I-SMART Goal 2 Scenario-based Tasks

Chapter 3: Testlet Prototype Walkthrough

Overview of Chapters

1. Introduction
2. Testlet co-design
3. Testlet prototype walkthrough
4. Think-aloud study
5. What we learned

I-SMART Goal 2

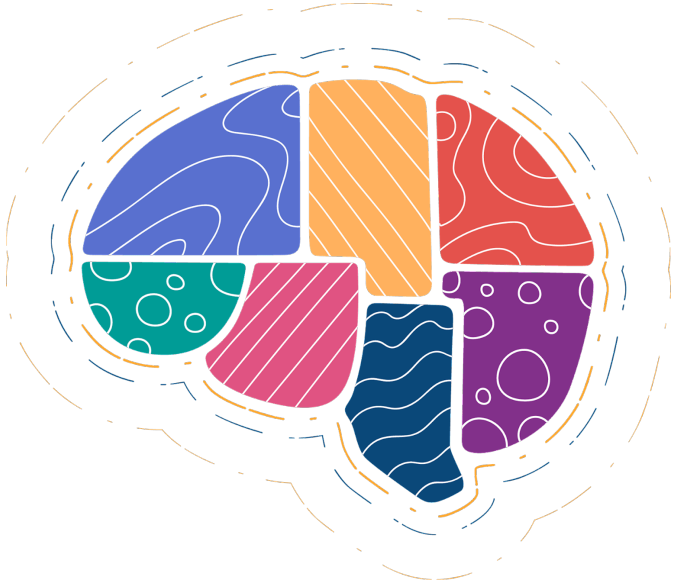
Design, develop, and evaluate learning map model-based assessments that incorporate science disciplinary content and science and engineering practices in highly engaging, universally designed, technology-delivered formats.

Focus of This Study

- Co-design and evaluate testlets for “secondary population" students
- Scenario-based tasks to evaluate range of depth of knowledge (DOK)
- Deeper application of UDL principles
- Greater emphasis on formative use of instructionally embedded testlets

Design strategy

Explore innovative approaches to science assessments using the principles of Universal Design for Learning (UDL)



EcoSim

Read aloud

Imagine...

You are the science expert helping the governor decide what to do about a problem in the ecosystem.

Choose an ecosystem to start.

Psst: watch the videos to help you decide!

Ocean >

The shark population is declining.

Rainforest >

The jaguar population is declining.

Vacant Lot >

The coyote population is declining.

Hint

Glossary

Third level consumer

Second level consumer

First level consumer

Squirrel

Producer

EcoSim

Read aloud

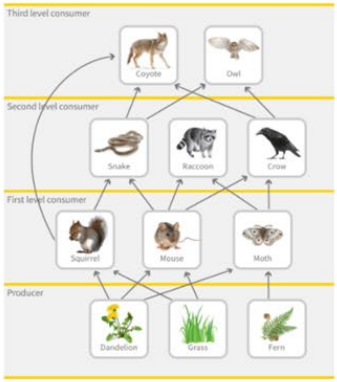
Storyboard

What happens to the squirrels's food?

1.
First, the coyote population is declining.

2.
More of the coyote's prey (snakes) survive.

3.
There are fewer squirrels.



Psst! Use the food web for clues.

Drag & drop

4a.
There are more dandelions.

4b.
There is fewer dandelions.

4c.
There is no change in the dandelions.

Check my answer

Hint

Glossary

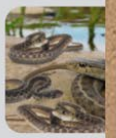
Read aloud

EcoSim

Storyboard complete

The ecosystem is out of balance.

1.
First, the coyote population is declining.



2.
More of th
prey (snak

ore you move on, is there any new
king you'd like to add to your pros
cons list?

Back Next

Should we make laws to protect coyotes?

Pros	Cons
What are some benefits?	What are some problems?
If we protect coyotes, there will be more of them to eat the snakes. (edit)	Coyotes are dangerous to dogs and cats. (edit)
Coyotes are third level consumers that help keep the whole ecosystem in balance. (edit)	Add
Add	

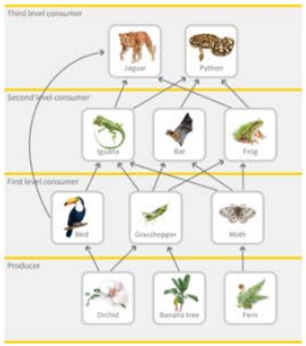
Hint Glossary

Read aloud

EcoSim

Well done...

As an ecologist, what advice will you give the governor?



1. First, the jaguar population is declining.

2. More of the jaguar's prey (iguanas) survive.

3. There are fewer birds.

4. There are more orchids.

Your claim:

Dear Governor,

As an ecologist, I think you **should** / **should not** make a law to protect the jaguars.

Evidence:

Use evidence from your work to support your claim to the governor.

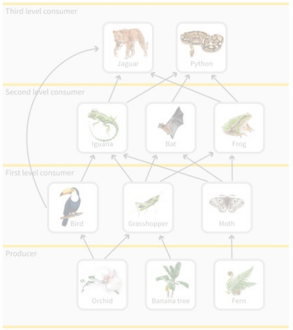
- Pros & Cons List
- Food web
- Storyboard

When finished adding all your evidence. Send your advice to the governor

Hint Glossary

EcoSim

Read aloud



Add a note from your food web

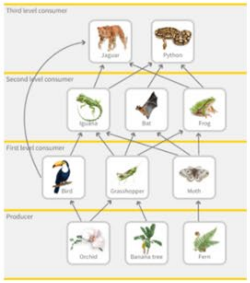
Hint Glossary

EcoSim

Read aloud

Well done...

As an ecologist, what advice will you give the governor?



