*https://dx.doi.org/10.22161/ijeab.46.12* *ISSN: 2456-1878*

# Spatial Distribution and Habitat Utilization of Reptiles in a Mediterranean Area (Castel di Guido, Rome, Italy)

Antonio Pizzuti Piccoli[1], Alessia De Lorenzis[2], Irene Luchenti[1], Lavinia Canestrari[1]

[1]Natura per Tutti Onlus Organization, – Via Monteroni n°1265, 00055 Ladispoli (RM) ITALY.
[2]LIPU Lega Italiana Protezione Uccelli – Onlus, ITALY

***Abstract***— *The purpose of this study is to describe, for the LIPU Castel di Guido Oasis, within the Castel di Guido Farm, on the Roman coast, the different spatial distribution of the different species of reptiles that coexist in the area. The work also defines correlations between the presence of animals and the various environmental and vegetation types present. In the study area, Testudo hermanni is a species that has the feeding areas, as well as the deposition areas, in the prairies adjacent the plant formation of the Mediterranean maquis(within 5 meters). Hemidactylus turcicus and Tarentola mauritanica seem to have a localization exclusively in the context of anthropic structures. Chalcides chalcides and Podarcis siculus appear to be confined to prairie areas, while Podarcis muralis is associated with the presence of trees of high-trunk plant associations. For Lacerta bilineata, a correspondence is outlined for the areas with arboreal shrubby vegetation, especially close to more humid habitats. Among the snakes Hierophis viridiflavus appears to be an ubiquitous species, with the frequentation of different habitats in the same percentage; more localized appear Vipera aspis and Elaphe quatuorlineata, the first more linked to wooded areas with the presence of bushy and shrubby vegetal coverings, the second is often associated with the simultaneous presence of forests and water collections. In general it is confirmed, as regards the snake community, the importance of ecotonal and transitional zones. The work also highlights how the study area is important for the conservation of reptile populations in the Roman area.*

***Keywords***— ***Reptiles, habitat, spatial distribution, Mediterranean, vegetational aspects.***

## I. INTRODUCTION

The distribution of animals in their natural environment, and the selection of the habitat, are the result of the interaction between the species and the environmental factors characterizing a site (Heatwole, 1977; Orians, 2000).

It has been amply demonstrated, at the microhabitat level, that the persistence of most small terrestrial vertebrates in a particular site, strongly depends by specific factors, such as temperature, humidity, trophic availability and shelters against predators (Downes & Shine 1998; Oatway & Morris 2007; Peterman & Semlitsch 2013). This is especially true for heterothermic species, which have specific physiological needs and require suitable points for thermal exposure to the sun; furthermore, for small species, since they have limited spatial movements, the topography of the place also plays an important role (Capula *et al*.,1993; Grover 1996; Melville & Schulte 2001; Rittenhouse *et al*. 2003).

In this complex of interactions, the vegetation cover plays a decisive role in the composition of the environmental factors described above (Irschich & Losos 1999; Vanhooydonck *et al*. 2000; Hofer *et al*., 2002).

The purpose of this study is to describe, for the LIPU Castel di Guido Oasis, within the Castel di Guido Farm, on the Roman coast, the different spatial distribution of the different species of reptiles that coexist in the area and, at the same time, if there are well-defined correlations between the presence of animals and the various environmental and vegetation types present.

## II. STUDY AREA

The present study was carried out within the Castel di Guido Farm, located in the Municipality of Rome, in the stretch between the 16th and 20th km of the Aurelia road (Topographic Paper IGM Sheet n°149 Tablet I - SO Maccarese, scale 1: 25.000) (Fig.1). Inside the farm, since 1999, the LIPU Castel di Guido Oasis has been realized. The farm has been under the direct management of the

*https://dx.doi.org/10.22161/ijeab.46.12* *ISSN: 2456-1878*

Municipality of Rome since 1978 and has a production address of cereals and fodder as well as cattle breeding, both indoors (Italian Friesian cow) and the wild state (Maremma cow). The farm extends for 1966 hectares and is characterized by hilly nucleuses that degrade toward the coastal plain; the maximum altitude reached is 80 m asl, while the minimum altitudes reach about 10 m asl. The geological alternation of tufaceous layers superimposed on clay and sandy layers, with different behavior towards erosive exogenous agents, has determined over time the formation of a series of depressions and pianos. Human activity (reclamation works, agriculture, pastoralism) has further modified the territory, leading to the formation of hillocks and reliefs, interesting because they are characterized by relict vegetation (Chirici *et al*., 2001).

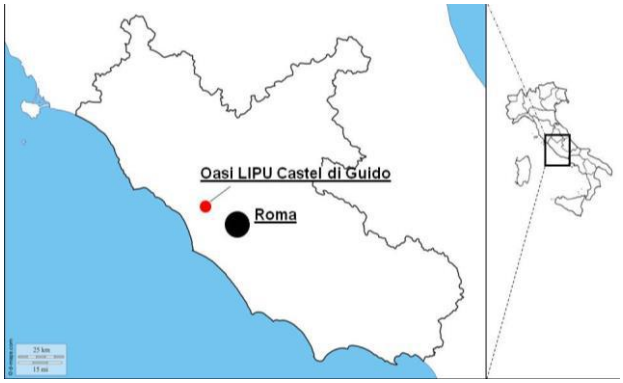


*Fig. 1. Location of the study area.*

The area is bioclimatically part of the transitional Mediterranean region, in the medium mesomediterranean thermotype unit and a superior sub-humid type (Blasi, 1994). The climate of the area is particularly mild by the proximity of the sea. The minimum temperatures are recorded in January (average value 3.9 °C), the maximum in July (average value 30.5 °C); rarely there are values below 0 °C and above 40 °C. In autumn the maximum rainfall occurs (over 275 mm), but also in spring there are frequent rains (175 mm) (Mangianti & Perini, 2001).

