

احجز مكانك واستعد للامتحان بثقة كاملة

$$F = \frac{Gm_1m_2}{r^2}$$

ملزمة العلوم الفصل الثالث

2026 Inspire 5 عام لعام

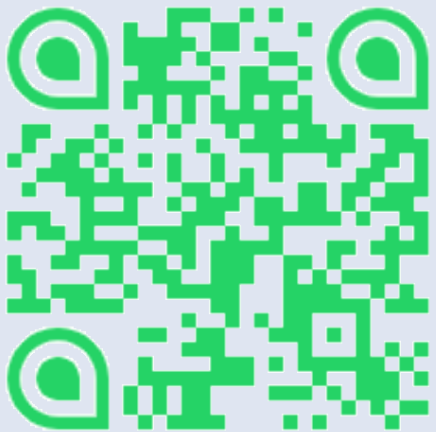
$$EF = ma$$

EF

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تنويه:
تم إنشاء هذه الملزمة لمساعدتك، ولكن المرجع الرئيسي هو الكتاب،
وسيكون هناك ملف إضافي للأمثلة.

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شرح لدروس الفصل
الثالث كامل

ب. 99
درهم فقط

ملازم

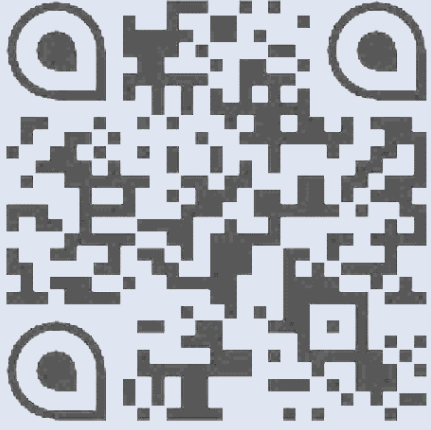
اختبارات



Module (1): Matter in Ecosystems

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Module (1): Matter in Ecosystems

01

First Lesson: Plant Survival



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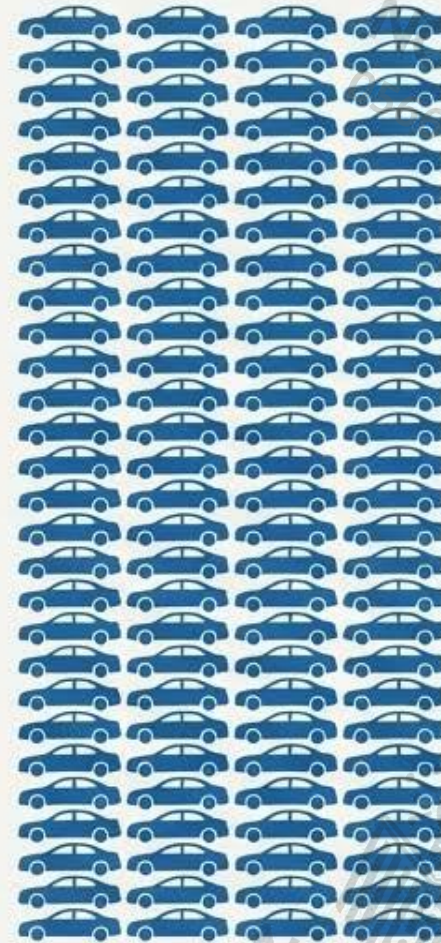
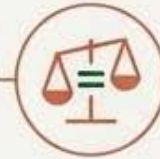
NOLOGIA™ Masterclass: The Blueprint of Plant Survival

- **Module Profile:** Matter in Ecosystems
- **Subject:** Botanical Systems Engineering & Survival Mechanisms
- **Objective:** Decode the structural, chemical, and environmental blueprints that allow microscopic seeds to engineer the largest living structures on Earth.

The 1,300-Ton Biological Mystery

Mass Measurement

The trunk alone weighs approximately 1,300 tons.