1. First, the jaguar population is declining.

2. More of the jaguar's prey (iguanas) survive.

3. There are fewer birds.

4. There are more orchids.

Hint Glossary

Your claim:

Dear Governor,

As an ecologist, I think you **should** / **should not** make a law to protect the jaguars.

Evidence:

Use evidence from your work to support your claim to the governor.

- Even though jaguars are dangerous to humans, making laws to protect Jaguars keeps the ecosystem in balance. (edit)
- Each animal in the food web affects the number of other animals and plants in the food web. (edit)
- Ecosystems out of balance cause lots of other problems. (edit)

When finished adding all your evidence. **Send your advice to the governor**

Middle school prototype

https://ismart-ms.cast.org

Plus key screens from the elementary (ismart-es.cast.org) and high school prototypes (ismart-hs.cast.org).

Essential Element: SCI.EE.MS-LS2-2

Use models of food chains/webs to identify producers and consumers in aquatic and terrestrial ecosystems.

Disciplinary Core Idea
LS2: Ecosystems: Interactions, Energy, and Dynamics

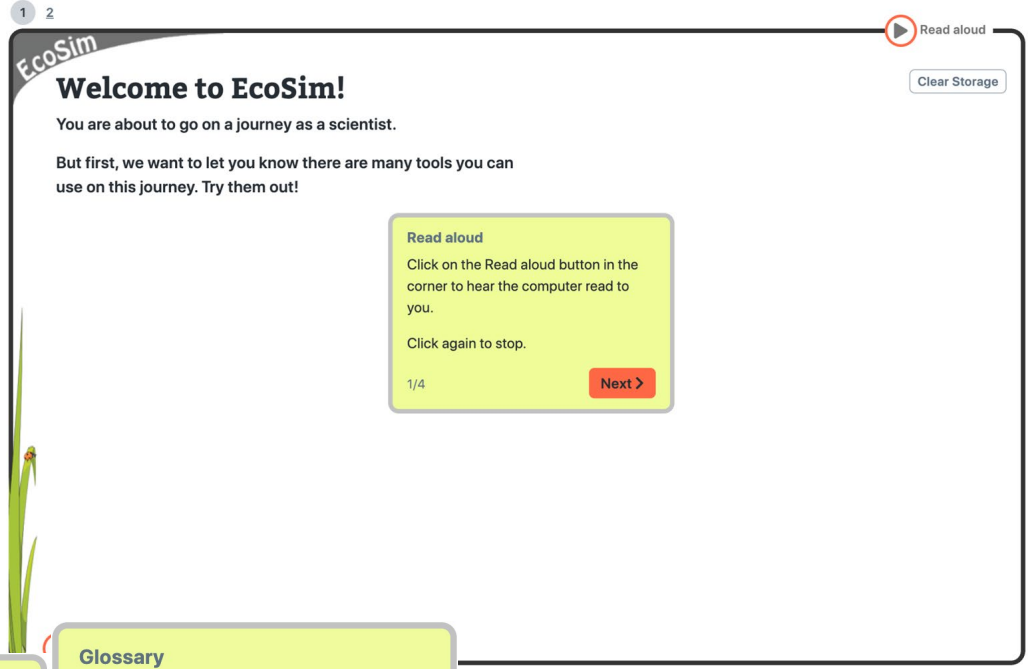
Science and Engineering Practices
Constructing Explanations and Designing Solutions: Construct an explanation that includes qualitative or quantitative relationships between variables that predict phenomena.

Crosscutting Concepts
Patterns: Patterns can be used to identify cause and effect relationships.

Essential Element: SCI.EE.MS-LS2-2

Target Nodes

1. Use a model to describe a feeding relationship between two living things.
2. *Recognize that people eat animals, which eat plants.*
3. Recognize that consumers eat plants or other animals.
4. Recognize predation.



Speech to text

Click in the text box, then on the microphone to speak.

Click again to stop.

Type something...

2/4 Back Next

Hint

Click on the hint button to get a hint.

Click the ✕ to close the hint box.

3/4 Back Next

Glossary

Click on the glossary button to see word definitions.

Click the ✕ to close the glossary.

4/4 Back Next

1 2

Read aloud

EcoSim

Imagine...

You are the science expert helping the governor decide what to do about a problem in the ecosystem.

Choose an ecosystem to start.

Psst: watch the videos to help you decide!

Ocean >

The shark population is declining.

Rainforest >

The jaguar population is declining.

Vacant Lot >

The coyote population is declining.

