Understanding the Relationships Between Phenomena and Factors Through the Simulation
- Session 3 -

Learning Guide

Learning Objectives:

1)Explore the factors that enhance and reduce resilience.

2) Understand the relationships between the factors that influence resilience through the simulation activity.

<Explanation Video for Session 3>

📺 영상 링크: https://youtu.be/Mp8EjH1dAA4

What are the Factors That Enhance Resilience?

Resilience refers to **the ability of both the environment and society to endure and recover from changes and shocks**. In the face of various natural threats arising from climate change, how can we create a sustainable environment and enhance the resilience of both society and the environment?

Let's explore the key factors influencing resilience and review examples as we reflect on the actions we should take.

(Activity) Access the metaverse and engage in conversations with your AI friends to research how each friend's country is addressing climate change and enhancing resilience.

<div align="center"><Guidelines></div>

1. Approach your friends and start the conversation.

2. Ask your friends the following interview questions to learn how their countries are addressing climate change and improving resilience.

<div align="center"><Questions></div>

˙In which country (or region) do you live?

˙What are the natural and environmental characteristics of the area where you live?

˙What strategies or policies is your country (or region) implementing to address climate change and enhance resilience?

˙What results have these strategies or policies achieved?

3. After asking all your questions, say goodbye to your friend and exit the metaverse.
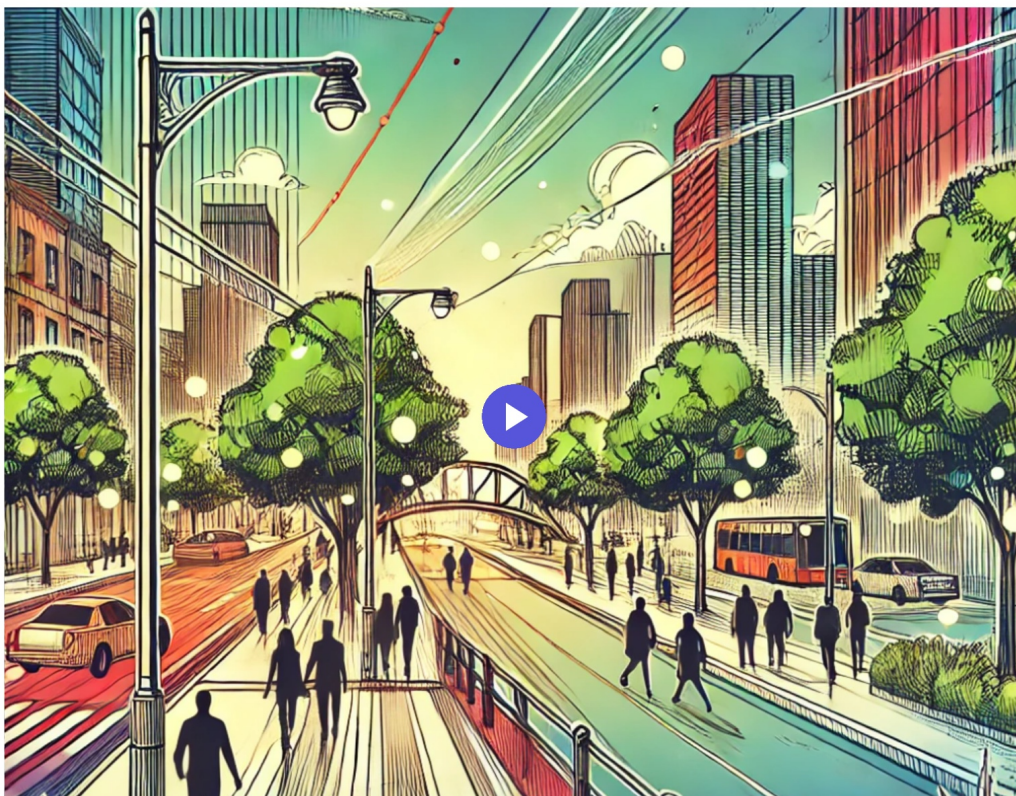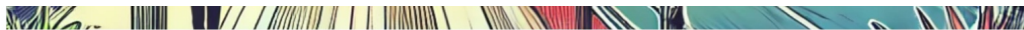
① **(Activity)** Summarize the interview by answering the following questions. - Jenny

Where does Jenny live?

