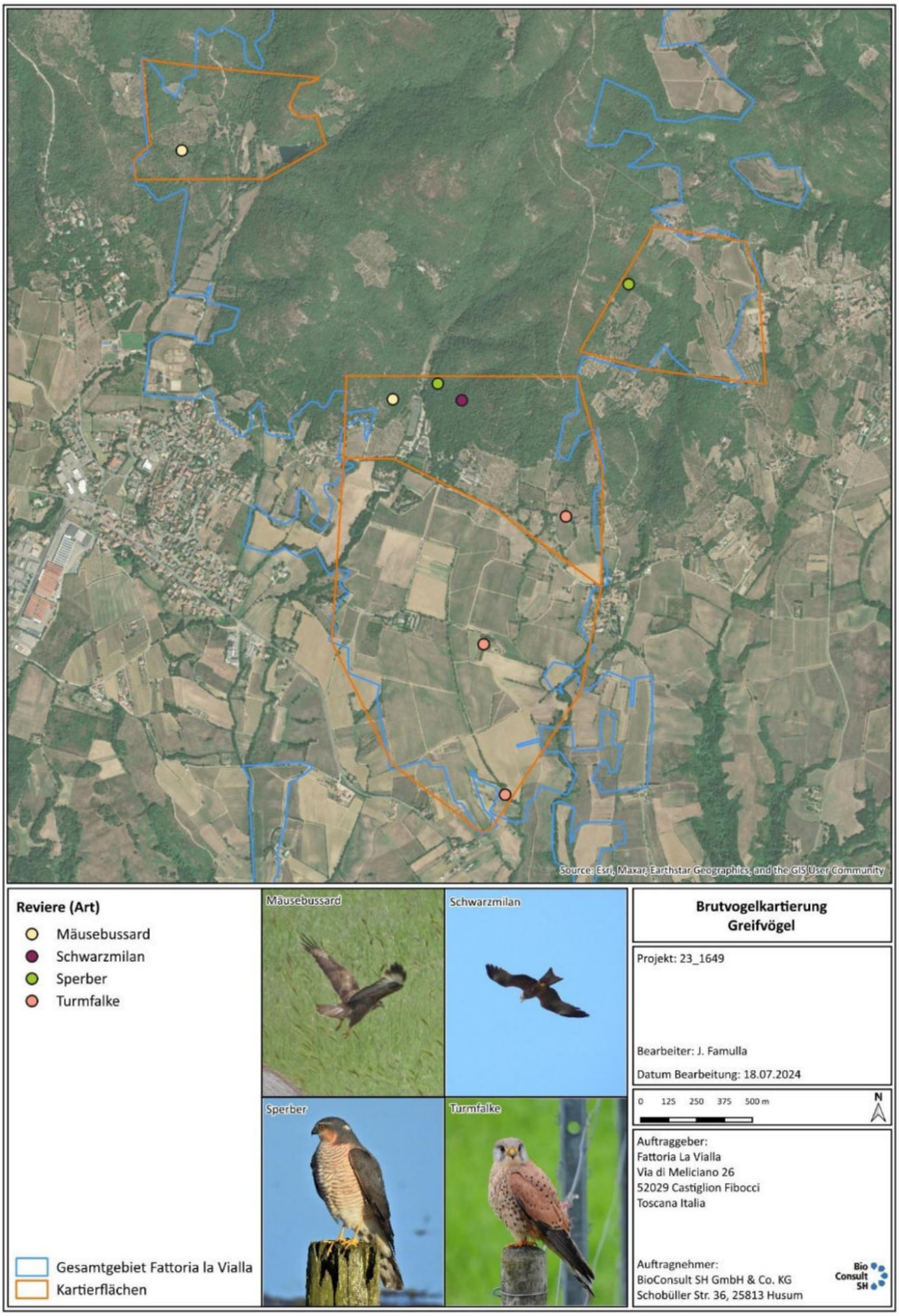

Fig. 3-19 Distribution of Common Buzzards, Black Kites, Eurasian Sparrow Hawks and Common Kestrels in the four subplots

3.2.19 Common Swift (*Apus apus*) and Barn Swallow (*Hirundo rustica*)

Three breeding pairs of Common Swifts were recorded in subplot 4, and a total of 12 territories were estimated (factor 4; Table 3.2). Barn Swallows were observed sporadically, with 9 breeding pairs in the four subplots. Based on the potential analysis, a total of 27 breeding pairs was estimated in the entire area (factor 3; Table 3.2 and Fig. 3-20).

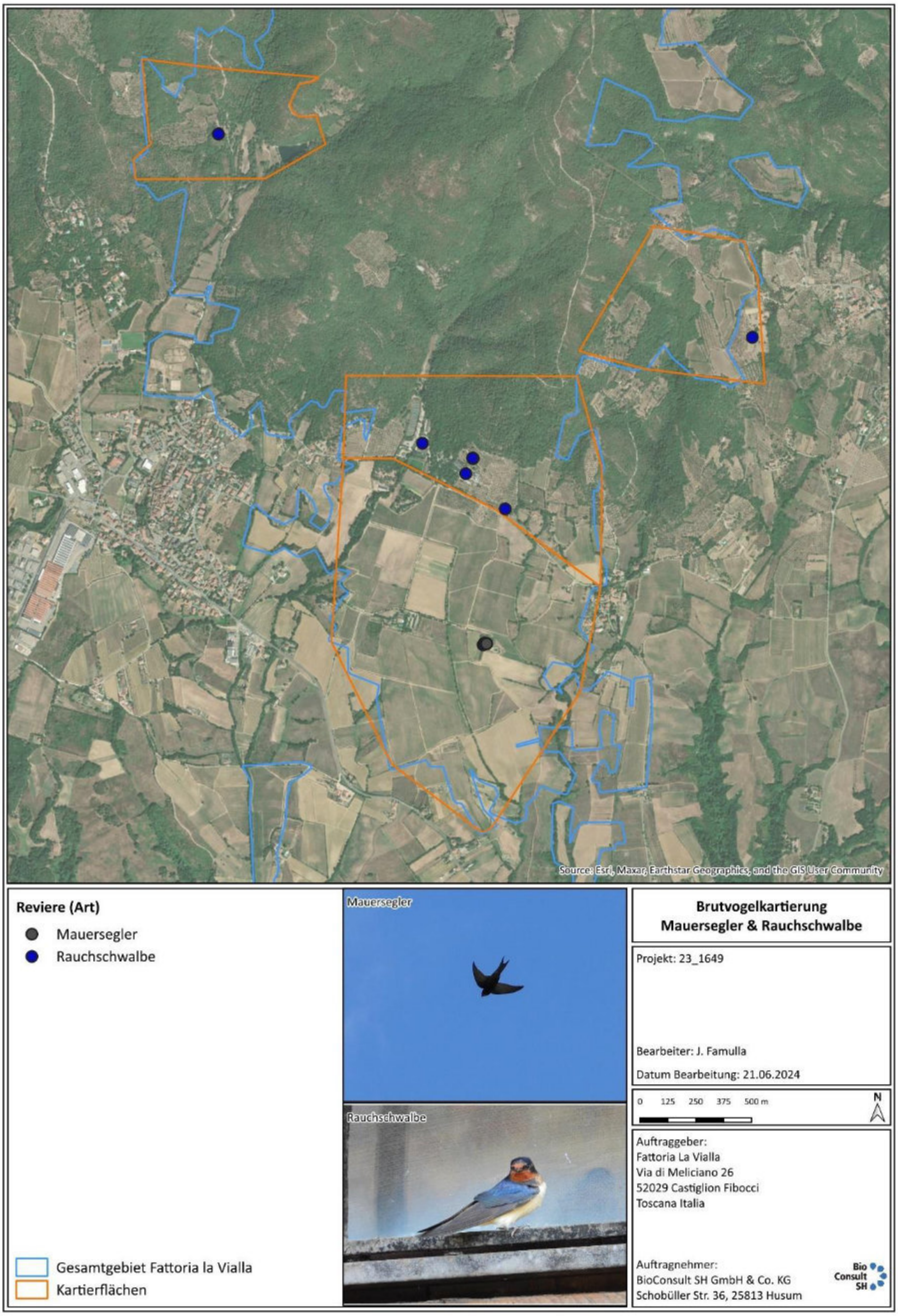

Fig. 3-20 Distribution of Common Swifts and Barn Swallows in the four subplots

3.2.20 Eurasian Blackcap (*Sylvia atricapilla*)

With a total of 137 recorded breeding pairs, Eurasian Blackcaps were by far the most common breeding birds. This species was distributed throughout all four subplots and, based on the potential analysis, is estimated to have a population of 206 breeding pairs in the entire area (factor 1.5; Table 3.1).

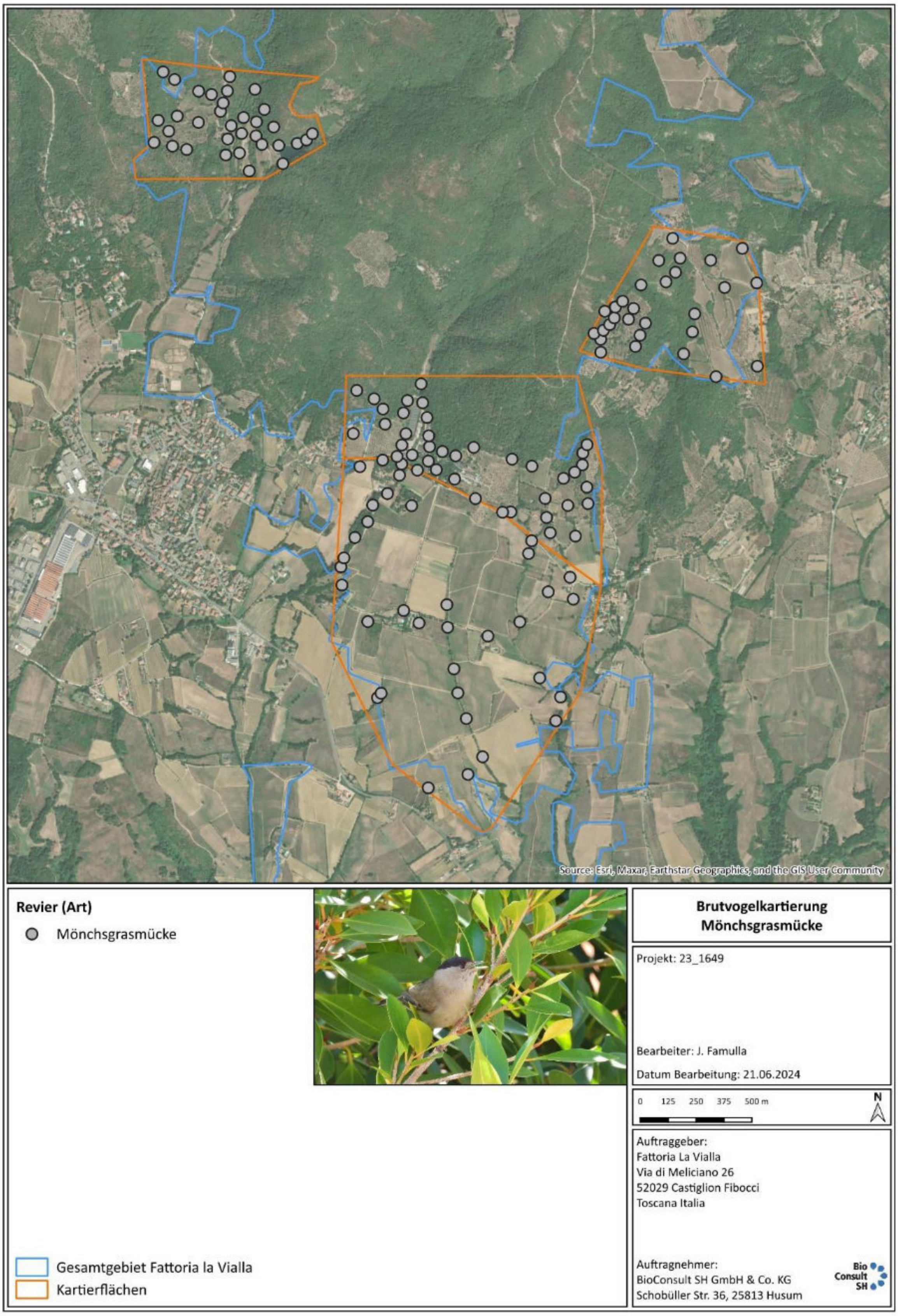

Fig. 3-21 Distribution of Eurasian Blackcaps in the four subplots

3.2.21 Nightingale (*Luscinia megarhynchos*) and Red-backed Shrike (*Lanius collurio*)

Nightingales were recorded in a total of 23 breeding territories in all four subplots; the total number of territories was estimated to be 46 (factor 2; Table 3.1). Red-backed Shrikes were recorded in two territories in subplot 4, Casa Conforto. Three territories are estimated for the entire area (factor 1.5; Table 3.2).