Hint Glossary

EcoSim

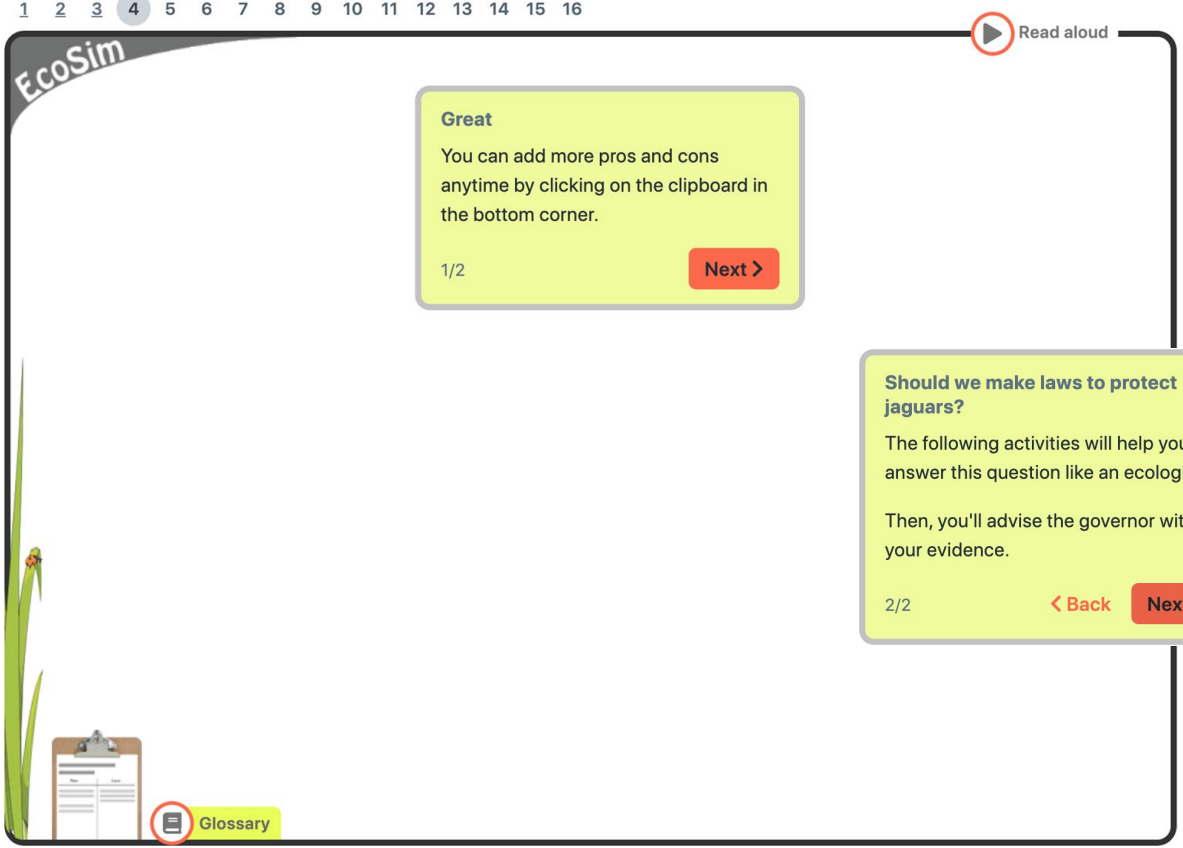
Read aloud

The governor's problem:

The population of jaguars is declining. Should we make laws to protect the jaguars? Why or why not?

First, use the clipboard to think aout the pros and cons.

Hint Glossary


EcoSim
Read aloud
Great
You can add more pros and cons anytime by clicking on the clipboard in the bottom corner.
1/2
Next
Should we make laws to protect jaguars?
The following activities will help you answer this question like an ecologist.
Then, you'll advise the governor with your evidence.
2/2
Back
Next
Glossary

EcoSim

Read aloud

Food webs

Food webs show feeding relationships between two living things.

Put an arrow between the bird and orchid to show the feeding relationship.

Drag & drop

Third level consumer

Second level consumer

First level consumer

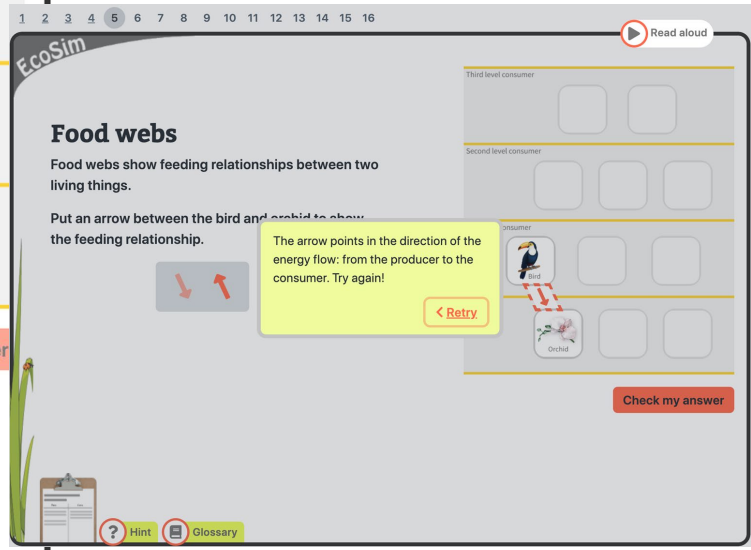
Bird

Producer

Orchid

Check my answer

Hint Glossary



EcoSim

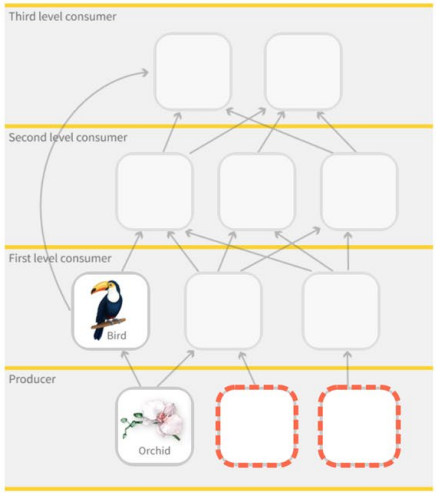
Read aloud

Food web: Producers

When you put lots of feeding relationships together, it makes a food web. At the base of a food web are the producers.

