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Digestive and nutritional strategies in European hare (*Lepus europaeus*) – effects of sex and season on gut length, nutrient composition of the gastrointestinal tract and caecotrophy

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The European hare, a small herbivore with hindgut fermentation, occupies habitats in which food quality changes across seasons. In the reproductive season females must cope with high energetic stress, such as lactation and pregnancy, while males pay the energetic costs for competing for mates. Previous research data has suggested that the gastrointestinal tract has evolved a flexible design in response to food quality and energetic demands. In this study, changes in the nutrient content and breeding requirements over the year affected the size and weight of most intestinal segments of both sexes. In May and August it was determined that a higher quantity of fiber versus a lower protein proportion and the length and content of the intestinal parts were generally higher than in November and February. In the reproductive season, when the demands of pregnancy and lactation were highest adult females enlarged the small intestine and caecum. Higher amounts of protein and ash and lower proportions of fiber were found in the caecum than in the stomach (food part) and colon (hard faeces) content. This supports the hypothesis that the fiber is poorly digested in this small herbivore and the caecotrophy is of great nutritional significance for the hares. Between the two age classes (adults and subadults) there was no significant difference concerning the amount of nutrients and the dimensions of the digestive tract. Finally, our data suggest that higher energy demands and seasonal nutrient variation have selected for changes in gut size and capacity in the European hare and these digestive strategical mechanisms, together with the caecotrophy behaviour, are adaptations for survival in their changeable habitat.

Litter size and maternal characteristics influence different immune parameters of juvenile Laboratory rats

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Many small mammals give birth to litters of highly variable sizes. Litter size i.e. the number of litter siblings, together with characteristics of the mother usually affect postnatal growth rates in altricial small mammals. In the Laboratory rat, postnatal growth is comparatively lower in pups of larger litters because those pups get a smaller amount of milk per individual offspring. Mothers also transmit different immune globulins und immune cells via milk supporting the development of the offsprings‘ immune system. In our study we tested for the effects of litter size, and of parity and body mass of the mother on some parameters of the cellular and functional immune system in juvenile Long-Evans laboratory rats (*Rattus norvegicus*). Litter sizes were not manipulated and ranged between 2 and 18 pups. Short before weaning, blood samples were taken from all pups of the litter and we quantified different immune cells and measured the activity of the complement system. We found consistent effects in almost all immune parameters tested: Lymphocyte numbers and activity of complement system were negatively correlated with litter size. All immune parameters tested were positively correlated with maternal body mass and were higher in offspring of primiparous mothers (first litter cycle) than in pups of following litters. In conclusion our study points out that maternal characteristics as well as litter size influence components of the immune system in juvenile rats around weaning.

Distribution and habitat use of the Grey wolf *(Canis lupus L., 1758)* in the Tuscany side of the National Park of Appennino Tosco-Emiliano

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The aim of the study was to develop a model of habitat use of the protected area by wolves to understand the possible influences of the bio-physical characteristics on wolf behaviour.

Wolf tracks were monitored, 2004 through 2007, during the snow season in the Tuscany side of the National Park of Apennine Tosco-Emiliano (~5000 ha): the snow-tracking method was used and wolf signs were the looked for along (403 km) from November to April. UTM coordinates were determinated for each track

using a portable GPS than transferred on Grass software. Aerial photographs (scale 1:10000) geo-referenced and digitalized were used with the National Forest Inventory. Land use selected and digitalized in vector format was composed by wood uses (hardwoods except fagus and chestnut, coniferous woods, mixed woods, fagus woods and chestnut woods), agricultural uses (pastures, grasses, winter and spring cereals) and other uses (shrubs and rocky areas). The other habitat variables selected were: altitude, slope, exposure, diversity index and presence of paved and dirt roads. Wolf presence was subjected to logistic regression in relationship to all the land uses and the habitat parameters. The wolf track length-covered track length ratio was used to select the most important parameters which affect wolf presence by the stepwise method (forward and backward methods: probability to enter and to leave $= 0.25$).

