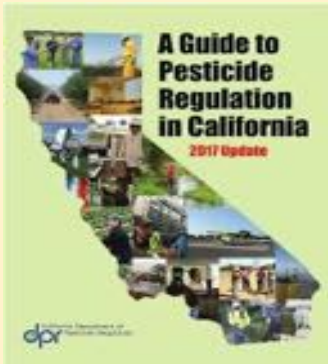




Influence of Pesticides on Bird Population in Santa Barbara

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Background information

- **Pesticides:** a substance used for destroying insects or other organisms harmful to cultivated plants or to animals.
- Many cities around the world, including Santa Barbara, CA, have begun to place restrictions on pesticide use.
- Studying the direct effect pesticides have on bird populations can lead to developing laws that will prevent bird decline.



(Rosenburg et al., 2019)



Background Information

Townsend's Warbler

-Habitat:

Coniferous forest

-Diet: insects and spiders



Red Winged Blackbird

-Habitat:

Fields

-Diet: insects and seeds



Song Sparrow

-Habitat:

Fields

-Diet: insects and seeds

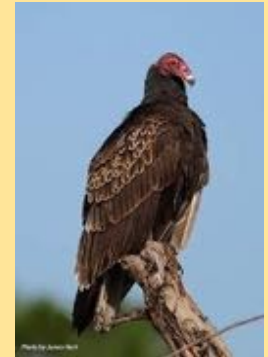


Turkey Vulture

-Habitat:

Fields

-Diet: carrion and human garbage



Research Findings

- Bird population **decline** has been linked to the **increased** use of pesticides around the world (American Bird Conservatory, 2020).
- Pesticides effect **almost all** species of birds in heavily agricultural areas (Thompson, 2014).



Research findings

- In general, bird populations across the country are quickly declining in all biomes, except wetlands (Rosenburg et al., 2019).
 - Suspected reasoning is due to the increased use of pesticides in agricultural areas
- Birds either **directly** feed on pesticide-filled vegetation, or feed on insects or rodents affected by pesticides, in turn **affecting the wellbeing of birds due to the unwanted chemicals in their bodies** (Royte, 2017).



Research Findings

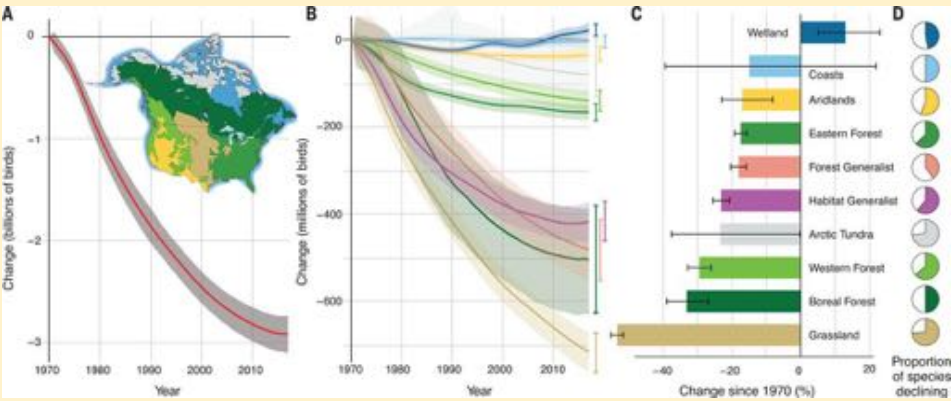


Figure 1. Average bird population in different biomes. Bird populations decline in every biome except wetlands.

Rosenburg et al., 2019. Gro Intelligence, 2018.