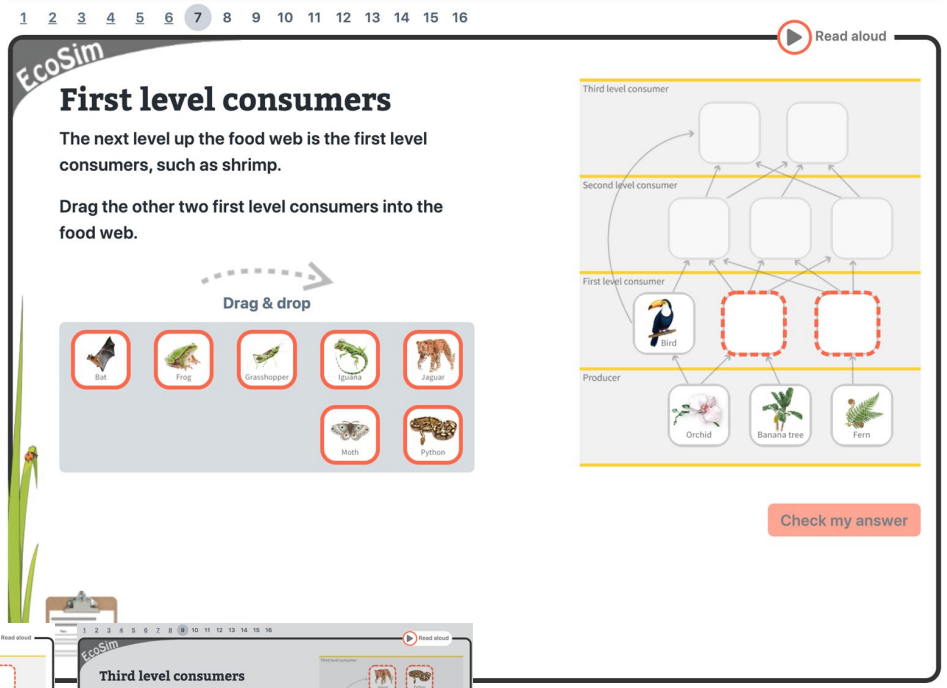
Put the other two producers into the food web.

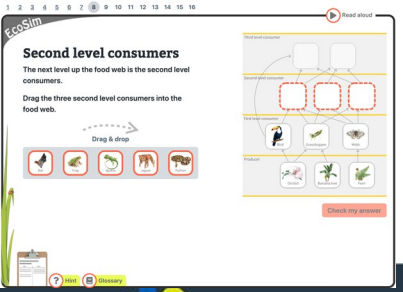
Drag & drop

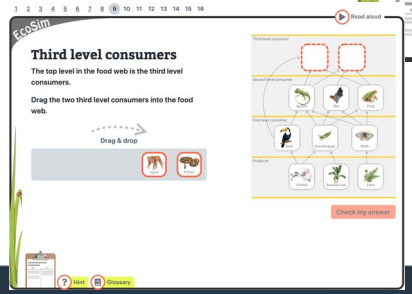


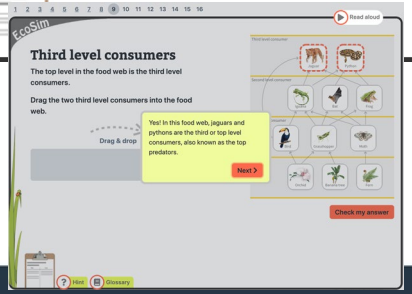
Check my answer

Hint Glossary


1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
Read aloud
EcoSim
First level consumers
The next level up the food web is the first level consumers, such as shrimp.
Drag the other two first level consumers into the food web.
Drag & drop
Bat
Frog
Grasshopper
Iguana
Jaguar
Moth
Python
Third level consumer
Second level consumer
First level consumer
Producer
Bird
Orchid
Banana tree
Fern
Check my answer


Read aloud
EcoSim
Second level consumers
The next level up the food web is the second level consumers.
Drag the three second level consumers into the food web.
Drag & drop
Check my answer
Hint
Glossary


Read aloud
EcoSim
Third level consumers
The top level in the food web is the third level consumers.
Drag the two third level consumers into the food web.
Drag & drop
Check my answer
Hint
Glossary


Read aloud
EcoSim
Third level consumers
The top level in the food web is the third level consumers.
Drag the two third level consumers into the food web.
Drag & drop
Yes! In this food web, jaguars and pythons are the third or top level consumers, also known as the top predators.
Next
Check my answer
Hint
Glossary

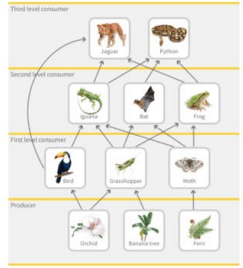
EcoSim

Read aloud

Storyboard

To advise the governor, think about what would happen by creating a storyboard. If there were no laws protecting jaguars, the jaguar population will go down.

What happens next to the jaguar's prey, the iguanas?



Psst! Use the food web for clues.

