

The Effect of The of Woodland Animals on The Distribution of The Yew Tree

Research Question:

Is distribution of *Taxus baccata* (yew tree) affected by distribution of woodland animals, measured as percent overlap of distribution of yew tree and wood animals; badgers, roe deer, blackbird, in Anatolia?

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Introduction

Every plant has its own method to spread through the world to increase its population density. In this essay I would like to explore how *Taxus baccata* (yew tree) spread through the world by the help of the woodland animals. This tree is primarily grown as an ornamental. The common yew, unlike many other conifers, does not produce seeds in a cone. Instead, each seed is protected by an aril, a red, fleshy, berry-like structure with an open tip. Most parts of the plant are poisonous, and consumption of the foliage can result in death.

Over the years animals and plants have always interacted, either in a good or a bad way. The Yew tree depends on woodland animals, such as deers, birds and badgers, to spread its seeds. It has shining red berries, which is where the seeds are. The berries are noxious to people and most warm blooded animals, the bright red color could be a handy warning. But the color too draws in the proper woodland animals. It makes a difference birds, badgers and deers discover the berries more effectively. They eat them and spread the poisonous seeds to more open regions in their poop. They swallow the entire berry, but as it was processed the sticky external coating. The noxious seeds pass through their framework undamaged and develop into new yew trees. (1)

The yew tree (*Taxus baccata*) is actually considered of least concern, but in Germany, Austria and Iranian it is in the red list. Not only these but in England there is no population left. Currently the largest and most important populations are in Turkey, Georgia and Russia. According to Russian sources, there is a population of 130 badgers in the Caucasus mountains. (2)

The yew tree (*Taxus baccata*) in Turkey is found in the Black Sea (Euxine) province of the Euro-Siberian phytogeographic region. especially in humid, shady areas. This Euro-Siberian species is also found in the Mediterranean and Aegean regions. in deep valleys and secluded, humid areas with plants shaping small communities. It is also found in small clusters in the province of Hatay in the Amanos mountains, in the province of Çanakkale in the Kaz Mountains, and in the province of Denizli on Akdağ Mountain. In the Black Sea region, it is found in the forests of Rize. Kurtün (Gümüşhane), Aynacık (Sinop), Yenice (Zonguldak), Düzce, Bolu and Demirköy. An evergreen, the yew can grow as high as 20 to 25 m and as wide as 1 to 2 m. Its bark has deep fissures. The flowers are unisexual and occur on different trees. After pollination, the female flowers shape arils. (3)

In 2016, the Yew tree (*Taxus baccata*), dated to the Bronze Age in Zonguldak, turned out to be the oldest known tree in Anatolia. The tree was also among the five oldest trees in the World, which is 4112-year-old. Murat Yıldız discovered it in the laboratory by analyzing the annual rings. The tree is

still very healthy and can live for at least 4,000 years if it is not destroyed by people, according to one of the encouraging findings of the inquiry. (4)

All things considered, the common yew's wood has been utilized for different curios, like instruments and longbows, yet because of the tree's sluggish development, it is at this point not of any business interest, except of pharmaceutical companies (for taxol). The tree is lenient to continued pruning and subsequently profoundly esteemed for supporting and shrubbery purposes in parks and recorded nurseries. Recently, substances from the species have been tried in the improvement of malignant growth medicines.

Normal yew is open minded to conceal and is regularly found in the understorey of backwoods stands. It can live on packed soils and rough landscape. The tree develops on most soil types, as long as they are very much depleted, however is touchy to durable times of helpless waste and ice. (5)

That's why I wanted to do research on this tree to see why it is considered differently in different regions. Therefore, I think it is necessary to determine how this tree spread around and work on its reproduction.

But the main reason is that our family lost a very important person to cancer, and researchers from Bartın University discovered a large amount of Taxol, a powerful anticancer ingredient, in 17 different populations of endangered yew trees in their trials. Faculty of Forestry, Department of Silviculture, Professor. Dr. Halil Barış Özel and Marmara Forestry Research Institute, Dr. In the research conducted by Mesut Tandoğan, important results have been achieved that will be a glimmer of hope in cancer treatment. (6) That gave me hope and realization of the importance of the yew tree.

Image 1: Yew tree and its berries



Nature is self-serving, and most self-serving of all are her plants. Splendid and sparkling berries bait creatures to eat them, so the endurance of the plant species is guaranteed. As such, the birds and different animals that feed on the shining, eye-getting products of rowan, blackberry, and the wide range of various pre-winter berry-carriers are working for the plant. A couple of hours subsequent to eating its delicious feast, the creature stores the seed (with a heap of treating droppings) in another area, at a protected separation from the parent bush or tree. With any karma, that spot will give a pleasant spot to the seed to grow, and with less consideration from the irritations and infections that might have developed in the dirt around the mother plant. (7)

Animals That Fed From The Yew Tree

All of the animals I have described below are fed from the yew tree, although the yew tree are not their main food source. (8) Although all of these animals are fed from yew trees, they are not frequently found in Anatolia, but since the distribution maps of the yew tree are similar, I decided to look at the distribution maps of these animals.