Equivalency

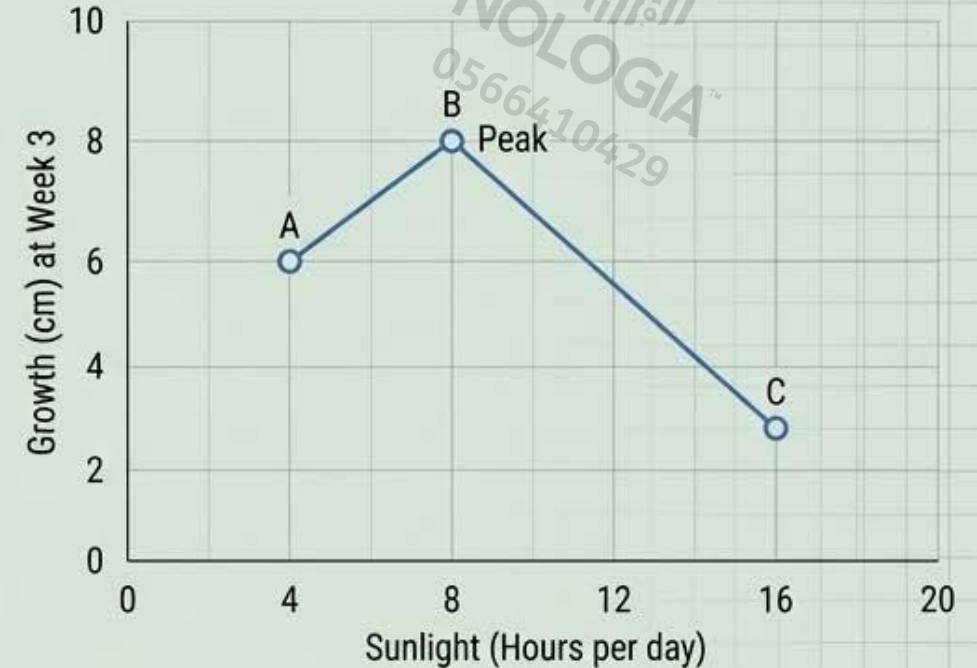
Equal to the weight of 650 standard cars.

The Diagnostic Question: How does a static organism acquire the resources needed to engineer this much mass?

Calibrating the Essential Inputs for Growth

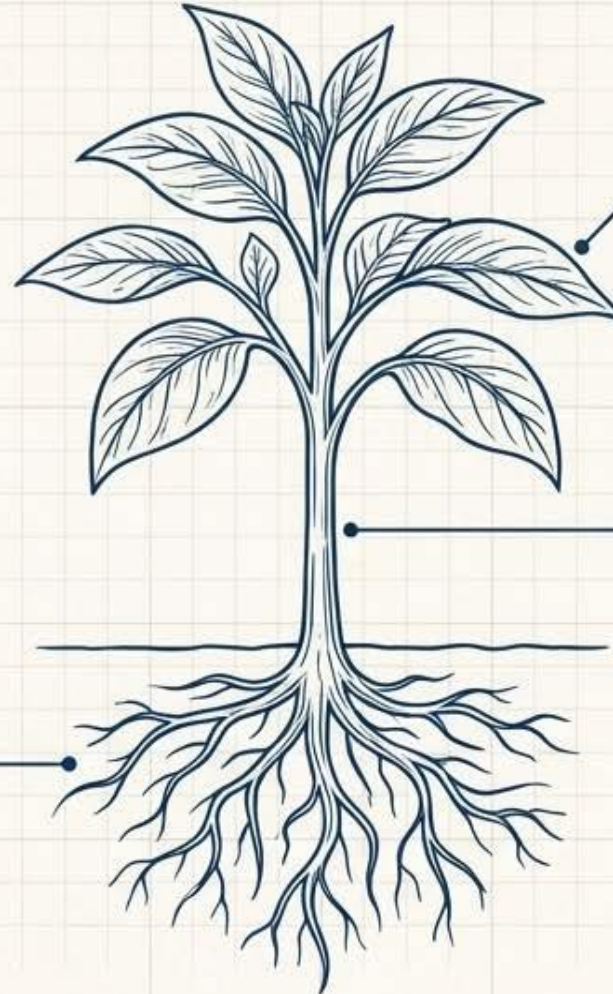


Virtual Lab Results (Parker's Data)