Results showed that wolf tracks were more present at altitudes between 1500 and 1700 m a.s.l. (45.9%, chi square $= 8.77$, $p < 0.05$) and on slopes greater than 25° (36,4% than 29.5% and 28.0%, for 15°-25° and less than 15°, respectively; chi square 6.50, $p < 0.05$). Instead, tracks were less present in cells with roads (34.2%) than in these without any kind of road (25.4%, chi square 8.5, $p < 0.01$). Wolf presence was strongly influenced by the year (in 2005 were observed more tracks than in others years, $p < 0.01$) and the month (Jan, Feb and Apr vs. Dec and Mar, chi square 8.5, $p < 0.01$).

Bivariate and multivariate analysis, followed by stepwise selection of the independent variables, showed that wolf tracks incidence was significantly influenced by altitude ($b = 0.04$, F Ratio 10.4 prob. $> F$ 0.0013), exposure (South & East vs. North & West, $b = -3.0$, F Ratio 1.66 prob. $> F$ 0.1982; North vs. West, $b = -4.44$, F Ratio 2.05 prob. $> F$ 0.153), road presence ($b = -0.01$, F Ratio 1.42 prob. $> F$ 0.2342), land use (fagus woods vs. every other use, $b = -4.87$, F Ratio 3.37 prob. $> F$ 0.066) and years (F Ratio 89, F prob. < 0.001).

Bears in central Austria are facing a second extinction

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The bear population in north-central Austria was founded by one male that immigrated from Slovenia in the 1970s and three bears released between 1989 and 1993. The small nucleus did well and regular reproductions resulted in at least 31 cubs born between 1991 and 2006. Nevertheless, the number of individuals recorded per year remained low and in 2008 only 2-3 closely related adult bears are still present.

Genetic monitoring started in 2000 and since then we have extensive data on the presence and absence of individual bears. Annual detection rate of individuals in consecutive years was high (41 out of 44 bear years) and allows us to pin-point the year of disappearance and thus estimate survival rates. Bears in the central Austrian bear population are subject to a high mortality rate, especially as yearlings. This rate is unknown from other well studied bear populations. The last genetic proof of bears lost shows no clear spatial pattern. Bears were last "seen" inside, as well as outside the core distribution area.

Rumors about shot bears, the sudden loss of two radio-collared bears and a lack of realistic alternative explanations all pointed towards illegal killings as the most likely explanation for the loss of bears in central Austria. In depth data analysis, several months of local investigations and the cooperation with the Criminal Investigation Department lead to further suspicious evidence and the discovery of a mounted bear in July 2007. The genetic fingerprint identified it to be a cub of „*Cilka*", the female released in 1992.

Since the actual population is beyond recovery, only re-stocking with bears from Slovenia can counteract a second extinction. At the same time the reasons for the population crash need to be removed. Therefore the local investigations and the co-operation with the Criminal Investigation Department have to continue. There is also a need for structural changes, like public involvement on the local level and an active role of the authorities in bear management on the institutional and political level.

Development of a non-invasive method for measuring stress in Mountain hares (*Lepus timidus*)

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In this study, a novel non-invasive method for measuring stress in the Mountain hare (*Lepus timidus*) was established and validated. An ACTH challenge test was performed on five captive specimens (3 females and 2 males) in order to select an appropriate enzyme-immunoassay (EIA) to measure faecal glucocorticoid metabolites (GCM). Finally, an 11-oxoetiocholanolone EIA was chosen. The assay showed low fluctuation in its baseline values and a clear response after stimulation of

Distribution and habitat use of the gray wolf (Canis lupus L., 1758) in the Tuscany side of the National Park of Appennino Tosco-Emiliano