The birds of the LIPU Castel di Guido Oasis are represented by numerous permanent and migratory species (Cecere, 2006); among the most representative mammals we find *Hystrix cristata* Linneo, 1758, *Vulpes vulpes* Linneo, 1758, *Meles meles* Linneo, 1758, *Martes foina* Erxleben, 1777, *Erinaceus europaeus* Linneo, 1758 and *Muscardinus avellanarius* Linneo, 1758 (Imperio *et al*., 2007). Noteworthy is the recently proven presence of the wolf *Canis lupus* Linneo, 1758.

About the herpetofauna, reptiles are represented by 14 species (Table 1) (Pizzuti Piccoli *et al*., 2017a); in the area we found 5 species of Amphibians: common toad *Bufo bufo* (Linneo, 1758), Italian green toad *Bufotes balearicus* (Boettger, 1880), Italian tree frog *Hyla intermedia* Boulenger, 1882, green frog *Pelophylax bergeri* (Gunther, 1986)/ *Pelophylax kl. hispanicus* (Bonaparte, 1839) and smooth newt *Lissotriton meridionalis* (Boulenger, 1882) (Pizzuti Piccoli & De Lorenzis, 2015).

The area is established as an "Area of National Herpetological Relevance – AREN" by the *Societas Herpetologica Italica* ; it is also included within the State Natural Reserve of the Roman Coast and it's included in the Special Conservation Zone "Macchia Grande di Ponte Galeria", according with the European Habitat Directive.

*Table 1. The reptile species observed in the LIPU "Castel di Guido" Oasis.*

| **Species observed** | |
|---|---|
| European pond terrapin | *Emys orbicularis* |
| Hermann's tortoise | *Testudo hermanni* |
| Mediterranean house gecko | *Hemydactilus turcicus* |
| European common gecko | *Tarentola mauritanica* |
| Italian slowworm | *Anguis veronensis* |
| Italian three-toed skink | *Chalcides chalcides* |
| Common wall lizard | *Podarcis muralis* |
| Italian wall lizard | *Podarcis siculus* |
| Western green lizard | *Lacerta bilineata* |
| Four-lined snake | *Elaphe quatuorlineata* |
| Western whip snake | *Hierophis viridiflavus* |
| Aesculapian snake | *Zamenis longissimus* |
| Grass snake | *Natrix helvetica* |
| Asp viper | *Vipera aspis* |

VEGETATIONAL ASPECTS OF "CASTEL DI GUIDO" OASIS

The LIPU Castel di Guido Oasis is characterized by an evident vegetational complexity and a great floristic richness, that emerge in the different habitats present. According to data provided in 1999 by the farm, in which the Oasis is included, the 1966 ha was divided into several coltures. We have 17% (366 ha) occupied by crops such as durum wheat, corn, barley, olive groves, and medic grass, both old and new plants, 22% (430 ha) by natural woods with a prevalence of *Quercus ilex* L. and *Quercus pubescens* Willd., 22% (433 ha) is used for permanent pasturages, 28% (552 ha) it is covered by pine forests and reforestation areas, while the remaining part of the territory is occupied by roads, rural buildings and their neighboring lands, stables, irrigation canals and and other man-made structures (Filesi, 2001; Bartolomucci & De Lorenzis, 2004).

In particular, the vegetational formations present in the LIPU Castel di Guido Oasis, for the purposes of this research, have been classified into the following 4 categories: natural woods, grasslands, reforestation, arable

*https://dx.doi.org/10.22161/ijeab.46.12* *ISSN: 2456-1878*

lands. The first three categories, relevant to the investigation, are described below.

NATURAL WOODS

On the reliefs and slopes the vegetation consists, predominantly, of high stains and scrublands dominated by *Quercus pubescens* and *Quercus ilex* with a sclerophilic undergrowth characterized by the *Phillyrea* sp., *Rhamnus alaternus* L., *Erica arborea* L. and the very fragrant *Pistacia lentiscus* L.; in these areas there are also *Quercus suber* L., *Quercus cerris* L. and the hybrid *Quercus crenata* Lam. (Filesi, 2001; Bartolomucci & De Lorenzis, 2004).

On the sandy-gravelly soils of the numerous escarpments at the sides of the hills, we find bushes dominated by *Spartium junceum* L. with *Rubus ulmifolius* S., *Ulmus minor* Miller and, more localized, *Cercis siliquastrum* L., while in the valleys the vegetation is kept fundamentally equal to the potential one, being still made up of dense woods, especially of *Quercus cerris* and *Quercus frainetto* Ten.; *Malus sylvestris* Miller, *Crataegus monogyna* Jacq., *Cornus mas* L. and *Sorbus domestica* L. participate in the formation of the arboreal /shrub layer. In sites with a particularly fresh and humid microclimate, *Carpinus betulus* L. and *Quercus robur* L. are found together with the other oaks; along the ditches can be found remnants of riparian vegetation in *Salix alba* L., *Phragmites australis* (Cavill), *Thypa latifolia* L. and *Carex pendula* Hudson together with various horsetails (Filesi, 2001; Bartolomucci & De Lorenzis, 2004).