○ Bangladesh

○ Mexico

○ Japan

○ United States

○ South Korea

제출

What are the natural and environmental characteristics of the area where Jenny lives?

○ A cold region with many volcanoes and glaciers, where geothermal activity is active.

○ A dry and hot desert climate, where droughts occur frequently and water shortages are a serious issue.

○ A lowland plain area where various rivers meet, with seasonal floods due to river overflow.

○ A mountainous region located in the Alps, with abundant snow and glaciers and a relatively mild climate.

제출

What strategies or policies is the country/region where Jenny lives implementing to address climate change and enhance resilience?

○ Harvesting rainwater and implementing climate-smart agriculture to prepare for droughts and use water efficiently.

○ Utilizing geothermal energy to reduce carbon emissions and establish an eco-friendly energy system.

○ Protecting the alpine ecosystem and operating disaster preparedness systems to respond to changes in snow and glaciers.

○ Using aquaculture to grow crops even during flooding periods and secure food.

제출

What results have these strategies or policies actually achieved?

○ Geothermal energy provides most of the electricity in an eco-friendly manner.

○ Due to aquaculture, food can be secured even during floods, and income has increased.

○ Rainwater harvesting has reduced water shortages, and crop yields have stabilized.

○ The disaster preparedness systems have improved the ability to respond to avalanches and floods.

제출

② **(Activity)** Summarize the interview by answering the following questions. - Harry

Where does Harry live?

○ Bangladesh

○ Mexico

○ Japan

○ United States

○ South Korea

제출

What are the natural and environmental characteristics of the area where Harry lives?

○ A cold region with many volcanoes and glaciers, where geothermal activity is active.

○ A dry and hot desert climate, where droughts occur frequently and water shortages are a serious issue.

○ A lowland plain area where various rivers meet, with seasonal floods due to river overflow.

○ A mountainous region located in the Alps, with abundant snow and glaciers and a relatively mild climate.

What strategies or policies is the country/region where Harry lives implementing to address climate change and enhance resilience?

○ Harvesting rainwater and implementing climate-smart agriculture to prepare for droughts and use water efficiently.

○ Utilizing geothermal energy to reduce carbon emissions and establish an eco-friendly energy system.

○ Protecting the alpine ecosystem and operating disaster preparedness systems to respond to changes in snow and glaciers.

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Exploring the Factors and Examples that Enhance Resilience

What factors contribute to enhancing resilience and enabling recovery from the environmental changes caused by climate change?

Let's explore these factors and examine real-world examples.

(1) Protection and Restoration of Forests and Wetlands

	Explanation	Image
Explanation	Forests and wetlands are vital defense systems that prevent natural disasters, address climate change, and protect biodiversity. When these ecosystems are damaged, the risk of floods and landslides increases, making their protection and restoration essential.	
Example	• **Restoration of the Baekdu Daegan Forest in South Korea** – Forest restoration has led to a reduction in floods and landslides, as well as an increase in biodiversity. • **Everglades Wetland Restoration in the United States** – Restoration efforts have improved water quality and restored flood control functions.	

(2) Public Transport Usage Rate

	Explanation	Image
Explanation	An increase in public transportation usage leads to a reduction in greenhouse gas emissions, whereas a	

reduction in greenhouse gas emissions, whereas a rise in personal vehicle use exacerbates air pollution and traffic congestion.

Example	**BRT Bogotá, Colombia** – Expanding public transportation has helped reduce traffic congestion and air pollution.	

(3) Climate-adapted Crop Cultivation

	Explanation	Image
Explanation	Growing crops that are resilient to climate change helps maintain agricultural productivity. In contrast, sticking to traditional farming methods may lead to unstable yields.	
Example	**Climate-adapted Rice Varieties in India** – The Development of drought- and flood-resistant varieties to maintain stable agricultural production.	