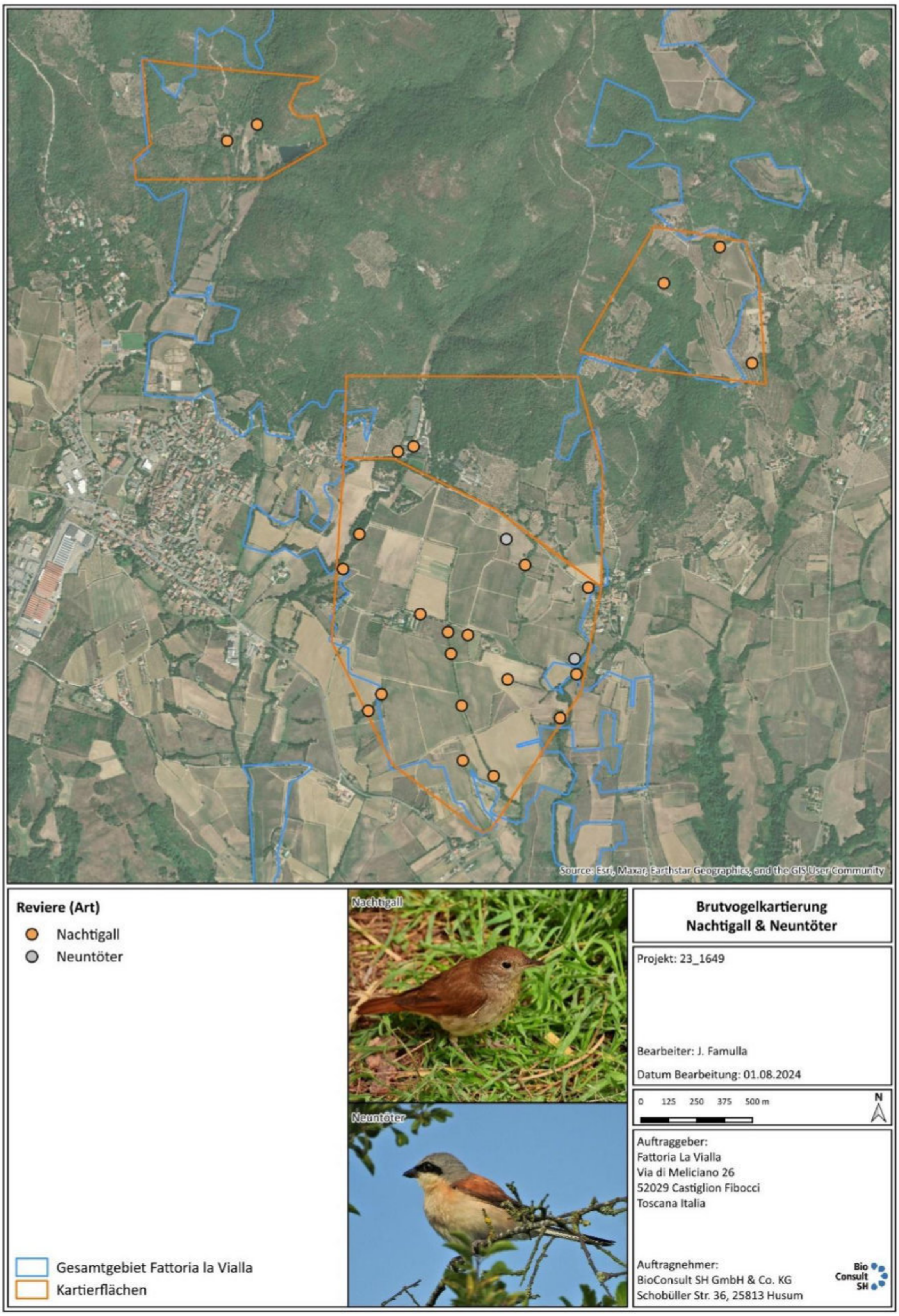

Fig. 3-22 Distribution of Nightingales and Red-backed Shrikes in the four subplots

3.2.22 Melodious Warbler (*Hippolais polygotta*) and Golden Oriole (*Oriolus oriolus*)

Melodious Warblers were only recorded in subplot 4, with five breeding pairs. On the basis of the potential analysis, the number of territories in the entire area is estimated at 8 (factor 1.5; Table 3.1, Fig 3-23). Golden Orioles breed in all the subplots except number 3, and they were represented by seven breeding pairs. A total of eleven breeding pairs were estimated for the entire area (factor 1.5; Table 3.2).

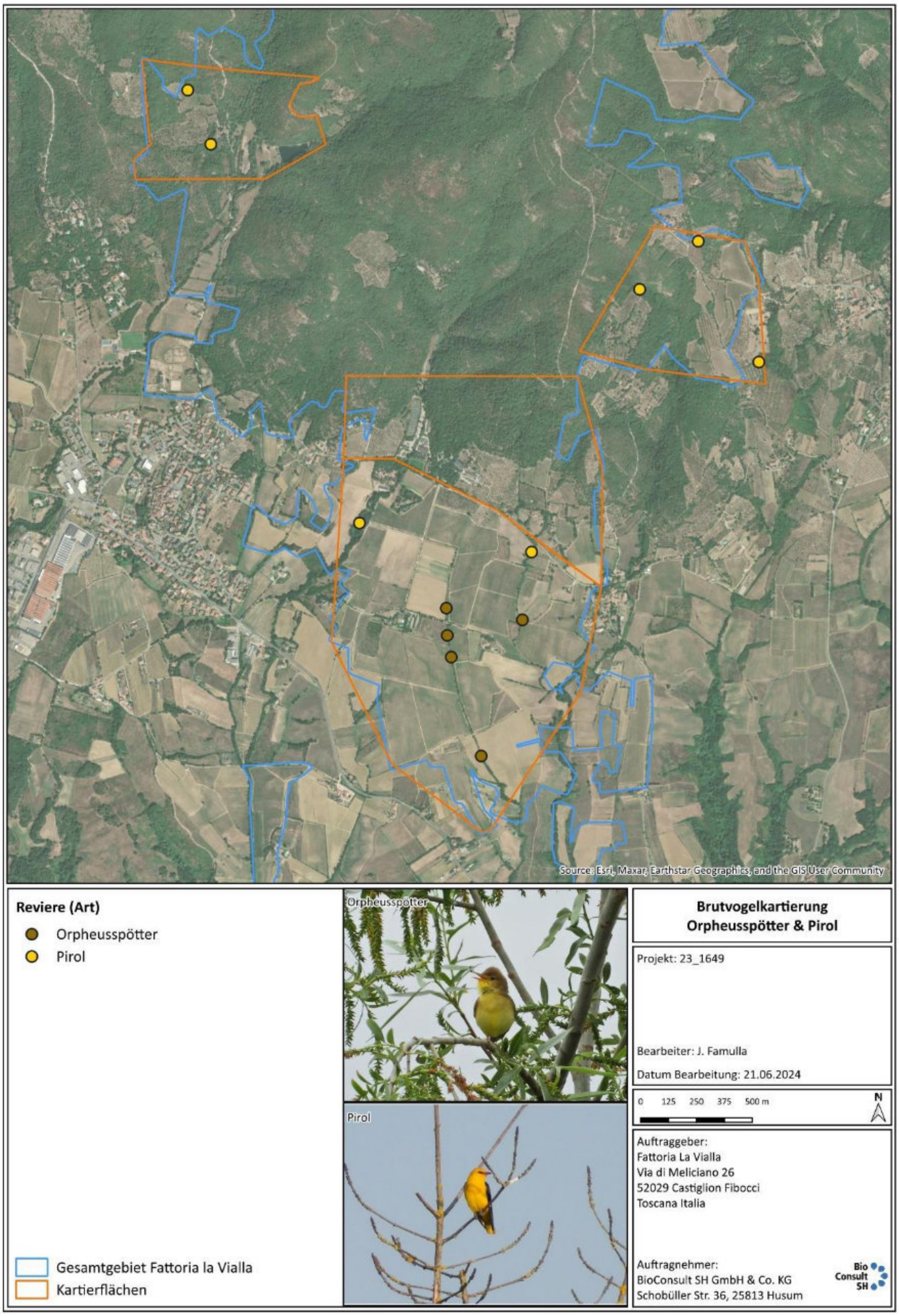

Fig. 3-23 Distribution of Melodious Warblers and Golden Orioles in the four subplots

3.2.23 Common Wood Pigeon (*Columbia palumbus*), Feral Pigeon (*Columbia livia domestica*), Eurasian Collard Dove (*Streptopelia decaocto*) and Turtle Dove (*Streptopelia turtur*)

A total of four different species of pigeons and doves were found in the four subplots (see Fig 3-24), however the Feral Pigeon was only recorded in subplot 4, Casa Conforto, with two territories. The Common Wood Pigeon had the most breeding pairs, with 26 breeding territories and a potential number of 39, followed by the Turtle Dove with 16 breeding pairs (potentially 24 breeding pairs, factor 1.5; Table 3.2). Eurasian Collard Doves were mapped in 9 territories, and a total of 18 territories was estimated (factor 2; Table 2.1).

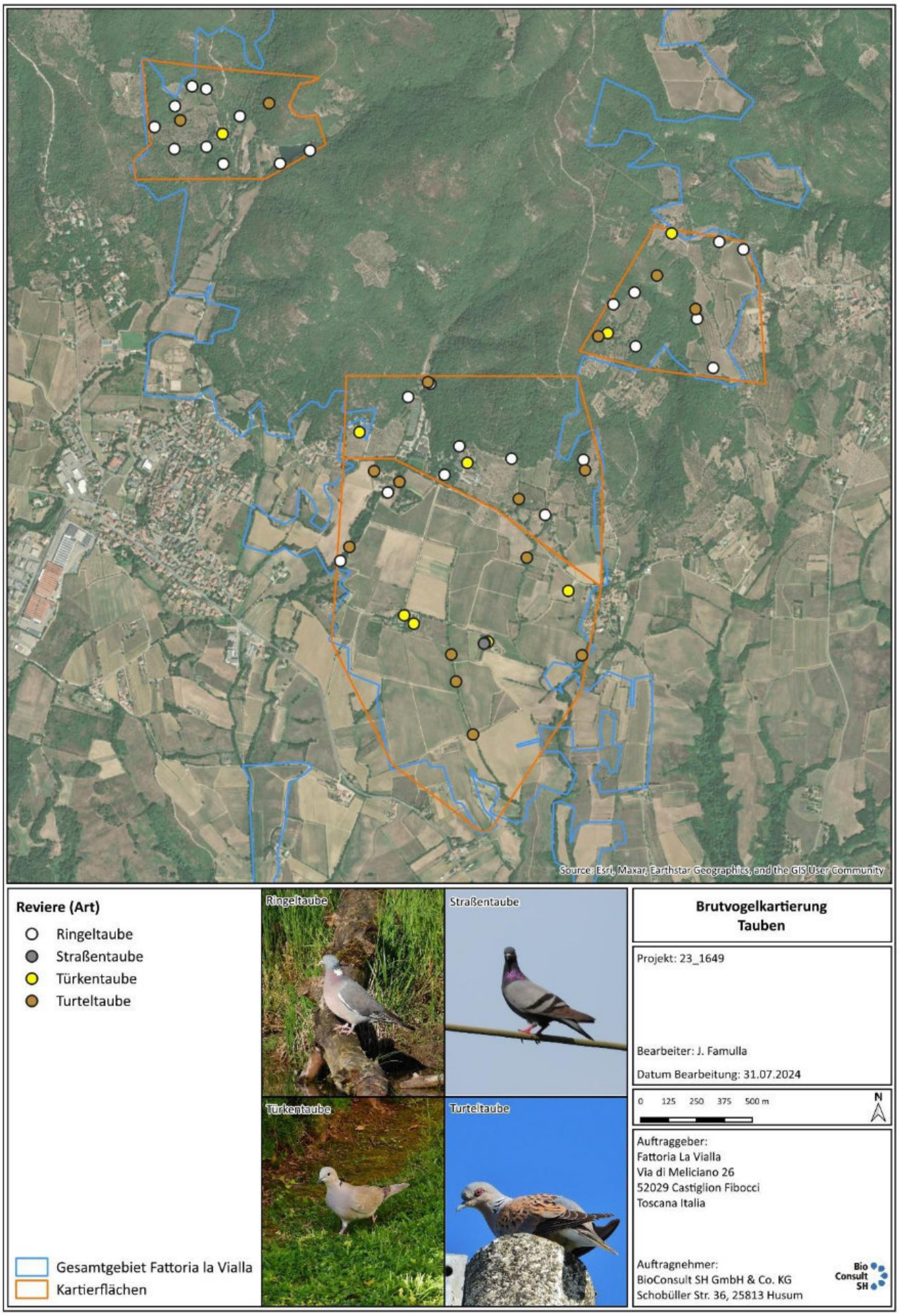

Fig. 3-24 Distribution of Common Wood Pigeons, Ferla Pigeons, Eurasian Collard Doves and Turtle Doves in the four subplots

3.2.24 Red-legged Partridge (*Alectoris rufa*) and Common Moorhen (*Gallinula chloropus*)

Two breeding pairs of Red-legged Partridges and Common Moorhens were recorded. The Red-legged Partridges were found in subplots 3 and 4, the Moorhens in subplots 2 and 4. This number of breeding pairs also corresponds to the number for the entire area (see Fig 3-25).