GRASSLANDS

At the base of the slopes, where the deforestation, excessive grazing and fires led to a rapid soil degradation (with consequent surfacing of debris and sands) vegetation consists of sparse evergreen bushes, some shrub species *Cistus monspeliensis* L., *Cistus* salviifolius L., Cistus creticus L. and herbaceous plants. Among the herbaceous plants *Compositae* prevail, such as *Helichrysum italicum* (Roth), *Anthemis tinctoria* L., *Senecio leucanthemifolius* Poiret, *Crupina vulgaris* Cass., *Hedypnois rhagadiloides* (L.), *Tragopogon hybridus* L., *Urospermum dalechampii* (L.), *Crepis zacintha* (L .), *Poaceae*, including *Cynosurus echinatus* L., *Briza maxima* L., *Dactylis glomerata* L., *Bromus madritensis* L., *Elytrigia atherica* (Link), *Aegilops geniculata* Roth, *Parapholis incurva* (L.), *Lagurus ovatus* L., *Phleum arenarium* L., *Bothriochloa ischaemum* (L.) and *Fabaceae*, among whose main species we mention *Lathyrus sphaericus* Retz., *Trifolium stellatum* L., *Lotus tetragonolobus* L., *Hymenocarpus circinnatus* (L.), *Onobrychis caputgalii* Scop., *Tripodium tetraphyllum* (L.). In this plant formation there are also many *Lamiaceae* such as *Teucrium capitatum* L. and *Salvia clandestina* L. and numerous orchids as *Anacamptis pyramidalis* (L.), *Serapias vomeracea* (Burm. F.), *Ophrys sphegodes* Mill., *Ophrys incubacea* Bianca, *Ophrys fuciflora* ( F.W. Schmidt) (Filesi, 2001; Bartolomucci & De Lorenzis, 2004).

REFORESTATIONS

In the area there are many fairly fertile lowland areas, on which agricultural activities (crops and pasture) have always insisted; currently, part of these areas have been redeveloped through reforestation. Although, for this purpose, native plants have not always been used and adapted to the climatic characteristics of the place, this redevelopment operation is still very important (Chirici *et al*., 2000)

The first forestation within the area concerned specimens of *Pinus halepensis* Miller and *Pinus brutia* Ten., nowadays evolved into two mature forest fragments, one of these present inside the Oasis. In 1987 another reforestation campaign was restarted which led to the construction of other smaller-scale forest fragments; today we also find young reforestations (13-20 years) with *Quercus pubescens*, *Quercus ilex*, *Quercus suber*, *Malus sylvestris* and *Crataegus monogyna*, *Pinus pinea* L., *Pinus halepensis*. From 1987 to 1995, about 550,000 plants of different tree species were planted throughout the farm (Chirici *et al*., 2000).

## III. MATERIALS AND METHODS

Data collection took place between January 2014 and December 2016; surveys were carried out weekly; the detection method adopted was that of the linear transept with "visual counts", V.E.S. = Visual Encounter Surveys. (Heyer, 1988; Crosswhite *et al*., 1999).

As a transept, a linear path of 2,200 meters, crossing all the representative environments and the ecotonal areas present, was chosen; were considered animal observations in the 5 meters to the right and to the left of the transept. The figures from n°2 to n°5 show the observations of the different reptiles carried out along the transept and superimposed on the vegetation map.

In the study, great attention was paid to ecotonal areas; the importance of ecotone is due to the fact that in it, generally, there is a greater biodiversity than in the biocenoses that it separates. For the reptile community, a the large number of localizations is concerned with the ecotones (Hofer *et al*., 2002) and this shows that snakes could cover a good part of their resource requirements in the transition zones present in the study area. It is assumed

*https://dx.doi.org/10.22161/ijeab.46.12* *ISSN: 2456-1878*

that much of the reptile population regularly uses the sunny side of transition environments to meet ecological needs (Hofer *et al*., 2002). In particular snakes, when moving, orient themselves along well-defined environment structures (Gregory *et al*., 1987). They move, over short distances, even along the ecotones whose texture facilitates the movement.

A sampling program, that takes this important function of ecotones into account, offers the possibility of detecting most of the reptiles residing in the study area during a season. During the transects, the animals were captured and marked where possible; this in order to obtain recapture rates that allow considerations on the mobility of individuals on the site.

In addition, for the study of snakes, metal coverboards positioned on the ground were used (Hofer *et al*., 2002).

The field work was carried out following the regulations and with all the authorizations necessary for this type of study. The animals, where captured, have always been studied on the field and released at the same capture site.

## IV. RESULTS AND DISCUSSION

TESTUDINES

*Emys orbicularis* (Linneo, 1758)

The only specimens of *Emys orbicularis*, five in all, were observed in May 2015, at a ditch on the border of the reserve; given the limited nature of the data, the species was not considered for the purposes of this work. The species, which constitutes a new presence for the area, certainly needs in depth monitoring, to define its status in the area and the frequentation of the different habitats (Pizzuti Piccoli *et al*., 2017b).

*Testudo hermanni* Gmelin, 1789

The observed animals were 41 and were almost always within the distance of 5 meters from the edge of the wooded area, rarely (<5% of the observations) were they in open meadow areas; 70% of the specimens observed were found in ecotonal areas between meadow and natural wood (with a low arboreal-shrub layer composed of species of the Mediterranean maquis). The 30% was instead observed in the prairie areas adjacent to the areas with reforestation.

Nests were found in the prairie areas, close to the natural areas, both predated and with hatched eggs, always at about 50 cm from the bushes.

SAURIA

*Hemidactylus turcicus* (Linneo, 1758); *Tarentola mauritanica* (Linneo, 1758).

In the study area, *Hemidactylus turcicus* and *Tarentola mauritanica* are present exclusively in the artificial areas (village, rural buildings, stables) of the Castel di Guido Farm, where they appear in syntopy. They are also located in the two Oasis structures (Visitor Center and Bird Ringing Station) consisting of prefabricated wooden artefacts. In general, in the study area the two species appear numerous, even if located exclusively in the anthropic sites mentioned above.