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Introduction

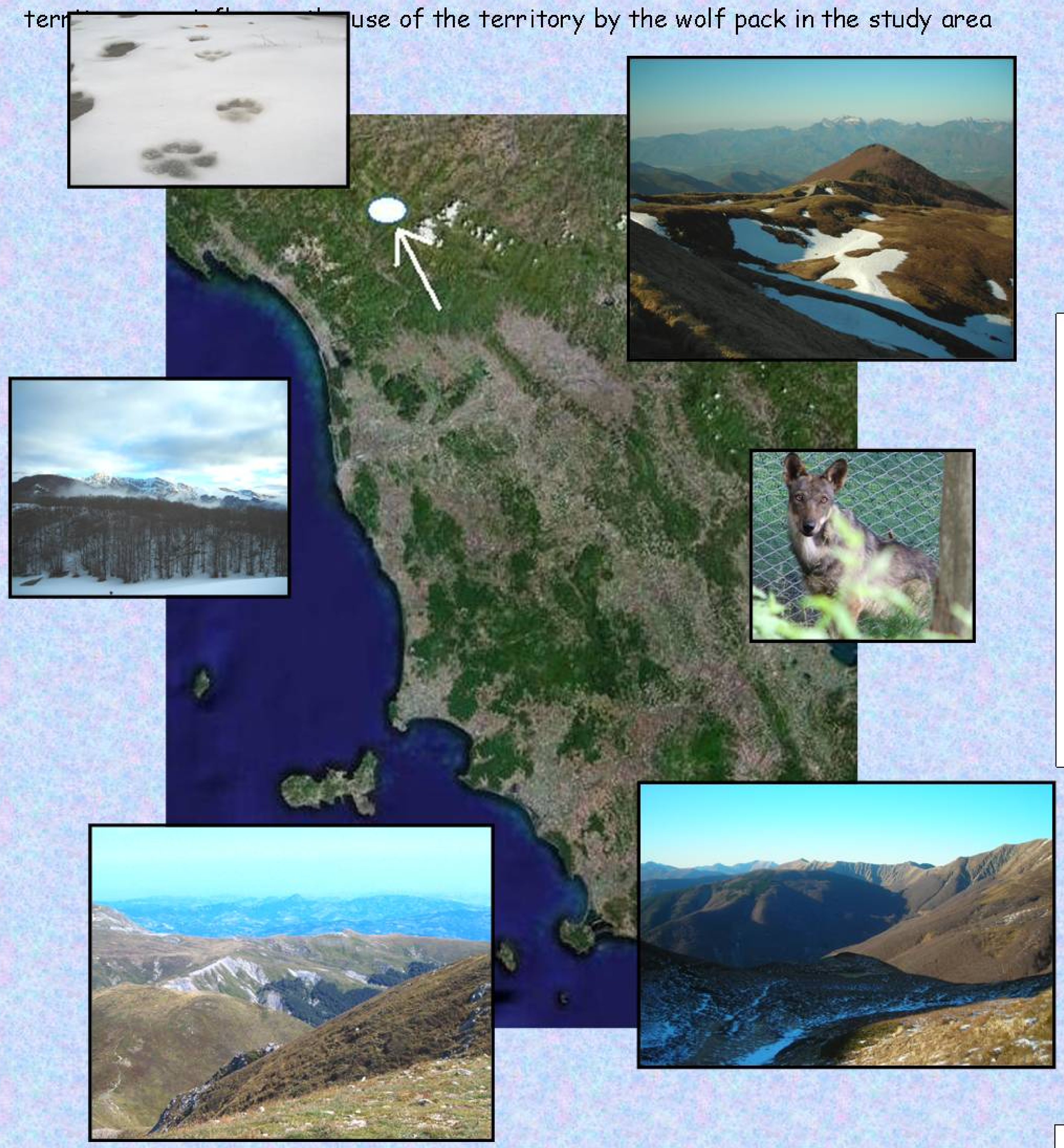
Understanding the organization of animals in space and time is a central question in ecology.

The dynamics of a population are directly linked to the spatial arrangement and movements of individuals caused by internal and external pressures on the population.