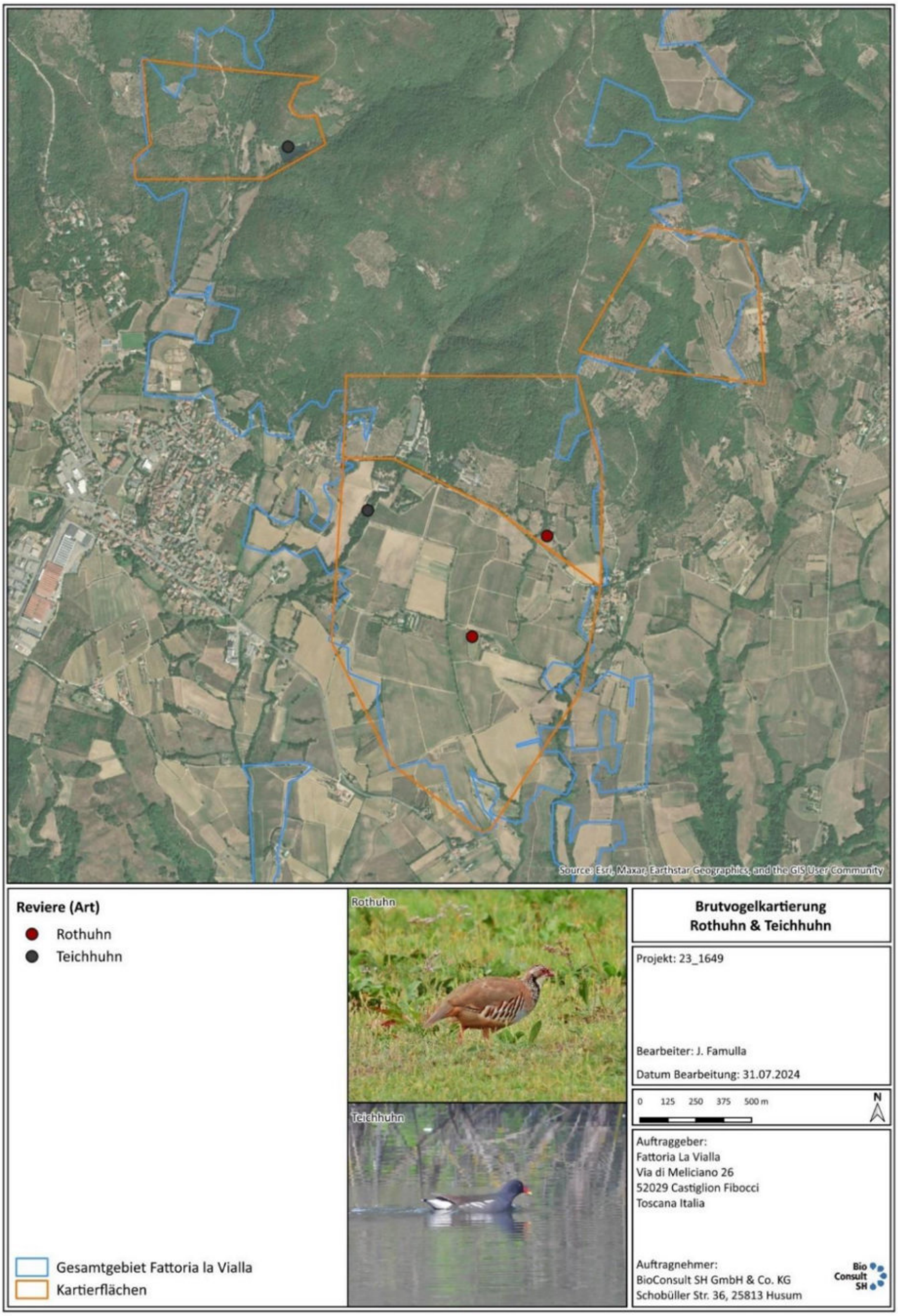

Fig. 3-25 Distribution of Red-legged Partridges and Common Moorhens in the four subplots

3.2.25 Eurasian Robin (*Erithacus rubecula*)

Robins, along with Eurasian Blackcaps and Great Tits, are among the most common breeding birds found in the area surveyed. 131 breeding territories were recorded, evenly distributed across all the subplots. Based on the potential analysis, the total number of territories in the entire area is estimated at 197 (factor 1.5; Table 3.1 and Fig. 3-26).

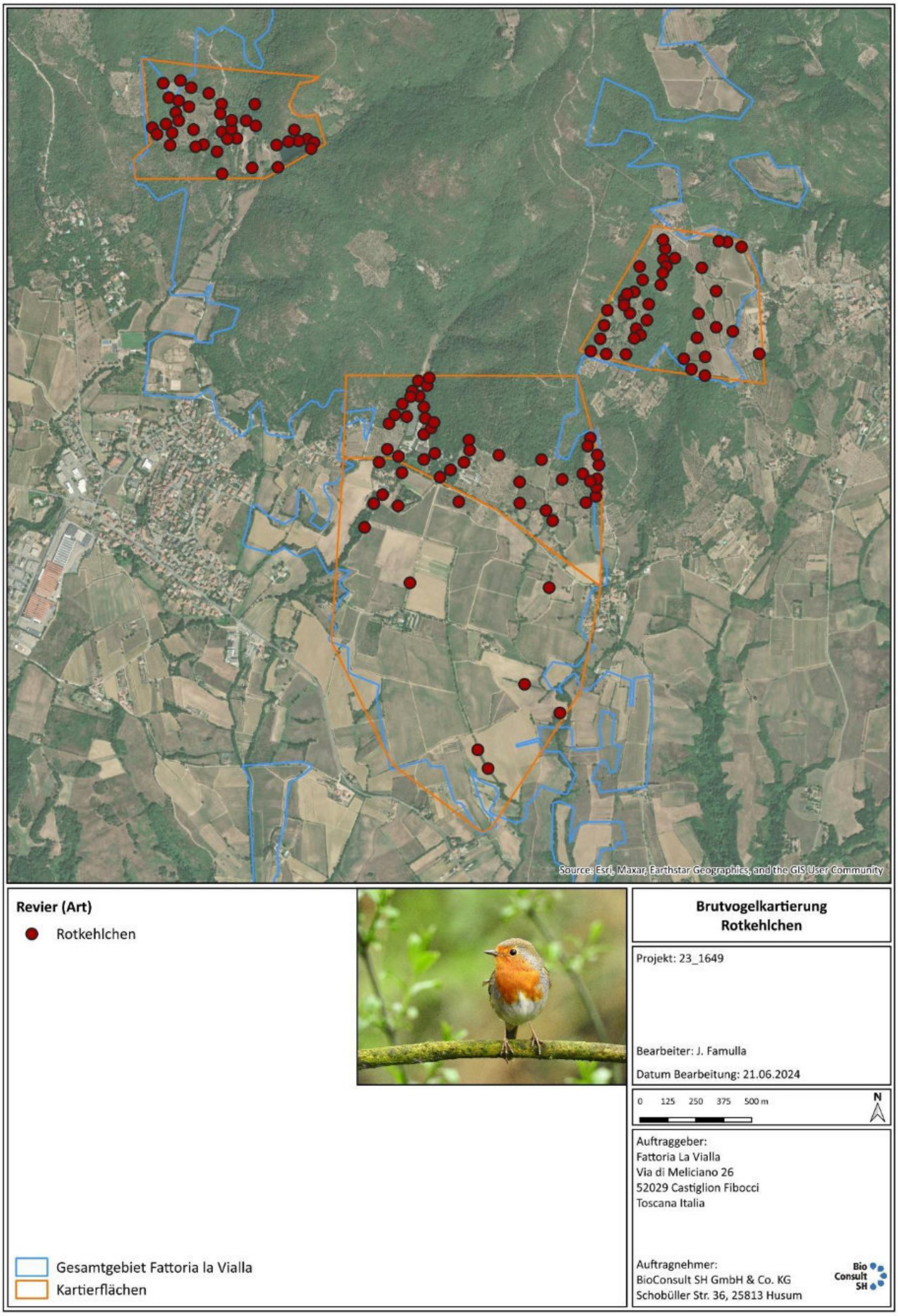

Fig. 3-26 Distribution of Eurasian Robins in the four subplots

3.2.26 Long-tailed Tit (*Aegithalos caudatus*) and Marsh Tit (*Poecile palustris*)

24 breeding pairs of Long-tailed Tits were recorded in the subplots. A total of 48 Long-tailed Tit territories can therefore be estimated for the entire area (factor 2; Table 3.2). March Tits were recorded with 2 territories in subplot 2, Big Lake, giving a potential total of 4 territories (factor 2; Table 3.2; Fig. 3- 27).

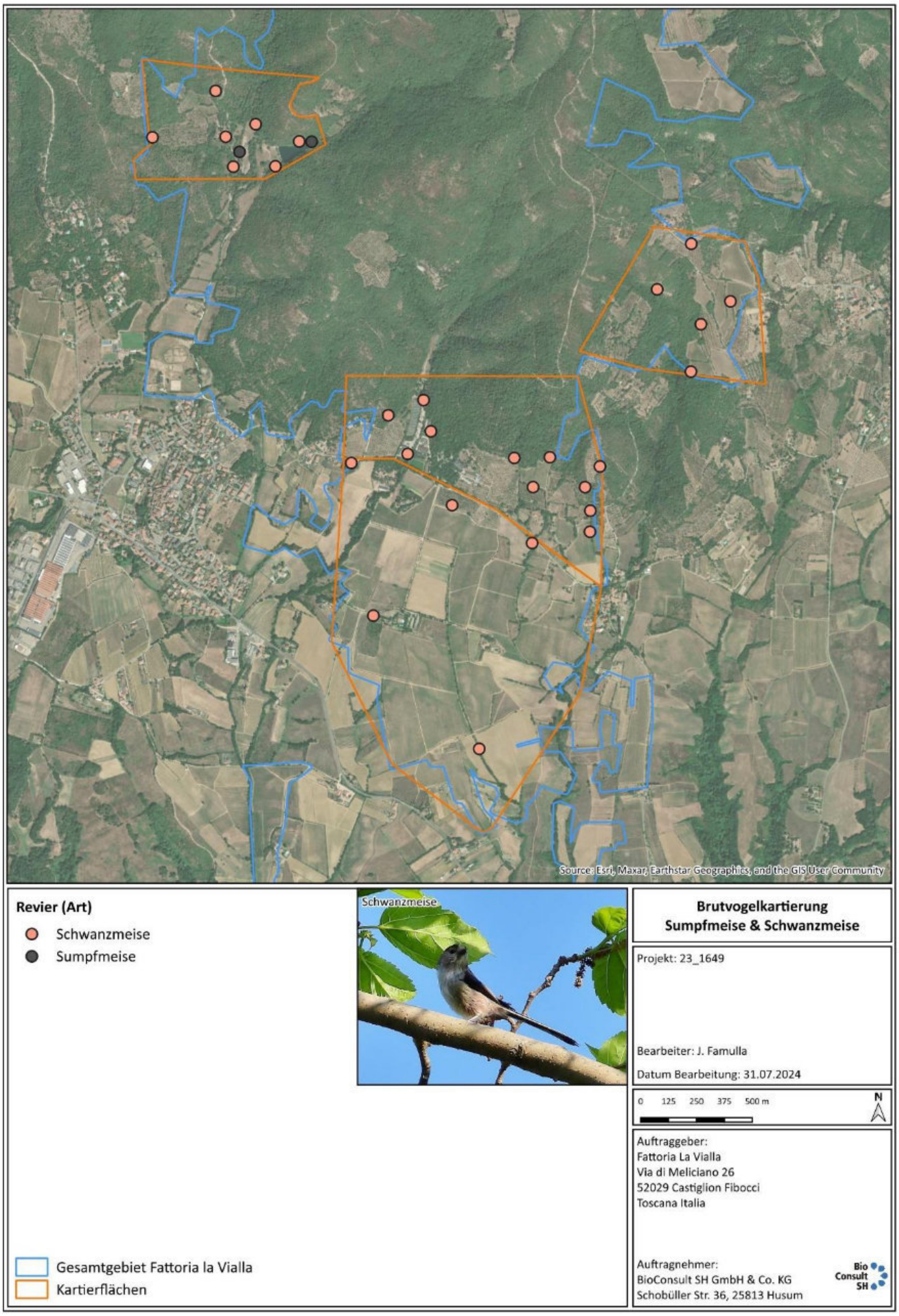

Fig. 3-27 Distribution of Long-tailed Tits and Marsh Tits in the four subplots

3.2.27 Song Thrush (Turdus philomes), Mistle Thrush (Turdus viscivorus) and Common Starling (Sturnus vulgaris)

Common Starlings were recorded in all the subplots except for number 1, with a total of 13 breeding territories. Based on the potential analysis, a total of 39 territories can be estimated for the entire area (factor 3; Fig 3-28 and Table 3.1). Song Thrushes and Mistle Thrushes were only observed in isolated cases. Song Thrushes were recorded in subplots 1, 3 and 4 with 3 breeding territories, so the Song Thrush population was estimated at 6 territories (factor 2; Fig. 3-28 and Table 3.1). A single Mistle Thrush sighting was recorded in subplot 2, Big Lake, and a total of 3 territories are estimated for the entire area (factor 3; Fig. 3-28 and Table 3.1).