*Anguis veronensis* Pollini, 1818

Only one specimen of *Anguis veronensis* was observed; the infrequence of findings can be related to the ecology of the species that makes it difficult to observe the species and the type of survey carried out in the field. The specimen was found in the morning hours (around 7.00 am) at a roadside area with boulders and brushwood

*Chalcides chalcides* (Linneo, 1758)

During the transects, 14 specimens of *Chalcides chalcides* were observed; all the specimens were found in the uncultivated grasslands with continuous turf.

*Podarcis muralis* (Laurenti, 1768); *Podarcis siculus* (Rafinesque Schmaltz, 1810); *Lacerta bilineata* Daudin, 1802

Lacerta bilineata is very common in the study area; during the survey, 104 individuals were observed. The species appears to be equally distributed in areas with natural forests and reforestation (respectively 57% and 43% of observations). It should be noted that 42% of the observations concern a very precise type of habitat, namely the areas close to small temporary ditches or drainage canals, with associated *Rubus* sp. vegetation and other shrubs. The two species *Podarcis muralis* and *Podarcis siculus* are very numerous in the territory. Of the 223 specimens observed of *Podarcis siculus*, 17% were found in wooded areas, while 83% of the observations were carried out in open meadow areas. For the species *Podarcis muralis*, 132 specimens were observed; of these, 6% were observed in lawn areas, while 94% were observed in wooded areas (33% of the specimens were found in areas with artificial reforestation, while 77% are present in areas with natural woods).

SERPENTES

*Natrix helvetica* (Lacépède, 1789), *Zamenis longissimus* (Laurenti, 1768), *Hierophis viridiflavus* (Lacépède, 1789), *Elaphe quatuorlineata* (Bonnaterre, 1790), *Vipera aspis* (Linneo, 1758).

*https://dx.doi.org/10.22161/ijeab.46.12* *ISSN: 2456-1878*

For the snakes *Natrix helvetica* and *Zamenis longissimus* it is not possible to delineate a specific use of the habitat because of the few observations made.

*Hierophis viridiflavus* seems to be the most present species in the different environments of the Oasis, resulting equally distributed in meadow areas and uncultivated (in this case also close to the rural buildings present), in the reforestation areas and natural wood (with the following percentages: meadows and uncultivated = 27%, natural forests = 41%, reforestation = 31%).

As for *Vipera aspis*, 64% of the observations refer to wooded areas, while in 36% of the cases the species was found in marginal areas between wooded and uncultivated areas, with the presence of brambles and undergrowth, always in areas with the presence of abundant vegetation cover.

For *Elaphe quatuorlineata* 63% of the observations are attributable to a well-defined habitat; these is characterized by wooded areas (high-trunk trees) bordering on water collections (in particular, in the Oasis, there is an artificial pool with a very large surface). This site, based on field observations, constitutes a site that meets (at least temporarily) the ecological needs of the species.

## V. CONCLUSION

The distribution of the species in the different habitats appears to be well defined for the species present, with the exception of *Emys orbicularis*, *Anguis veronensis*, Na*t*rix *helvetica* and *Zamenis longissimus* for which the exiguity of the observations does not allow to elaborate correlations with the habitat (Fig. 6).

*Testudo hermanni* is a species closely associated with the plant formation of the Mediterranean maquis, where it is often found; the feeding areas, as well as the deposition areas, consisting of the prairies are almost always adjacent (within 5 meters) to this type of vegetation.

*Hemidactylus turcicus* and *Tarentola mauritanica* seem to have a localization exclusively in the context of anthropic structures.

*Chalcides chalcides* and *Podarcis siculus* appear to be confined to prairie areas, while *Podarcis muralis* is associated with the presence of trees of high-trunk plant associations. For the *Podarcis muralis* it is remarkable the observation concerning the fact that, often, every individual occupies a single tree on which he finds an optimal exposure point, as well as, probably a refuge area from terrestrial predators. For *Lacerta bilineata*, a correspondence is outlined for the areas with arboreal shrubby vegetation, especially close to more humid habitats.

Among the snakes *Hierophis viridiflavus* appears to be a very vagile and ubiquitous species, with the frequentation of different habitats in the same percentage; more localized appear *Vipera aspis* and *Elaphe quatuorlineata*, the first more linked to wooded areas with the presence of bushy and shrubby vegetal coverings, the second is often associated with the simultaneous presence of forests and water collections. These observations, for snakes, are in agreement with other published studies for different areas **(**Gregory *et al*., 1987; Filippi & Luiselli, 2000; Hofer *et al*., 2002**)**; moreover, it appears evident, always in the case of snakes, that presence in the habitat is correlated, above all, to the trophic availability proper for the different species (this should allow an optimal utilization of the environmental resources, in mutual respect of the roles). In general it is confirmed, as regards the snake community, the importance of ecotonal and transitional zones, in agreement with the data in the literature (Capula *et al*., 1993; Hofer *et al*., 2002; Cattaneo, 2005; Corti *et al*., 2010).

In conclusion, the work is a first analysis of the correlation between species and habitat attended for the LIPU "Castel di Guido" Oasis; surely it will be important to deepen with further research, after this first preliminary analysis, the ecology of the species found. Given the number of species and individuals observed, the work also highlights how the study area is important for the conservation of reptile populations in the Roman area.

## ACKNOWLEDGEMENTS

The Authors are grateful to Augusto Cattaneo for the contribution given to the realization of the work.