1	The Essential Trio	2	Simulation Data	3	NOLOGIA Insight
	Growth requires a precise, mathematical calibration of Water, Air, and Sunlight.		- Input A (4 hrs sun): 6 cm growth -> Sub-optimal - Input B (8 hrs sun): 8 cm growth -> Optimal Maximum - Input C (16 hrs sun): 3 cm growth -> System Overload		More is not always better. Biological systems require optimized, not infinite, inputs.

The Primary Hardware: Structural Blueprints



Leaves (The Solar Arrays)

Flat, expanded surface areas engineered to capture light energy and facilitate gas exchange with the atmosphere.

Stem (The Central Pylon)

Provides structural integrity and houses the specialized tissue networks responsible for vertical transport.

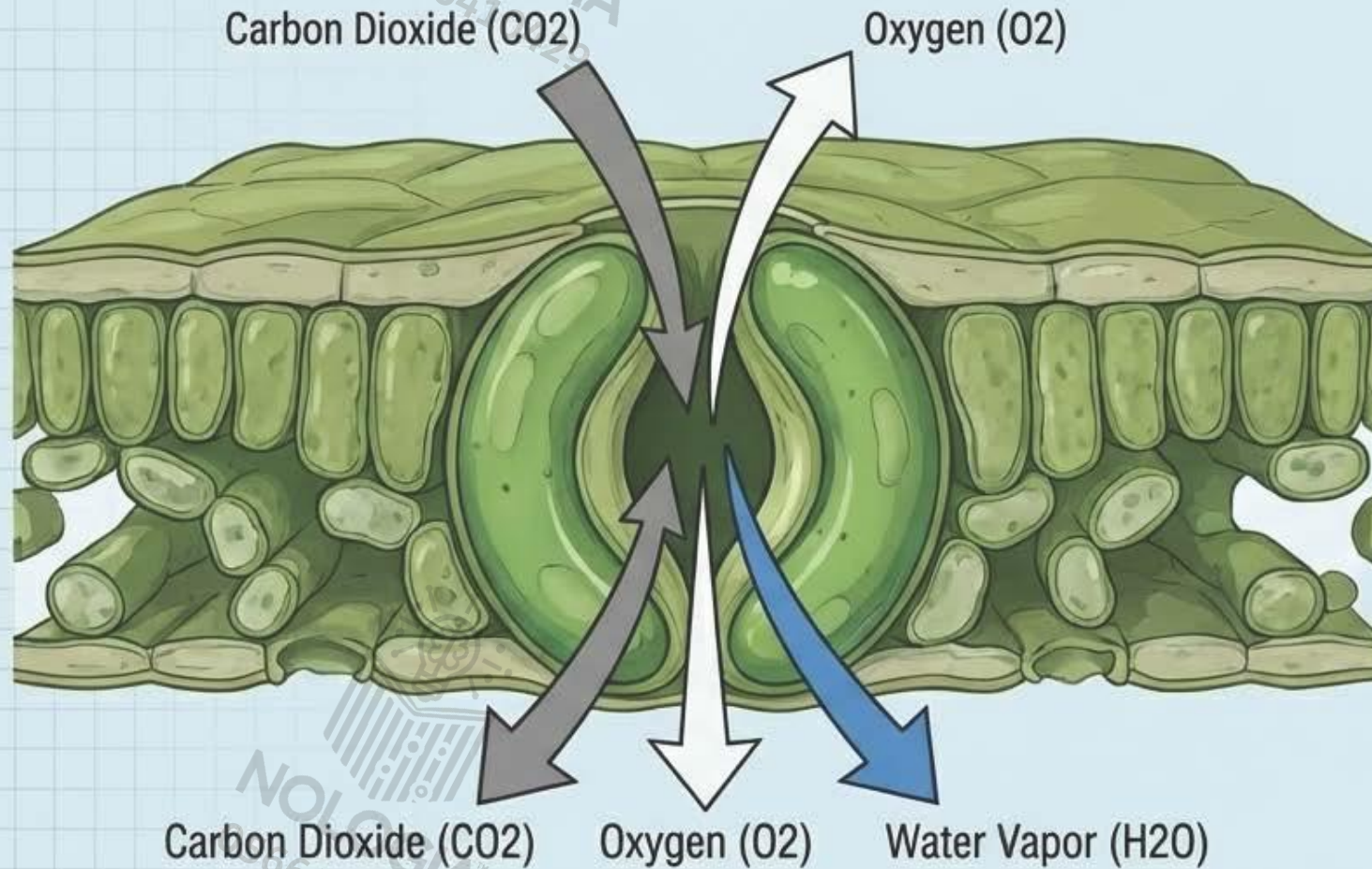
Roots (The Extraction Grid)

