


Short Performance Assessment: HS-LS2-2

Grade Level: **High School**

Adapted from [SNAP](#)¹

Title	Fire Ants & Garden Insects		
Designed by	Next Generation Science Assessment (NGSA) project	Course(s)	High School Living Environment
Modified by	Rachel Witt, Carol-Ann Winans, Micah Chervin		

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Performance Expectation	<p>HS-LS2-2: Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales.</p> <p>Clarification Statement: Examples of mathematical representations include finding the average, determining trends, and using graphical comparisons of multiple sets of data.</p> <p>Assessment Boundary: Assessment is limited to provided data.</p>
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Science and Engineering Practice	<p>Using Mathematics and Computational Thinking</p> <ul style="list-style-type: none"> Use mathematical representations of phenomena or design solutions to support and revise explanations.
Disciplinary Core Ideas	<p>LS2.A: Interdependent Relationships in Ecosystems</p> <ul style="list-style-type: none"> Ecosystems have carrying capacities, which are limits to the numbers of organisms and populations they can support. These limits result from such factors as the availability of living and nonliving resources and from such challenges such as predation, competition, and disease. Organisms would have the capacity to produce populations of great size were it not for the fact that environments and resources are finite. This fundamental tension affects the abundance (number of individuals) of species in any given ecosystem. <p>LS2.C: Ecosystem Dynamics, Functioning, and Resilience</p> <ul style="list-style-type: none"> A complex set of interactions within an ecosystem can keep its numbers and types of organisms relatively constant over long periods of time under stable conditions. If a modest biological or physical disturbance to an ecosystem occurs, it may return to its more or less original status (i.e., the ecosystem is resilient), as opposed to becoming a very different ecosystem. Extreme fluctuations in conditions or the size of any population, however, can challenge the functioning of ecosystems in terms of resources and habitat availability.
Crosscutting Concept	<p>Scale, Proportion, and Quantity</p> <ul style="list-style-type: none"> Using the concept of orders of magnitude allows one to understand how a model at one scale relates to a model at another scale.

Student Performance	<ol style="list-style-type: none"> Representation Mathematical Modeling Analysis Revision
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¹ The Short Performance Assessment (SPA) and the Assessment Rubric adapted from the Stanford NGSS Assessment Project <http://snapgse.stanford.edu/>



Name_____

The Red Imported Fire Ant (*Solenopsis invicta*) is an introduced insect species that has spread through much of the United States. Roughly \$1 billion is spent annually to control the pest. Scientists, farmers, and others are concerned that the presence of these ants could result in major changes to local food webs.



Red Imported Fire Ant (National Invasive Species Information Center)

The map below shows the range where Fire Ant populations may expand. Certain areas are marked to indicate climates where insufficient precipitation may prohibit the growth of Fire Ant populations.

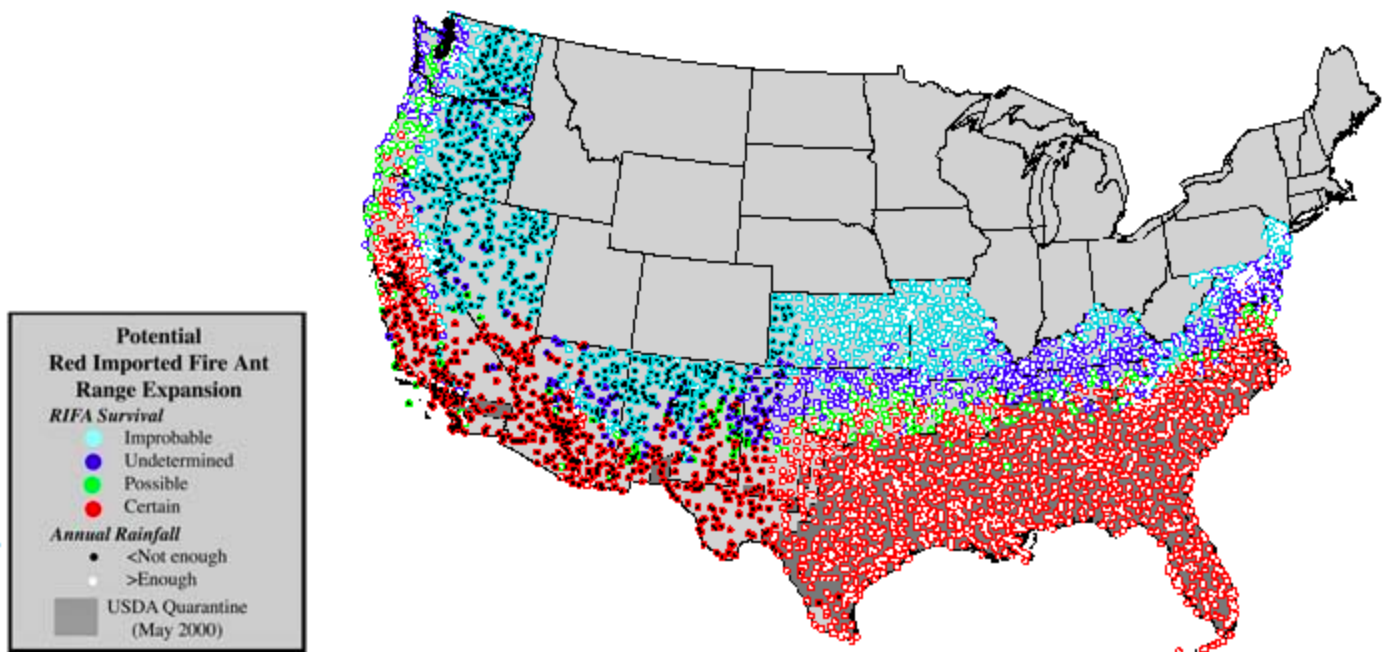


Figure 1. Range of Red Imported Fire Ant (USDA 2017)