Badgers (*Meles meles*)

Image 1: A badger (*Meles meles*)



Badgers are rarely found in the wild regardless of their sound populace size, boundless conveyance across central area Scotland and effectively unmistakable structure. This is to a great extent because of their nighttime propensities and general bashfulness. These exceptionally friendly creatures have unmistakable gatherings of people, normally of four to six grown-ups. Badgers live in organizations of underground passages called setts, and most gatherings of people have various setts in the region they use. Most significant is the primary sett, where reproducing and most other action happens. You can detect a sett by its enormous doorways and hills of exhumed earth outside. (9)

Badgers are artful omnivores with an exceptionally wide eating regimen. They are progressively normal at the Royal Botanic Gardens, Kew, having started in Richmond Park. The greater part of the encompassing vegetation comprises of outlandish bushes and grass, however there are a few huge yew trees (*Taxus baccata*) that organic product lavishly. This showed that they were eating the whole leafy foods were going through the badger's framework, as proven by excrement pits brimming with defecation containing the remaining parts of yew arils with flawless seeds inside a couple of meters of the yew trees and setts. Badgers can eat yew 'berries' without risk of punishment, with a large portion of the harmful alkaloids being held in each solid seed encompassed by its adhesive aril as it goes quickly through the stomach. (10)

Roe Deer (*Capreolus capreolus*)

Image 2: A roe deer (*Capreolus capreolus*)



Roe deer exist single or in little gatherings, with bigger gatherings normally taking care of together throughout the colder time of year. At particularly high densities, groups of at least 15 roe deer can be found in open fields throughout the spring and summer. Guys are occasionally regional, from March to August. Youthful females as a rule build up ranges near their moms; adolescent guys are compelled to scatter further abroad.

Their eating routine is changed and incorporates buds and leaves of deciduous trees and bushes, thorn, rose, ivy, spices, conifers, plants, heather, and grasses. (11)

The roe is one of the really local deer of the British Isles, the other being the red deer. Records of them date to before the Mesolithic time frame (6000 to 10000 years BC). Today, roe deer are bountiful all through the British Isles. They are unequivocally connected with forests and have expanded in both populace and dissemination with the increment in forest planting in the twentieth century and key renewed introductions in Victorian occasions. Already, roe deer experienced a practically calamitous decrease due to over-hunting and deforestation. Roe deer are not found in Northern Ireland. Roe deer are especially connected with the edges of forests and backwoods. They are additionally found in regions with brushes, clean, and hedgerows and utilize agrarian fields here as well. (12)

In wintertime, there has been snow cover for a really long time and the temperatures have been amazingly cold. Deers become pushed and starving. They are attacking yards searching for food and they are perusing off the needles on the yews. They are likewise dropping a lot of needles simultaneously. They are clipping delicate closures of deciduous branches with buds off trees and bushes. Yews are toxic, however starving deer can benefit from them and not be impacted. At the

point when the climate warms and the deer are taking care of regularly and have put on weight, they don't go close to the yews. (13)

Blackbird (*Turdus merula*)

Image 3: A blackbird (*Turdus merula*) eating berries from the yew tree



Male blackbirds are altogether dark in shading. Females, nonetheless, are really dull brown, with lighter earthy colored streaks on the bosom. Adolescents appear to be like the completely developed female yet have copper streaks. Guys have a radiant yellow bill and unmistakable yellow eye-ring. Females have a more blunt, yellow-earthy colored mouth.

Worms are a top choice for blackbirds. They can hear development just underneath the ground's surface and chase by positioning their head, listening cautiously. They likewise eat different bugs, caterpillars, fallen organic product, and berries, scavenging on the ground and in the undergrowth. (14)

Our local vegetation is very much outfitted with red-berrying species: other than the mountain debris, the Sorbus class gives us whitebeam (*S. aria*), with its silver-upheld light green leaves. Hawthorn (*Crataegus monogyna*), holly (*Ilex aquifolium*), crab apple (*Malus sylvestris*), canine rose (*Rosa canina*), axle (*Euonymus europaeus*), and guelder rose (*Viburnum opulus*) all have fine, blushing organic products, as does yew (*Taxus baccata*). All aspects of yew is exceptionally poisonous to people, however the berries are eaten by birds with no unsafe impact. The red tissue, or aril, around the seed is eatable, yet the actual seed contains poisonous alkaloids. Birds' stomach related frameworks, in contrast to those of people, can't separate the seed covering, so the poisons are not delivered, and the seed is scattered unblemished in their droppings. Between pre-spring and late-winter. Around then they are significant grub for captured birds, wood pigeons, blackbirds, thrushes, and numerous other flying animals. (15)

Research Question

Is distribution of *Taxus baccata* (yew tree) affected by distribution of woodland animals, measured as percent overlap of distribution of yew tree and wood animals; badgers, roe deer, blackbird, in Anatolia?