Anchor the system into the foundation. Actively absorb water and essential nutrients from the surrounding soil.

Vocabulary Definition: Energy

The ability to perform work or change something. Plants use these structures to obtain the materials needed for energy.

Stomata: The Microscopic Gateways



Mechanism

Tiny, dynamic openings located on the underside of most leaves.

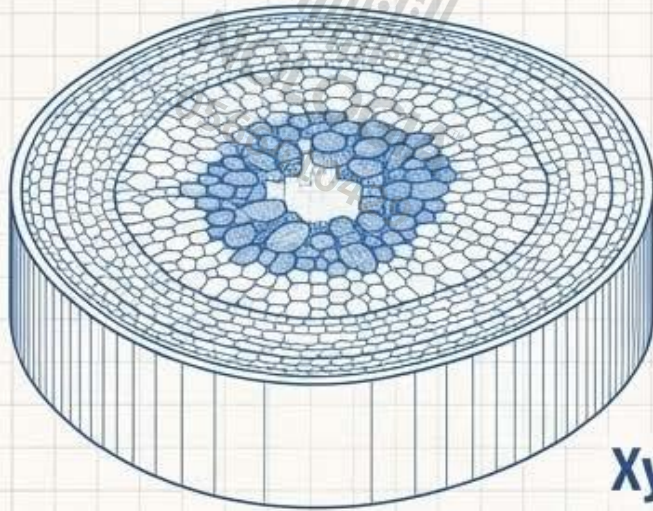
Intake

Allows vital Carbon Dioxide from the surrounding air to enter the internal system.

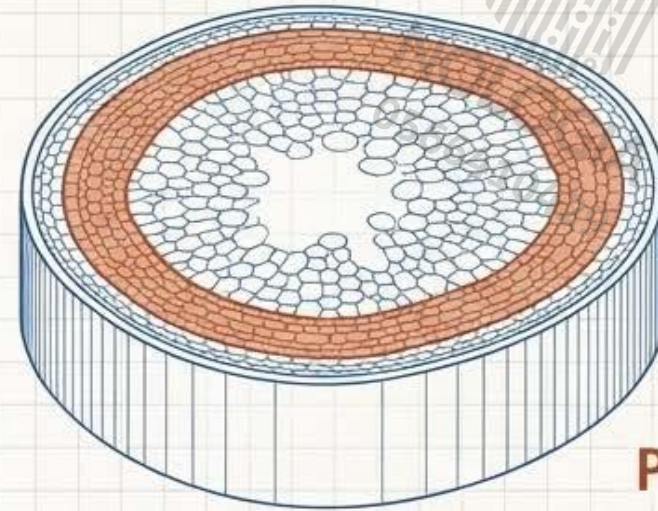
Regulation

These gateways can physically close to seal the leaf, preventing vital water from escaping during high-heat or drought conditions.

