

GEOGRAPHICAL DISTRIBUTION AND ECOLOGY OF PERSIAN SQUIRREL (SCIURUS ANOMALUS) IN THE GREEK ISLAND OF LESBOS

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ABSTRACT

The ecology of the Persian squirrel (*Sciurus anomalus*) was established on the east Aegean island of Lesbos. In this paper with the program GIS, the island of Lesbos was divided in 460 cells, each cell is 2X2km. Then using GPS we took points from 89 locations which we put in our GIS map of the island. (Decimal coordinates). The presence of the squirrel was based on direct visual observations (the green dots on the map), indirect observations is the remains of consumed acorns and almonds or many witness that they were taken from locals (pink dots on the map) and we have the blue dots which represents the suitable habitats for the Persian squirrel, taking under consideration their preferences. Habitat change was observed, which caused mainly from the fruition of specific trees which Persian squirrel prefers. Also with corine 2000 that we have in our GIS map we digitized some pieces of land which is suitable for Persian squirrel habitats, such us olive groves and mixed forests, so in that way we could compare that pieces with the dots and find in which habitats the squirrels are more likely to find. Several squirrels found dead on the roads, it's a fact that there is habitat loss and fragmentation which threatens the Persian's squirrel population.

Keywords: Persian squirrel, *Sciurus anomalus*, island of Lesbos, distribution, ecology.

Introduction

The Persian squirrel (*Sciurus anomalus*) Gueldenstaedt, (1785) (Figure 1), is the only species of the squirrel family (*Sciuridae*) in the Middle east. This species is distributed in Greece, Turkey, Armenia, Georgia, Azerbaijan, Iran, Iraq, Palestine, Jordan, Lebanon and Syria in coniferous and temperate mixed forests. (Harrison & Bates, 1991).

In Greece the Persian squirrel can be found only in the east island of Aegean, Lesbos (Hecht Markou P., 1994). The Persian squirrel (*Sciurus anomalus*), has the smallest body size from all others species of its genus that are found in Europe. The head of the Persian squirrel, the front legs and the tail has a red- brown color and its back is grey- silver. The belly has a yellow- white color and the tip of the tail it's black. (Eustratios D. Valascos *et al*, 2012). The average body size for adult male persons is 40,5cm and for the females is 38,5cm.



Figure 1: Persiann squirrel (*Sciurus anomalus*)

The Persian squirrel is active in daytime as the other species of his genus (Grey squirrel, Red squirrel) and it does not fall into hibernation. The hours that the squirrels are more active depends on the season and the weather conditions. Very little is known concerning the biology and the ecology of the Persian squirrel within its range of distribution. Gavish (1993) gave some field observations about the behavior and ecology at the Mount Hermon.

In this study, main concern is the distribution and the presence or absence of the Persian squirrels the ecology and the behavior that we observe. Also some other habits of the Persian squirrel like its preference in some particular tree vegetation (table 1) and the some threats are also recorded.

Table 1: Species of vegetation that we observed to be consumed by the Persian squirrel

Almond tree	<i>Prunus dulcis</i>
Pear tree	<i>Pyrus communis</i>
Oak tree	<i>Quercus macrolepis</i>
Almond-leaved pear	<i>Pyrus amygdaliformis</i>
Plum tree	<i>Prunus domestica</i>
Walnut tree	<i>Juglans regia</i>
Black pine	<i>Pinus nigra</i>
Shield Clover	<i>Trifolium clypeatum</i>
Terebinth	<i>Pistacia terebinthus</i>
Turkish pine	<i>Pinus brutia</i>

Materials and methods

The study area

The island of Lesbos extends over 1,630Km and it's located in the North east Aegean. (39°, 21'-38°,37', 300'' N and 25°, 49',30''- 26°, 38' West of Greenwich). The island it's volcanic in the west side and its tallest mountain is Mt. Lepetymnos (968m). The island has one of the richest floras in the world thanks to favorable soil and weather conditions. Today more than 1400 taxa (species and subspecies of plants) can locate in the island of Lesbos.

Excluding the west side of the island which is compared to the rest of the island dry and rough without tree vegetation. The east, south and central areas are full of olive trees (11.000.000 approximately), and various tree vegetation (Pine woods, oak trees, chestnuts trees etc.). The main Pine forest species of Lesbos with a wide expansion is the Turkish pine (*Pinus brutia*) and the Black pine (*Pinus nigra*). In the area of Agiasos we can locate one big chestnut forest (*Castanea sativa*).