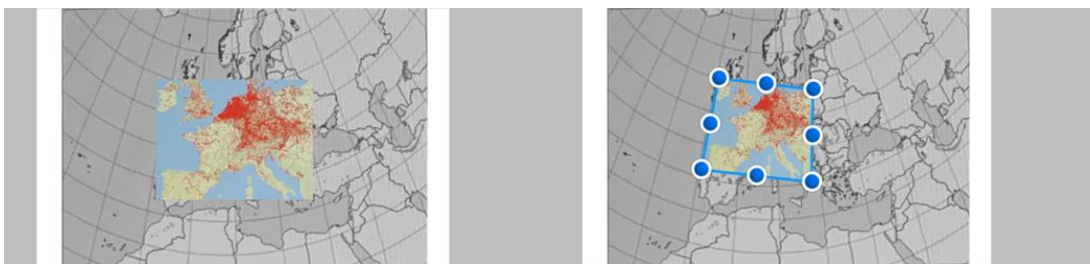
Hypothesis

My hypothesis is that the animals that fed from the yew tree and the yew tree must have similar distribution maps, because the seeds of trees mostly travel by the help of animals. But the animals I am going to look at is not commonly found in the Anatolia.

Procedure

1. For all the species (badgers, blackbird, roe deer) find the perfect map for your research from the database. It is necessary to review many research and previously written theses. You should not move with the first map you find; a more suitable map can be found.
2. Photoshop each animal distribution map onto the yew tree distribution map, to see the overlapping parts (because the scales of the maps are not same, it might not possible them to fit perfectly, so that you should place them as close as possible to the perfect fit). The easiest app for this is called Ibis Paint. You can easily rotate the maps by your fingers just doing the enlarging and belittling movements.
- 3.

Image 4: Procedure of photoshopping the maps



4. Stacked the maps and counted the squares with the roe deer, blackbird, and badgers (separately) on the yew tree map and looked at its ratio in the total squares where the yew tree was located.
5. For this, place a square pattern onto the map. For each map the number of the squares you should place might be differ, so that you should set it up in the best way.
6. Count the squares that has the yew tree (it doesn't matter if the population density dense or not).

7. Then, count the squares that has the overlapping places of animals that is found in the squares of yew tree distribution map, be careful when you count. It is possible to count wrongly, so count a few times to check if it is the correct number.
8. After that, calculate the percentage of overlapping. When making this calculation, the direct proportion method should be used. The formula is,
$$\frac{(\text{number of overlapping squares (both contains animal and the yew tree)} \times 100)}{\text{number of squares that only contains the yew tree}}$$

Data Collection

Image 5: Spread map of the yew tree in Europe (map scale: 1/700.000)

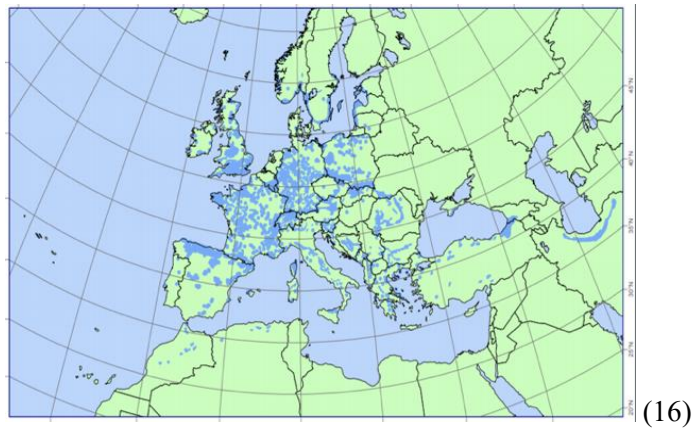


Image 6: Spread map of badgers in Europe (map scale: 1/900.000)

