

5. Annual plants complete their life cycle, including germination, seed production, and death, within one year. *Ambrosia trifida* (giant ragweed) is an annual plant that readily colonizes any land that has had a disturbance such as plowing. The plant is considered an invasive species in regions outside of its native range. In a particular region, the seeds of *A. trifida* germinate from early March through the end of the summer, while the seeds of other annual plants require warmer soil temperatures and thus germinate from late April through the end of the summer.

Researchers studied the influence of *A. trifida* on the biodiversity of other annual plant species that grow in the same field. In early spring, the researchers marked off identical plots of land in a field that had been plowed the previous fall and not replanted with new crops. All plants that grew on one half of the plots were left untouched (Figure 1A), while all germinating *A. trifida* seedlings were removed from the other half of the plots throughout the spring and summer (Figure 1B). In late summer, the researchers counted and identified all plants that grew in the plots. The distribution of plants is represented by the symbols in Figures 1A and 1B.

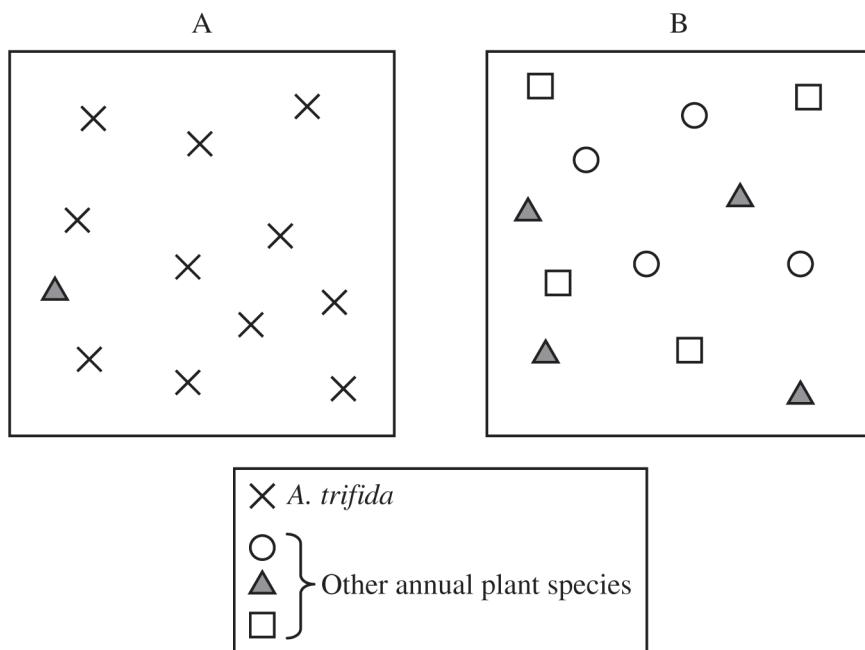


Figure 1. Representations of plant identity and distribution in experimental plots in late summer. Each box represents one typical experimental plot, and each symbol represents 10 individual plants.

**Question 5: Analyze a Model or Visual Representation****4 points**

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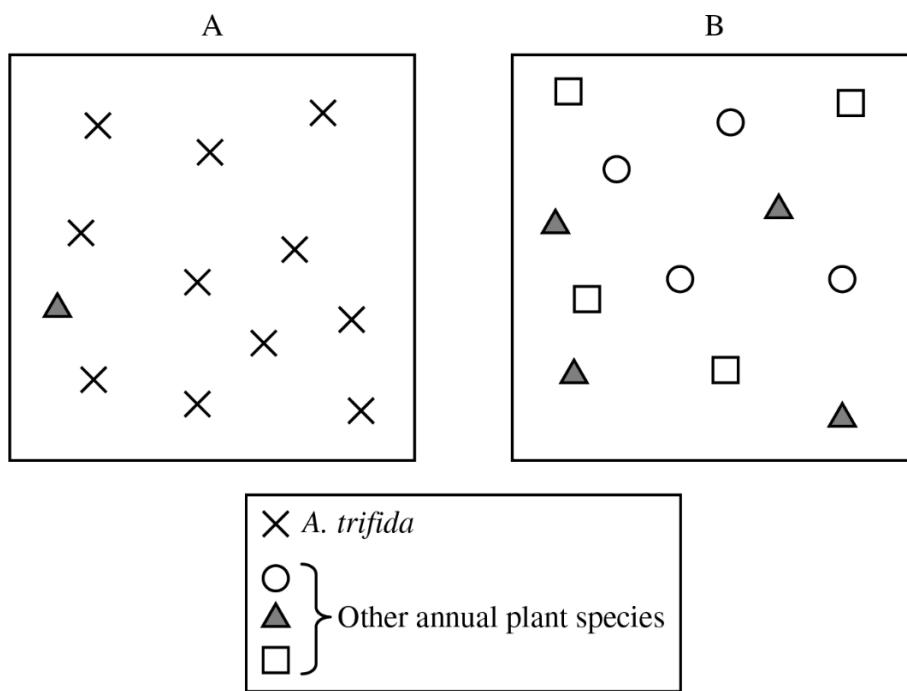
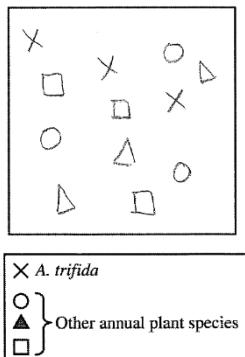


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- (a) **Describe** a cause of logistic growth of the ragweed population. 1 point
- Accept one of the following:
- A factor that becomes limiting would cause the population size to stabilize.
  - Space/sunlight/herbivory/phosphorus/nitrogen/other density-dependent factor becomes limiting, and the population stabilizes.
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- (b) Based on the representation in Figure 1, **explain** why the scientists claim that plot B would be more resilient than plot A in response to a sudden environmental change. 1 point
- (Plot B is more resilient) because it has much greater (species) diversity than plot A does.
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- (c) In a third group of plots, the researchers removed all seedlings of all plants that germinated before June 1. All plants that germinated after June 1 were left untouched. Using the template in the space provided for your response and the symbols shown in Figure 1, represent the expected plant species that would be found in this third group of plots three months later. Draw no more than 12 symbols. Assume all other environmental conditions are the same as for the initial study described. 1 point



- All four species, including *A. trifida*, must be added to the template.

- (d) Explain how an invasive species such as ragweed affects ecosystem biodiversity, as illustrated in Figure 1. 1 point
- The explanation requires a process or relationship - and must state that biodiversity decreases.
  - Examples of appropriate responses include:
    - There are no predators of the invasive species, so its population grows faster and reduces biodiversity.
    - The invasive species germinates earlier, uses up resources, and reduces biodiversity.
    - The invasive species outcompetes other species and reduces biodiversity.

**Total for question 5 4 points**