

CAP LTER Data Explorations

Bird Distribution Across Phoenix



Objective(s):

Students will analyze graphs of bird distributions across the Phoenix area and suggest possible causes for these patterns

Author:

Ecology Explorers Team,

Time:

15-30 minutes

Grade Level:

9-12

Standards:

AZ Science Strands: S1C3, S1C4, S3C1, S4C3, S4C4, S4C5

NGSS - Core Ideas: ESS3.A:

Natural resources; ESS3.C: Human impacts on Earth systems; LS1.D: Information Processing; LS2.A: Interdependent relationships in ecosystems; LS2.C: Ecosystem dynamics, functioning, and resilience; LS4.C: Adaptation LS4.D: Biodiversity and humans

Practices: Analyzing and interpreting data; Engaging in argument from evidence; Obtaining, evaluating, and communicating information

Crosscutting Concepts:

Patterns; Cause and effect; Scale, proportion and quantity

ELA: RST7: Integrate content from diverse formats; WHTS2:

Write to convey ideas and information

Math Domains: Number and Quantity; Measurement and Data; Statistics and Probability

Background:

The Phoenix urban core is composed of several contiguous cities and is situated within the Sonoran Desert. This area is being studied by scientists as part of the long-term ecological research network (LTER) funded by the National Science Foundation. Our project, the Central Arizona-Phoenix LTER (CAP LTER) is focusing on researching the effects of urbanization on the surrounding desert ecosystem and vice versa. The Phoenix area is growing rapidly with a population with 300,000 people in 1950 and 3 million+ in 2005. The area receives annual precipitation of 180 mm (6 inches) and can experience summer temperatures as high as 48 C (115 F). The rain comes twice a year (winter & summer), which contributes to the high species diversity of the Sonoran Desert as compared to the North American deserts. Urbanization of this area has led to decreased agricultural development (formerly focused to the west, south, and southeast of the urban core) and increased water control via dams, reservoirs, and canals.

Below are several graphs of different bird species distributions within and around the urban core of Phoenix, Arizona. The bird species include native and non-native species. Red indicates areas with the highest frequency of bird encounter and blue the lowest. These graphs suggest potential 'causal mechanisms' that might explain the distribution patterns found. The data presented here were collected over one year.

Advanced Preparation:

The data presented here are called Krig maps which are based on data taken at specific geographical locations and statistics. This model is called "Kriging" (a type of interpolation) and it predicts what areas around the sampling points might look like. Using this type of model, scientists can look for patterns across a larger area based on the data from their randomly selected sampling sites. This type of graph includes both the actual measures (in this case bird species abundance) at each sampling site and then the predicted number of bird species between the sampling sites. A scale is then applied to indicate the full range from lowest measurement to highest measurement. The graphs presented here use color to indicate points along that range, and it is important to note these colors do not correspond with any particular number, but rather the point within the range of abundance for that species within this study area. The white area in the maps is the Salt River Pima Maricopa Indian Community, no bird species data was collected in this area.

Students should have been introduced to basic information about population and community ecology.

Materials:

Student Worksheets w/ Bird Distribution Graphs

Evaluation:

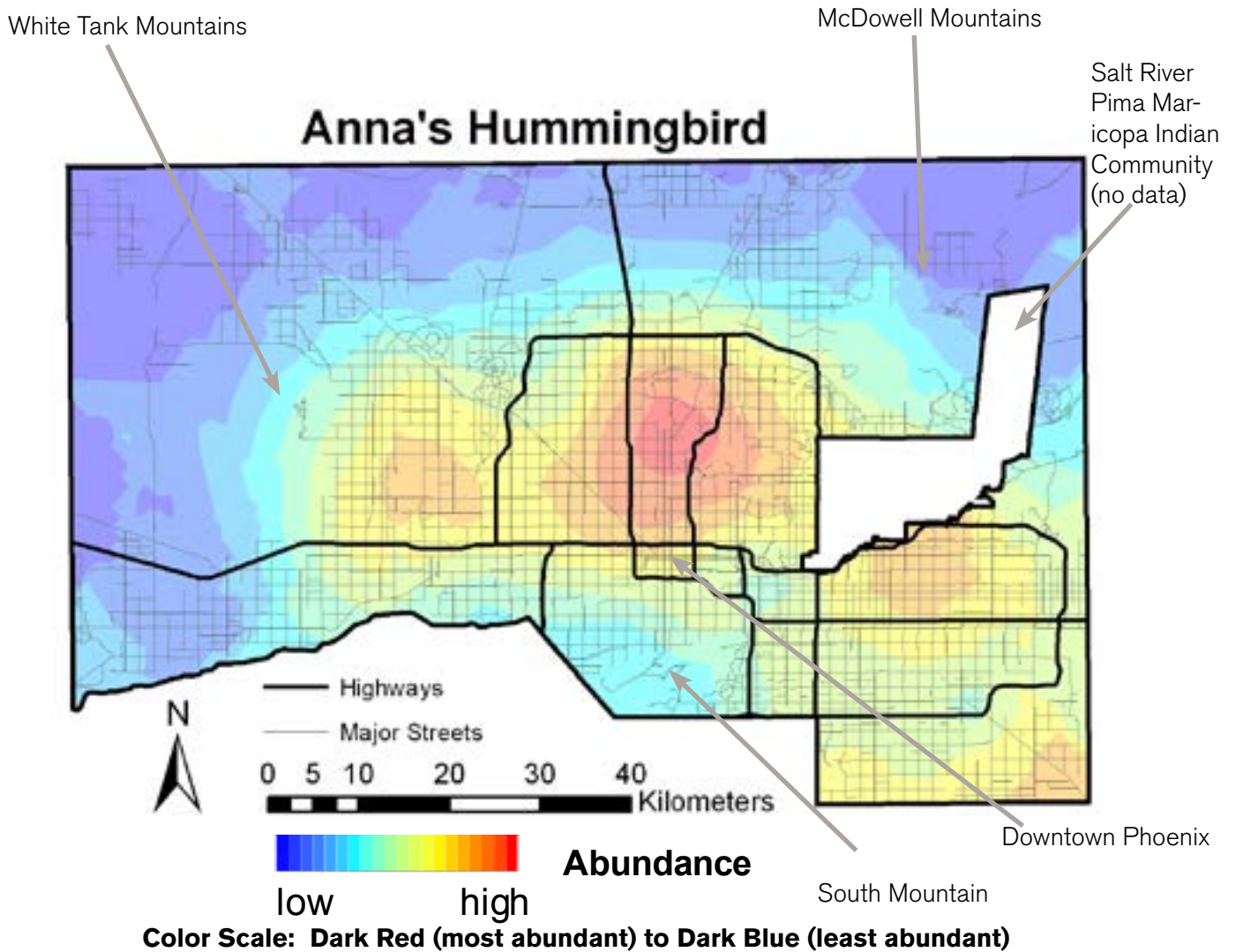
Student responses to reflection questions, and participation during the activity and discussion.

Extensions:

Have students conduct their own observations of birds on campus or at home following the Ecology Explorers Bird Protocol (<http://ecologyexplorers.asu.edu>)