1.
First, the jaguar population is declining.

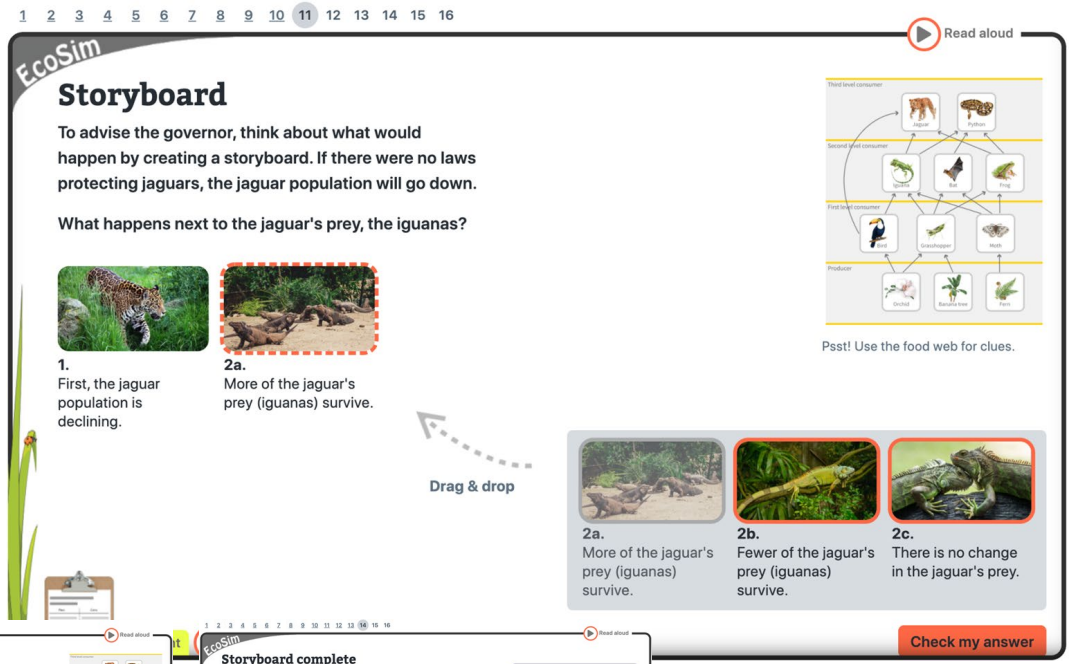
Drag & drop

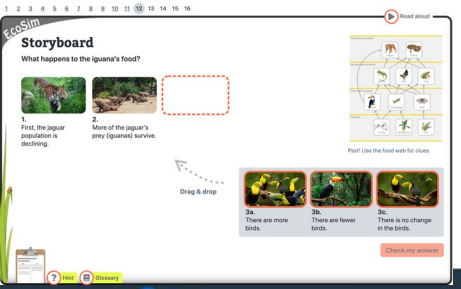
2a.
More of the jaguar's prey (iguanas) survive.

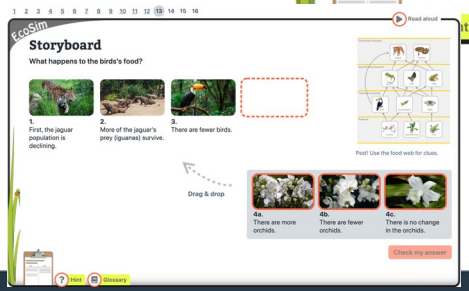
2b.
Fewer of the jaguar's prey (iguanas) survive.

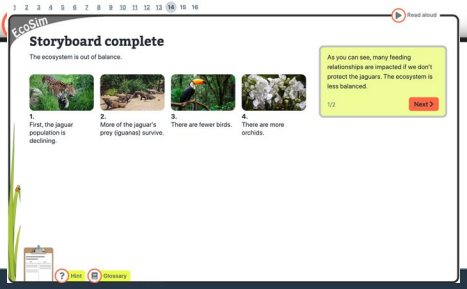
2c.
There is no change in the jaguar's prey.