(4) Climate Change Response and Disaster Preparedness Systems

	Explanation	Image
Explanation	Establishing disaster preparedness systems helps minimize the damage caused by climate change and natural disasters. On the other hand, a lack of preparedness reduces the resilience of local communities.	
Example	**Delta Works in the Netherlands** – Use of dams and canals to address the risks of rising sea levels and flooding.	

(5) Use of Renewable Energy

	Explanation	Image
Explanation	Renewable energy sources like solar and wind reduce carbon emissions, whereas continued reliance on fossil fuels accelerates climate change.	
Example	**Germany's Energy Transition Policy** – Expansion of solar and wind energy and efforts to reduce carbon emissions.	

⊘3 **(Activity)** Draw lines to match the description with the appropriate resilience-enhancing factor.

Let's connect each explanation with the relevant factor that strengthens resilience.

This factor reduces the risks of environmental changes through the conservation and restoration of nature, helping to maintain diverse species and ecosystems, which contributes to enhancing disaster response capabilities.

○

This factor contributes to maintaining stable production and supply even amidst unexpected changes by preparing to adapt to surrounding climatic conditions.

○

This factor strengthens long-term climate change response capabilities by increasing the use of sustainable energy sources, reducing carbon emissions, and lowering environmental burdens.

○

○

Use of renewable energy

○

Climate-adapted crop cultivation

○

Protection and restoration of forests and wetlands

제출

Exploring the Factors and Effects that Enhance Resilience

Have you explored the various factors that enhance resilience? Now, let's examine the effects these factors have.

Factors such as the restoration of forests and wetlands, the expansion of public transportation, the cultivation of climate-resilient crops, the establishment of disaster preparedness systems, and the use of renewable energy play a crucial role in responding to climate change and natural disasters. Through these efforts, we can protect the environment and enhance the resilience of society.

Key Factors that Enhance Resilience

Nature Protection and Climate Change Response
Carbon absorption and greenhouse gas reduction
Water purification and biodiversity protection

Urban Environmental Improvement
Reduction of greenhouse gas emissions
Mitigation of air pollution and alleviation of traffic congestion

Strengthening Food Security and Disaster Resilience
Maintaining stable food production despite climate change
Reducing damage from floods, typhoons, and enhancing community resilience

Energy Transition and Sustainability

Energy Transition and Sustainability

· Carbon emission reduction

· Promoting the transition to sustainable energy sources

Health of forests and wetlands

Expansion of public transportation

Cultivation of climate-resilient crops

Establishment of disaster preparedness systems

Use of renewable energy

Strengthening resilience to food-related disasters

Nature conservation and climate change response

Energy transition and ensuring sustainability

Improvement of urban environments

Of course, these are not the only factors that enhance resilience. Other factors, such as the circular economy (resource recycling), strengthening public health systems, sustainable urban design, and disaster preparedness education, also play a vital role.

By properly managing these factors, we can effectively respond to climate change, minimize the damage from natural disasters, and move toward a sustainable future.

4 **(Activity)**Which of the following is NOT a positive effect brought by the factors that enhance resilience?

Choose the option that does NOT represent a positive effect of the factors that enhance resilience.

○ 1. trengthening food and disaster resilience

○ 2. Urban environment improvement

○ 3. Nature conservation and climate change response

○ 4. Increased risk of natural disasters

○ 5. Energy transition and securing sustainability

제출

# Exploring the Factors and Effects that Reduce Resilience

Let's explore the factors that reduce resilience and the damage they cause.

Key factors that reduce resilience:

· **Indiscriminate Land Development**: Urban and agricultural expansion destroys ecosystems and increases the risk of natural disasters.

· **Inefficient Transportation Systems**: Increased personal vehicle use intensifies greenhouse gas emissions and air pollution.

· **Agricultural Methods That Do Not Adapt to Climate Change**: Relying on traditional farming methods leads to a decrease in crop yields due to climate change.

· **Inadequate Disaster Prevention and Management**: The lack of disaster prevention systems exacerbates damage from floods, typhoons, and other natural disasters.