The NOLOGIA Transport Table: Xylem vs. Phloem



Xylem



Phloem

Xylem (The Water Main)

- **Payload:** Transports Water.
- **Location:** Runs through the center of the stem.
- **Direction:** One-way flow (Strictly Upward).
- **Source:** Extracted from the soil by the roots.

Phloem (The Sugar Grid)

- **Payload:** Transports Sugars (Food).
- **Location:** Specialized outer tissues within the plant structure.
- **Direction:** Multi-directional (Drives movement to ALL parts of the plant).
- **Source:** Manufactured in the leaves via photosynthesis.

Defying Gravity: The Transpiration Elevator

1. Evaporation

Water turns to vapor and exits the leaves through the stomata gateways.

2. The Pull

Because water molecules naturally cohere (stick together), this evaporation creates a vacuum-like tension.

3. Replacement

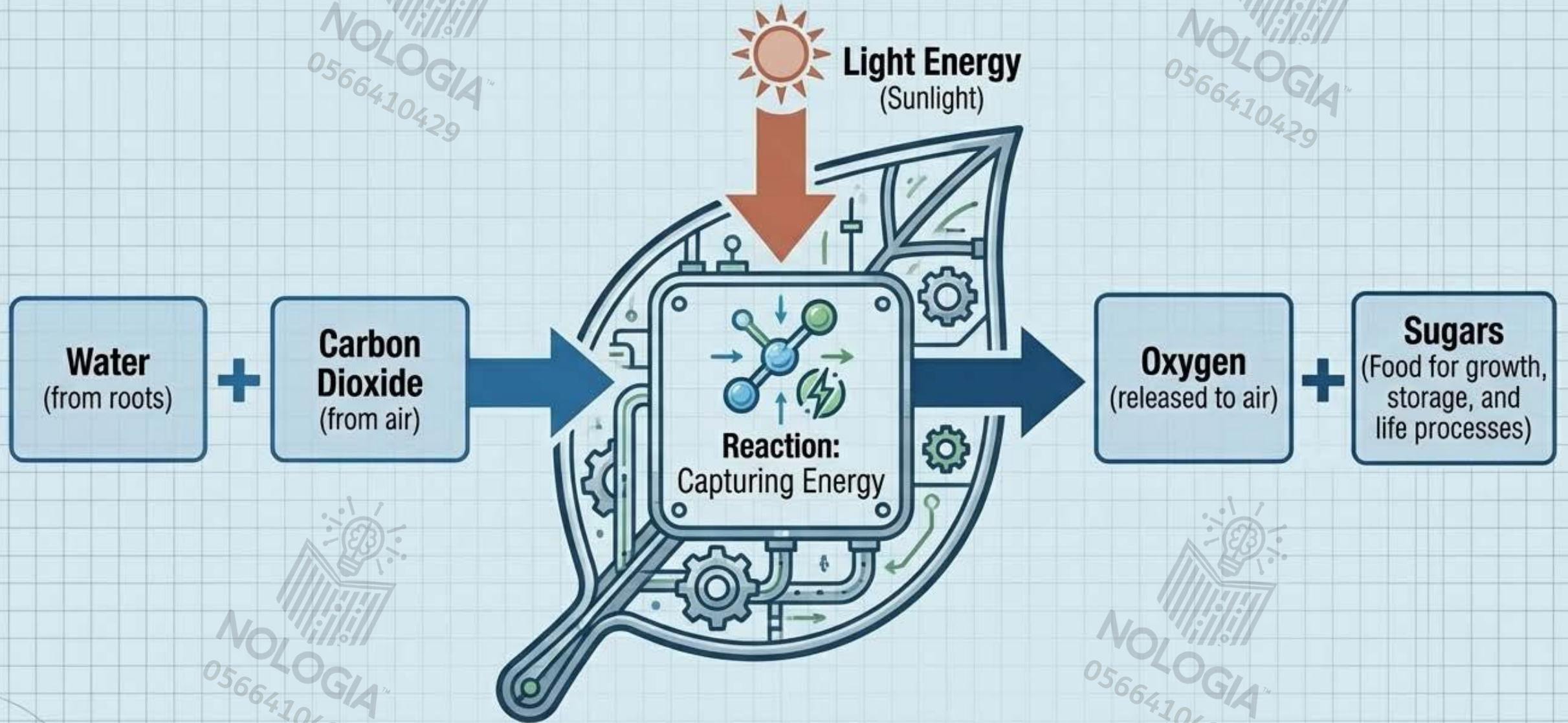
As water evaporates at the top, more water is forcefully pulled from the bottom of the plant to the top to replace it.

