

Example 25
Chi-square test of independence
Setup

An ecologist has live trapped small mammals from four different habitats which are close to one another. He has noted that the number of deer mice differs between the habitats and would like to know if the difference is significant.

	Ditch	Cropland	Pasture	Remnant	n
Observed	56	52	25	13	146

Example 25
Chi-square test of independence
Solution

1. State your question: Does the deer mouse occurrence differ between habitats?
 - a. Is it a good scientific question? Definable, measurable, and controllable
 - b. Identify your population: Counts of deer mice
 - c. Identify your dependent variable: Counts of deer mice
 - d. Identify your independent variable: Habitats
2. State your hypothesis set
 - a. Verbal hypothesis: Below
 - b. Statistical hypothesis (H_0 , H_A):
 - H_0 : The occurrence of deer mice does not differ between habitats.
 - H_A : The occurrence of deer mice does differ between habitats.
 - c. Is your hypothesis set exhaustive? Yes
 - d. Is your hypothesis set exclusive? Yes
3. State your significance level: $\alpha = 0.05$
4. Select the appropriate test.
 - a. Variable scale:
 - i. Dependent variable: Nominal (Counts)
 - o Converted or transformed? No
 - ii. Independent variable: Nominal
 - o Converted or transformed? No
 - b. What information is given or available?
 - i. Sample data
 - c. Number of samples: 1
 - d. Are the data paired or unpaired? Unpaired
 - e. What aspect of the variable do you want to compare?
 - i. Goodness of fit
 - f. State the test to be used: X^2 (Test of independence)
 - i. Are assumptions of the test met? Yes
 - o Random samples – Assumed
 - o Independent samples – Assumed
 - o No more than 20% of the expected values are less than 5 and none of the expected values are less than 1.
– Yes

5. Conduct your sampling

	Ditch	Cropland	Pasture	Remnant	n
Observed	56	52	25	13	146

6. Graph the data

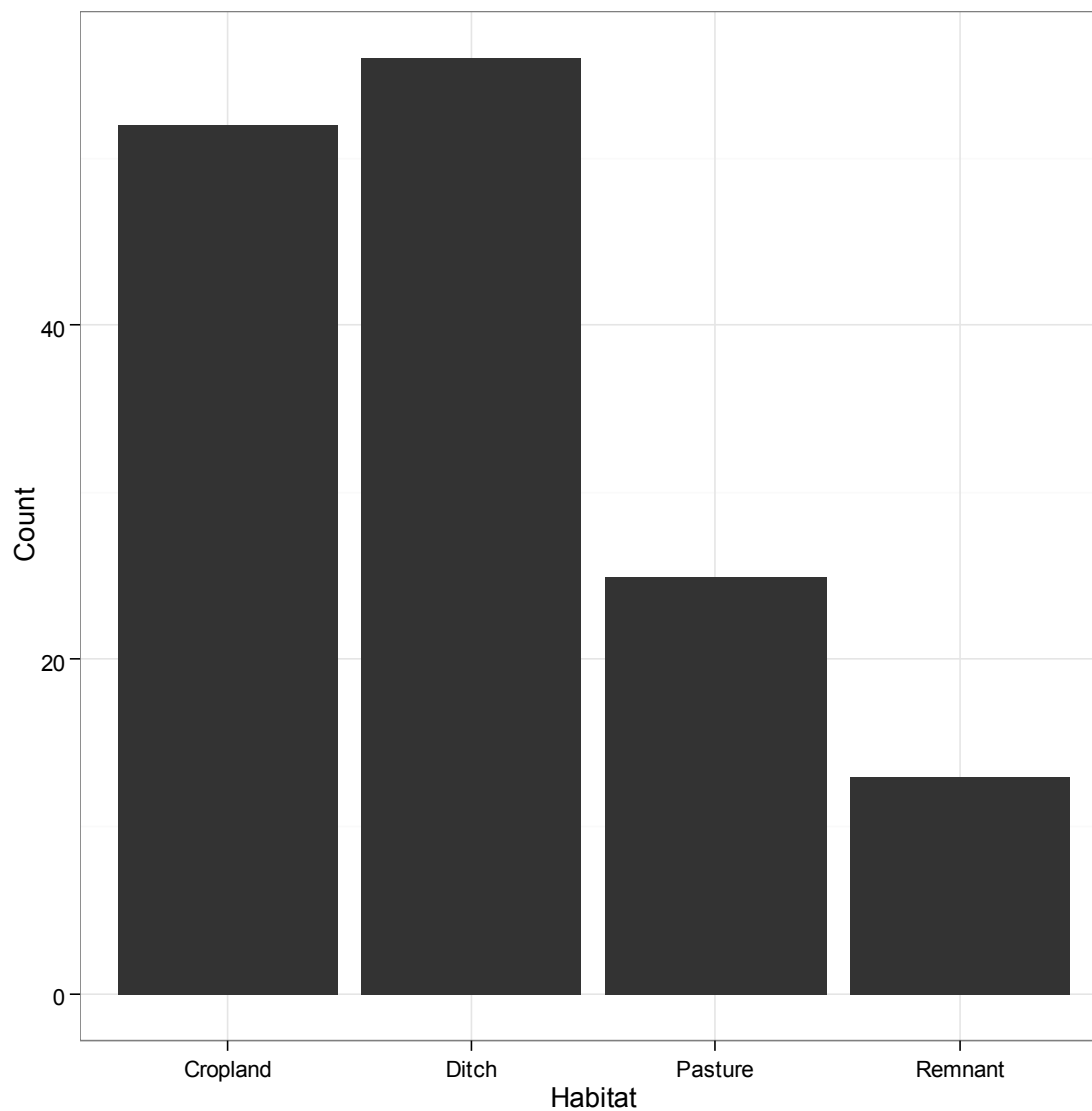


Figure 1. Number of mice live captured in four habitats in western Kansas.

7. Summarize the data (Calculated the expected values).

$$1+1+1+1=4$$

$$1 \div 4 = 0.25$$

$$0.25 * 146 = 36.5$$

	Ditch	Cropland	Pasture	Remnant	n
Observed	56	52	25	13	146
Expected	36.5	36.5	36.5	36.5	146

8. Calculate your test statistic.

Chi-squared test for given probabilities

data: Mice\$Frequency

X-squared = 35.7534, df = 3, p-value = 8.443e-08

9. Retain or reject your null hypothesis based on your test statistic.

The calculated p-value (8.443e-08) is less than the significance level (0.05), so we reject the null hypothesis and retain the alternate hypothesis.

10. Interpret the results in biological terms.

Deer mice are not evenly distributed among habitats ($X^2 = 35.753$, df = 3, $p < 0.001$).