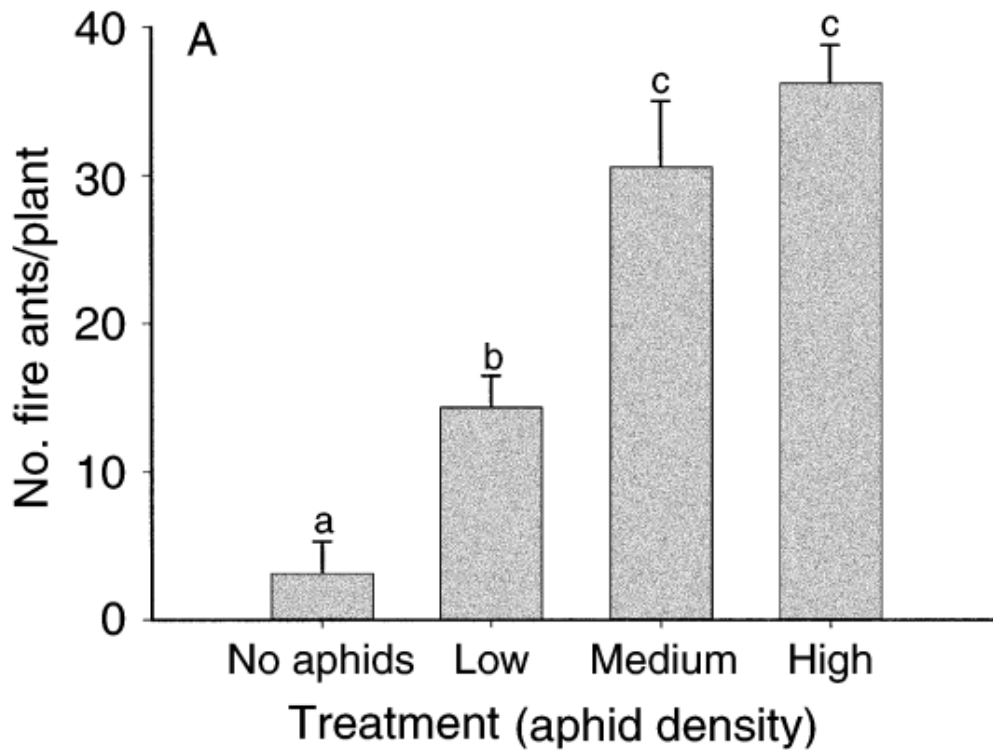


Figure 2. Aphid density v. number of fire ants/plant

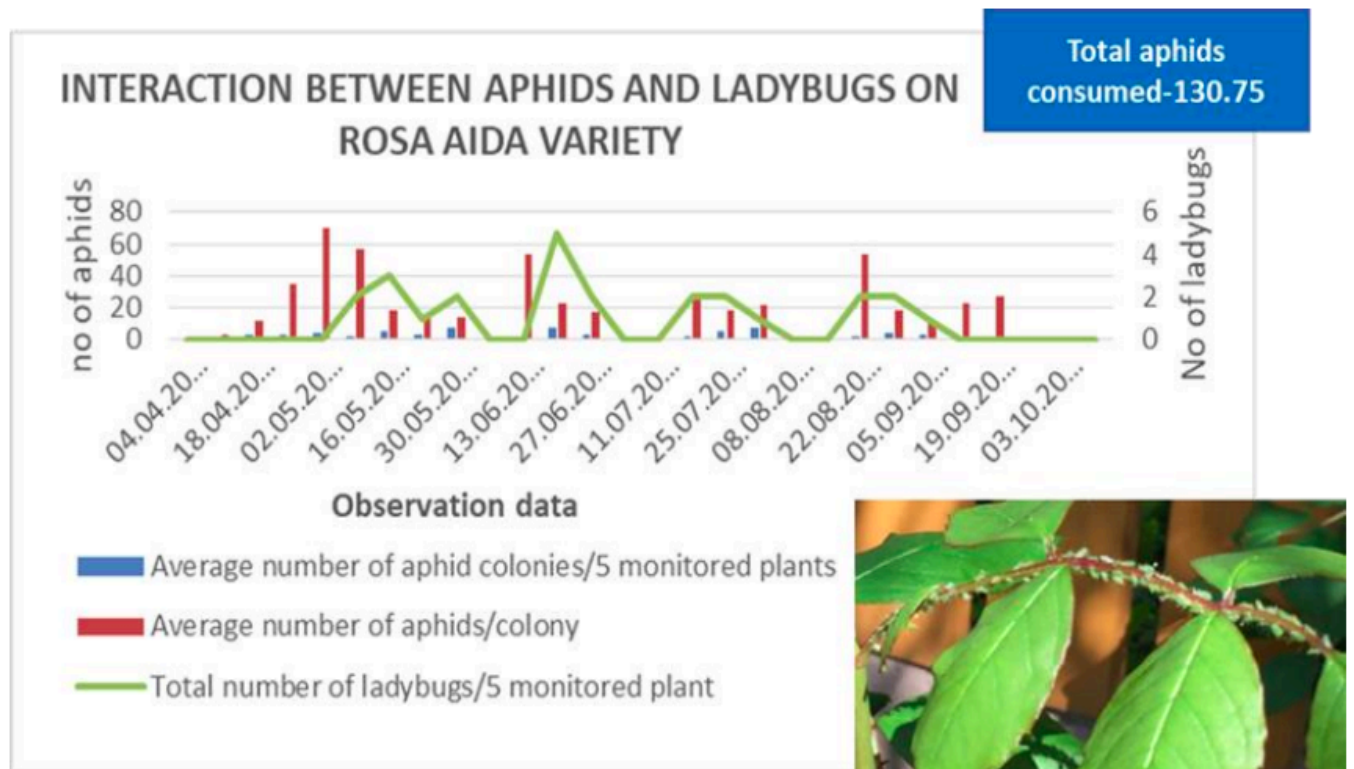


Figure 3. Interaction between aphids and ladybugs

Using the figures above, fill in the chart below.

Figure	Identify the trends in the figures above that are relevant to factors affecting biodiversity in this ecosystem.
1. Range of Red Imported Fire Ant	
2. Aphid density v. number of fire ants/plant	
3. Interaction between aphids and ladybugs	

4. From the trends you identified in the chart, develop an explanation based on evidence to describe the complex set of interactions between organisms within this ecosystem.

Compared to their native South America, Fire Ants have had significant success expanding their range in North America, possibly due to their mutualistic relationship with small, sap-sucking insects called aphids. Dr. Micky Eubanks, one of the authors of a 2005 study on the pests, said that “..fire ants protect aphids in exchange for the honeydew that aphids produces and the ants eat.” The honeydew that aphids produce is essentially carbohydrate-rich feces. This extra boost of energy allows Fire Ants to out-forage native species and expand their territory. In exchange for protection from Fire Ants aphids provide an energy-rich supply of food.



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Aphid producing honeydew (Wikipedia)



Fire Ants "ranching" aphid honeydew (Texas A&M AgriLife)



Native range of Fire Ants in South America

5. What might explain why Fire Ants have not expanded their range in their native South America as much as in the United States?

6. Fire ants also prey on ladybugs. Knowing this, revise your original explanation to describe the complex set of interactions between organisms within this ecosystem.

7. On the scale of global climate change with rainfall variation, if the proportion of fire ants were to increase, predict how this would impact the populations of both ladybugs and aphids.

<https://pdfs.semanticscholar.org/a553/df71301f041d872ff393de9cd5a713f7d249.pdf>