NOLOGIA Definition: Transpiration

The evaporation of water from a plant's leaves, acting as the engine that pulls replacement water upward.



The Photosynthesis Engine: Manufacturing Energy



Environmental Engineering: Adapting to Extremes

The Foundation Rule

All plants need physical space for roots to spread out and absorb vital nutrients. When plants grow too close together, they compete and starve each other of resources.



Extreme: Desert Cacti

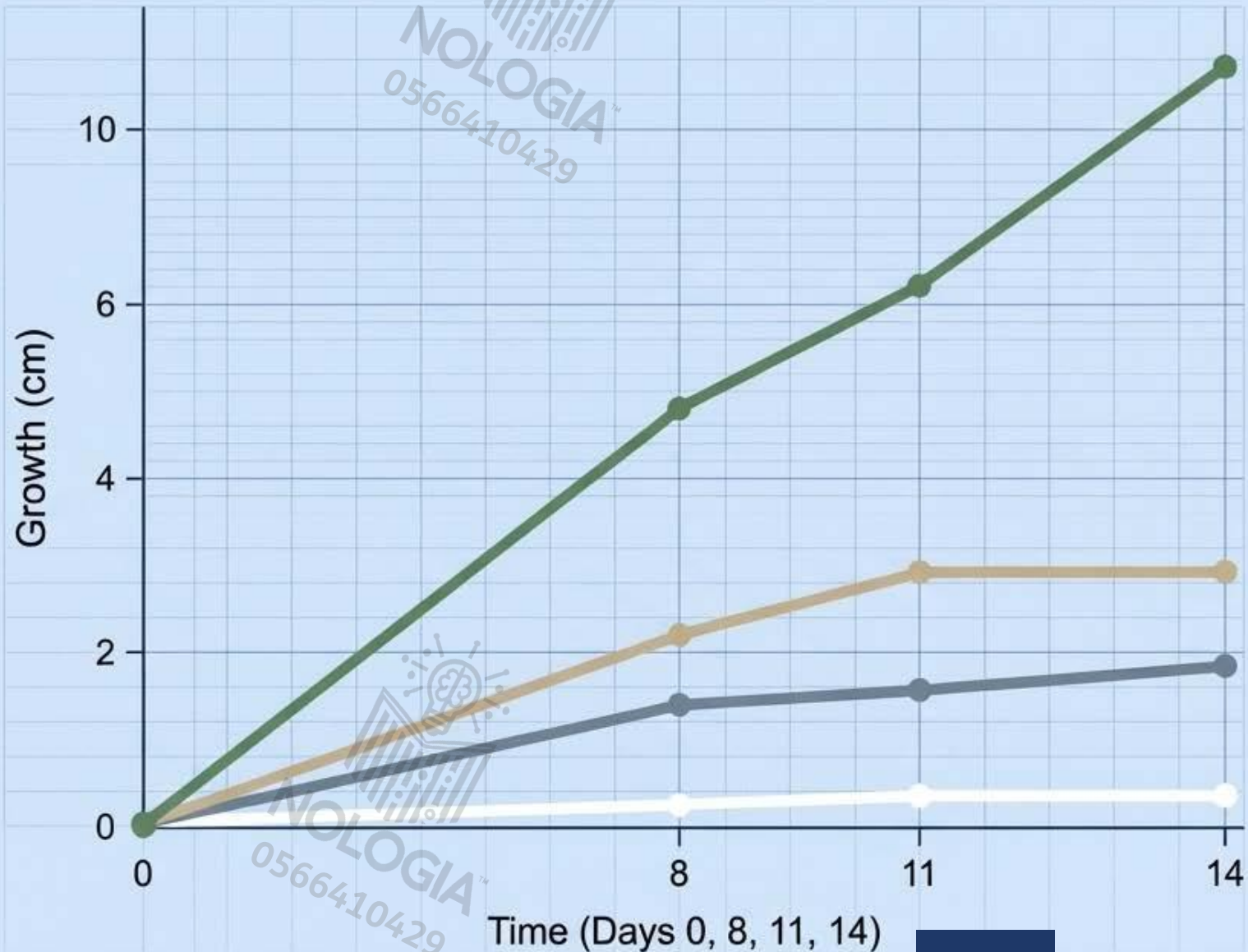
Engineered for severe water scarcity. They survive with extremely low rainfall by maximizing internal water storage capabilities and minimizing leaf surface area.