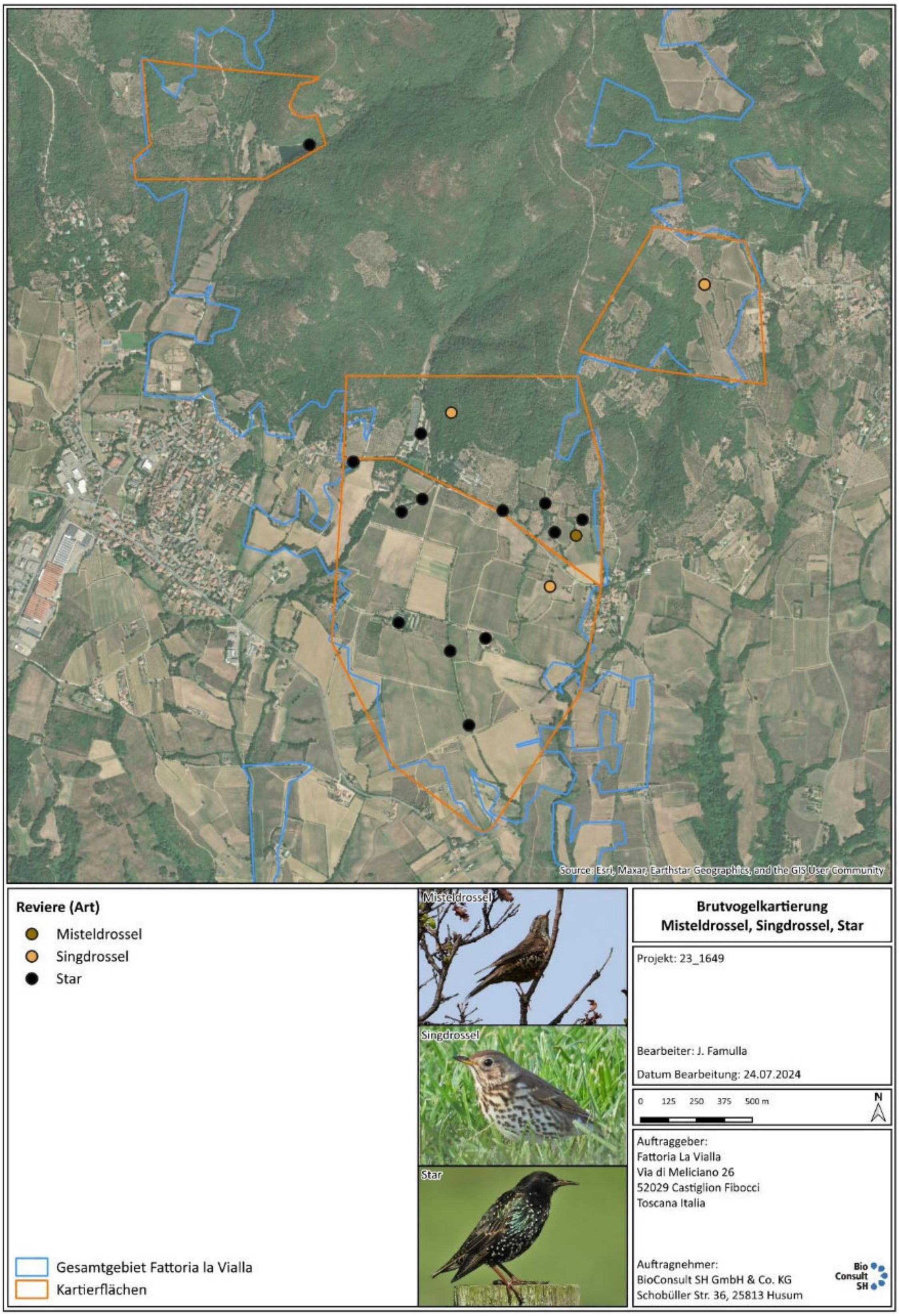

Fig. 3-28 Distribution of Mistle Thrushes, Sing Thrushes and Common Starlings in the four subplots

3.2.28 Common Firecrest (*Regulus ignicapilla*), Eurasian Wren (*Troglodytes troglodytes*) and Chiffchaff (*Phylloscopus collybita*)

Common Firecrests, Wrens and Chiffchaffs were recorded uniformly throughout the subplots (see Fig 3-29). Firecrests were recorded in 28 breeding territories, and on the basis of the potential analysis a total of 56 territories is estimated (factor 2, Table 3.2). Wrens were recorded in 25 breeding pairs (potential analysis for the entire area 33 territories; factor 1.5; Table 3.3). Chiffchaffs were recorded in 18 territories, with 27 territories according to the potential analysis (factor 1.5; Table 3.2).

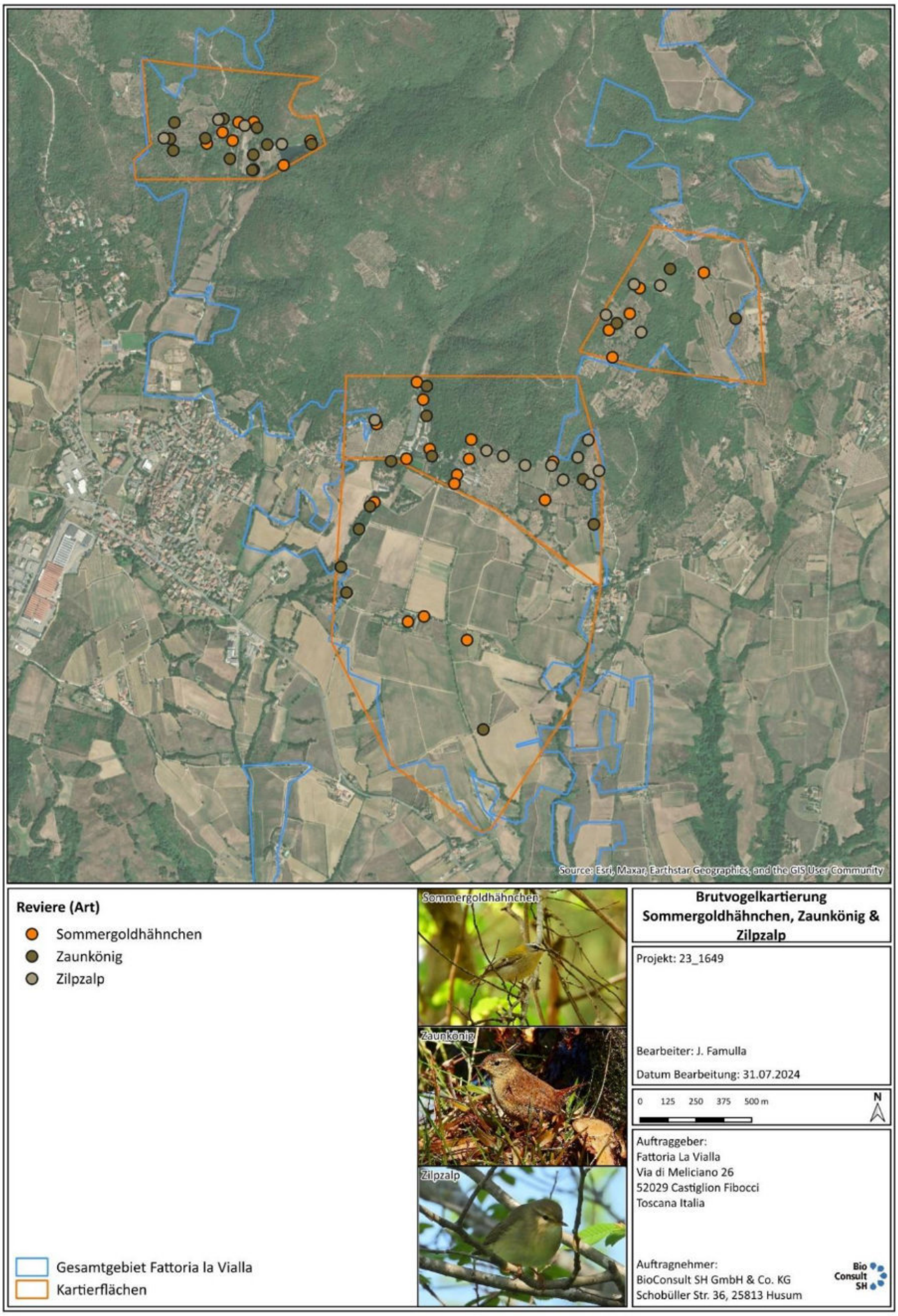

Fig. 3-29 Distribution of Common Firecrests, Eurasian Wrens and Chiffchaffs in the four subplots

3.2.29 Mallard (*Anas platyrhynchos*) and Little Grebe (*Tachybaptus ruficollis*)

Both Mallards and Little Grebes were found on the two larger bodies of water on Fattoria La Vialla's estate. One breeding pair of Mallards was recorded, and two breeding pairs of Little Grebes were observed (Fig. 3-30). No multiplication factor was applied to calculate the breeding population in the entire area for either species. It was assumed that all breeding pairs were found during the mapping of the four subplots. Moreover, no other suitable habitats for these water bird species were available.

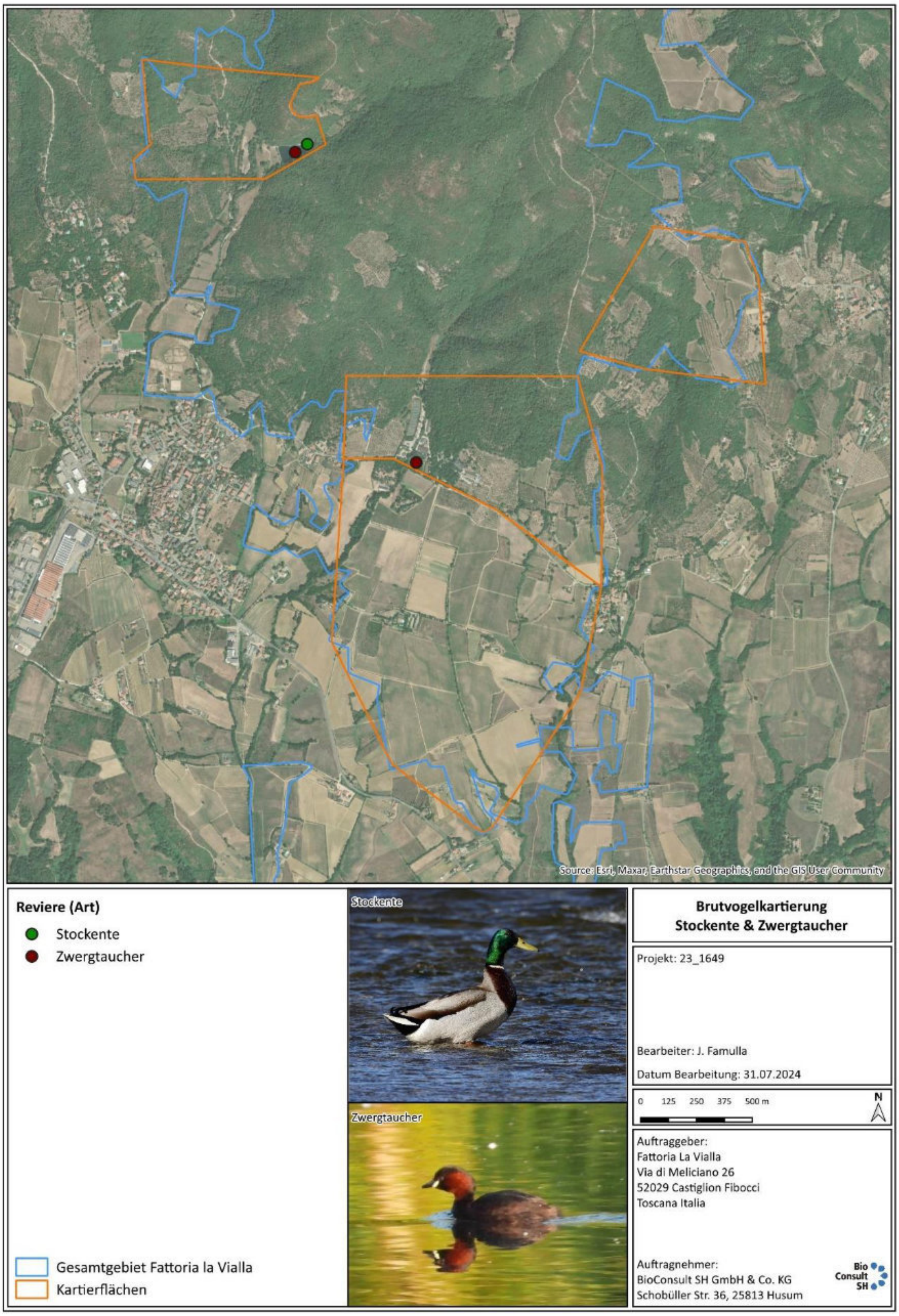

Fig. 3-30 Distribution of Mallards and Little Grebes in the four subplots

3.2.30 Tawny Owl (*Strix aluco*), Long-eared Owl (*Asio otus*), Little Owl (*Athene noctua*) and Eurasian Scops Owl (*Otus scops*) Tab. 3.2

A total of four species of owls were recorded. The Eurasian Scops Owl was the most common, with 9 confirmed breeding territories (see Fig. 3-31). The Scops Owls mainly breed in the immediate vicinity of the Fattoria and Casa Conforto, and a total of 15 breeding pairs is estimated for the entire area (factor 1.5). Tawny Owls were recorded in subplots 2 and 3, with a total of 4 breeding territories; based on the potential analysis there are 6 territories in the entire area (factor 1.5; Table 3.2). 5 breeding pairs of Little Owls were recorded in subplot 4, Casa Conforto, and a total of 8 territories was estimated (factor 1.5; Table 3.2). Just one breeding pair of Long-eared Owls was recorded at the edge of the forest in subplot 3, Fattoria; according to the potential analysis a total of 3 breeding pairs was estimated (factor 3; Table 3.2).