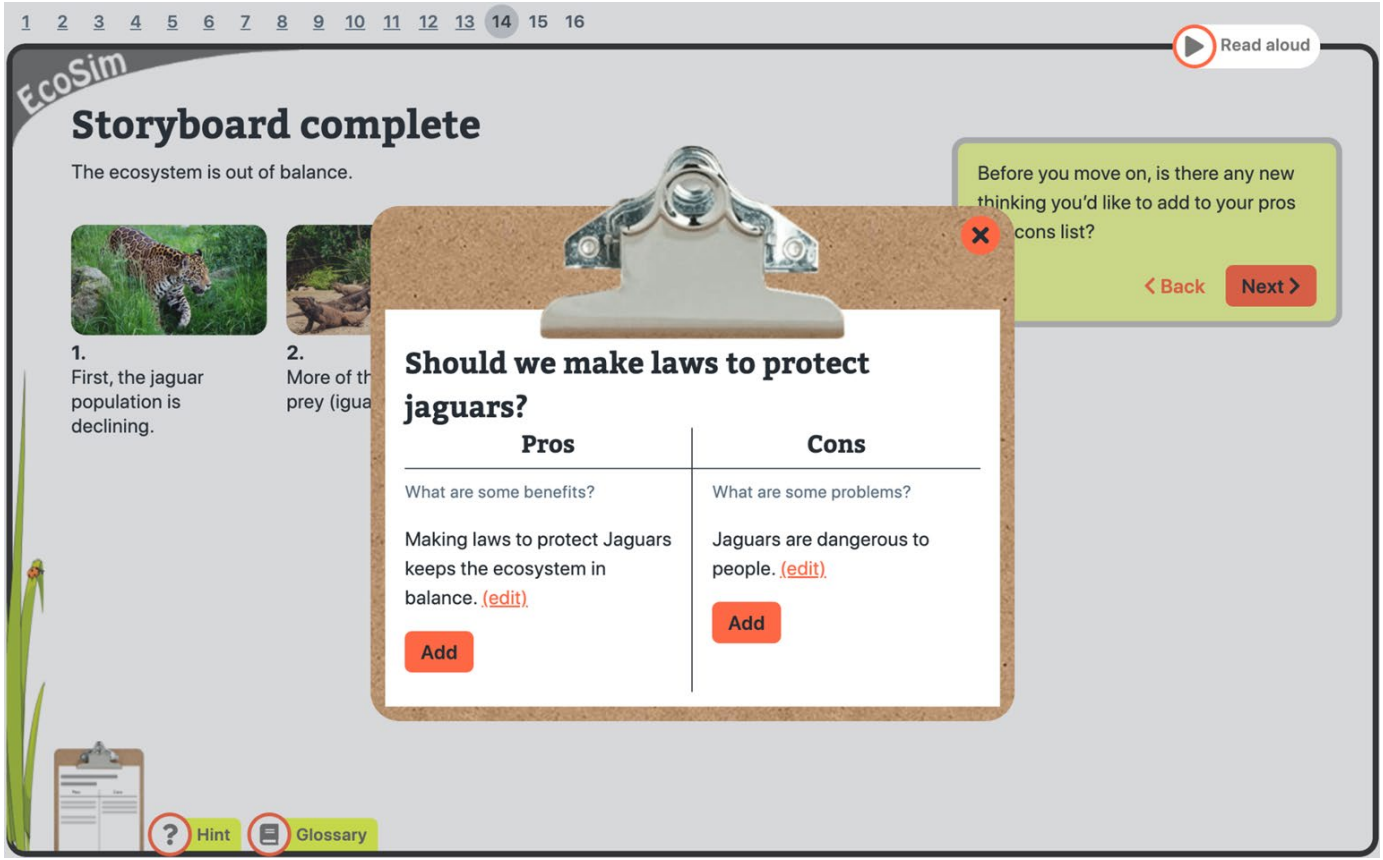
Hint Glossary


1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
EcoSim
Read aloud
Storyboard
To advise the governor, think about what would happen by creating a storyboard. If there were no laws protecting jaguars, the jaguar population will go down.
What happens next to the jaguar's prey, the iguanas?
1.
First, the jaguar population is declining.
2a.
More of the jaguar's prey (iguanas) survive.
Drag & drop
Psst! Use the food web for clues.
2a.
More of the jaguar's prey (iguanas) survive.
2b.
Fewer of the jaguar's prey (iguanas) survive.
2c.
There is no change in the jaguar's prey.
Check my answer


EcoSim
Storyboard
What happens to the iguana's food?
1.
First, the jaguar population is declining.
2.
More of the jaguar's prey (iguanas) survive.
Psst! Use the food web for clues.
Drag & drop
3a.
There are more birds.
3b.
There are fewer birds.
3c.
There is no change in the birds.
Check my answer
Hint
Glossary


EcoSim
Storyboard
What happens to the birds's food?
1.
First, the jaguar population is declining.
2.
More of the jaguar's prey (iguanas) survive.
3.
There are fewer birds.
Psst! Use the food web for clues.
Drag & drop
4a.
There are more orchids.
4b.
There are fewer orchids.
4c.
There is no change in the orchids.
Check my answer
Hint
Glossary


EcoSim
Storyboard complete
The ecosystem is out of balance.
1.
First, the jaguar population is declining.
2.
More of the jaguar's prey (iguanas) survive.
3.
There are fewer birds.
4.
There are more orchids.
As you can see, many feeding relationships are impacted if we don't protect the jaguars. The ecosystem is less balanced.
1/2
Next
Hint
Glossary

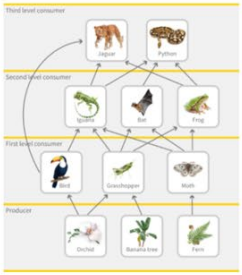

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16
Read aloud
EcoSim
Storyboard complete
The ecosystem is out of balance.
1.
First, the jaguar population is declining.
2.
More of th
prey (igua
Before you move on, is there any new thinking you'd like to add to your pros cons list?
Back
Next
Should we make laws to protect jaguars?
Pros
Cons
What are some benefits?
Making laws to protect Jaguars keeps the ecosystem in balance. (edit)
Add
What are some problems?
Jaguars are dangerous to people. (edit)
Add
Hint
Glossary

EcoSim

Read aloud

Well done...

As an ecologist, what advice will you give the governor?



1. First, the jaguar population is declining.

2. More of the jaguar's prey (iguanas) survive.

3. There are fewer birds.

4. There are more orchids.

Hint Glossary

Your claim:

Dear Governor,

As an ecologist, I think you **should** / **should not** make a law to protect the jaguars.

Evidence:

Use evidence from your work to support your claim to the governor.

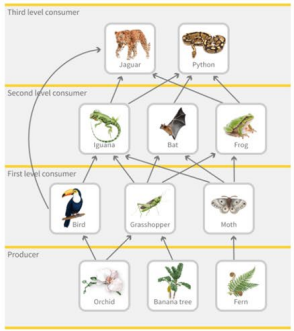
- Pros & Cons List
- Food web
- Storyboard

When finished adding all your evidence. Send your advice to the governor

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16

EcoSim

Read aloud



Add a note from your food web

Say why you think we should or shouldn't make a law to protect jaguars, what would happen if we don't protect the jaguars by using evidence from your food web.

State your evidence...

Save Cancel

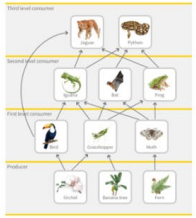
Hint Glossary

8 9 10 11 12 13 14 15 16

Read aloud

...

t advice will you give the governor?



1. First, the jaguar population is declining.

2. More of the jaguar's prey (iguanas) survive.

3. There are fewer birds.

4. There are more orchids.

Hint Glossary

Your claim:

Dear Governor,

As an ecologist, I think you should / should not make a law to protect the jaguars.

Evidence:

Use evidence from your work to support your claim to the governor.

- Even though jaguars are dangerous to humans, making laws to protect Jaguars keeps the ecosystem in balance. (edit)
- Each animal in the food web affects the number of other animals and plants in the food web. (edit)
- Ecosystems out of balance cause lots of other problems. (edit)

When finished adding all your evidence. Send your advice to the governor

Read aloud

EcoSim

Well done!

The governor has sent you a thank you letter.

From the office of the Governor

Dear student,

Thank you for your advice on what to do about the jaguars! We truly value your suggestions as an ecologist.

Now we clearly understand the problem and what to do about it. We are condfident that our rainforest will again return to a balanced ecosystem — for the benefit of all the rainforest life, and for us humans, too!