Extreme: Rainforest Vines

Engineered for extreme light competition. In dense environments, woody vines adapt by climbing high into the tree canopy to access vital sunlight blocked by taller trees.

The Foundation Lab: Analyzing Growth Mediums



Graph Key & Results

- Traditional Soil**
Highest Growth. Rich in naturally occurring nutrients and holds moisture optimally.
- Sand Environment**
Moderate/Poor Growth. Roots can easily spread, but it has poor water and nutrient holding capacity.
- Gravel Environment**
Poor Growth. Water drains too rapidly; lacks nutrient retention.
- Cotton Control**
Minimal Growth. Represents a zero-soil environment. Holds initial water but provides absolutely zero environmental nutrients.

Hacking the Medium: Soil-less Hydroponics

Traditional Soil Systems



- **Mechanism:** Roots must expend significant energy expanding through dense dirt to hunt for water and naturally occurring nutrients.
- **Requirement:** Demands vast amounts of land, space, and time.

Hydroponic (Soil-less) Gardens



- **Mechanism:** Agricultural technicians bypass the soil entirely, delivering a perfectly calibrated liquid nutrient solution directly to the exposed roots.
- **Advantage:** Maximizes growth speed, saves massive amounts of space, and allows precise control over the plant's intake.

STEM Blueprint: Agricultural & Food Science Technician



Mission Objectives



Crop Quality Control

Monitor soil composition and check for destructive pests that threaten plant survival.



Livestock Management

Develop scientific methods to prevent and cure common illnesses in farm animals.