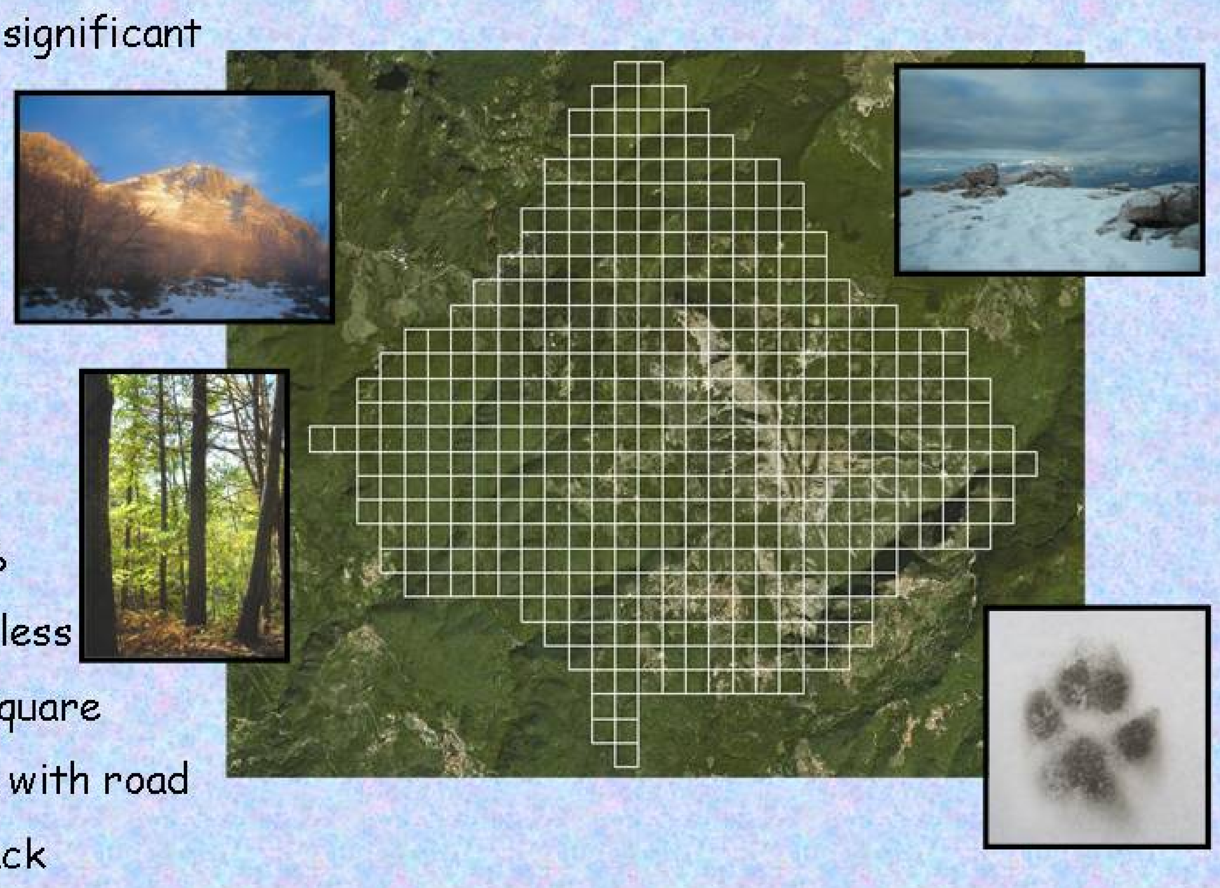
These ecological factors are of central relevance for threatened and endangered species.

We investigated movements and space-use patterns of a wolf pack inhabiting the Tuscany region slope of the Appennino tosco emiliano national park, 2004 through 2007.