*https://dx.doi.org/10.22161/ijeab.46.12* *ISSN: 2456-1878*

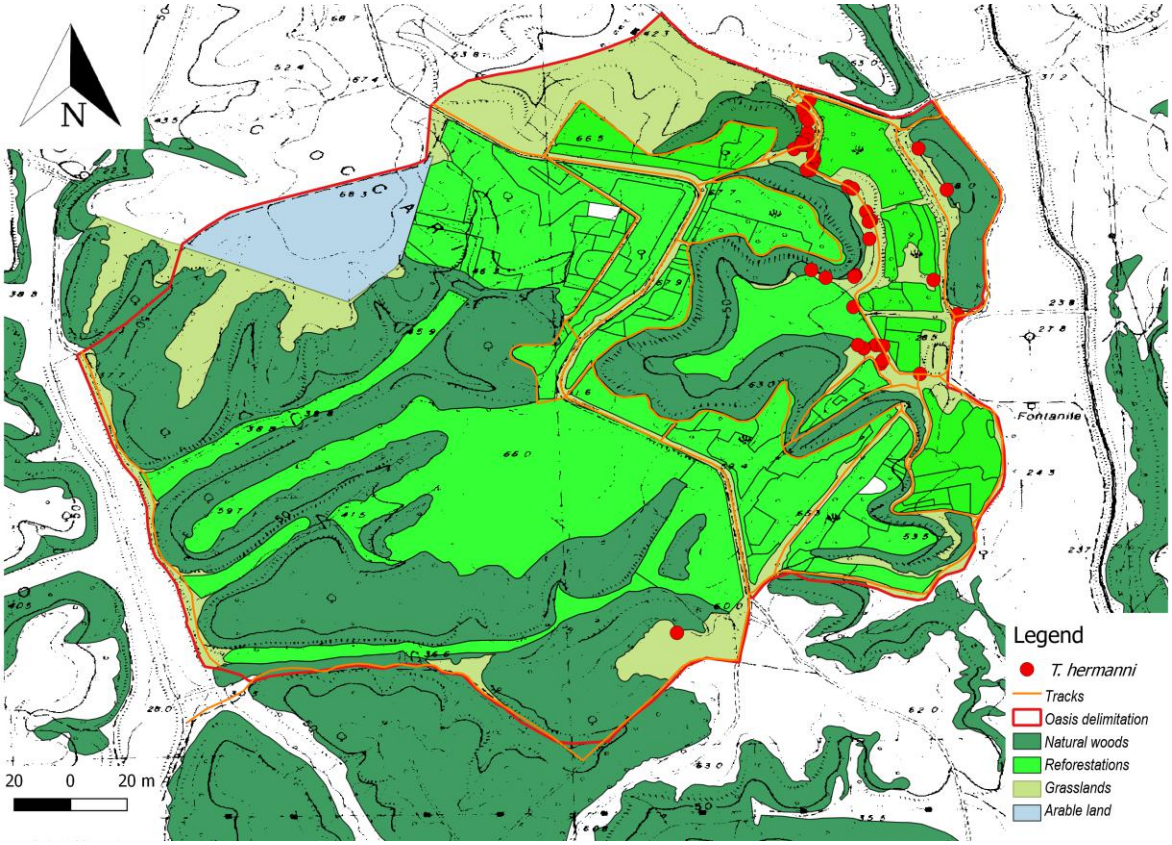


*Fig. 2. Distribution and habitat utilization of Testudo hermanni in the study area.*

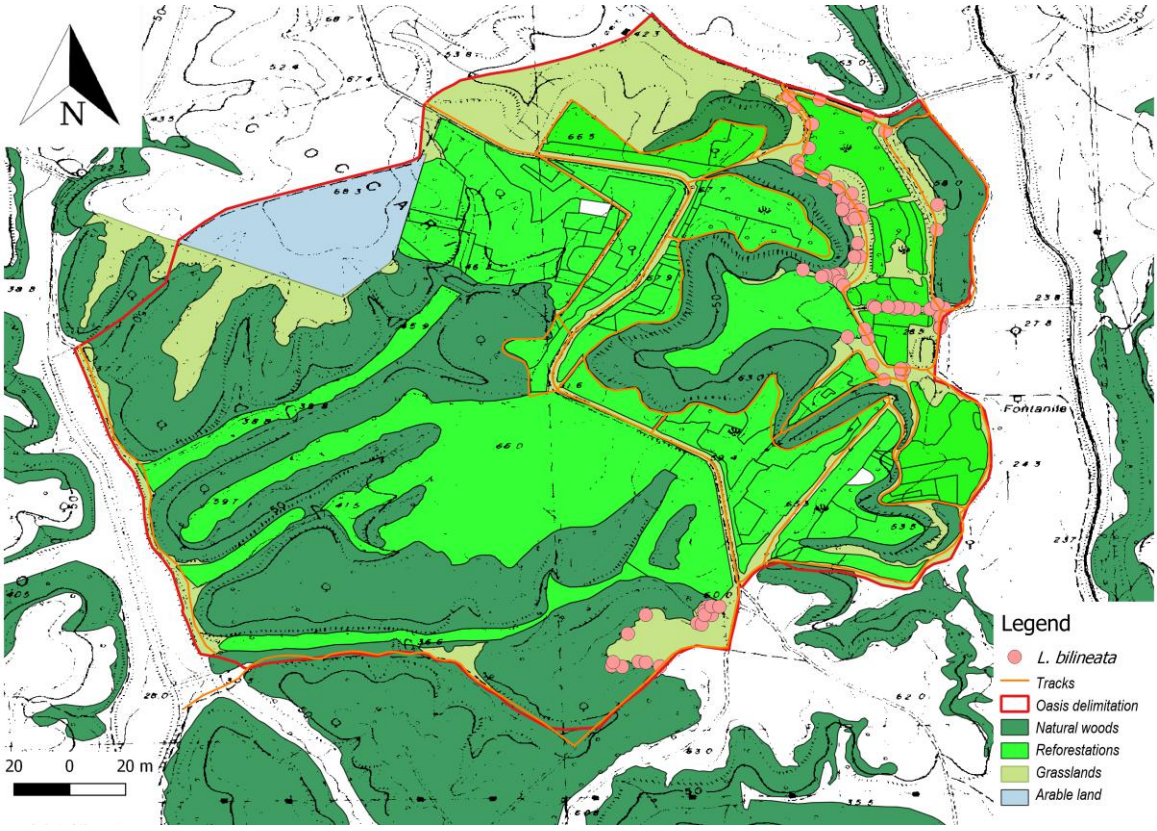


*Fig. 3. Distribution and habitat utilization of Lacerta bilineata in the study area.*