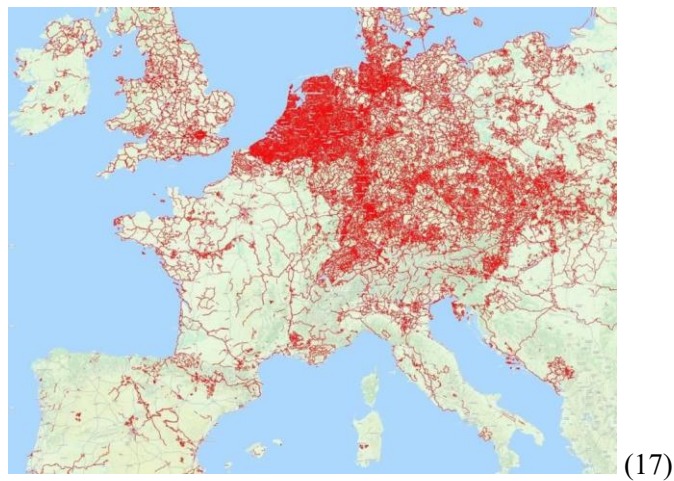
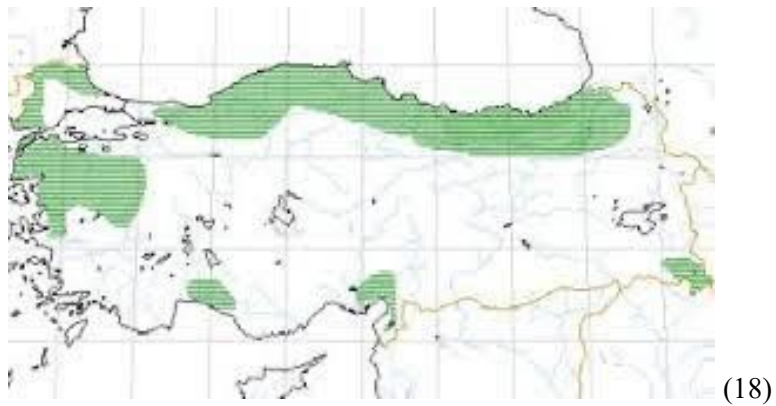
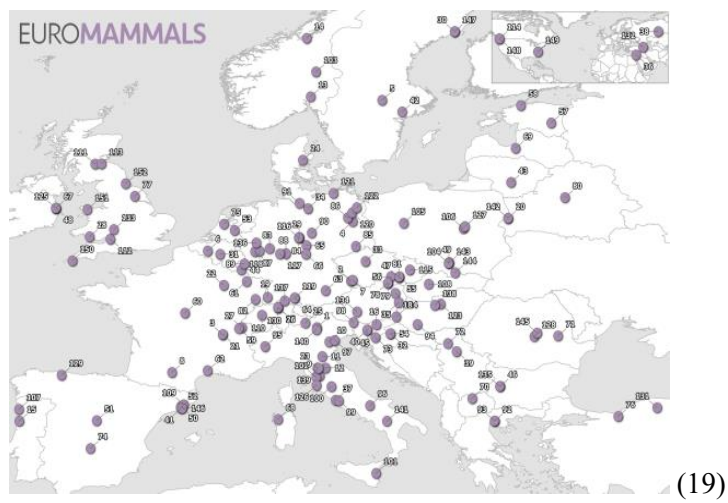


Image 7: Spread map of roe deer in Anatolia (map scale: 1/27.000.000)



(18)

Image 8: Spread map of blackbird in Europe (map scale: 1/1.000.000)

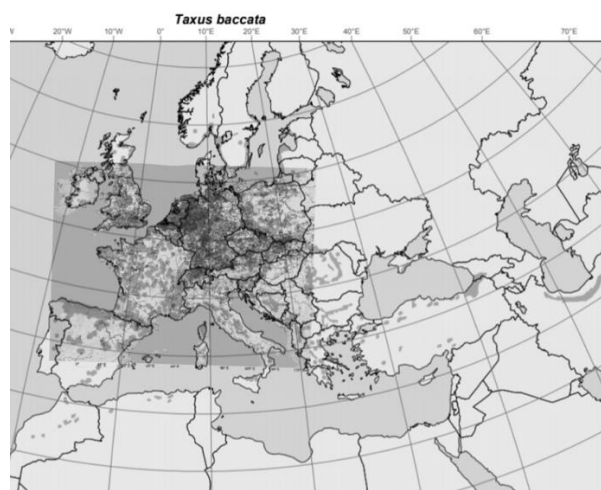


(19)