US Farmers Spend a Significant Amount on Inputs

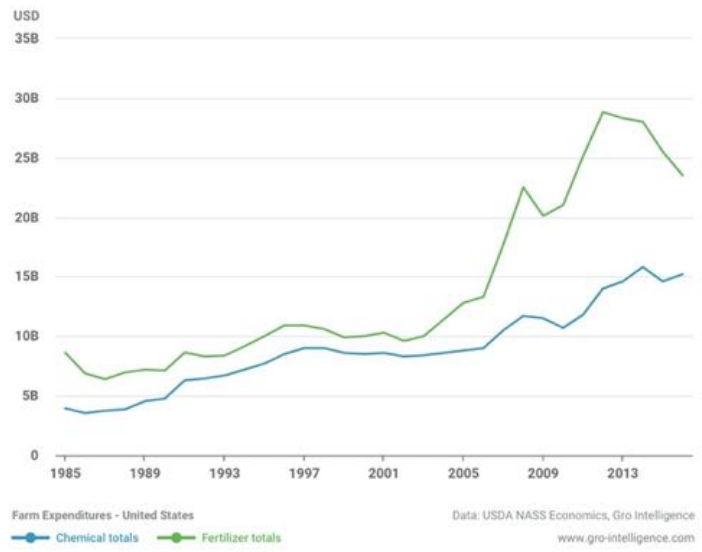


Figure 2. Spendings on chemicals and fertilizers by farmers from 1985-2013. Both total spendings increased over the years.

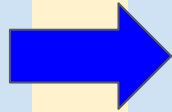
Questions and hypothesis

- **Questions:** Does the use of pesticides play a role in four bird species? Will areas with decreased pesticide use have a greater bird population?
- **Hypothesis:** The bird population in Santa Barbara will be greater post 1997 due to regulations created to decrease pesticide use.

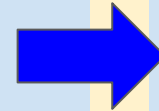


Methods

#1. Bird species were gathered from eBird to ensure both were present in Santa Barbara and the Virginia control.



#2. Data was collected from Christmas Bird count.



#3. Data analysis of data points and graphs were constructed in excel to compare Santa Barbara to control.

The eBird logo, featuring the word "eBird" in a green and black font.



Data needs

- Data must be collected regarding pre and post 1997 in which the targeted location did and did not use pesticides countywide.
- 1990-2019 was the available range for bird counts.
 - This time frame was chosen because the county Santa Barbara passed a regulatory law on pesticides that year.
- Observational studies such as the Christmas bird count data has counted bird species in various locations over 20+ years
 - Can be used to see the rise or decline in bird populations in Santa Barbara with the change in pesticide regulations.



Data sources

- Christmas bird count will be used to find specific species counts for the townsend warbler, turkey vulture, song sparrow, and red-winged blackbird
 - Santa Barbara (examining pre and post 1997)
 - Waynesboro, Virginia (used as control; no pesticide laws)



Analysis

- Data of the species count number per year from Christmas bird count was be organized in Excel.
 - T-Tests were performed to compare bird populations of each species in each location pre and post 1997.
- Limitations
 - Limited bird count data for given location available pre pesticide band



1990-2019 Bird Population Data

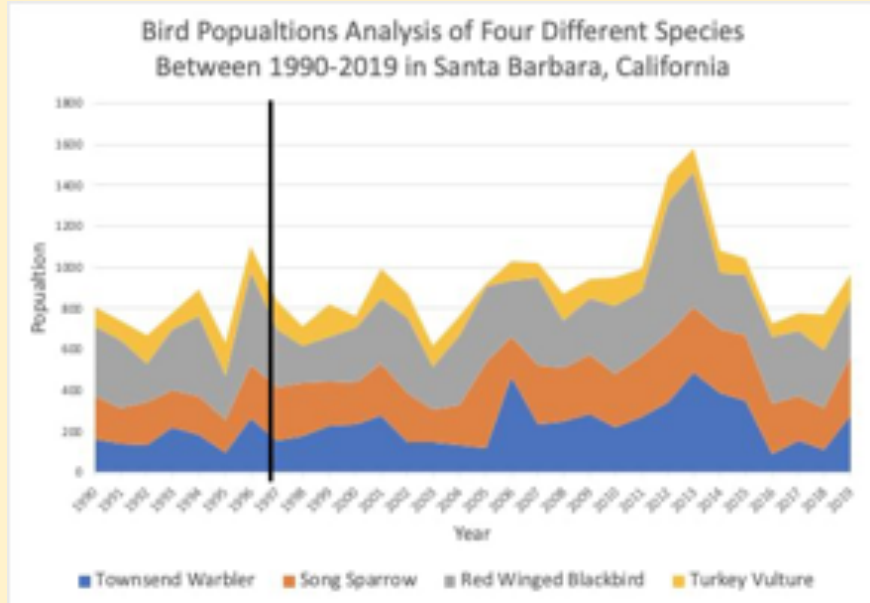


Figure 3. Bird Population Analysis of Bird Species Over 30 Years in Santa Barbara, California.