The vegetation of the island it's mostly some dominant species which include shrubs and brush wood and in the meadows dominant species are the *Sarcopoterium spinosum*, also we can find some evergreen, sclerophyllus types of maqui vegetation, those are shrubs with dominant species the *Pistacia lentiscus* and *Quercus coccifera*. The Persian squirrel as an arboreal species, it depends mostly from the trees, the distribution of the squirrels are related to the presence of some particular trees and from the dispersal of those trees in the island of Lesbos (Hecht-Marcou).

According to studies for the tallest mountains of Lesbos, the squirrels are founded only in the areas that are covered with tree vegetation, even in the top of the mountains, Persian squirrels were found, with the precondition, that the top has tree vegetation. The big variety of the tree vegetation and the plenty water resources in the island of Lesbos, they make it the most suitable habitat for the Persian squirrels.

There is three basic conditions for the presence of the Persian squirrels in one area: firstly, the area has to have rich variety in food resources, secondly the area has to provide security and protection with the brunches of the trees and the leafs and thirdly, the area has to have cavities in the tree trunks for nesting (Hecht- Marcou).The weather and the climate of the island play also important role for the Persian squirrels, because according to Hecht- Marcou, the Persian squirrel likes the warm climate and detest the cold.

Materials

For the fieldwork we use GPS (for collecting our coordinates), binoculars, one notebook (We note the habitat, the tree species, the kind of food, the number of the squirrels observed, what kind of activity they were performing, the area in which we were, if the observation was direct, indirect or a suitable habitat, also we note the time and date, the small habitat and finally the cell on the map (in our grid) in the GIS (Geographical Information System) program, we also use a camera.

Methods

At first we put our data from the fieldwork notebook into the excel program. Simultaneously we use the program GIS in which we separate the island of Lesbos into cells of 2X2 Km (460 in total), and then we put our coordinates (in decimal degrees) from the GPS we had on the field into the GIS program (WGS84).

The direct observations are marked in our map with green dots (23 in total), the indirect observations they are coming from witnesses and food remains (like bitten almonds and pine cones) they are marked with the pink dots (29 in total) and eventually the suitable habitats (the habitats which the Persian squirrel prefers (like mixed forests) they are those marked with the blue dots (37 in total) in our GIS map.

In the GIS program we utilize the corine 2000 (as a layer), the corine layer show us what land use, exists in every area of the island (e.g. olive groves, mixed forests, broadleaf forests etc.) We digitize in total 223 polygons of suitable land uses in the island.

After that procedure we found for each cell (with dots: direct, indirect and suitable habitat) what land cover has and we calculate the percentage (%) for the frequency of the presence of the Persian squirrel in olive groves, mixed forests, broad leaf forests, land covered with agricultural fields, or with natural vegetation, or complex ecosystems of crops, yearly or permanent crops, transitional arboreal- bushy areas.

Results

From the 460 cells of the island the direct observations was in 23 cells, the indirect in 29 and the suitable habitats was in 37 cells, that means that we can meet a Persian squirrel in 89 cells. Of course that's not absolute. The rest 371 cells, is mostly areas of the west island of Lesbos, pine forests (They prefer mixed clumps, not just pine trees) and some pieces of the sea (it was inevitable some cells of our grid to contain sea, because the island has two gulfs and the coastline). The West part of the island it is composed mostly by pasturage lands it looks like a moonscape, without tree cover (few oak trees and shrubs), so it cannot cover the needs of the Persian squirrels. In other areas like the pinewoods we cannot either find Persian squirrels, because the pinewood alone can't cover the needs of the Persian squirrels, they need a variety of food (not only pine cones, but also pears, plums, almonds etc.) and they cannot nest the pines, they prefer olive trees (*Olea Europea*) for that purpose or even oriental planes (*Platanus orientalis*). Suitable habitats for the Persian squirrel, considered the mixed clumps of trees, like e.g. the edge of a pinewood that another tree vegetation begins (like olive trees). Also the olive groves isn't such a suitable habitat without some other trees inside them, trees like almond trees, walnut trees, oak trees and other fruit trees.