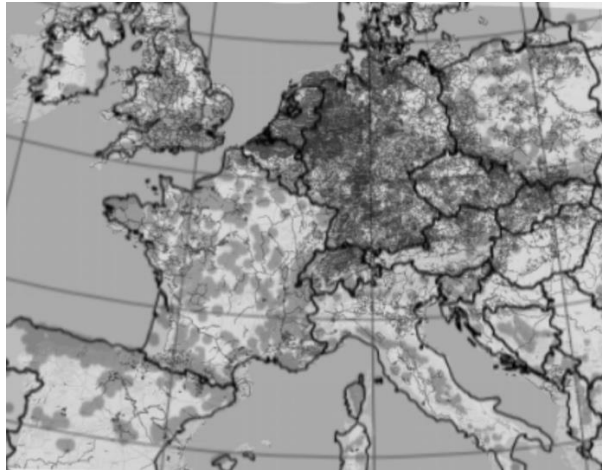
Data Collection & Analysis

Meles meles (Badgers)

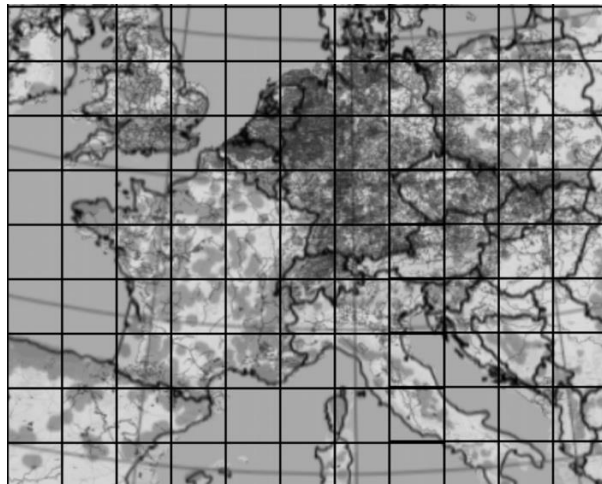
Map 1: Badgers spread map on yew tree spread map (map scale: 1/700.000)



Map 2: Badgers spread map on yew tree spread map (map scale: 1/1.000.000)



Map 3: Stacked maps of yew tree and badgers with square areas (map scale: 1/1.000.000)



Map 4: Stacked maps of yew tree and badgers with red dots which show the places that both species are found (map scale: 1/1.000.000)

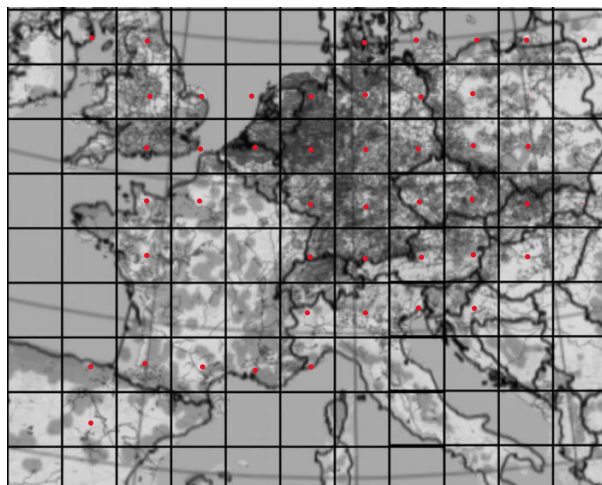


Table 1: Number of squares that contains yew tree and both *Meles meles* (Badgers) & Yew tree in Europe (from map 4)

Name of the Species	Number of Squares That the Species In
Yew Tree	76
<i>Meles meles</i> (Badgers) & Yew Tree	47

- $(47 \times 100) / 76 = 61.84\%$ (the overlapping percentage)

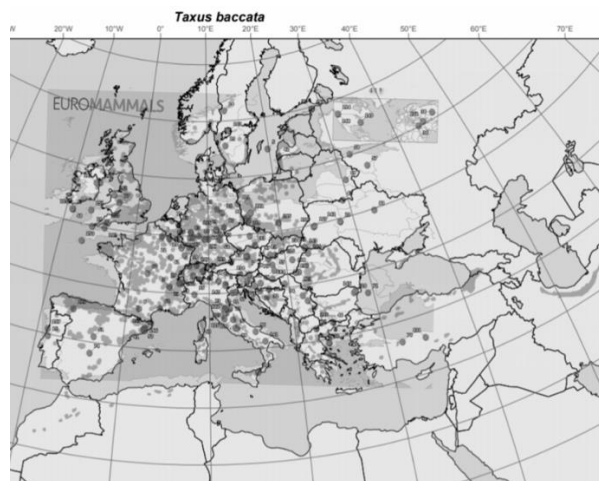
The number of squares that contains the yew tree is 76