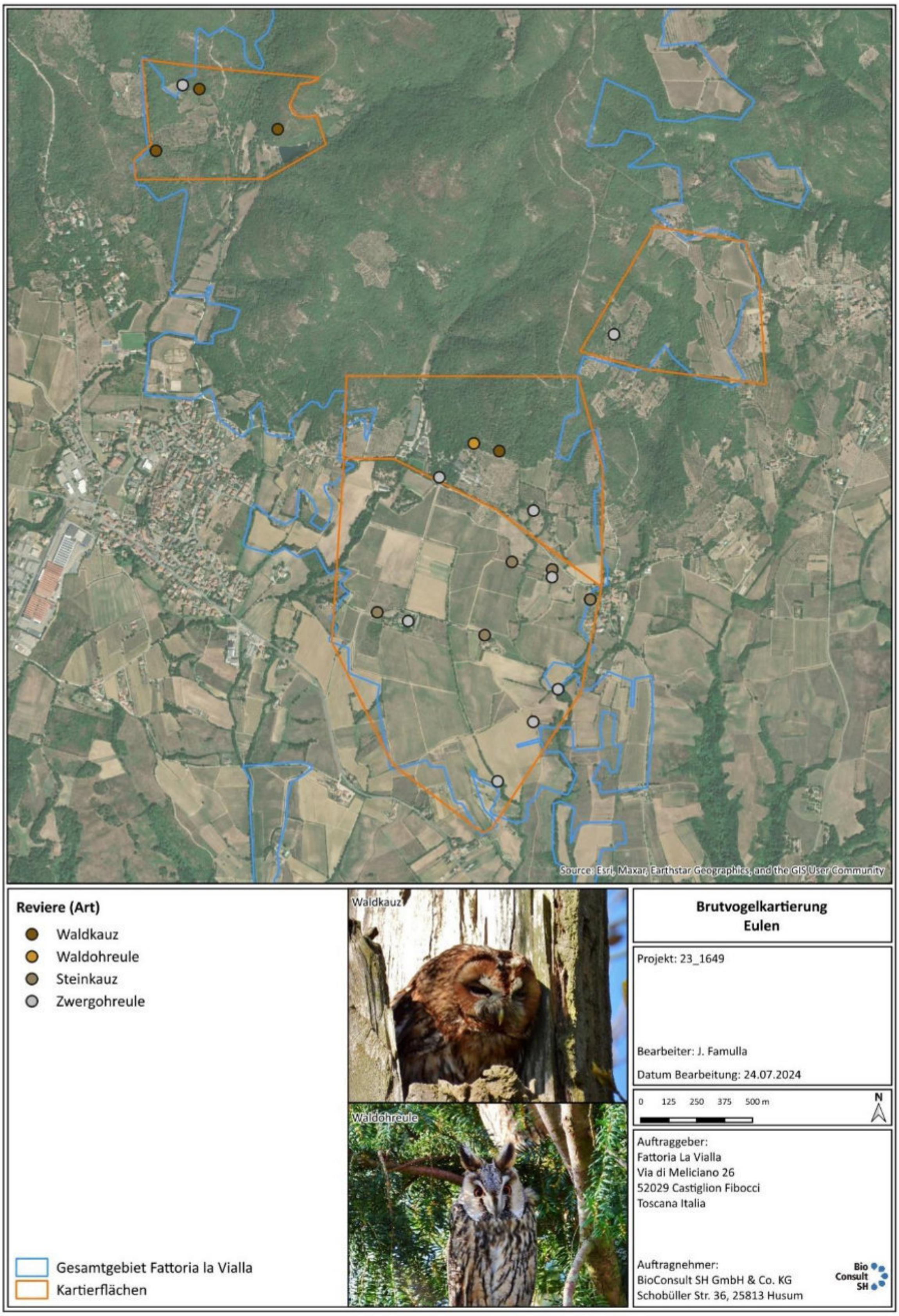

Fig. 3-31 Distribution of Tawny Owls, Long-eared Owls, Little Owls and Eurasian Scoops Owls in the four subplots

3.3 Supplementary bird list

In addition to the breeding bird mapping carried out (see methodology in Section 2 and results in Section 3.1), other bird species were identified through visual observation and acoustic localisation. A total of 138 different species of birds were recorded in the immediate vicinity (a maximum of two kilometres from the perimeter of the Fattoria La Vialla estate: *Castiglion Fibocchi*, *Meliciano, Pieve San Giovanni* and *Ponte Buriano in the Arno Nature Reserve*). The additional bird species listed in the table below are not breeding birds, but migratory, resting birds and/or visitors in search of food (see list in Table 3.3).

Table 3.3 Additional list of bird species identified visually or acoustically in the mapping areas and immediate vicinity of the Fattoria, with scientific names

Number	Species	Scientific name	Notes
		Anatidae	
1	Australian Shelduck	*Tadorna tadornoides*	Escaped from captivity
2	Smew	*Mergellus albellus*	
		Grebes	
3	Little Grebe	*Tachybaptus ruficollis*	
4	Great Crested Grebe	*Podiceps cristatatus*	
		Flamingos	
5	Greater Flamingo	*Phoenicopterus roseus*	Night-time passage Fattoria, heard
		Herons	
6	Eurasian Bittern	*Botaurus stellaris*	Heard at Ponte Buriano
7	Black-crowned Night Heron	*Nycticorax nycticorax*	
8	Squacco Heron	*Ardeola ralloides*	
9	Cattle Egret (see Fig. 3-33)	*Bubulcus ibis*	
10	Grey Heron	*Ardea cinerea*	
11	Purple Heron	*Ardea purpurea*	
12	Great Egret	*Casmerodius albus*	
13	Little Egret	*Egretta garzetta*	
		Cormorants	
14	Pygmy Cormorant	*Phalacrocorax pygmeus*	
15	Great Cormorant	*Phalacrocorax carbo*	
		Accipitridae	
16	Eurasian Honey Buzzard	*Pernis apivorus*	
17	Short-toed Snake Eagle	*Circaetus gallicus*	
18	Northern Goshawk	*Accipiter gentilis*	
19	Western Marsh Harrier	*Circus aeruginosus*	
20	Long-legged Buzzard	*Buteo rufinus*	Resting
		Rails	
21	Eurasian Coot	*Fulica atra*	
		Stone Curlews	

Number	Species	Scientific name	Notes
22	Eurasian Stone Curlew	*Burhinus oedicnemus*	Located at Fattoria with acoustic recording
	Avocets and Stilts		
23	Black-winged Stilt	*Himantopus himantopus*	Night-time passage Fattoria, heard
	Plovers, Dotterels and Lapwings		
24	Little Ringed Plover	*Charadrius dubius*	Sighted at Ponte Buriano
	Sandpipers		
25	Common Snipe	*Gallinago gallinago*	Sighted at Ponte Buriano
26	Common Sandpiper	*Actitis hypoleucos*	
27	Green Sandpiper	*Tringa ochropus*	
28	Common Greenshank	*Tringa nebularia*	
	Gulls		
29	Mediterranean Gull	*Larus melanocephalus*	Night-time passage Casa Conforto, heard
30	Yellow-legged Gull (see Fig. 3-35)	*Larus michahellis*	
	Doves and Pigeons		
31	Stock Dove	*Columba oenas*	
32	Common Pigeon	*Columba livia*	
	Cuckoos		
33	Great Spotted Cuckoo	*Clamator glandarius*	Sighted at Scampata di Sotto, heard and sighted above the Fattoria
	Barn Owls		
34	Barn Owl	*Tyto alba*	
	Owls		
35	Eurasian Eagle Owl	*Bubo bubo*	
	European Nightjar		
36	European Nightjar	*Caprimulgus europaeus*	
	Swifts		
37	Alpine Swift	*Tachymarptis melba*	Sighted at Ponte Buriano
	Kingfishers		
38	Common Kingfisher	*Alcedo atthis*	
	Bee-eaters		
39	European Bee-eater (see Fig. 3-32)	*Merops apiaster*	
	Woodpeckers		
40	Eurasian Wryneck	*Jynx torquilla*	Sighted, heard
	Falcons		
41	Eurasian Hobby	*Falco subboteo*	
42	Peregrine Falcon	*Falco peregrinus*	
	Corvids		
43	Western Jackdaw	*Coloeus monedula*	
44	Carrion Crow - Hooded Crow hybrid	*Corvus corone x cornix*	
45	Northern Raven	*Corvus corax*	
	Tits		

Number	Species	Scientific name	Notes
46	Coal Tit	*Periparus ater*	Sighted and heard Fattoria
		Larks	
47	Eurasian Skylark	*Alauda arvensis*	Sighted at Casa Conforto
		Swallows and Martins	
48	Sand Martin	*Riparia riparia*	
49	Common House Martin	*Delichon urbicum*	
50	Red-rumped Swallow	*Cecropis daurica*	
		Cettiidae Warblers	
51	Cetti's Warbler		Sighted and heard at Ponte Buriano
		Leaf Warblers	
52	Willow Warbler	*Phylloscopus trochilus*	Sighted and heard at Ponte Buriano
		Acrocephalid Warblers	
53	European Reed Warbler	*Acrocephalus scirpaceus*	
		Thrushes	
54	Ring Ouzel	*Turdus torquatus*	Sighted at Spedale
		Old World Fly Catchers	
55	Black Redstart	*Phoenicurus ochruros*	Sighted at Ponte Buriano
56	Northern Wheatear	*Oenathe oenanthe*	
		Accentors	
57	Dunnock	*Prunella modularis*	Sighted at Spedale
		Wagtails and Pipits	
58	Grey Wagtail	*Motacilla cinerea*	Sighted and heard Fattoria
59	Tawny Pipit	*Anthus Campestris*	Sighted
60	Meadow Pipit	*Anthus pratensis*	Sighted at the Fattoria, Casa Conforto and Ponte Buriano
61	Water Pipit	*Anthus spinoletta*	
		Finches	
62	Hawfinch	*Coccothraustes coccothraustes*	Sighted at Ponte Buriano
63	Common Linnet	*Carduelis cannabina*	
64	Siskin	*Carduelis spinus*	
		Buntings	
65	Yellowhammer	*Emberiza citrinella*	Heard at Casa Conforto
66	Rock Bunting	*Emberiza cia*	Sighted at Spedale

Fig. 3-32 European Bee-eater (*Merops apiaster*) at Casa Conforto (Photo: R. Schaack, 12.05.2024)

Fig. 3-33 Cattle Egret (*Bubulcus ibis*) at Casa Conforto (Photo: R. Schaack, 14.05.2023)

Fig. 3-34 Eurasian Hoopoe (*Upupa epops*) at Casa Conforto (Photo: R. Schaack, 19.05.2023)

Fig. 3-35 Yellow-legged Gull (*Larus michahellis*) on the compost heap at Casa Conforto (Photo: R. Schaack, 12.05.2023)

3.4 Other species

3.4.1 Bats and other mammals

The bat population was mainly made up of Kuhl's Pipistrelle (Pipistrellus *kuhlii*), followed by Daubenton's Bat (*Myotis daubentonii*), detected at location no. 2, the Big Lake (see Fig. 2-12). A list of the bat species can be found in Table 3.4.

Tab. 3.4: List of bat species detected at the three bat box locations

Spectrum of Species found at Fattoria La Vialla – Bats			
German Name	English Name	Scientific Name	Genus
Documented presence			
Alpenfledermaus	Savi's Pipistrelle	Hypsugo savii	Hypsugo
Weißrandfledermaus	Kuhl's Pipistrelle	Pipistrellus kuhlii	Pipistrellus
Zwergfledermaus	Common Pipistrelle	Pipistrellus pipistrellus	
Großer Abendsegler	Common Noctule	Nyctalus noctula	Nyctalus
Kleiner Abendsegler	Lesser Noctule	Nytalus leisleri	
Große Hufeisennase	Greater Horseshoe Bat	Rhinolophus ferrumequinum	Rhinolophus
Kleine Hufeisennase	Lesser Horseshoe Bat	Rhinolophus hipposiderus	
Wasserfledermaus	Daubenton's Bat	Myotis daubentonii	Myotis
Großes Mausohr	Greater Mouse-Eared Bat	Myotis myotis	
Fransenfledermaus	Natterer's Bat	Myotis natteri	
Bart/Brandfledermaus	Whiskered/Brandt's Bat	M. mystacinus/ M. brandtii	
Graues/Braunes Langohr	Grey/Brown Long-Eared Bat	Plecotus austriacus/ P. auritus	Plecotus
Europäische Bulldoggfledermaus	European Free-Tailed Bat	Tadaria teniotis	Tadaria
Breitflügelfledermaus	Serotine Bat	Eptesicus serotinus	Eptesicus
Mopsfledermaus	Barbastelle Bat	Barbastella barbastellus	Barbastella
Possible presence			
Rauhautfledermaus	Nathusius' Pipistrelle	P. nathusii	Pipistrellus
Species not fully identified			
Myotis			
Nyctaloid			

A list of the other mammals recorded by the wildlife cameras can be found in Table 3.5 and in Figures 3-36 and 3-41. Entire packs of wolves were sighted on Fattoria La Vialla's land.

Tab. 3.5: List of mammal species detected using wildlife cameras

Mammal Species – Wildlife Camera	
Species	Scientific Name
Crested Porcupine	*Hystrix cristata*
European Rabbit	*Oryctolagus cuniculus*
European Hare	*Lepus europaeus*
European Wildcat	*Felis silvestris*
Wolf	*Canis lupus*
Red Fox	*Vulpes vulpes*
Beech Marten	*Martes foina*

European Pine Marten	*Martes martes*
European Badger	*Meles meles*
Common Weasel	*Mustela nivalis*
Raccoon	*Procyon lotor*
Wild Boar	*Sus scrofa*
Roe Deer	*Capreolus capreolus*
Red Deer	*Cervus elaphus*
European Fallow Deer	*Dama dama*

Fig. 3-36 Photo of a Crested Porcupine (*Hystrix cristata*) captured by a wildlife camera (03.04.2024)

Fig. 3-37 Photo of a Red Fox (*Vulpes vulpes*) captured with a wildlife camera (04.04.2024)

Fig. 3-38 Photo of a Wild Boar (*Sus scrofa*) captured by a wildlife camera (08.04.2024)

Fig. 3-39 Photo of a Red Deer (*Cervus elaphus*) captured by a wildlife camera (11.04.2024)

Fig. 3-40 Photo of a European Badger (*Meles meles*) captured by a wildlife camera (29.03.2024) 98

Fig. 3-41 Photo of a Wolf (*Canis lupus*) captured by a wildlife camera (12.04.2024)

4 CONCLUSIONS

Fattoria La Vialla, a biodynamic farm in Tuscany, Italy, has set itself the goal of actively promoting biodiversity on its agricultural land. This involves consistently implementing the holistic approach of biodynamics, in order to practice sustainable and future-proof agriculture.