How To Read This Graph/Map of Bird Distribution

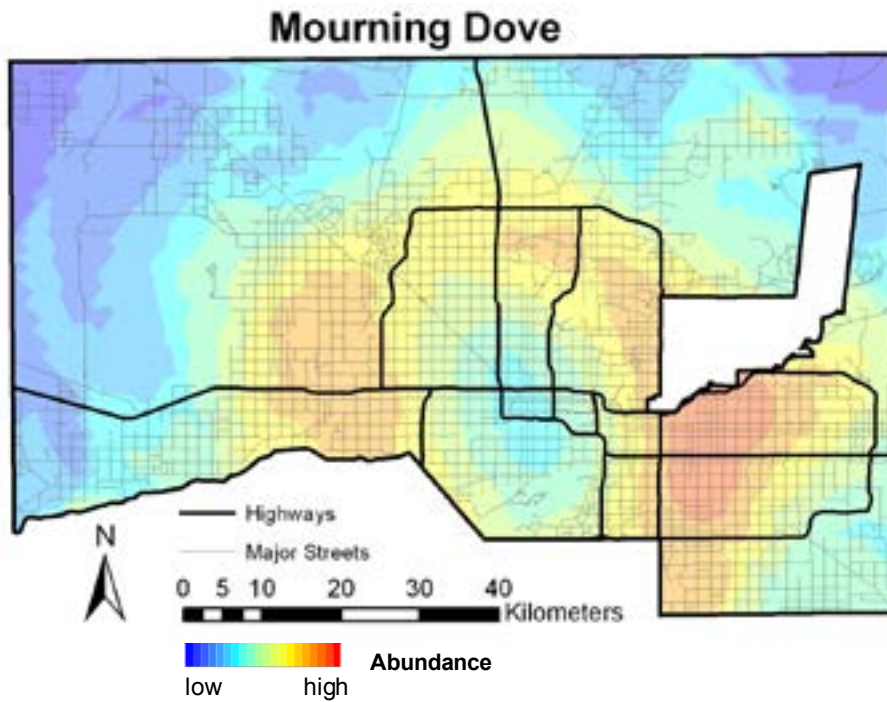
Graph 1



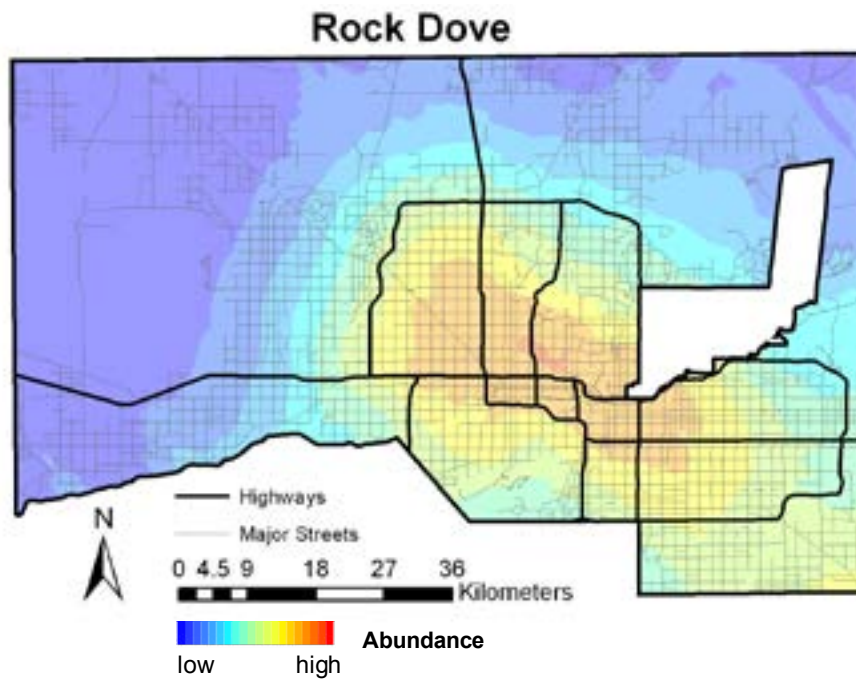
Based on this graph, Anna's Hummingbirds are most abundant in the Phoenix metropolitan area and especially neighborhoods just north of downtown