The number of squares that contains the *Meles meles* and yew tree is 47

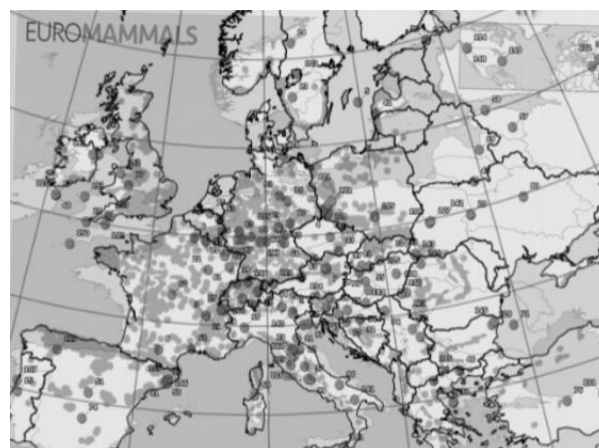
So that, the overlapping percentage is 61.84%

Turdus merula (Blackbird)

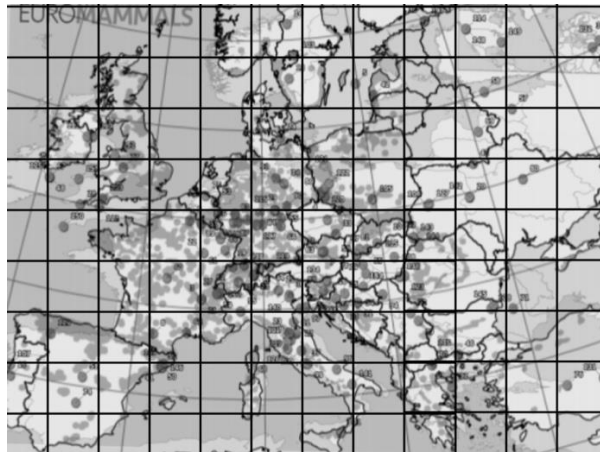
Map 5: Blackbird spread map on yew tree spread map (map scale: 1/700.000)



Map 6: Blackbird spread map on yew tree spread map (map scale: 1/1.000.000)



Map 7: Stacked maps of yew tree and blackbird with square areas (map scale: 1/1.000.000)



Map 8: Stacked maps of yew tree and blackbird with red dots which show the places that both species are found (map scale: 1/1.000.000)

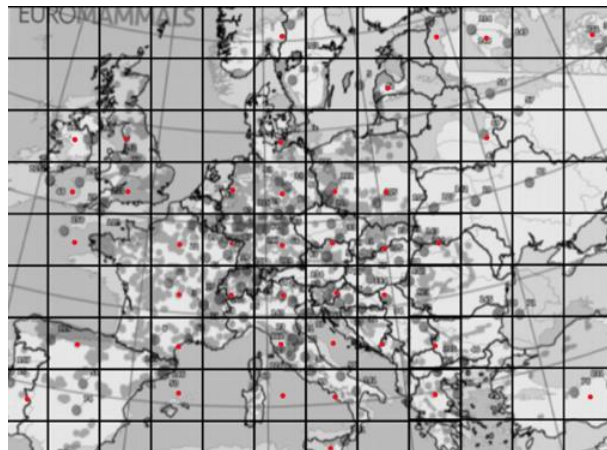


Table 2: Number of squares that contains yew tree and both *Turdus merula* (Blackbird) & Yew tree in Europe (from map 8)

Name of the Species	Number of Squares That the Species In
Yew Tree	78
<i>Turdus merula</i> (Blackbird) & Yew Tree	40

- $(40 \times 100) / 78 = 51.28 \%$ (the overlapping percentage)

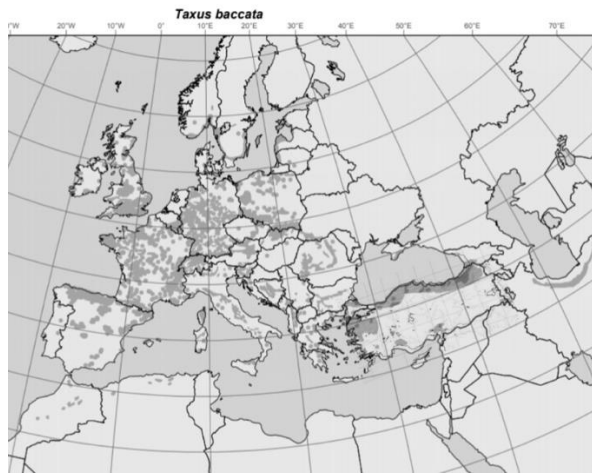
The number of squares that contains the yew tree is 78