· **Continued Use of Fossil Fuels**: Dependence on fossil fuels like coal and oil increases carbon emissions and accelerates climate change.

The damage and negative impacts resulting from these issues:

· **Increased Risk of Natural Disasters**: Higher frequency and severity of landslides, floods, and droughts.

· **Ecosystem Destruction**: Loss of biodiversity and depletion of biological resources.

· **Environmental Degradation**: Acceleration of climate change due to increased greenhouse gas emissions, along with worsening air and water pollution.

· **Instability in Food Production**: Reduced crop yields, leading to food insecurity and economic damage.
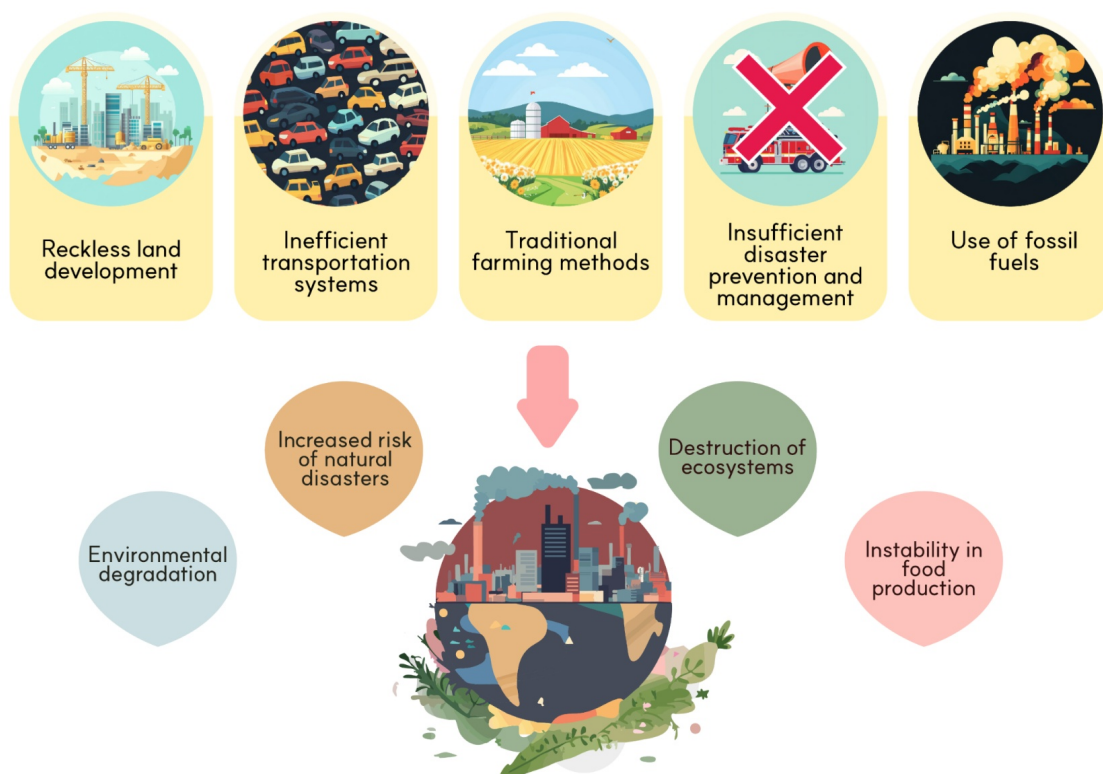
These issues do not occur in isolation; rather, they are interconnected and ultimately reduce the resilience of both nature and society, weakening the ability to respond to climate change and disasters.

Therefore, it is essential to reduce these factors and enhance resilience through sustainable policies and practices.

⬤5 **(Activity)** Which of the following is NOT a consequence of factors that lower resilience?

Choose the option that is NOT a consequence of factors that lower resilience.

○ 1. Environmental degradation

○ 2. Urban environment improvement

○ 3. Ecosystem destruction

○ 4. Food production instability

○ 5. Increased risk of natural disasters

제출

⬤6 **(Activity)** Classify the following factors as either enhancing resilience or reducing it.

Let's classify the following factors from the list below.