The results of the survey carried out by BioConsult SH illustrate the high level of biodiversity that exists. In order to maintain this excellent situation and promote it to an even greater extent, the following measures should be implemented or continued:

Wildflower strips and hedges:

In order to create and maintain habitats for insects and small creatures, numerous wildflower strips have been created on the estate (see Fig 1-1). These not only provide food for pollinating insects such as bees, butterflies and wild bees (see species lists in Appendixes A.3 to A.7), but also promote the presence of beneficial insects that naturally control pests. In addition, hedgerows have been introduced to serve as shelters for birds, small mammals and other wildlife.

Promoting soil fertility:

Healthy soil is fundamental for a high level of biodiversity. The Fattoria relies on the use of compost and biodynamic preparations to promote soil vitality. Earthworms, microorganisms and fungi benefit from these measures and contribute to the improvement of soil structure and nutrient binding. Promoting soil fertility not only strengthens plant health, but also increases biodiversity.

Crop rotation and intercropping:

Instead of using monocultures, intercropping is practised on the Fattoria's land, with different plant species grown in the same field. This increases plant diversity and create a variety of food sources for insects and other animals. Furthermore, crop rotation and low-impact cultivation also protect the soil and promote natural diversity. We recommend maintaining or establishing a structure with small plots of land (alternating meadows and pastures).

Promoting the presence of wild plants and herbs:

The Fattoria grows a variety of different herbs, which not only have beneficial properties for both animals and humans, but also make an important contribution to increasing biodiversity. These plants are typically hardy, easy to care for and provide an important source of food for numerous insect species.

Water bodies and wetlands:

There are several bodies of water, both large and small, on the Fattoria's land. They provide habitats for amphibians, dragonflies and water birds (see species lists in Appendixes A.2 and A.5.1).

Mowing:

In order to preserve and promote biodiversity at the Fattoria, we recommend extensive use of grassland with limited grazing density (max. 2 to 3 animals/ha) during the nesting season, and late mowing (end of June/beginning of July) to protect the nests and young of ground-nesting birds. If this is not possible, strips at least 5 m wide should be left uncut around the edge of the fields. Posts and fencing should be left as hunting and singing perches for various bird species. We recommend partial and periodical maintenance (mowing, mulching roughly every 2 to 5 years) of fallow land when the vegetation there becomes too thick.

With 72 breeding bird species and an overall total of more than 138 different bird species, the Fattoria has high level of avifaunal diversity. The biodynamic farming practices used by the Fattoria have a major impact on biodiversity in general, not only on the bird species but also on wild bees, butterflies, reptiles, amphibians, bats and other mammals. The entire area of the estate is a species-rich and ecologically stable system, which makes a valuable contribution to the preservation of regional biodiversity.

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A APPENDIX

A.1 Breeding birds

Tab. A.A.1 List of breeding birds recorded in subplot 1, with Red List status for Italy and the EU and listing in EU Bird Directive

	English Name	Scientific Name	BV	BN	BP	RL IT	RL EU	VSchRL
1.	Mallard	*Anas platyrhynchos*		1	**1**			
2.	Little Grebe	*Tachybaptus ruficollis*	1		**1**			
3.	Common Buzzard	*Buteo buteo*	1		**1**			
4.	Common Moorhen	*Gallinula chloropus*	1		**1**			
5.	Common wood pigeon	*Columba palumbus*	10		**10**			
6.	Eurasian collared dove	*Streptopelia deaocto*	1		**1**			
7.	Eurasian turtle dove	*Streptopelia turtur*	2		**2**			
8.	Common Cuckoo	*Cuculus canorus*	1		**1**			
9.	Tawny Owl	*Strix aluco*	3		**3**			
10.	Eurasian Scops Owl	*Otus scops*	1		**1**			
11.	European Nightjar	*Caprimulgus europaeus*	1		**1**			I
12.	Eurasian Hoopoe	*Upupa epops*	2		**2**			
13.	Green Woodpecker	*Picus viridis*	2		**2**			
14.	Great Spotted Woodpecker	*Dendrocopos major*	1		**1**			
15.	White-backed Woodpecker	*Dendrocopos leucotos*	1		**1**	x		I
16.	Barn Swallow	*Hirundo rustica*	1		**1**			
17.	White Wagtail	*Motacilla alba*		1	**1**			
18.	Grey Wagtail	*Motacilla cinerea*	1		**1**			
19.	Eurasian robin	*Erithacus rubecula*	37	1	**38**			
20.	Nightingale	*Luscinia megarhynchos*	2		**2**			
21.	Common redstart	*Phoenicurus phoenicurus*	1		**1**			
22.	Blackbird	*Turdus merula*	20	1	**21**			
23.	Eurasian blackcap	*Sylvia atricapilla*	33		**33**			
24.	Sardinian Warbler	*Sylvia melanocephala*	5		**5**			
25.	Eastern Subalpine Warbler	*Sylvia cantillans*	1		**1**			
26.	Moltoni's Warbler	*Sylvia subalpina*	5		**5**			
27.	Chiffchaff	*Phylloscopus collybita*	4		**4**			
28.	Common Firecrest	*Regulus ignicapilla*	8		**8**			
29.	Eurasian Wren	*Troglodytes troglodytes*	11		**11**			
30.	Great Tit	*Parus major*	23	1	**24**			
31.	Eurasian Blue Tit	*Cyanistes caeruleus*	24		**24**			
32.	Marsh Tit	*Poecile palustris*	2		**2**			
33.	Long-tailed Tit	*Aegithalos caudatus*	4	3	**7**			
34.	Eurasian Nuthatch	*Sitta europaea*	11		**11**			
35.	Short-toed Treecreeper	*Certhia brachydactyla*	6		**6**			

	English Name	Scientific Name	BV	BN	BP	RL IT	RL EU	VSchRL
36.	Eurasian Jay	*Garrulus glandarius*	1	1	**2**			
37.	Hooded Crow	*Corvus cornix*	1		**1**			
38.	Common Starling	*Sturnus vulgaris*		1	**1**			
39.	Golden Oriole	*Oriolus oriolus*	2		**2**			
40.	Italian Sparrow	*Passer italiae*	3		**3**	x	VU	
41.	Common Chaffinch	*Fringilla coelebs*	19		**19**			
42.	European Goldfinch	*Carduelis carduelis*	1		**1**			
43.	European Serin	*Serinus serinus*	2		**2**			
44.	Cirl Bunting	*Emberiza cirlus*	4		**4**			

Key: BV: Suspected breeding, BN: confirmed breeding, BP: breeding pairs, RL IT: status according to Italian red list of breeding birds (GUSTIN ET AL. 2021), RL EU: status according to the European Red List of Birds (BIRDLIFE INTERNATIONAL 2021), Threat level: EX = extinct, CR = critically endangered, EN = endangered, VU = vulnerable, V = early warning list, NT = near threatened, VSchRL: species listed in Annexes I, II or III of the European Birds Directive.

Tab. A.A.2 List of breeding birds recorded in subplot 2. See key above

	English Name	Scientific Name	BV	BN	BP	RL IT	RL EU	VSchRL
1.	Eurasian Sparrow Hawk	*Accipiter nisus*	1		**1**			
2.	Common Wood Pigeon	*Columba palumbus*	7		**7**			
3.	Eurasian Collared Dove	*Streptopelia deaocto*	2		**2**			
4.	Eurasian Turtle Dove	*Streptopelia turtur*	3		**3**			
5.	Common Cuckoo	*Cuculus canorus*	3		**3**			
6.	Eurasian Scops Owl	*Otus scops*	1		**1**			
7.	European Nightjar	*Caprimulgus europaeus*	2		**2**			
8.	Eurasian Hoopoe	*Upupa epops*	1	1	**2**			
9.	Green Woodpecker	*Picus viridis*	3		**3**			
10.	Great Spotted Woodpecker	*Dendrocopos major*	1		**1**			
11.	Lesser Spotted Woodpecker	*Picus minor*	1		**1**			
12.	Woodlark	*Lullula arborea*	2	1	**3**			
13.	Barn Swallow	*Hirundo rustica*	1		**1**			
14.	Eurasian Robin	*Erithacus rubecula*	39		**39**			
15.	Nightingale	*Luscinia megarhynchos*	3		**3**			
16.	Common Redstart	*Phoenicurus phoenicurus*	2		**2**			
17.	Song Thrush	*Turdus philomelos*	1		**1**			
18.	Blackbird	*Turdus merula*	25	1	**26**			
19.	Eurasian Blackcap	*Sylvia atricapilla*	29		**29**			
20.	Sardinian Warbler	*Sylvia melanocephala*	8		**8**			
21.	Common Whitethroat	*Sylvia communis*	1		**1**			
22.	Eastern Subalpine Warbler	*Sylvia cantillans*	2		**2**			

	English Name	Scientific Name	BV	BN	BP	RL IT	RL EU	VSchRL
23.	Moltoni's Warbler	*Sylvia subalpina*	7		**7**			
24.	Dartford Warbler	*Sylvia undata*	1		**1**			
25.	Western Bonelli's Warbler	*Phylloscopus bonelli*	1		**1**			
26.	Chiffchaff	*Phylloscopus collybita*	4		**4**			
27.	Common Firecrest	*Regulus ignicapilla*	5		**5**			
28.	Eurasian Wren	*Troglodytes troglodytes*	3		**3**			
29.	Great Tit	*Parus major*	26		**26**			
30.	Eurasian Blue Tit	*Cyanistes caeruleus*	20		**20**			
31.	Long-tailed Tit	*Aegithalos caudatus*	3	2	**5**			
32.	Eurasian Nuthatch	*Sitta europaea*	4	1	**5**			
33.	Short-toed Treecreeper	*Certhia brachydactyla*	4		**4**			
34.	Magpie	*Pica pica*	1	2	**3**			
35.	Eurasian Jay	*Garrulus glandarius*	3		**3**			
36.	Hooded Crow	*Corvus cornix*	1		**1**			
37.	Golden Oriole	*Oriolus oriolus*	3		**3**			
38.	Italian Sparrow	*Passer italiae*	6		**6**	X		
39.	Common Chaffinch	*Fringilla coelebs*	6		**6**			
40.	European Serin	*Serinus serinus*	4		**4**			
41.	Cirl Bunting	*Emberiza cirlus*	7	1	**8**			

Table A.A.3 List of breeding birds recorded in subplot 3. See key above.

	English Name	Scientific Name	BV	BN	BP	RL IT	RL EU	VSchRL
1.	Red-legged Partridge	*Alectoris rufa*	1		**1**			
2.	Common Pheasant	*Phasianus colchicus*	1		**1**			
3.	Little Grebe	*Tachybaptus ruficollis*		1	**1**			
4.	Black Kite	*Milvus migrans*	1		**1**			
5.	Common Buzzard	*Buteo buteo*		1	**1**			
6.	Eurasian Sparrow Hawk	*Accipiter nisus*	1		**1**			
7.	Common Kestrel	*Falco tinnunculus*	1		**1**			
8.	Common Wood Pigeon	*Columba palumbus*	6	1	**7**			
9.	Eurasian Collared Dove	*Streptopelia deaocto*	2		**2**			
10.	Eurasian Turtle Dove	*Streptopelia turtur*	3		**3**			
11.	Common Cuckoo	*Cuculus canorus*	1		**1**			
12.	Long-eared Owl	*Asio otus*		1	**1**			
13.	Tawny Owl	*Strix aluco*	1		**1**			
14.	Eurasian Scops Owl	*Otus scops*	2		**2**			
15.	European Nightjar	*Caprimulgus europaeus*	2		**2**			I
16.	Eurasian Hoopoe	*Upupa epops*	1	4	**5**			
17.	Green Woodpecker	*Picus viridis*	2		**2**			
18.	Great Spotted Woodpecker	*Dendrocopos major*	2	1	**3**			

	English Name	Scientific Name	BV	BN	BP	RL IT	RL EU	VSchRL
19.	Woodlark	*Lullula arborea*	2		**2**			
20.	Barn Swallow	*Hirundo rustica*	3	3	**6**			
21.	White Wagtail	*Motacilla alba*		2	**2**			
22.	Grey Wagtail	*Motacilla cinerea*	1		**1**			
23.	Eurasian Robin	*Erithacus rubecula*	41		**41**			
24.	Nightingale	*Luscinia megarhynchos*	2		**2**			
25.	Common Redstart	*Phoenicurus phoenicurus*	6	2	**8**			
26.	Song Thrush	*Turdus philomelos*	1		**1**			
27.	Mistle Thrush	*Turdus viscivorus*	1		**1**			
28.	Blackbird	*Turdus merula*	21	5	**26**			
29.	Eurasian Blackcap	*Sylvia atricapilla*	40		**40**			
30.	Sardinian Warbler	*Sylvia melanocephala*	10	1	**11**			
31.	Eastern Subalpine Warbler	*Sylvia cantillans*	2		**2**			
32.	Moltoni's Warbler	*Sylvia subalpina*	3		**3**			
33.	Dartford Warbler	*Sylvia undata*	1		**1**			
34.	Chiffchaff	*Phylloscopus collybita*	9	1	**10**			
35.	Common Firecrest	*Regulus ignicapilla*	10	1	**11**			
36.	Eurasian Wren	*Troglodytes troglodytes*	5		**5**			
37.	Spotted Flycatcher	*Muscicapa striata*	3		**3**			
38.	Great Tit	*Parus major*	27	2	**29**			
39.	Eurasian Blue Tit	*Cyanistes caeruleus*	21	4	**25**			
40.	Long-tailed Tit	*Aegithalos caudatus*	5	6	**11**			
41.	Eurasian Nuthatch	*Sitta europaea*	6	1	**7**			
42.	Short-toed Treecreeper	*Certhia brachydactyla*	9		**9**			
43.	Magpie	*Pica pica*	1	1	**2**			
44.	Eurasian Jay	*Garrulus glandarius*	4		**4**			
45.	Hooded Crow	*Corvus cornix*	4		**4**			
46.	Common Starling	*Sturnus vulgaris*	4	1	**5**			
47.	Italian Sparrow	*Passer italiae*	11	3	**14**	x		
48.	Tree sparrow	*Passer montanus*		2	**2**			
49.	Common Chaffinch	*Fringilla coelebs*	10		**10**			
50.	European Goldfinch	*Carduelis carduelis*	6		**6**			
51.	European Greenfinch	*Carduelis chloris*	4	1	**5**	x		
52.	European Serin	*Serinus serinus*	15	3	**18**			
53.	Cirl Bunting	*Emberiza cirlus*	9		**9**			

Table A.A.4 List of breeding birds recorded in subplot 4. See key above.