<http://eds.b.ebscohost.com/eds/pdfviewer/pdfviewer?vid=20&sid=c72aa0f4-dd0e-42e8-8466-34d412685f9b%40pdc-v-sessmgr04>

<https://fireant.tamu.edu/fire-ants-aphid-ranching-skills-may-be-key-to-their-successful-u-s-invasion/>






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ORIGINAL ASSESSMENT

Liz noticed an increase in fire ants (insects) in her garden. She used a chemical to decrease the number of fire ants. She is wondering if the decrease in the fire ant population will affect the population of other insects in her garden, such as ladybugs and aphids (small insects). To figure this out, Liz collected data on what the three insects eat and how their populations changed after she used the chemical to decrease fire ants.

Food and Change in Population in Population of Insects in Liz's Garden		
Type of Insect	Main Food in Garden	Change in population of the type of insect (after Liz used a chemical on fire ants)
Fire Ant 	Lady bugs, Honeydew (made from aphids)	90% decrease
Lady Bug 	Aphids	70% decrease
Aphid 	Plants	60% decrease

Use the data table to write a scientific explanation about how a decrease in the fire ant population will affect the population of ladybugs and aphids in Liz's garden. Your explanation should include:

1. A **claim** that states whether the decrease in fire ants will affect the ladybugs and aphids in the same way.
2. **Evidence** from Liz's data table about how the decrease in fire ants will affect the population of ladybugs and aphids.
3. **Reasoning** that describes the types of relationships that exist between the fire ants and the other two insects (ladybugs and aphids).



Assessment Rubric* - Question 1

	Emerging	Developing	Approaching Proficiency	Excelling
Description of performance				
Sample student responses				

Assessment Rubric* - Question 2

	Emerging	Developing	Approaching Proficiency	Excelling
Description of performance				
Sample student responses				

Insert additional Assessment Rubrics (if needed) here.



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