Health of forests and wetlands	Irresponsible land development	Expansion of public transportation
Growing climate-adapted crops	Inefficient transportation systems	Agricultural methods not adapted to climate change
Establishment of disaster preparedness systems	Inadequate disaster prevention and management	Use of renewable energy
	Continued use of fossil fuels	

Factors that enhance resilience

Factors that reduce resilience

제출

Learning How to Use the Simulation

This simulation is designed to help you manage a region affected by climate change and understand the factors influencing resilience.

Watch the video to learn how to use the simulation.

**⊘7** **(Activity)**Watch the video below and run the simulation to learn how to use it

<How to Use the Simulation>

📹 영상 링크: https://youtu.be/YXMts_vMcSs

<Simulation>

📄 웹페이지 링크: https://hn-simulation.rootsall.net/resilience/?id=118827#/view/?lang=en&dataset=stage1

제출

⊘8 **(Activity)**Have you learned how to use the simulation? After running the simulation, let's choose the most appropriate answer based on the results.

After investing 10 points in each resilience factor and running the simulation,

Select the appropriate number of natural disaster occurrences after 20 years.

○ 3 times

○ 5 times

○ 8 times

○ 12 times

제출

Select the appropriate number of species after 20 years.

○ 38 species

○ 66 species

○ 74 species

○ 91 species

제출

Select the appropriate population number after 20 years.

○ 524,000 people

○ 419,000 people

○ 653,000 people

○ 841,000 people

제출

Understanding the Relationships Between the Factors

Influencing Resilience Through Simulation (1)

Have you learned how to use the simulation? If so, let's freely manipulate the simulation to understand and organize the relationships between the factors that influence the resilience of a region.

Observe how the six factors in the simulation impact the frequency of natural disasters, biodiversity, and population numbers. As you analyze these relationships, share your insights.

<Simulation>

📄 웹페이지 링크: https://hn-simulation.rootsall.net/resilience/?id=118835#/view/?lang=en&dataset=stage1

9 Select the resilience factors that you believe are important for reducing natural disasters during the simulation.

Select and group the resilience factors that are important for reducing natural disasters.

Restoration of Green Spaces	Enhancing Public Transport	Climate-adapted Crops	Flood Prevention Management

Renewable Energy Use	Wetland Restoration

Resilience factors important in reducing natural disasters

제출

˙What role did the factors you selected play in reducing the frequency of natural disasters? Share your opinions.

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[3066] tiptap

제출

10 ˙Select the resilience factors that are important for increasing biodiversity during the simulation.

Select the resilience factors that are important in increasing biodiversity during the simulation and group them.

Restoration of Green Spaces	Enhancing Public Transport	Climate-adapted Crops	Flood Prevention Management

Renewable Energy Use		Wetland Restoration

Resilience factors that are important in increasing biodiversity

제출

˙What role did the factors you selected play in increasing biodiversity? Share your opinions.

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제출

● 11 ˙Select the resilience factors that you believe are important for increasing the population.

Select the resilience factors that contribute to increasing the population.

Restoration of Green Spaces	Enhancing Public Transport	Climate-adapted Crops	Flood Prevention Management

Renewable Energy Use	Wetland Restoration

Resilience factors important in increasing the population

제출

˙What role did the factors you selected play in increasing the population? Share your opinions.

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제출

Understanding the Relationships Between Resilience Factors
through Simulation (2)

You can strategically invest limited points (resources) into **six factors**: **restoration of greenery, wetland restoration, enhancing public transportation, introduction of climate-adapted crops, flood control management,** and **expanding the use of renewable energy**.

While conducting the simulation, observe how investments in each factor lead to positive changes in reducing the **frequency of natural disasters, increasing species diversity,** and **promoting population growth**.

<Situation>

Due to climate change, dry weather has led to large-scale wildfires, causing the loss of both greenery and climate-resilient crops in the area. If this situation is not addressed, biodiversity loss and worsening food and water shortages will be exacerbated, natural disasters will become more frequent, the population will decrease, and the community's ability to recover will become more difficult.