1. What do neighborhoods in Phoenix have that might attract them (see bird fact page)?

Graph 2

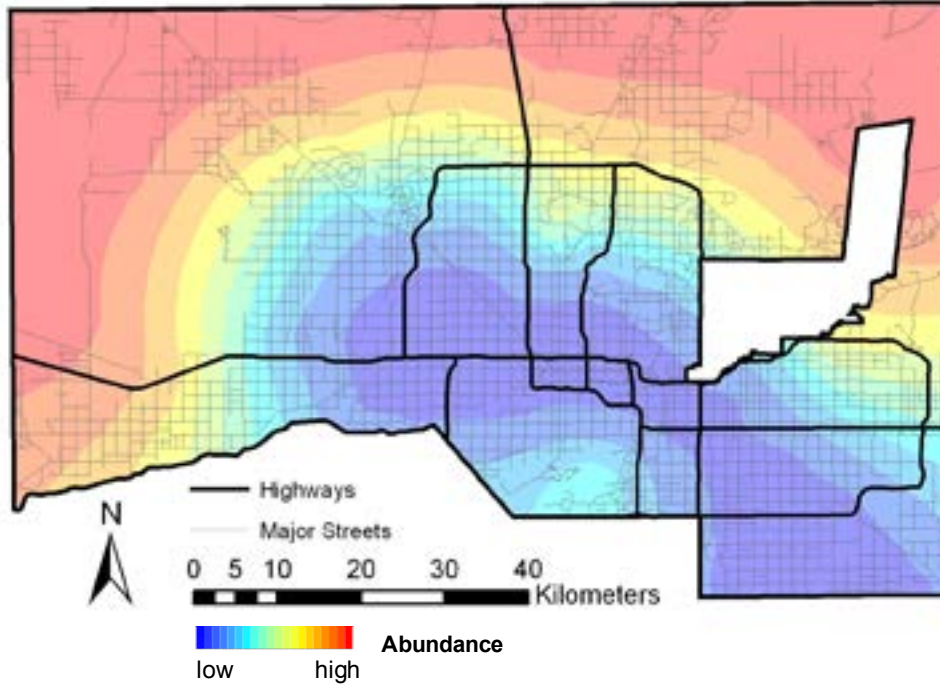


Graph 3



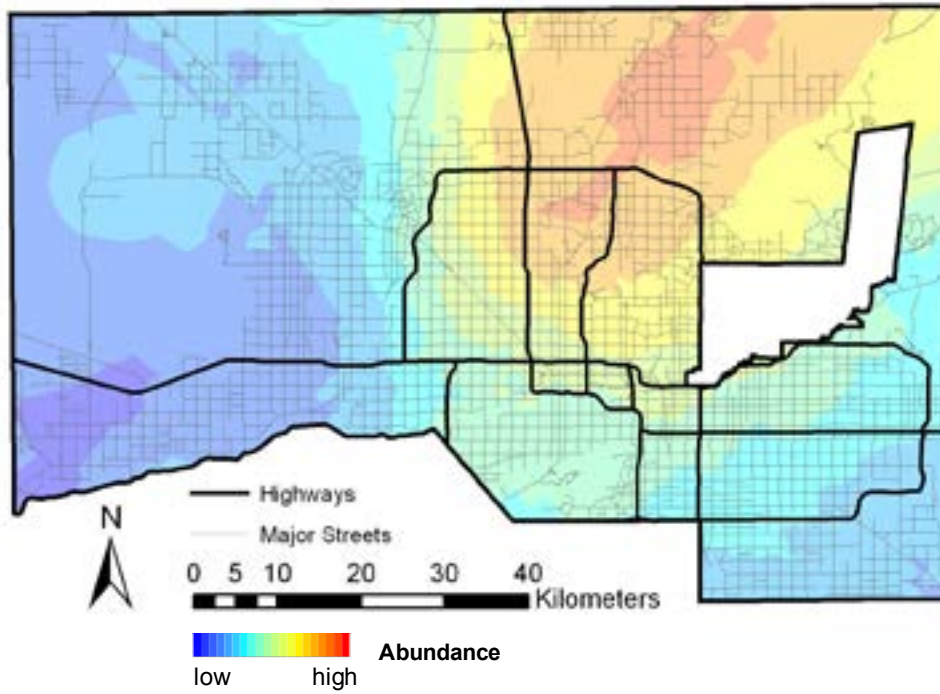
Graph 4

Black-throated Sparrow



Graph 5

Curve-billed Thrasher



Student Worksheet

Bird Distribution (page 4)



Bird Facts

Anna's Hummingbird

Eats: flower nectar, small insects, tree sap, sugar water in hummingbird feeders

Nest: cup-shaped made of spider web, dead leaves, lichen

Other: range expanding due to provision of artificial and exotic floral nectar sources year-round in gardens

Black-throated Sparrow:

Eats: new shoots of grass and forbs, insects

Nests: sturdy, made of grass, plant fibers, lined with fine material

Other: forms small winter flocks with other sparrow species

Curve-billed Thrasher:

Eats: spiders, snails, isopods, berries, cactus fruit, nectar

Nests: mostly in spiny shrub or cactus, bulky, of twigs, grass

Other: remain paired throughout the year in same area used for nesting

Rock Dove/Rock Pigeon (Pigeon):

Eats: seeds, fruits, and sometimes invertebrates

Nest: flimsy platform of sticks on a ledge

Other: feeds on the ground in flocks, non-native

Mourning Dove

Eats: seeds, incl. waste grain from cultivated fields

Nest: located in trees, on ground, or anywhere with support, flimsy, crossed sticks, twigs

Other: has multiple broods, flocks for much of the year

Resource: Ehrlich, P, D. Dobkin and D. Wheye. 1988. The Birder's Handbook.

Student Worksheet

Bird Distribution (page 5)



2. Rock Doves (pigeons) (Graph 3) and Mourning Doves (Graph 2) are both quite common in the city. What might contribute to the generally high concentration of these birds across the city?
- 3) Looking at Graphs 2 & 3. Are both birds most abundant in the same locations around Phoenix? What might account for this distribution pattern?
- 4) The Curve-billed Thrasher (Graph 5) is more abundant to the northeast of the Phoenix urban center where the McDowell Mountains are located. What are three potential characteristics about the mountains and the adjacent suburban development that might attract this species?
5. Of the five species of birds shown in these graphs, explain which bird species would be most negatively impacted by the desert being converted to houses.