*https://dx.doi.org/10.22161/ijeab.46.12* *ISSN: 2456-1878*

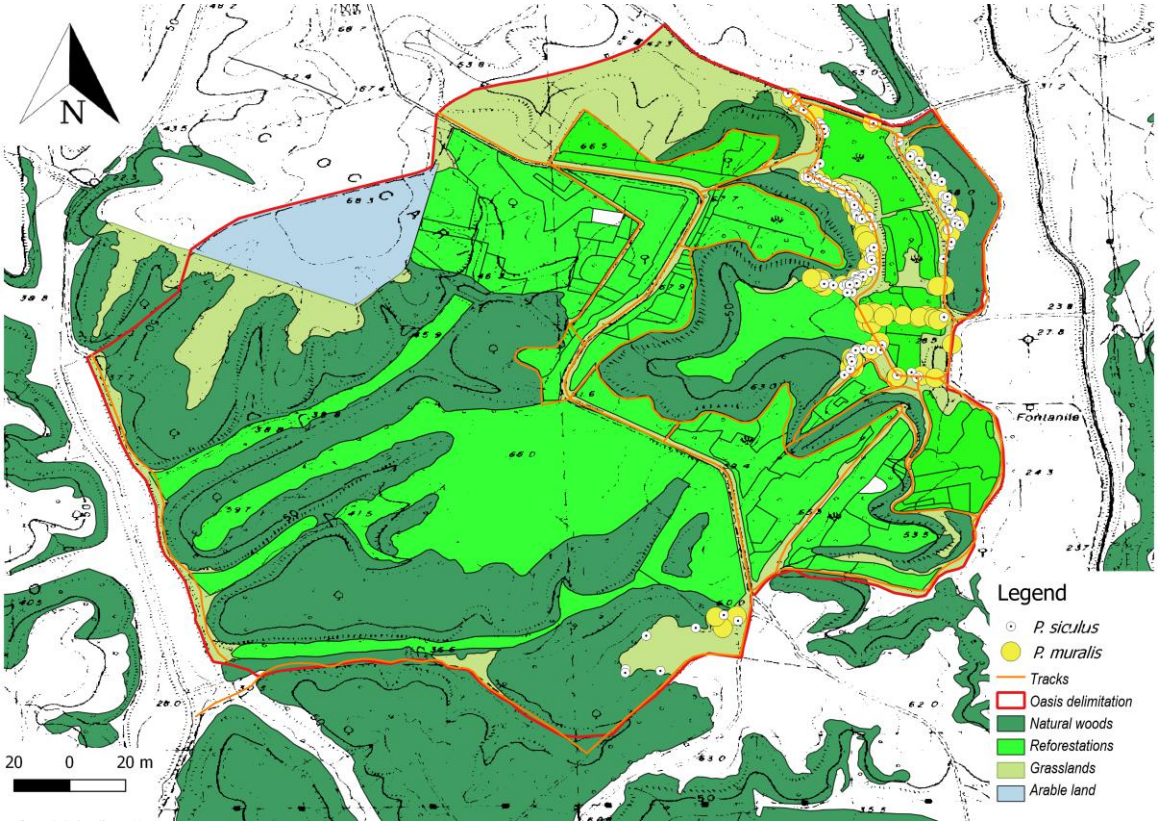


*Fig. 4. Distribution and habitat utilization of Podarcis siculus and Podarcis muralis in the study area.*