Follow the guidelines below to restore the region's resilience in the simulation, increase biodiversity and population, and reduce natural disasters. Check the issues the region is facing and implement strategies to strengthen resilience, making the region more resilient even in the face of climate change.

Additionally, explore the relationships between various factors that influence resilience.

⬤⬤ 12 **(Activity)** Read the situation above and follow the guidelines to run the simulation.

<Guidelines>

˙The base score reflects the current state of the region. The lower the score, the worse the situation.
˙You can add up to 30 points to each factor, and the total points available for use are 52 points.

<Goal>
Strategically allocate the 52 points across different factors to restore the area where greenery and climate-resilient crops have been lost, and increase the region's resilience. **Run the simulation to increase the population over time, reduce natural disasters, and improve biodiversity in the region.**

˙Capture and attach the results of investing in resilience factors to increase population, reduce natural disasters, and improve biodiversity.

📄 웹페이지 링크: https://hn-simulation.rootsall.net/resilience/?id=118843#/view/?lang=en&dataset=stage2

제출

⬤⬤ 13 **(Activity)** Answer the questions below to write the results of the simulation.

˙Share how you distributed the total of 52 points across the different factors.

<Example>

12 points for Green Space Restoration, 8 points for Wetland Restoration, 11 points for Public Transport Enhancement, 4 points for Climate-Resilient Crops, 6 points for Flood Management, 8 points for Renewable Energy Use.

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[3581] tiptap

제출

⬤ 14 ˙Write down the top 3 factors where I invested the most points.

<Example>

Green Space Restoration, Public Transport Enhancement, Renewable Energy Use.

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[3658] tiptap

제출

⬤ 15 ˙Write down the reasons why you invested a large amount of points in the three chosen factors, and explain how adjusting the points influenced the region's resilience, reduced the frequency of natural disasters, and increased the population and biodiversity.

<Example>

I allocated a large number of points to green space restoration, public transport enhancement, and expanding renewable energy use, distributing the remaining points among the other factors. First, I invested heavily in green space restoration was to help restore areas damaged by wildfires, even if only slightly. As green spaces increased, the land became more stable and absorbed rainwater effectively, which reduced the occurrence of natural disasters. Additionally, the environment became more suitable for plants and animals, boosting species diversity. As the natural environment improved, people would have been more inclined to settle in the region.

Enhancing public transport makes mobility easier and reduces transportation costs, which likely helped people with their work and education. As a result, the population would have increased. Expanding renewable energy use helped reduce environmental pollution by promoting clean energy and decreasing the use of fossil fuels, which negatively impact climate change. Furthermore, the reduction in energy costs likely increased people's satisfaction with their lives. I believe these three factors worked together to reduce natural disasters, increase biodiversity, and contribute to a growing population.

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[3739] tiptap

16 `'After conducting the simulation, reflect on what you learned about the relationships between the factors that influence resilience.

<Example>

At first, I focused primarily on allocating points to **restore the green spaces and climate-adapted crops** that were destroyed by wildfires, while neglecting the other factors. However, as I continued with the simulation, I realized that simply addressing the problem areas was not enough to significantly enhance the overall resilience of the region. I understood that managing various factors in a balanced way and improving them together is essential for reducing natural disasters, restoring ecosystems, and ensuring the stable growth of the community. I recognize that resilience is not achieved by focusing on a single issue, but by addressing various factors.

[3820] is-empty
[3819] tiptap

17 **(Activity)**Write about the most interesting part of the simulation. If you didn't find anything particularly interesting, you can write "None."

< Example >

While allocating points to the factors that influence resilience, I enjoyed experimenting with putting all my points into one factor and then dividing them among various factors. It was interesting to see how changes in the distribution of my points affected the frequency of natural disasters, biodiversity, and the population. The immediate results and observing how my decisions impacted the simulation were fun.

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[3897] tiptap

18 **(Activity)**Write about the most challenging part of the simulation. If there wasn't anything particularly difficult, you can write "None."

< Example >

At first, I invested most of my points in restoring the greenery, but the region did not recover as expected, making it difficult for me to achieve the desired results.

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[3975] tiptap