Sincerely,

The Governor

The Governor

Glossary

Elementary School Prototype

Key screens

Essential Element: SCI.EE.5.LS2-1

Target Nodes

1. Recognize that plants produce their own food and that animals get food from other plants or animals.
2. Create a model that shows the movement of matter through living things.
3. Recognize that matter moves from the soil to plants to animals and back to the soil.

Read aloud

EcoSim

Pros & cons::

To help make this decision, let's think about the pros and cons of removing the tree versus leaving it.

Use your clipboard to organize your thoughts on the pros and cons.

Should we remove the tree?

Pros	Cons
What are some benefits?	What are some problems?
We should remove the tree to get it out of the way. (edit)	Squirrels like to play in the fallen tree. (edit)
Add	Add

Next >

Hint Glossary

EcoSim

Storyboard

To think more about th
flow, of nutrients.

Put these pictures in
ecosystem. Start with

Check my answer

Drag & dr

Hint

EcoSim

Storyboard

Read aloud

Place the other four images to tell the story of the tree that is part of an ecosystem.

You can check the next image on the left each time you see the "Check my answer" button.

Check my answer

A tree **sprouts** from a seed.

A growing tree gets nutrients from the **soil** and **air**.

Animals get **shelter** and **food** from the tree.

Drag & drop

Decomposers break down a tree's nutrients and return it to the soil.

A tree **falls** during a storm.

Hint Glossary

EcoSim

Food web

Ecologists show thi
ecosystem with a f

The diagram on the
the flow of nutrient

Place the pictures t
Start by filling in th

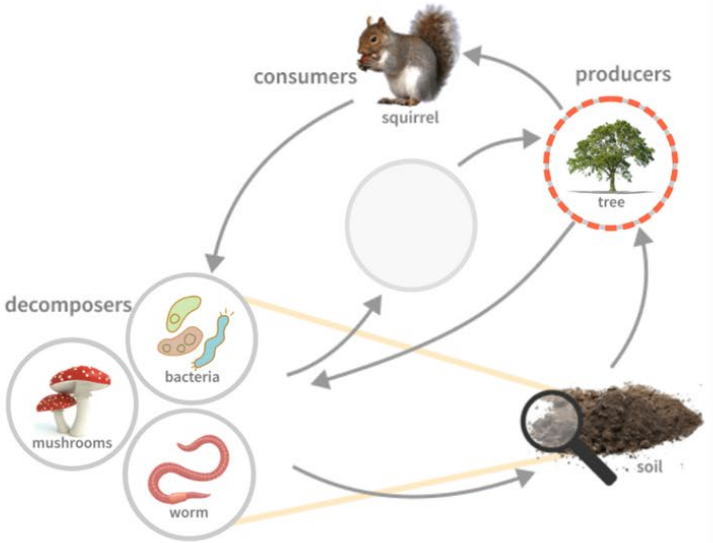
Hint

EcoSim

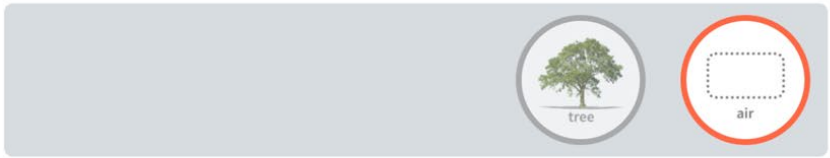
Food web

Read aloud

Now fill in the producer.



Drag & drop



Check my answer

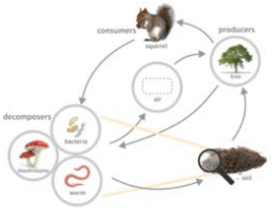
Hint Glossary

Read aloud

EcoSim

Well done...

As an ecologist, what advice will you give the principal: should we remove the fallen tree?



A tree **sprouts** from a seed.

A growing tree gets nutrients from the **soil** and **air**.

Animals get **shelter** and **food** from the tree.

A tree **falls** during a storm.

Decomposers break down a tree's nutrients and return it to the soil.

Hint

Glossary

Your claim:

Dear Principal,

We **should** / **should not** remove the tree.

Evidence:

Use evidence from your work to support your claim to the principal.

- Pros & Cons List
- Food web
- Storyboard

When finished adding all your evidence.

Send your advice to the principal

High School Prototype

Key screens

Essential Element: SCI.EE.HS-LS2-2

Target Nodes

1. Explain changes in population with simple causal reasoning.
2. Explain the dependence of a population on other organisms and the environment.
3. Explain change in population with semi-complex reasoning.
4. Identify factors that affect carrying the capacity of an ecosystem.

Read aloud

EcoSim

The governor's problem:

The population of sharks is declining. Should we make laws to protect the sharks? Why or why not?

First, click on the clipboard to think aout the pros and cons.

Hint Glossary

Next >

Read aloud

EcoSim

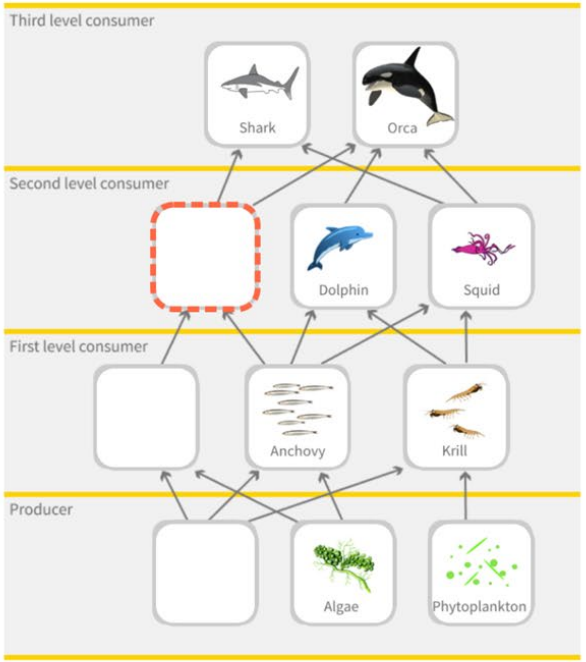
Food webs

When the ecosystem is balanced, many organisms live in it, as you can see in this food web.