	English Name	Scientific Name	BV	BN	BP	RL IT	RL EU	VSchRL
1.	Red-legged Partridge	*Alectoris rufa*	1		**1**			
2.	Common Pheasant	*Phasianus colchicus*	8		**8**			

	English Name	Scientific Name	BV	BN	BP	RL IT	RL EU	VSchRL
3.	Common Quail	*Coturnix coturnix*	2		**2**			
4.	Common Kestrel	*Falco tinnunculus*	1	1	**2**			
5.	Common Moorhen	*Gallinula chloropus*	1		**1**			
6.	Feral Pigeon	*Columba livia f. domestica*		2	**2**			
7.	Common Wood Pigeon	*Columba palumbus*	2		**2**			
8.	Eurasian Collared Dove	*Streptopelia deaocto*	4		**4**			
9.	Eurasian Turtle Dove	*Streptopelia turtur*	8		**8**			
10.	Common Cuckoo	*Cuculus canorus*	2		**2**			
11.	Little Owl	*Athene noctua*	5		**5**			
12.	Eurasian Scops Owl	*Otus scops*	5		**5**			
13.	European Nightjar	*Caprimulgus europaeus*	1		**1**			
14.	Common Swift	*Apus apus*	3		**3**			
15.	Eurasian Hoopoe	*Upupa epops*		1	**1**			
16.	Green Woodpecker	*Picus viridis*	5		**5**			
17.	Great Spotted Woodpecker	*Dendrocopos major*						
18.	Lesser Spotted Woodpecker	*Picus minor*	1		**1**			
19.	Crested Lark	*Galerida cristata*	3		**3**			
20.	Woodlark	*Lullula arborea*	10	1	**11**			
21.	Barn Swallow	*Hirundo rustica*	1		**1**			
22.	White Wagtail	*Motacilla alba*		1	**1**			
23.	Eurasian Robin	*Erithacus rubecula*	12	1	**13**			
24.	Nightingale	*Luscinia megarhynchos*	16		**16**			
25.	Common Redstart	*Phoenicurus phoenicurus*	3	1	**4**			
26.	Whinchat	*Saxicola rubetra*	2		**2**			
27.	Stonechat	*Saxicola rubicola*	7	1	**8**			
28.	Song Thrush	*Turdus philomelos*	1		**1**			
29.	Blackbird	*Turdus merula*	12	8	**20**			
30.	Eurasian Blackcap	*Sylvia atricapilla*	35		**35**			
31.	Sardinian Warbler	*Sylvia melanocephala*	9		**9**			
32.	Zitting Cisticola	*Cisticola juncidis*	17		**17**			
33.	Melodious Warbler	*Hippolais polygotta*	5		**5**			
34.	Common Firecrest	*Regulus ignicapilla*	4		**4**			
35.	Eurasian Wren	*Troglodytes troglodytes*	6		**6**			
36.	Great Tit	*Parus major*	23	1	**24**			
37.	Eurasian Blue Tit	*Cyanistes caeruleus*	6		**6**			
38.	Long-tailed Tit	*Aegithalos caudatus*	4	1	**5**			
39.	Eurasian Nuthatch	*Sitta europaea*	6		**6**			
40.	Short-toed Treecreeper	*Certhia brachydactyla*	2		**2**			
41.	Magpie	*Pica pica*		1	**1**			
42.	Eurasian Jay	*Garrulus glandarius*	3		**3**			
43.	Hooded Crow	*Corvus cornix*	4		**4**			
44.	Common Starling	*Sturnus vulgaris*	3	4	**7**			
45.	Golden Oriole	*Oriolus oriolus*	2		**2**			

	English Name	Scientific Name	BV	BN	BP	RL IT	RL EU	VSchRL
46.	Italian Sparrow	*Passer italiae*	17	3	**20**			
47.	Tree Sparrow	*Passer montanus*	8	2	**10**			
48.	Common Chaffinch	*Fringilla coelebs*	6		**6**			
49.	European Goldfinch	*Carduelis carduelis*	6	2	**8**			
50.	European Greenfinch	*Carduelis chloris*	5	1	**6**	x		
51.	European Serin	*Serinus serinus*	19	4	**23**			
52.	Cirl Bunting	*Emberiza cirlus*	3		**3**			
53.	Corn Bunting	*Emberiza calandra*	11	1	**12**			

A.2 Amphibians and Reptiles

Table A.A.5 List of amphibian and reptile species recorded in the four mapping areas and the vicinity

Toads	**Bufonidae**
Common Toad	*Bufo bufo*
Tree Frogs	**Hylidae**
Italian Tree Frog	*Hyla intermedia*
True Frogs	**Ranidae**
Italian Frog	Rana italica
Italian Pool Frog	*Pelophylax lessonae bergeri*
Tortoises	**Testudinidae**
Hermann's Tortoise	*Testudo hermanni*
Pond Turtles and Terrapins	**Emydidae**
European Pond Turtle	*Emys orbicularis*
Red-eared Terrapin	*Trachemys scripta elegans*
Yellow-bellied Terrapin	*Trachemys scripta scripta*
Geckoes	**Gekkonidae**
Moorish Gecko	*Tarentola mauritanica*
Lizards	**Lacertidae**
Western Green Lizard	*Lacerta bilineata*
Common Wall Lizard (subsp. Nigriventris)	*Podarcis muralis nigriventris*
Italian Wall Lizard	*Podarcis siculus*
Anguids	**Anguidae**
Common Slow Worm	*Anguis fragilis*
Colubrids	**Colubridae**
Green Whip Snake	*Hierophis viridiflavus*
Southern Smooth Snake	*Coronella girondica*
Four-lined Snake	*Elaphe quatuorlineata*
Aesculapian Snake	*Zamenis longissimus*
Barred Grass Snake	*Natrix helvetica*
Dice Snake	*Natrix tesselata*
Vipers	**Viperidae**
Asp Viper	*Vipera aspis*

Fig. A.A-1 Male Italian Wall Lizard (Podarcis siculus) (Photo: R. Schaack, 17.05.2022).

A.3 Butterflies

Table A.A.6 List of butterflies recorded in the four mapping areas and the vicinity

Swallowtail Butterflies	Papilionidae
Old World Swallowtail	*Papilio machaon*
Scarce Swallowtail	*Iphiclides podalirius*
Pierid Butterflies	**Pieridae**
Black-veined White	*Aporia crataegi*
Large White	*Pieris brassicae*
Large White	*Artogeia rapae*
Wood White	*Leptidea sinapis*
Orange Tip	*Anthocharis cardamines*
Clouded Yellow	*Colias crocea*
Gossamer-winged Butterflies	**Lycaenidae**
Green Hairstreak	*Callophrys rubi*
Ilex Hairstreak	*Satyrium Ilicis*
Common Blue	*Polyommatus icarus*
Brown Argus	*Aricia agestis*
Green-underside Blue	*Glaucopsyche alexis*
Holly Blue	*Celastrina argiolus*
Small Copper	*Lycaena phlaeas*
Brush-footed Butterflies	**Nymphalidae**
Southern White Admiral	*Limenitis reducta*
Red Admiral	*Vanessa atalanta*
Painted Lady	*Vanessa cardui*
Queen of Spain Fritillary	*Issoria lathonia*

Marbled Fritillary	*Brenthis daphne*
Glanville Fritillary	*Melitaea cinxia*
Spotted Fritillary	*Melitaea didyma*
Knapweed Fritillary	*Melitaea phoebe*
Satyr Butterflies	Satyridae
Meadow Brown	*Maniola jurtina*
Large Wall Brown	*Lasiommata maera*
Wall Brown	*Lasiommata megera*
Small Heath	*Coenonympha pamphilus*
Speckled Wood	*Pararge aegeria*
Skippers	Hesperiidae
Large Skipper	*Ochlodes sylvanus*
Red-underwing Skipper	*Spilia sertorius*
Oberthür's grizzled skipper	*Pyrgus armoricanus*
Southern Grizzled Skipper	*Pyrgusmalvae/malvoides*

Fig. A.A-2 Orange-tip butterfly (*Anthocharis cardamines*) (Photo: R. Schaack, 18.05.2023)

A.4 Moths

Tab. A.A.7 List of moths recorded in the four subplots and the vicinity

Erebidae	
Cream-spot Tiger	*Arctia villica*
Nine-spotted Moth	*Amata phegea*
Feathered Footman	*Coscinia striata*
Geometer Moths	**Geometridae**
Satin Wave	*Idaea subsericeata*
Portland Ribbon Wave	*Idaea degeneraria*
Lustrous Least Carpet	*Idaea filicata*
Brindled Beauty	*Lycia hirtaria*
Common Heath	*Ematurga atomaria*
Yellow Belle	*Aspitates ochrearia*
Tawny Wave	*Scopula rubiginata*
Speckled Yellow	*Pseudopanthera macularia*
Yellow Shell	*Camptogramma bilineata*
Black-veined Moth	*Siona lineata*
Leafroller Moths	**Tortricidae**
Leche's Twist Moth	*Ptycholoma lecheana*
Pied Grey	*Eudonia delunella*
Mountain-ash Tortricid	*Choristoneura hebenstreitella*
Green Oak Tortrix	*Tortrix viridana*
Dorset Cream Wave	*Stegania trimaculata*
Hawk Moths	**Sphingidae**
Hummingbird Hawk Moth	*Macroglossum stellatarum*
Owlet Moths	**Noctuidae**
Four-spotted Moth	*Tyta luctuosa*
Lappet Moths	**Lasiocampidae**
Oak Eggar	*Lasiocampa quercus*
Fungus Moths	**Tineidae**
	Euplocamus anthracinalis
Mandibulate Moths	**Micropterigidae**
Yellow-barred Pollen-moth	*Micropterix aureatella*
Fairy Longhorn Moths	**Adelidae**
	Adela australis

Plume Moths	Pterophoridae
White Plume Moth	*Pterophorus pentadactyla*
Concealer Moths	**Oecophoridae**
Hedge Beauty	*Alabonia geoffrella*

5.1 Dragonflies

Tab. A.A.8 List of dragonflies recorded in the four mapping areas and the vicinity

Broad-winged Damselflies	Calopterygidae
Banded Demoiselle	*Calopteryx splendens*
Beautiful Demoiselle	*Calopteryx virgo*
White-legged Damselflies	**Platycnemididae**
Blue Featherleg	*Platycnemis pennipes*
Spread-winged Damselflies	**Lestidae**
Common Winter Damselfly	*Sympecma fusca*
Willow Emerald Damselfly	*Chalcolestes viridis*
Narrow-winged Damselflies	**Coenagrionidae**
Blue-tailed Damselfly	*Ischnura elegans*
Common Blue Damselfly	*Enallagma cyathigerum*
Azure Damselfly	*Coenagrion puella*
Dainty Damselfly	*Coenagrion scitulum*
Large Red Damselfly	*Pyrrhosoma nymphula*
Hawkers	**Aeshnidae**
Emperor Dragonfly	*Anax imperator*
Skimmers	**Libellulidae**
Broad-bodied Chaser	*Libellula depressa*
Black-tailed Skimmer	*Orthetrum cancellatum*
Red-veined Darter	*Sympetrum fonscolombii*
Scarlet Dragonfly	*Crocothemis erythraea*
Violet Dropwing	*Trithemis annulata*