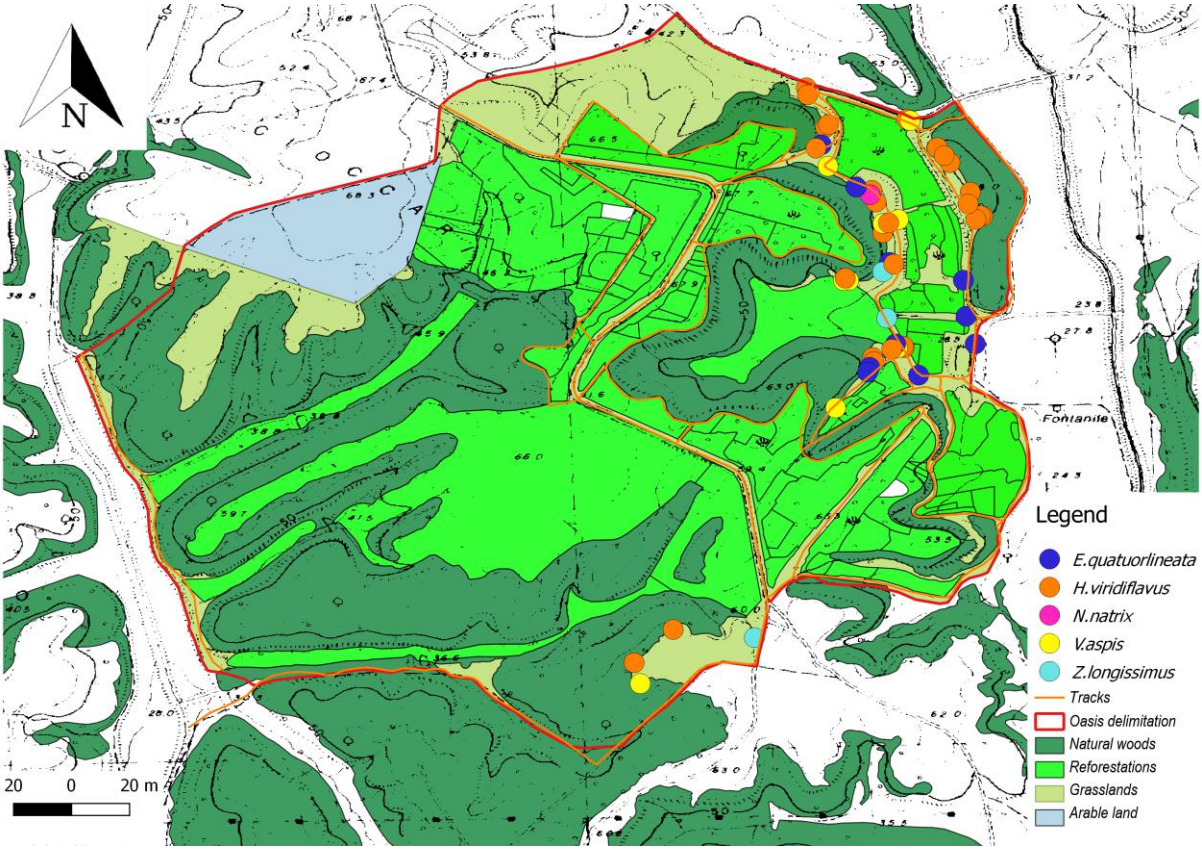


*Fig.5. Distribution and habitat utilization of snake species in the study area.*

*https://dx.doi.org/10.22161/ijeab.46.12* *ISSN: 2456-1878*

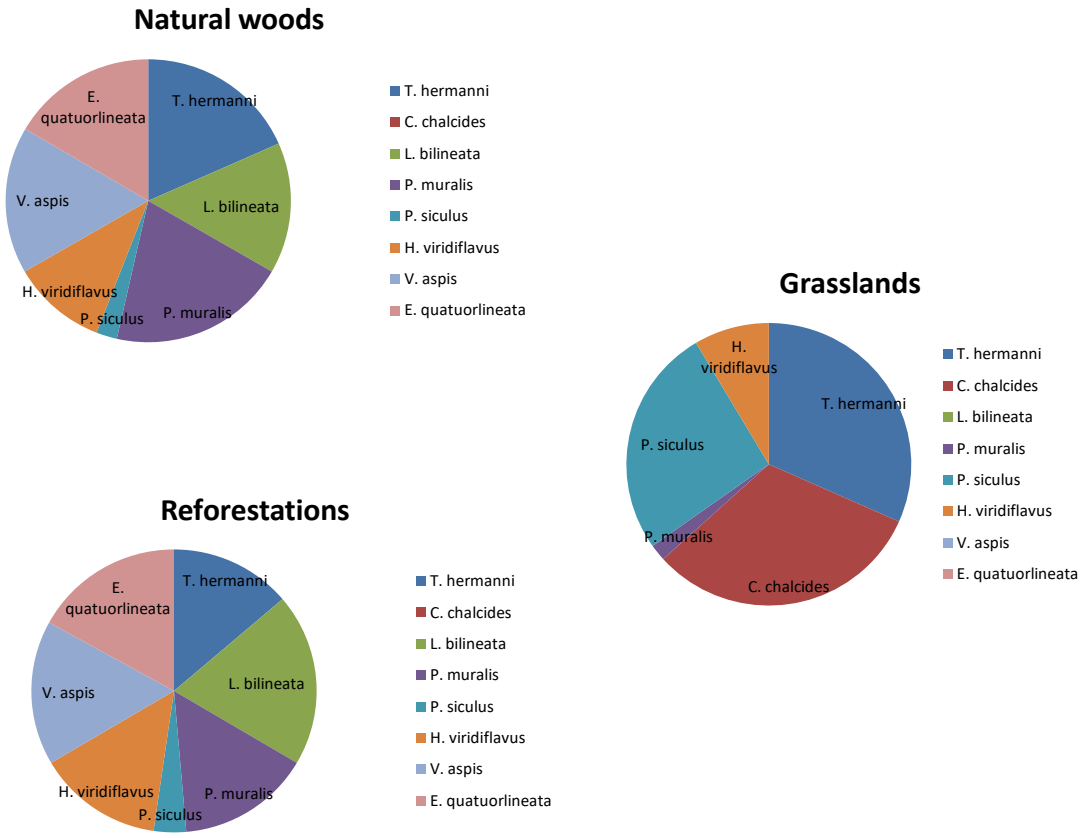


*Fig.6. Reptiles observed in the study period and their presence percentage in the different habitats (some taxa are excluded; see text).*

## REFERENCES


[1] BARTOLUCCI F. & DE LORENZIS A., 2004. La flora vascolare. Collana i quaderni dell'Oasi "Castel di Guido". Vol 1. *Comune di Roma*.

[2] BLASI C., 1994. Fitoclimatologia del Lazio, *Regione Lazio*, Roma.

[3] CAPULA M., LUISELLI L. & RUGIERO L., 1993. Comparative ecology in sympatric *Podarcis muralis* and *P. sicula* (Reptilia: Lacertidae) from the historical centre of Rome: What about competition and niche segregation in an urban habitat? *Boll. Zool.*, 60: 287-291.

[4] CATTANEO A, 2005. L'erpetofauna della Tenuta Presidenziale di Castelporziano (Roma) *Atti Mus. Stor. nat. Maremma*, 21: 49-77

[5] CECERE J. G., 2006. L'Avifauna - ricerche e check-list. Collana i quaderni dell'Oasi "Castel di Guido". Vol 3. *Comune di Roma*.