Drag the missing second level consumer into this food web.

Drag & drop

Seaweed Tuna Shrimp



Check my answer

Hint Glossary

EcoSim

First leve

Drag the missing f

Hint

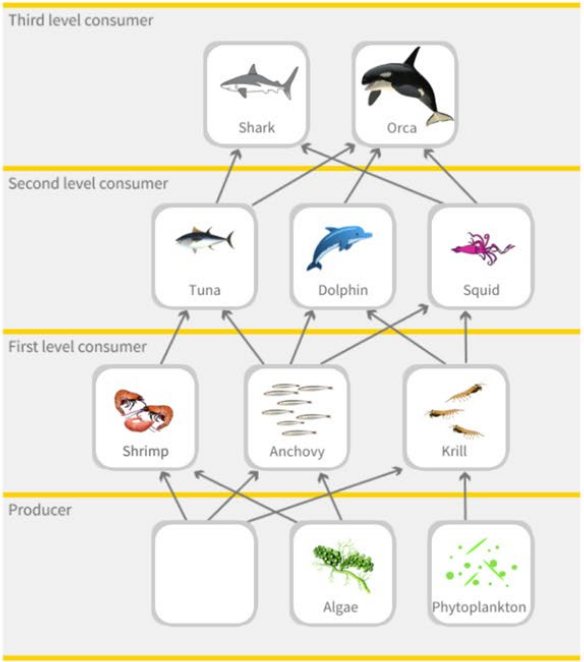
EcoSim

First level consumers

Read aloud

Complete the sentence:

If the shark population declines, the population of first level consumers might increase / decrease.



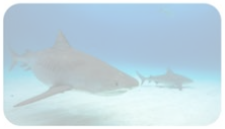
Check my answer

Hint Glossary

EcoSim

Populatio

A small shark popu
establishes itself. V
situation?



1.

Hint

EcoSim

Population condition 1: Build the graph

1.
There is plenty of food and space for the sharks to live and reproduce.

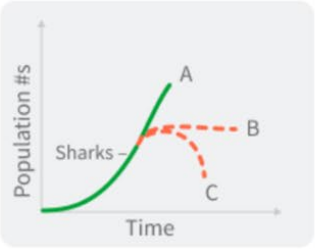
Read aloud

Choose the graph segment that shows what's likely to happen next to the shark population.

A - The population grows exponentially.

B - The population levels off.

C - The population begins to decline.



Check my answer

Hint Glossary

EcoSim

Read aloud

Population condition 3: What's next?

Competition between sharks is fierce. What happens next?

1. There is plenty of food and space for the sharks to live and reproduce.

2. There is increasing competition between sharks for food and space.

3.

Drag & drop

Hint Glossary

EcoSim

Read aloud

Population condition 3: Finish the graph

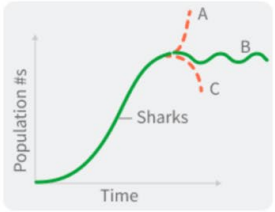
1. There is plenty of food and space for the sharks to live and reproduce.

2. There is increasing competition between sharks for food and space.

3. The shark population maxes out.

Choose the graph segment that describes a population that has leveled off, but continues to rise and fall a little.

- **A** - Shark population begins to grow exponentially again.
- **B** - Shark population levels off and fluctuates cyclically.
- **C** - Shark population declines rapidly.



Check my answer

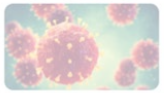
Hint Glossary

EcoSim

Carrying c

Which of these fact
carrying capacity?

yes no



Disease

yes no

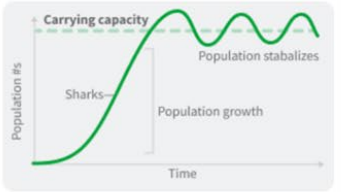
Pollution

EcoSim

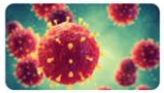
Carrying capacity factors

Which of these factors are likely to contribute to shark carrying capacity?

Read aloud



Your carrying capacity graph.

✓ yes no	✓ yes no	✓ yes no	✓ yes no	✓ yes no
				
Disease	Habitat space	Competition	Predation by other animals	Hunting by humans
✓ yes no	✓ yes no	✓ yes no	yes ✓ no	yes ✓ no
				
Pollution	Climate	Food availability	Earthquakes	Sunspot activity

Check my answer

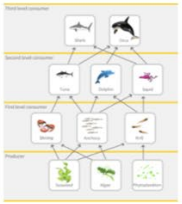
Hint

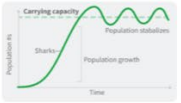
Hint Glossary

EcoSim

Read aloud

Well done. As an ecologist, what advice will you give the governor?





1.
There is plenty of food and space for the sharks to live and reproduce.

2.
There is increasing competition between sharks for food and space.

3.
The shark population maxes out.

Your claim:

Dear Governor,

As an ecologist, I think you **should** / **should not** make a law to protect the sharks.

Evidence:

Use evidence from your work to support your claim to the governor.

- Pros & Cons List
- Food web
- Storyboard
- Factors

When finished adding all your evidence. Send your advice to the governor

Hint Glossary

Next Up …

1. Introduction
2. Testlet co-design
3. Testlet prototype walkthrough
4. Think-aloud study
5. What we learned