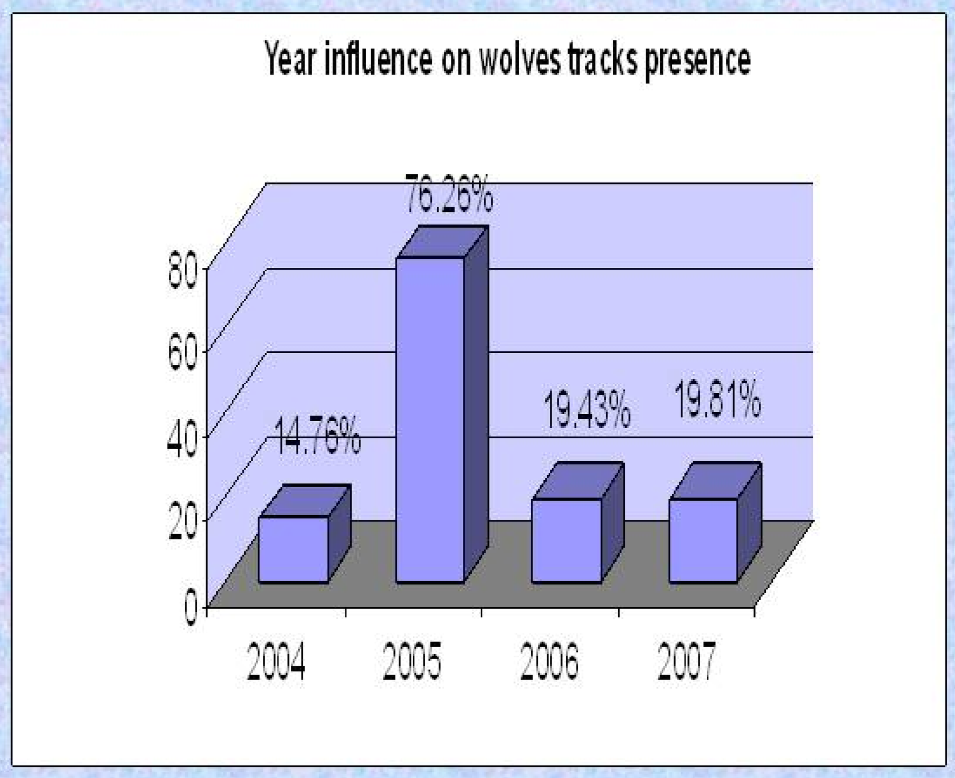
The aim of the study was to understand how the bio-physical characteristics of a terr [illegible] use of the territory by the wolf pack in the study area

