



# Effects of Hedera helix on the biodiversity of NYC Parks

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## Abstract

Invasive species are organisms that are not native to an ecosystem and cause harm to the environment. Species that grow and reproduce quickly, and spread aggressively, with the potential to cause harm, are given the label “invasive” (The National Wildlife Federation). The question was: how does *Hedera helix* affect the biodiversity of NYC parks? It was hypothesized that the *Hedera helix* will have a negative impact/reduce biodiversity. The objectives were to: collect plant samples from three different NYC parks, Kissena Park, Forest Park, and Crocheron Park, extract DNA from those samples, and compare biodiversity within and between the parks. DNA extractions were made using the Chelex DNA isolation method. Isolated DNA was amplified and sequenced using Gel electrophoresis and Polymerase chain reaction. Trends from the results showed negative impacts of the English ivy on the biodiversity of ecosystems. The hypothesis was supported by the results.

## Introduction:

*Hedera Helix* (English Ivy), is a vigorous, fast-growing, herbaceous evergreen climbing vine that covers and kills trees. The English Ivy is native to Europe, Western Asia, and northern Africa. *Hedera Helix* is able to reach anywhere between 6 to 9 inches in height off the ground and could spread up to 100 feet (Molekule Science). Today, this type of invasive species can be found in many NYC parks and has the appearance of oval leaves that produce yellow-green flowers during the fall and turn black with blue berries in the spring. The English Ivy suffocates other herbaceous plants by growing over them. As a result, the plants covered by English Ivy can hardly carry out photosynthesis and the amount of pressure applied by the invasive species results in imperfect growth of branches and even foliage. (Purdue Extension, 2016). The increased presence of the English Ivy plant reduces the diversity of plant species in an ecosystem due to being a cause of forest regeneration failure from destroying tree seedlings and saplings.

Based on background research, it was hypothesized that *Hedera Helix* will have a negative impact on the ecosystem's biodiversity because it is an invasive species that alters the variety of species and biological communities. The independent variable in this experiment was the location of the parks and the two groups of samples collected in each park. Group A contained *Hedera Helix* spread out more dominantly and Group B was where *Hedera Helix* was also present but not as dominantly spread. The dependent variable in this experiment is the biodiversity present in each of the three parks the samples were collected from. The outcome of the biodiversity is dependent on the plant species used for barcoding.

## Materials & Methods

### Materials

- 10% Chelex Solution (2 tubes of 100  $\mu$ L)
- 2 Sterile plastic pestles
- 6 Sterile toothpicks or pipette tips
- Tissue sample(s) (from Part I)
- 2 Microcentrifuge tubes (1.5mL)
- 2 Microcentrifuge tube locks
- For sample storage: 95%+ EtOH [Ethanol] (2 tubes of 1000  $\mu$ L) or freezer
- Permanent marker
- Mug of boiling water
- Aluminum foil
- Possible: 2 Razor blades, scissor, tweezer, or 2, 10- $\mu$ L pipette tips for tissue removal from specimen
- Ziploc bags
- Scissors
- Something to write with

### Methods

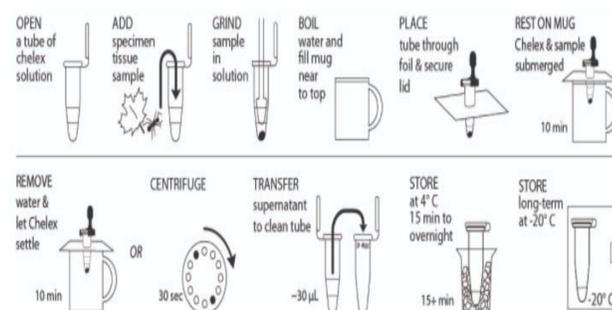
#### I. SPECIMEN/SAMPLE COLLECTION

The first step of this process was collecting samples from the different parks being compared in this test. To collect samples, a permit was secured because collecting specimens from a public park was prohibited without consent. Samples were collected from three different NYC parks: Kissena Park, Forest Park and Crocheron Park. Samples were collected from a given quadrant. Two groups of samples were created to compare the effects of the invasive species. Group A, where the invasive species was dominant, and Group B where the species was not dominant. After collecting the specimens in Ziploc bags, the bags were labeled with the park name and the group. Additionally, pictures of the samples were taken for future reference.

#### II. DNA ISOLATION

11c. Chelex Isolation Protocol: Isolate DNA at Home

### ISOLATE DNA FROM PLANT OR ANIMAL SAMPLES



## Results

Based on the quantitative data above, when comparing groups A and B from each park, it was found that biodiversity was greater in the quadrants where the English ivy was not dominant and the biodiversity was less in the quadrants where it was dominant. It was concluded that the presence of *Hedera helix* affected the biodiversity of the parks negatively.

### Tables & Figures

The tables below show the number of species present in group A (*Hedera Helix* was dominant) and group B (*Hedera Helix* was not dominant) and the percentage of *Hedera helix* in each group's quadrant.

#### KISSENA PARK

	% of <i>Hedera Helix</i>	# of species besides <i>Hedera Helix</i>
Group A	90%	2
Group B	10%	4

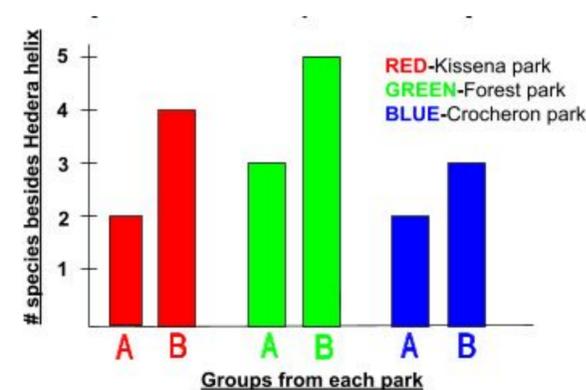
#### FOREST PARK

	% of <i>Hedera Helix</i>	# of species besides <i>Hedera Helix</i>
Group A	80%	3
Group B	25%	5 (including 1 that wasn't sequenced)

#### CROCHERON PARK

	% of <i>Hedera Helix</i>	# of species besides <i>Hedera Helix</i>
Group A	60%	2
Group B	40%	3

The bar graph below compares the biodiversity (number of different species) between each group and compares the biodiversity between each park as well.



Group A is where the *Hedera Helix* was present but was spread out dominantly  
Group B is where the *Hedera Helix* was present but was not spread out dominantly.

## Discussion

The qualitative and quantitative data imply that the *Hedera helix* affected the biodiversity of the parks negatively. When looking at the trend of biodiversity in the bar graph, it can be concluded that in areas where the English ivy was present and was greatly spread out, biodiversity was low for all parks. These results were expected as the trends shown in the results were visible while collecting samples. The hypothesis that the *Hedera helix* species would negatively impact/reduce the biodiversity of the parks was supported by the results.

There were many possible errors in the experiment. Firstly, as a result of the pandemic, the school was virtual. Hence, we did not have access to a lab leaving us the option to perform DNA extraction from our homes. Consequently, we were not under teacher supervision while extracting DNA which might have caused unknown errors in the extractions. Possible ways to improve the experiment could be to conduct the experiment in person and under mentor supervision. Another way the experiment can be improved is by correctly isolating the samples so that they can be sequenced correctly. A final way in which the experiment could have been improved is by being more specific and detailed with hypothesizing, labeling, organizing, and collecting samples.

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