The black line at 1990 represents when pesticides were banned in Santa Barbara, California. Data was collected from Christmas Bird Count Database from the 1990-2019.

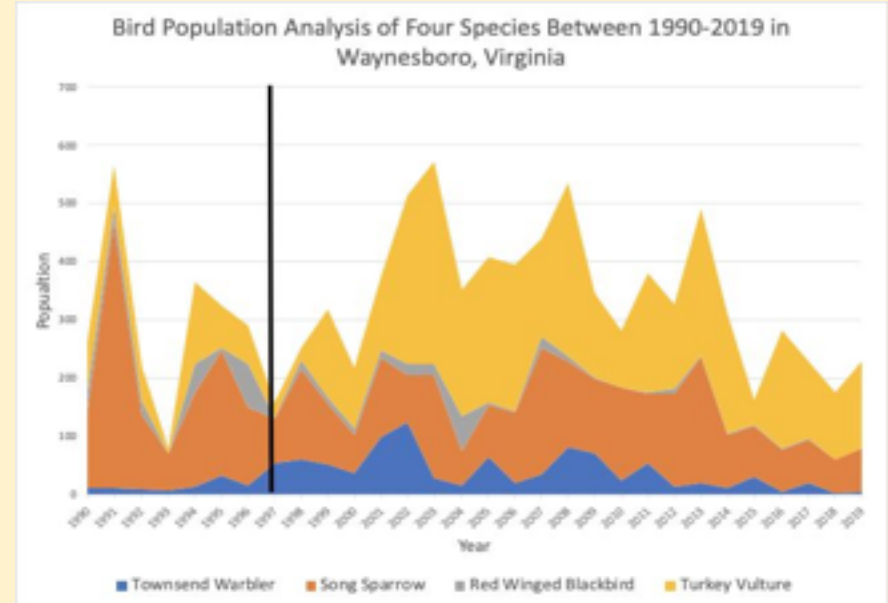


Figure 4. Bird Population Analysis of Bird Species Over 30 Years in Waynesboro, Virginia..

The black line at 1990 represents when pesticides were banned in Santa Barbara, California. Data was collected from Christmas Bird Count Database from the 1990-2019.

Pre and Post 1997 Data

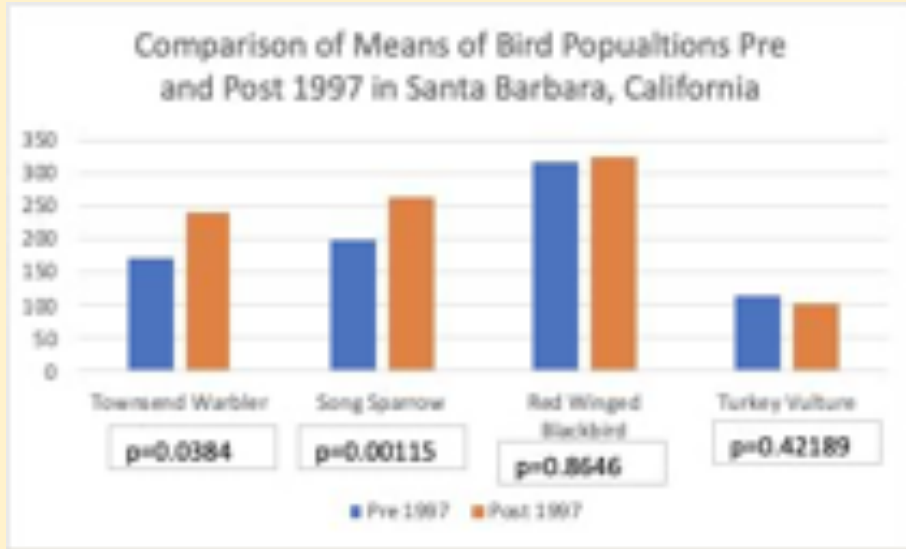


Figure 5. Bird Population Pre and Post 1997 in Santa Barbara, California. Data was retrieved from Christmas Bird Count Database determining the number of each bird species population and averaging them to determine pre and post 1997. The p-values less than 0.05 are highly significant.