According to the general idea of the subpopulations (Levins 1970), the probability for one subpopulation to extinct is reduced when one habitat reduces but on the contrary the probability of one subpopulation to extinct increases with the isolation of the habitats (fragmentation). Furthermore other characteristics of the landscape like roads, tree fences and ditches can affect positively or negatively to the dispersal movements between the occupied and the empty habitats. The fieldwork was started at 23 of May and finished in the 15 of October 2014.

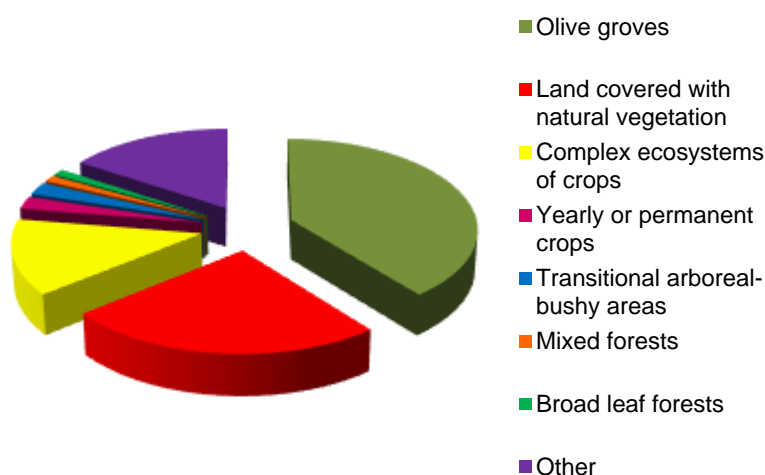
The frequency of the presence from Persian squirrels in percentage (%) is given on the table 2 and in the figure 2 we see the results in pie form.

We observe that even though the mixed forests it's the preference of the Persian squirrels, has a very low percent of use, that is because in the island exists only one mixed forest, but we can't find many mixed clumps of trees into the olive groves.

Table 2: The land covers and the percentage that the Persian squirrels use, according to our results

Land cover		%
Olive groves	35	39,3
Land covered with natural vegetation	22	24,8
Complex ecosystems of crops	12	13,42
Yearly or permanent crops	2	2,25
Transitional arboreal- bushy areas	2	2,25
Mixed forests	1	1,14
Broad leaf forests	1	1,14
Other	14	15,7
Total:	89	100

Table 3: The percentage (%) of the land use in pie form



Discussion

In some touristic areas like Molyvos the Persian squirrels was familiar with our presence and they wasn't cautious at all, they just continue their activities. Others however, when they realize our presence, they climb in the trees immediately with their tails ablaze (sign that they was scared) and when we look in another direction they vanished. They are quite sociable with their family (mother and young) and they like to play and chase one another around. They are more active in the morning and evening hours but we noticed that many of them they were active at noon (14:00-16:00) too, that could be happening because the human activities stops in noon. Moreover we noticed that the Persian squirrels "follow" the fruiting of their favorite trees. In the middle of June they move from the pines into areas with almond (*Prunus dulcis*), pear trees (*Pyrus communis*) and some species of peach trees (e.g. *Prunus domestica*).

In the end of August they move in the walnut trees (*Juglans regia*) and in the end of September they move again in the pines. That entire movement precondition that the squirrels must move also their nest too. We observe that the Persian squirrels have a special taste in almonds and according to the witness of local people they are every summer in the almond trees. It wasn't easy to locate a Persian squirrel, it's a clever and very quick animal and the most of the times doesn't tolerate our presence, so we forced to visit the same area several times, to observe just one, or gather some clues (like bitten almonds and pine cones). <<For the indirect observations, the fresh remains of pine cones it's affine indicator of the presence or absence of the Persian squirrels>> (AMR *et al*, 2006) (figure 2). We collected several witnesses which they said that the population of the Persian squirrels is in decline, compared to the past (before 20 years). <<The public educational efforts will be very important for the conservation>> (Wilshusen *et al*, 2002, ABI-SAID, 2006).



Figure 2: Bitten Pine cones in the tree

The 85% of the people we ask about the Persian squirrel, they didn't know that it's a unique species for Europe which we can see only in Lesbos. Very few know and even less people appreciate the value of this species which helps in the natural regeneration, in the contrary the local use to eat the squirrels or shoot them for fun, the people consider them as a pest.

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