The number of squares that contains the *Turdus merula* and yew tree is 40

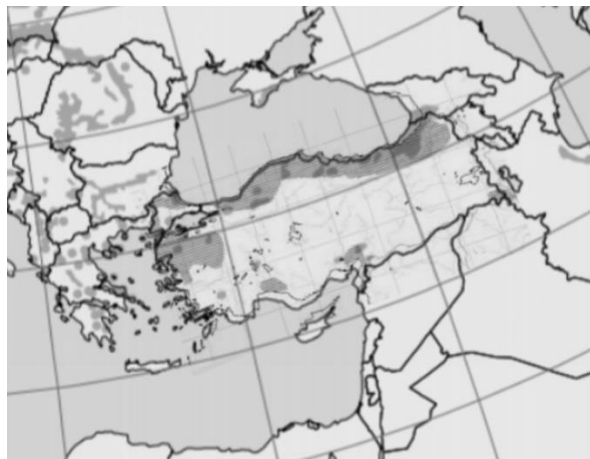
So that, the overlapping percentage is 51.28 %

Capreolus capreolus (Roe deer)

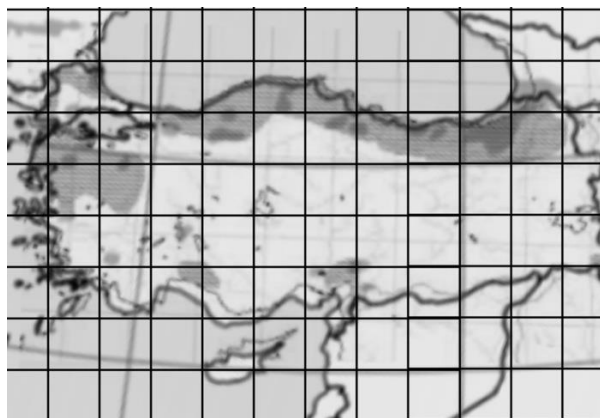
Map 9: Roe Deer spread map on yew tree spread map (map scale: 1/700.000)



Map 10: Roe Deer spread map on yew tree spread map (map scale: 1/9.000.000)



Map 11: Stacked maps of yew tree and roe deer with square areas (map scale: 1/27.000.000)



Map 12: Stacked maps of yew tree and roe deer with red dots which show the places that both species are found (map scale: 1/27.000.000)

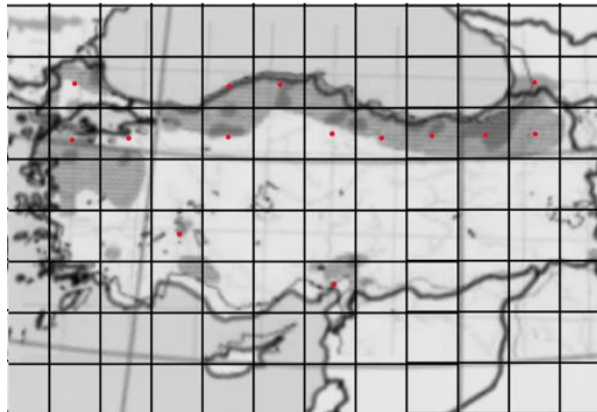


Table 3: Number of squares that contains yew tree and both *Capreolus capreolus* (Roe deer) & Yew tree in Anatolia (from map 12)

Name of the Species	Number of Squares That the Species In
Yew Tree	25
<i>Capreolus capreolus</i> (Roe deer) & Yew Tree	14

- $(14 \times 100) / 25 = 56\%$ (the overlapping percentage)

The number of squares that contains the yew tree is 25

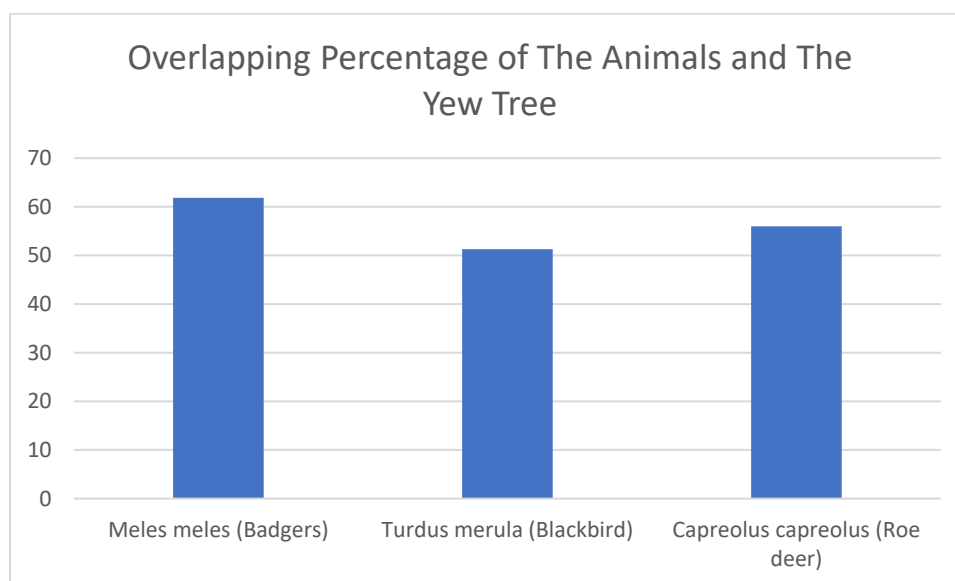
The number of squares that contains the *Capreolus capreolus* and yew tree is 14