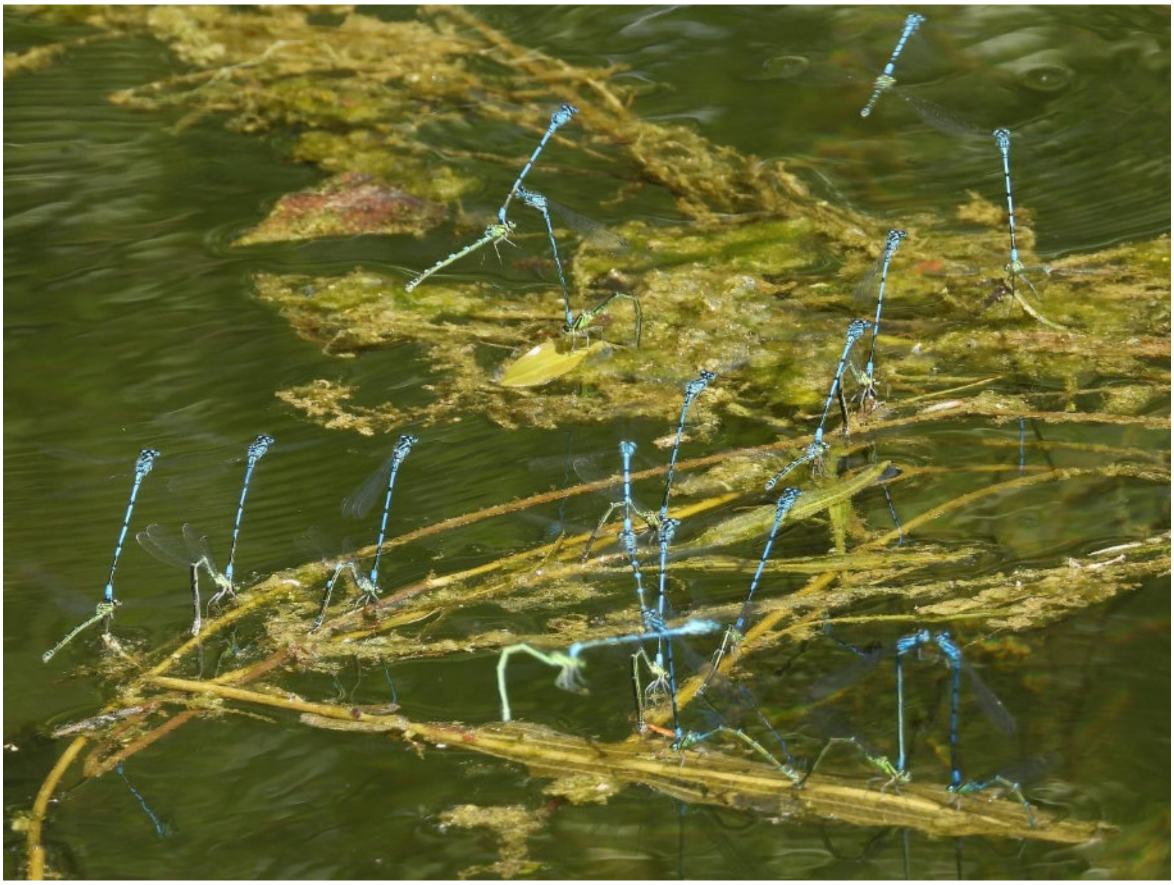

Fig. A.A-3 Pairs of Azure Damselflies (*Coenagrion puella*) "in tandem" during egg laying (Photo: R. Schaack, 13.05.2023)

A.5 Bees Wasps and Ants

Tab. A.A.9 List of Bees, Wasps and Ants recorded in the four mapping areas and the

Honey Bees, Bumble Bees and Allies	Apidae
Common Carder Bee	*Bombus pascuorum*
Bumblebees	*Bombus terrestris/lucorum/magnus/cryptarum*
Large Garden Bumblebee	*Bombus ruderatus*
Early Bumblebee	*Bombus pratorum*
Vestal Cuckoo Bumblebee	*Bombus vestalis*
Longhorn Bees	*Eucera longicornis/nigrescens*
Hairy-footed Flower Bee	*Anthophora plumipes*
Four-banded Flower Bee	*Anthophora quadrimaculata*
Variable Nomad Bee	*Nomada zonata*
Fabricius' Nomad Bee	*Nomada fabriciana*
Carpenter Bees	*Xylocopa violacea/valga*
Masked and Plaster Bees	**Colletidae**
Masked Bees	*Hylaeus* sp.
Plaster Bees	*Colletes* sp.

Sweat Bees	**Halictidae**
Blood Bees	*Sphecodes* sp.
Mining Bees	**Andrenidae**
Early Mining Bee	*Andrena haemorrhoa*
Common Mini-miner Bees	*Andrena minutula* (-group)
Ashy Mining Bee	*Andrena cineraria*
	Andrena curvungula
Leafcutting Bees	**Megachilidae**
Large-headed Resin Bee	*Heriades Truncorum*
Gold-fringed Mason Bee	*Osmia aurulenta*
Red Mason Bee	*Osmia bicornis*
	Osmia leiana/niveata
Red-Haired Osmia	*Osmia rufohirta*
Seven-toothed Red Resin Bee	*Rhodanthidium septemdentatum*
European Wool Carder Bee	*Anthidium manicatum*
Square-headed Wasps	**Crabronidae**
	Lestica clypeata
Hornets and Paper Wasps	**Vespidae**
European Hornet	*Vespa crabro*
European Paper Wasp	*Polistes dominula*
Scoliid Wasps	**Scoliidae**
	Scolia hirta
Carrot Wasps	**Gasteruptiidae**
	Gasteruption sp.
Argid Sawflies	**Argidae**
Rose Sawfly	*Arge ochropus*
Stem Sawflies	**Cephidae**
	Calameuta pallipes
Common Sawflies	**Tenthredinidae**
	Tenthredopsis sp.
Wayward Sawfly	*Tenthredo temula*
	Macrophya diversipes
	Macrophya montana
Ants	**Formicidae**
Barbary Harvester Ant	*Messor barbarus*
Acrobat Ant	*Crematogaster scutellaris*

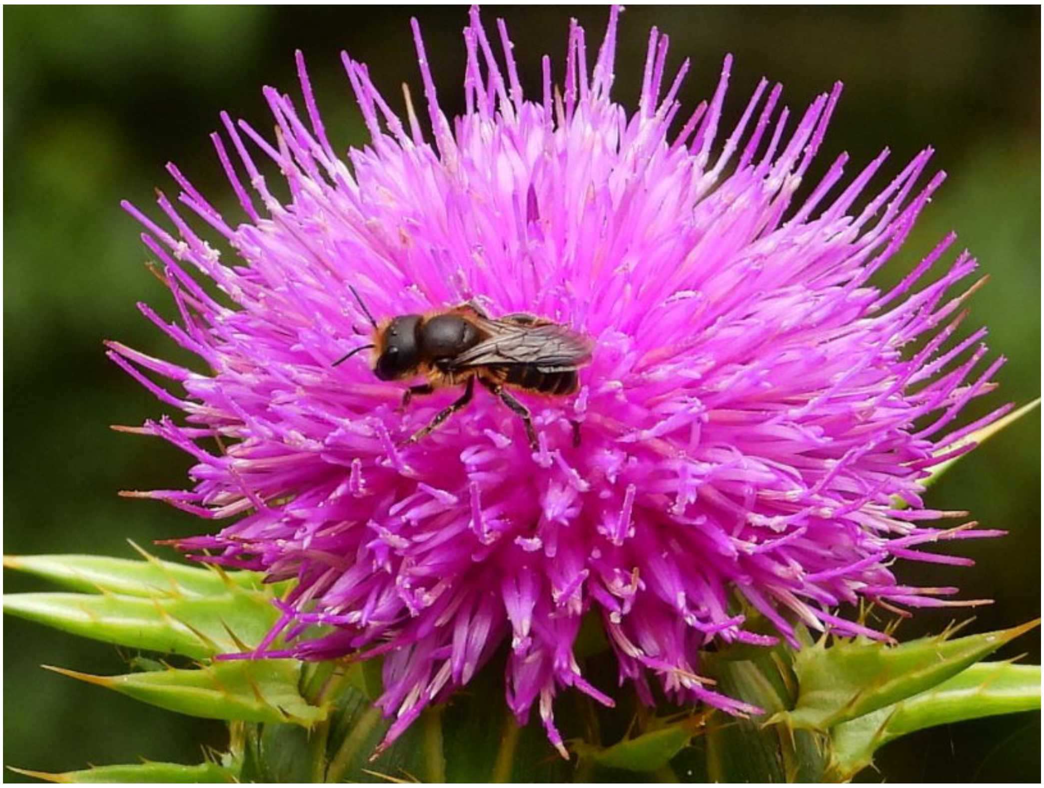

Fig. A.A-4 Orange-vented Mason Bee (*Osmia leiana*) on a thistle flower (Photo: R. Schaack, 15.05.2023)

A.6 Beetles

Tab. A.A.10 List of beetles recorded in the four mapping areas and the vicinity

Leaf Beetles	Chrysomelidae
	Cryptocephalus sp.
Seed Beetles	*Bruchinae* sp.
Rosemary Beetle	*Chrysolina americana*
Bloody-nosed Beetle	*Timarcha tenebricosa*
Lachnaia sp.	*Lachnaia* sp.
	Labidostomis lusitanica
Cryptocephalus sericeus	*Cryptocephalus sericeus*
Ladybirds	**Coccinelidae**
Asian Ladybird	*Harmonia axyridis*
Seven-spot Ladybird	*Coccinella septempunctata*
Variegated Ladybird	*Hippodamia variegata*
Soft-Winged Flower Beetles	**Melyridae**
Malachite Beetle	*Malachius bipustulatus*
Scarab Beetles	**Scarabaeidae**
	Valgus hemipterus

Rose Chafer	*Cetonia aurata*
Mediterranean Spotted Chafer	*Oxythyrea funesta*
Earth-boring Dung Beetles	**Geotrupidae**
Spring Dor Beetle	*Geotrupes vernalis*
Longhorn Beetles	**Cerambycidae**
Flat-faced Longhorn Beetle	*Morimus asper*
Small Black Longhorn Beetle	*Stenurella nigra*
	Dinoptera collaris
Striped Thistle Longhorn Beetle	*Agapanthia cardui*
Golden-bloomed Grey Longhorn Beetle	*Agapanthia villosoviridescens*
	Anastrangalia dubia
Wasp Beetle	*Clytus arietis*
Fairy-ring Longhorn Beetle	*Pseudovadonia livida*
Rove Beetles	**Staphylinidae**
Devil's Coach Horse Beetle	*Ocypus olens*
Stag Beetles	**Lucanidae**
Lesser Stag Beetle	*Dorcus parallelipipedus*
False Blister Beetles	**Oedemeridae**
	Oedemera croceicollis
Thick-legged Flower Beetle	*Oedemera nobilis*
	Chrysanthia geniculata
Ground Beetles	**Carabidae**
Green Tiger Beetle	*Cicindela campestris*
Rain Beetle	*Pterostichus melanarius*
Checkered Beetles	**Cleridae**
Checkered Bee Beetle	*Trichodes alvearius*
Soldier Beetles	**Cantharidae**
Dark Soldier Beetle	*Cantharis fusca*
Common Red Soldier Beetle	*Rhagonycha fulva*
Water Scavenger Beetles	**Hydrophilidae**
Lesse Silver Water Beetle	*Hydrochara caraboides*
Jewel Beetles	**Buprestidae**
	Anthaxia salicis
Hungarian Jewel Beetle	*Anthaxia hungarica*
Splendour Beetle	*Ptosima undecimmaculata*
Darkling Beetles	**Tenebrionidae**

	Omophlus sp.
Click Beetles	Elateridae
	Cidnopus pilosus

Fig. A.A-5 Checkered Bee Beetle (*Trichodes alvearius*) on a flower (Photo: R. Schaack, 23.05.2023)

A.7 True Bugs

Shield Bugs	Pentatomidae
Gorse Shield Bug	*Piezodorus lituratus*
Mottled Shield Bug	*Raphigaster nebulosa*
Bishop’s Mitre	*Aelia acuminata*
Black-shouldered Shield Bug	*Carpocoris purpureipennis*
	Carpocoris pudicus
Vernal Shield Bug	*Peribalus strictus*
Cabbage Bug	*Eurydema ventralis*
Italian Striped Bug	*Graphosoma italicum*
Seed Bugs	Lygaeidae
Black-and-red Bug	*Lygaeus equestris*
Plant Bugs	Miridae
Spotted Plant Bug	*Closterotomus fulvomaculatus*

Jewel Bugs	**Scutelleridae**
	Odontotarsus purpureolineatus
Broad-headed Bugs	**Alydidae**
	Camptopus lateralis
	Micrelytra fossularum
Scentless Plant Bugs	**Rhopalidae**
Banded Rhopalid	*Stictopleurus punctatonervosus*
Cinnamon Bug	*Corizus hyoscyami*
Leaf-footed Bugs	**Coreidae**
Dock Bug	*Coreus marginatus*
Denticulate Leatherbug	*Coriomeris denticulatus*
Box Bug	*Gonocerus acuteangulatus*
	Ceraleptus gracilicornis
Assassin Bugs	**Reduviidae**
	Rhynocoris erythropus
	Rhynocoris annulatus
Issid Planthoppers	**Issidae**
Common Issid Planthopper	*Issus coleoptratus*
Treehoppers	**Membracidae**
Horned Treehopper	*Centrotus cornutus*
Spittlebugs	**Aphrophoridae**
Alder Spittlebug	*Aphrophora alni*
Froghoppers	**Cercopidae**
Black and Red Froghopper	*Cercopis vulnerata*
Riffle Bugs	**Veliidae**
Water Cricket	*Velia caprai*
Water Striders	**Gerridae**
	Aquarius paludum