[6] CHIRICI G., CORONA P., MARCHETTI M. & VANNUCCINI M., 2000. Procedura di valutazione degli interventi di rimboschimento come strumenti di composizione dell'ecotessuto paesistico. *Italia Forestale e Montana* 4: 253-267

[7] CHIRICI G., CORONA P., FILESI L. & VANNUCCINI M., 2001. Lineamenti ambientali della Tenuta di Castel di Guido. Pp. 23-30 in: CORONA P. (ed.), 2001. I rimboschimenti della Tenuta di Castel di Guido: Materiali di studio. *Innovazione e Agricoltura*, Roma, 4 (suppl.).

[8] CORTI C., CAPULA M., LUISELLI L., RAZZETTI E. & SINDACO R., 2010. Fauna d' Italia. Reptilia. *Calderini Ed.*, Bologna.

[9] CROSSWHITE D.L., FOX S.F. & THILL R.E., 1999. Comparison of Methods for Monitoring Reptiles and Amphibians in Upland Forests of the Ouachita Mountains. *Proc. Oklaoma Acad. Sci.*, 79: 45-50.

[10] DOWNES, S. & SHINE, R. 1998. Sedentary snakes and gullible geckos: predator-prey coevolution in nocturnal rock-dwelling reptiles. *Anim. Behav.* 55: 1373–1385.

[11] FILESI L., 2001. Vegetazione attuale e potenziale della Tenuta di Castel di Guido. Pp. 31-42 in: CORONA P. (ED.), I rimboschimenti della Tenuta di Castel di Guido: Materiali di studio. *Innovazione e Agricoltura*, Roma, 4 (suppl.).

[12] FILIPPI E. & LUISELLI L., 2000. Status of the Italian snake fauna and assessment of conservation threats. *Biol. Conserv.*, 93: 219-225.

[13] GREGORY P.T., MAC CARTNEY J.M. & LARSEN KW, 1987. Spatial patterns and movements. In Seigel R.A., Collins J.T. & Novak S. (Eds.). Snake: Ecology and Evolutionary Biology. *McGraw – Hill, New York*. pp. 366-395

[14] GROVER M. C., 1996. Microhabitat use and thermal ecology of two narrowly sympatric Sceloporns (*Phrynosomatidae*) lizards. *Journal of Herpetology* 2:152-160.

[15] HEATWOLE, H. (1977). Habitat selection in reptiles. In C. Gans & D. W. Tinkle (Eds.). Biology of the Reptilia, Vol. 7, *Academic*

[16] HEYER R.W., 1988. Measuring and monitoring biological diversity: standard methods for amphibians. *Smithsonian Institution Press*, 297 pp.

[17] HOFER U., MISSLIN S. & CAMPONOVO I., 2002. Monitoraggio delle popolazioni di Saettone (*Elaphe Longissima*), di Biacco (*Hierophis viridiflavus*), e di Natrice dal collare (*Natrix natrix*) in località Boschi, Stabio TI. *Boll. Soc. ticinese Sc. nat.*, 90: 59-67.

[18] IMPERIO S., PANCHETTI F., CECERE J.G. & MAURIZI E., 2007. I Mammiferi: Insettivori, Lagomorfi e Roditori. Collana i quaderni dell'Oasi "Castel di Guido". Vol 4. *Comune di Roma*.

[19] IRSCHICK D. J. & LOSOS, J. B., 1999. Do lizards avoid habitats in which performance is submaximal? The relationship between sprinting capabilities and structural habitat use in carribean anoles. *American Naturalist* 154: 293-305.

[20] MANGIANTI F. & PERINI L., 2001 - Osservazioni Meteorologiche dell'anno 1998-1999-2000-2001. Ufficio Centrale di Ecologia Agraria e difesa delle piante coltivate dalle avversità meteoriche. *Osservatorio Meteorologico Torre Calandrelli*, Collegio Romano, Roma.

[21] MELVILLE J. & SCHULTE II J. A., 2001. Correlates of active body temperatures and microhabitat occupation in nine species of central Australian agamid lizards. *Austral Ecology* 26: 660-669.

[22] OATWAY M.L. & MORRIS D.W., 2007. Do animals select habitat at small or large scales? An experiment with meadow voles (*Microtus pennsylvanicus*). *Can J Zool* 85:479–487.

[23] ORIANS, G. H. (2000): Behaviour and community structure. ETOLOGÍA 8: 43-51.

[24] PETERMAN W.E. & SEMLITSCH R.D., 2013. Fine-scale habitat associations of a terrestrial salamander: the role of environmental gradients and implications for population dynamics. *PLoS ONE* 8(5): e62184.

[25] PIZZUTI PICCOLI A. & DE LORENZIS A., 2015. Gli anfibi. Collana i quaderni dell'Oasi "Castel di Guido". Vol 5. *Comune di Roma*.

[26] PIZZUTI PICCOLI A., DE LORENZIS A. & FORTUNA F. (2017a). Osservazioni preliminari sui Rettili dell'Oasi LIPU Castel di Guido (Lazio settentrionale, Italia). *Naturalista sicil*., 41: 147 – 159.

[27] PIZZUTI PICCOLI A., SCALAS I. & DI STANO L. (2017b). First Record of *Emys orbicularis* (Boulenger, 1882), (Reptilia, Testudinati) in the "Castel di Guido" Natural Park (Northern Latium, Italy): a Case of Interest for Species Conservation. *International Journal of Environment, Agriculture and Biotechnology (IJEAB). Vol-2, Issue-1, Jan-Feb- 2017*.

[28] RITTENHOUSE T. A. G., SEMLITSCH R.D., 2007. Distribution of amphibians in terrestrial habitat surrounding wetlands. *WETLANDS* 27:153–161.

[29] VANHOOYDONCK B. & VAN DAMME R., 2003. Relationships between locomotor performance, microhabitat use and antipredator behaviour in lacertid lizards. *Functional Ecology* 14: 160-169.