So that, the overlapping percentage is 56%

Table 4: Processed data table of the map 4, 8 and 12

Name of Animals That Overlaps With The Yew Tree	Overlapping Percentage (%)
<i>Meles meles</i> (Badgers)	61.84
<i>Turdus merula</i> (Blackbird)	51.28
<i>Capreolus capreolus</i> (Roe deer)	56.00

Graph 1: Overlapping Percentage of Animals and The Yew Tree



Results & Discussion

As we look at the Map 4, Map 8 and Map 12 we can see that the distribution is very similar. The widespread places for the yew are common for badgers, blackbird and roe deer; and the rare places for the yew are rare for the animals too.

For badgers and blackbird the widespread areas are mostly the middle of Europe (Germany, France, Belgium, Netherlands, etc.) and the rare areas are end of the Europe (the UK, Spain, Portugal, etc.).

The roe deer, it is common in only the Black Sea region of the Anatolia. At the same time, it is clear that the yew tree also only common in that region. Except for the Black Sea region, the only region they both have in common is Isparta and Antakya (the lower red dots in Map 12)

Animals often stay in places available to them, that is, where they can survive and feed themselves. In this article, I wanted to look at the relationship between the animals and their food sources, because animals and their food source plants are in a cycle. Animals are fed to survive, but that is not at all, they bring their continuity to the plant they are fed, although they are not aware of it. For example, in 'Bird functional traits affect seed dispersal patterns of China's endangered trees across different disturbed habitats' article it is said that, the role of bird functional features in endangered tree seed dispersion patterns across damaged habitats. Bird physical qualities may alter the level of species-specific contribution to seed dispersal distance across disturbed habitats, whereas bird behavioural factors may define the species' ecological function in seed removal. (20) An indication of this is that the distribution maps of both species are similar, and in some cases almost the same.

From the overall look to the maps, we can definitely tell that the spread of the animals and the spread of the yew tree overlaps and has really similar distribution maps. So that, my hypothesis is supported. All the animals- badgers, roe deer and blackbird – have an overlap percentage over the 50% (badgers 61.84%, roe deer 56%, blackbird 51.28%), that means that all the animals are connected to the yew tree at some point. So that it is possible for the animals to spread the tree. Also in the other hand, we can also say that animals choose to live in the locations where the yew tree is located.

But the real problem of my hypothesis is that, the region I was looking. The maps that I use are not my own sources, because of that I couldn't find the spread maps of badgers and blackbirds in Anatolia. If I were able to look at the same places for all the animals, and the result came as the same, my hypothesis would be fully supported by evidence.

Evaluation

As a student, I came up with this procedure in the simplest way, but there are more complex modeling methods of this type, but the basic logic is the same which is comparing the maps and calculating the percentage of the overlap. While I was trying to find a procedure, I had a really hard time, but I feel like because of this I did develop myself about problem solving and expand my point of view.

Weaknesses in the study include the possible error that comes with this procedure, because of the low quantity of the data and human errors. As I said before, I was able to only look at the maps that I found on the database. The maps that I use are from some other people's researches, and because my study is dependent on the database, I was unable to find the exact maps and data that I want. For example, I only did want to look at Anatolia but, because there wasn't any research beforehand, I had to expand the area. Then, I thought I should only look at the Europe region. After these problems, I try to search for another way of doing this research but the ways that I found all were way too unapproachable for me to do.

Conclusion

This research investigated the research question: Is the distribution of *Taxus baccata* (yew tree) affected by the distribution of woodland animals, measured as percent overlap of distribution of yew tree and woodland animals; badgers, roe deer, blackbird?

Generally, trees spread more to the environment with the help of animals. In this study, it was investigated whether three animals, roe deer, blackbird and badger, have an effect on the distribution

of this tree. To investigate this effect, the distribution maps of the animals and the yew tree were compared and an overlapping percentage was found for each animal, all with percentages above 50%. Thus, at some point, it can be deduced that the animals affect the distribution of the tree and that the tree provides a habitat for the animals. In other words, the similarity of the distribution maps to a large extent creates mutualism for the tree and each animal, helping both living things to benefit both parties. Which means distribution of *Taxus baccata* (yew tree) affected by distribution of woodland animals.

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