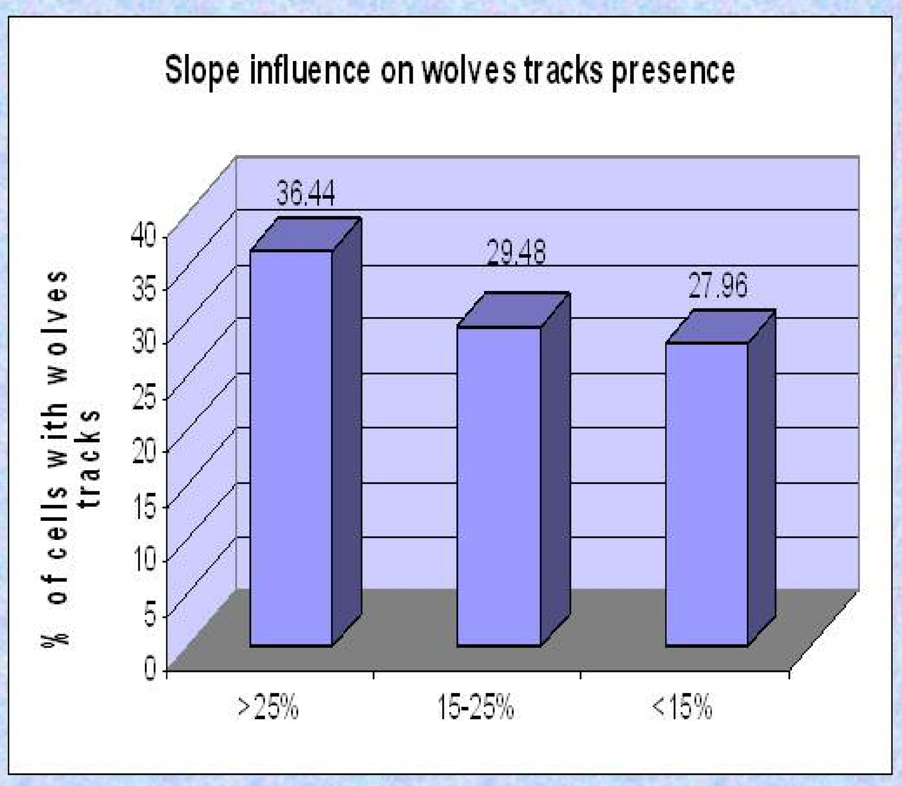


Results

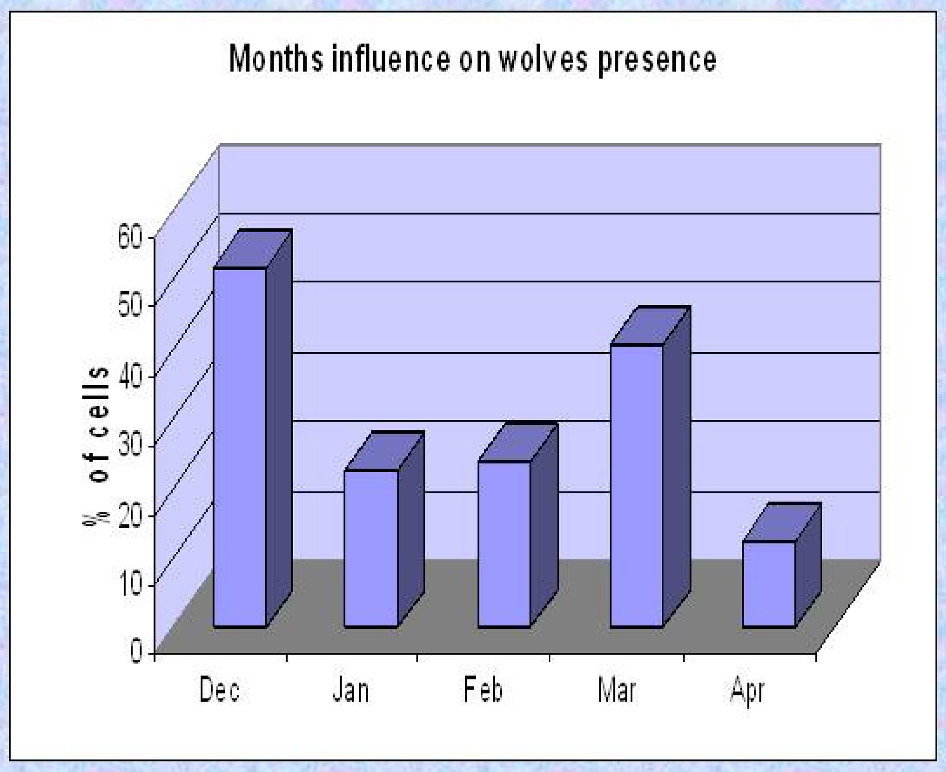


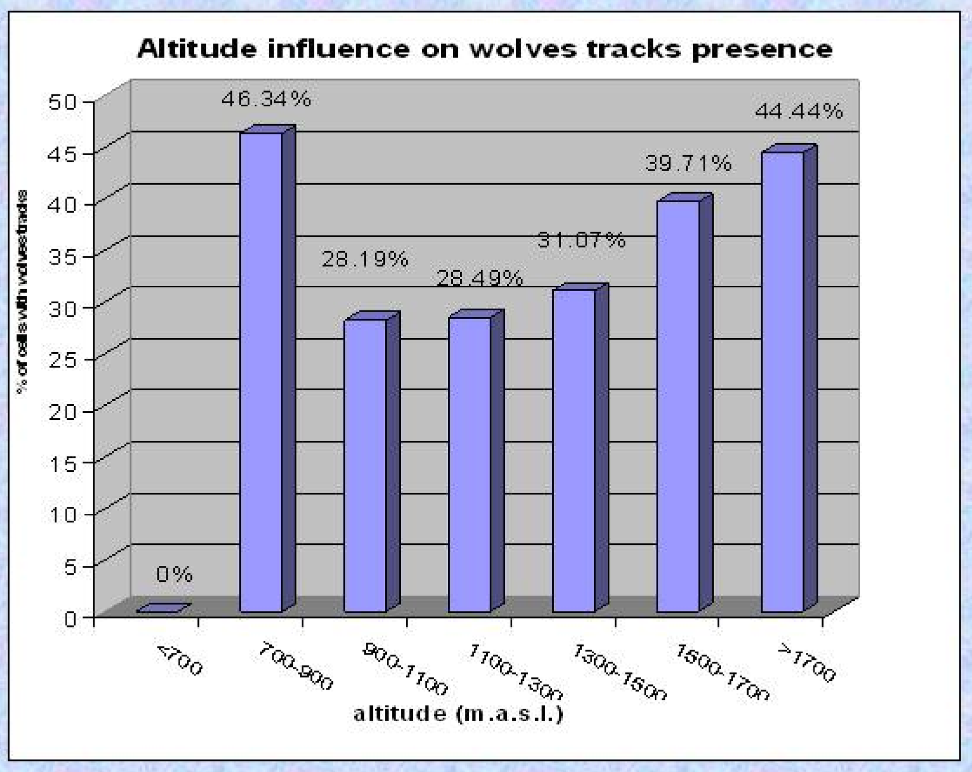
Results show a statistically significant association between wolves tracks and altitudes more than 1500 m a.s.l. (chi square = 8.77,p<0.05) and between wolves tracks and slopes greater than 25° (36,4% than 29.5% and 28.0%, for 15°-25° and less than 15°, respectively; chi square 6.50, p<0.05). Instead, cells with road were crossed by a minor track percentage (25.4%) than cells without any kind of road (34.2 %, chi square 8.5, p<0.01). The presence of the wolf was strongly influenced by the year (in 2005 were observed more tracks than in others years, p<0.01) and the month (Jan, Feb and Apr *vs.* Dec and Mar), chi square 8.5, p<0.01.





Bivariated and multivariated analysis, followed by stepwise selection of the independent variables, showed that wolf tracks incidence is significantly influenced by altitude (b= 0.04, F Ratio 10.4 prob. >F 0.0013), exposure (South & East *vs.* North & West, b= -3.0, F Ratio 1.66 prob. >F 0.1982; North *vs.* West, b = -4.44, F Ratio 2.05 prob. >F 0.153), road presence (b= -0.01, F Ratio 1.42 prob. >F 0.2342), land use (beeches *vs.* every other use, b= -4.87, F Ratio 3.37 prob. >F 0.066) and years (F Ratio 89, F prob. < 0.001).





Materials and Methods

We used the snow-tracking to monitore wolf tracks in the study area (~5000 ha), during snow season, 2004 through 2007. Track surveys are limited to days when fresch snowfalls allows for track detection and identification (from November to April). Wolf signs were looked for along (403 km) and followed backwards.

UTM coordinates were determinated for each track using a portable GPS and transferred on Grass software. Aerial photographs (scale 1:10000) geo-referenced and digitalized were used with the National Forest Inventory.

Land use selected and digitalized in vector format was composed by wood uses (hardwoods except fagus and chestnut, coniferous woods, mixed woods, fagus woods and chestnut woods), agricultural uses (pastures, grasses, winter and spring cereals) and other uses (shrubs and rocky areas). The other habitat variables selected were: altitude, slope, exposure, diversity index and presence of paved and dirt roads.

Wolf presence was submitted to logistic regression in relationship to all the land uses and the habitat parameters. The wolf track length-covered track length ratio was used to select the most important parameters which affect wolf presence by stepwise method (forward and backward methods: probability to enter and to leave = 0.25).

Statistical analysis were performed with JUMP software.

Discussion

Snow tracking data show that wolf habitat use, as expected, in the study area is influenced by some parameters linked to environment and period (years and months). In fact, the higher and more inclined territories were used probably since the human presence is absent in these areas and the beeches give protection and a good preys availability.

Finally, using whole of the results, we want to create a map to predict probability of territorial use either in the study area or in similar and neighboring areas.