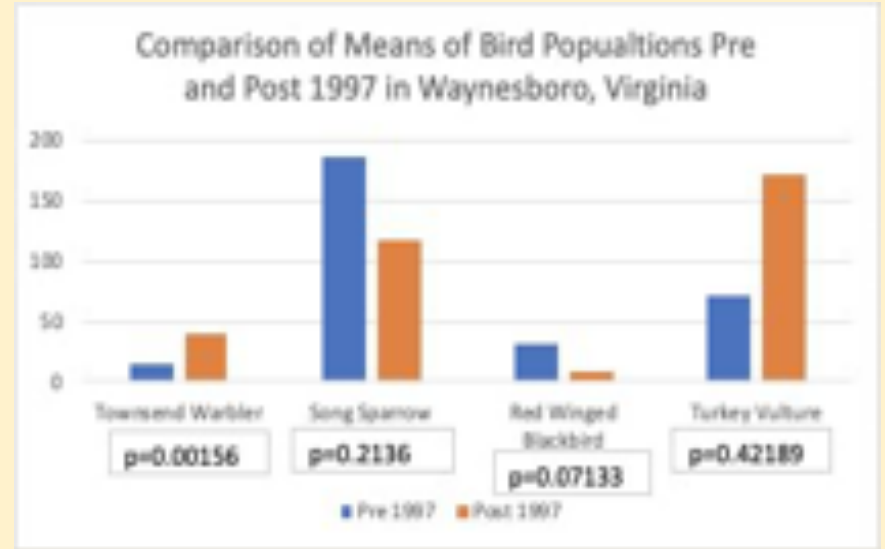


Figure 5. Bird Population Pre and Post 1997 in Waynesboro, Virginia. Data was retrieved from Christmas Bird Count Database determining the number of each bird species population and averaging them to determine pre and post 1997. The p-values less than 0.05 are highly significant.

Results (Figure 5)

- Santa Barbara, California (NO PESTICIDES)
 - Warbler: **Increase** in population after 1997 with a p-value of 0.0384 which is **significant**.
 - Sparrow: **Increase** in population after 1997 with a p-value of 0.00115 which is **significant**.
 - Blackbird: **Slight increase** in population after 1997 with a p-value of 0.8646 which is **not significant**.
 - Vulture: **Slight decrease** in population with a p-value of 0.42189 which is **not significant**.



Results (Figure 6)

- Waynesboro, Virginia (PESTICIDES)
 - Warbler: **Increase** in population after 1997 with a p-value of 0.00156 which is **significant**.
 - Sparrow: **Decrease** in population after 1997 with a p-value of 0.2136 which is **not significant**.
 - Blackbird: **Decrease** in population after 1997 with a p-value of 0.07133 which is **significant**.
 - Vulture: **Increase** in population with a p-value of 0.000259 which is **not significant**.



Discussion

- This could build upon the “Decline of North American Avifauna” article to better conclude how pesticides play a role in the bird population declines.
- Compare our results to other studies done regarding pesticides and bird populations in other areas around the world.
 - Examine confounding variables regarding pesticides and bird abundance.



Take home message

- Implementing regulatory laws can increase bird populations.
- Finding trends help uncover which species of birds are most susceptible to pesticides.
- There should be future studies done on areas that have heavier agricultural impact such as Virginia.
- More studies should be done on the effects of pesticides before implementing them on the surrounding ecosystem rather than the target to prevent disruption.



This image represents the feedback loop of pesticides on birds.

Works cited

- Audubon Christmas Bird Count. 2020.
- American Bird Conservatory. Pesticides. 2020.
- Lehman, PE. 2020. THE BIRDS OF SANTA BARBARA COUNTY, CALIFORNIA.
- Rosenburg, KE., Dokter, AM., Blancher, PJ., Sauer, JR., Smith, AC., Stanton, JC., Panjabi, A., Helft, L., Parr, M., Marra, PP. 2019. Decline of North American Avifauna. *Science*.
- Royte, E. 2017. The Same Pesticides Linked to Bee Declines Might Also Threaten Birds. *Audubon*.
- Thompson, H. 2014. Popular Pesticides Linked to Drops in Bird Populations. *Smithsonian Magazine*.