



**Gel Electrophoresis and the Conservation of Endangered Species:  
Plight of the Southwestern Willow Flycatcher**

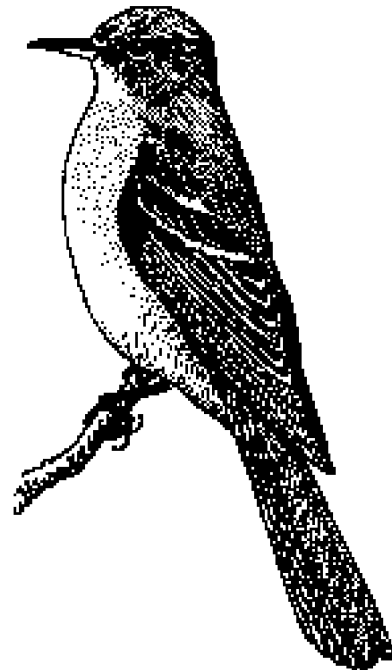
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Molecular genetics can be a highly useful technique for conservation biologists. It is widely accepted among conservation biologists that different populations of the same species have different chances of long-term survival based on a variety of factors, including the amount of genetic diversity in the population. Over time, according to this theory, a population with greater genetic diversity is less likely to go extinct than a population with less genetic diversity. \*

Why do you think populations with greater genetic diversity would survive better than populations with less genetic diversity?

In the following activity, you have been asked to participate in an effort to conserve the last remaining populations of an endangered species of songbird -- the Southwestern Willow Flycatcher (*Empidonax traillii extimus*).

The Southwestern Willow Flycatcher is a passerine bird species, which breeds in dense riparian habitats along rivers, streams, or other wetlands throughout the Southwestern United States, including the extreme southwest portion of Colorado. These habitats are close to water and include dense stands of vegetation such as willow, tamarisk, and Russian olive, often with an overstory of cottonwood trees.



Currently this species is on the Federal Endangered Species List, and various efforts are being implemented to protect existing populations. One potential way to try and prevent local populations from extinction is through restoration of damaged or marginal habitats so that they are better suited to support the endangered species in question.

For this activity, assume that the Colorado Division of Wildlife is going to restore one riparian area in Southwestern Colorado for the purpose of conserving one breeding population of the Southwestern Willow Flycatcher. There are two potential areas for habitat restoration but the state can only afford to restore one.

**Area 1:** A stretch of degraded riparian habitat within a former cattle ranch, which was abandoned after years of over-grazing.

**Area 2:** A fragmented and degraded riparian area where water flow has been restored to full capacity after several years of being diverted to a nearby orchard.

Both Area 1 and Area 2 have small populations (4-6 breeding pairs) of Southwestern Willow Flycatchers.

Your job is to subject both populations to a molecular genetic analysis and make a recommendation to the Colorado Division of Wildlife about which area to restore based on your results.

After several mosquito-bitten days of mist-netting in SW Colorado, you collect blood samples from 8 different birds in each population. You return to your lab, where you extract the DNA and use PCR (polymerase chain reaction) to amplify a section of each bird's genome. Having checked the scientific literature on closely related bird species, you have chosen to amplify an area of the genome, which is likely to be variable in this species.

In order to analyze the results of your PCR amplification, you must use gel electrophoresis.

Set up two gels and gel boxes according to the instructions for "Kitchen Electrophoresis".

In one gel, load and run the eight samples from the population in Area 1 and in the other gel, load and run the eight samples from the population in Area 2.

Label your gels so that you know which sample is in each well.

Run the gels at 100 volts for approximately 20 minutes.

Sketch the results from both gels below.

**Area 1**

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**Area 2**

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Based on your analysis of the populations of Southwestern Willow Flycatchers in these two areas, which of the two areas would you recommend be given priority for restoration?

Why?

Do you think the above data are sufficient to form a sound conclusion as to which population has the greatest genetic diversity? If not, what additional data would you seek?

\*There is some controversy among scientists as to how important genetic diversity is in maintaining stable populations. Critics of the view that genetic diversity increases the likelihood of population survival frequently cite the example of the cheetah, which has survived numerous centuries with almost no genetic diversity.