Supply Chain Tech

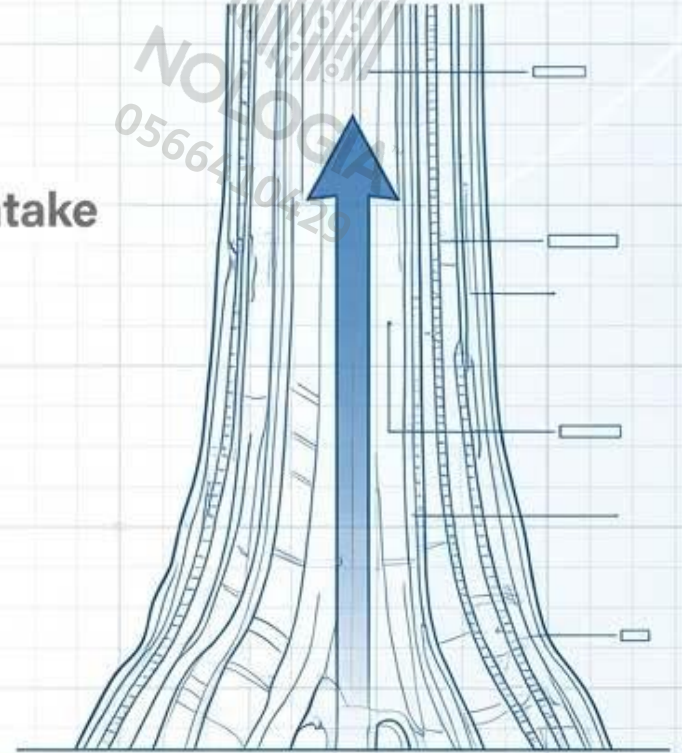
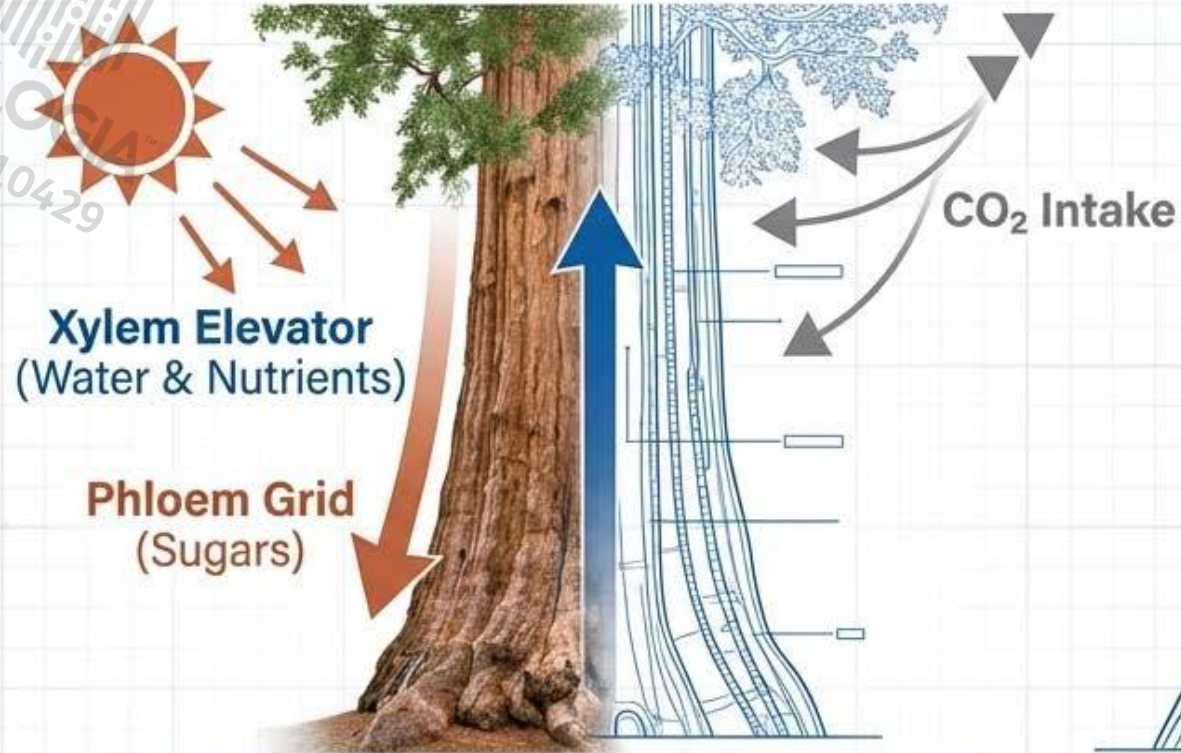
Utilize advanced technology to find safer, more efficient ways to package, preserve, and distribute food.



Food Safety

Research and implement new ways to maintain the strict safety and quality of meat and produce during transport.

Synthesis: Assembling the 1,300-Ton Giant

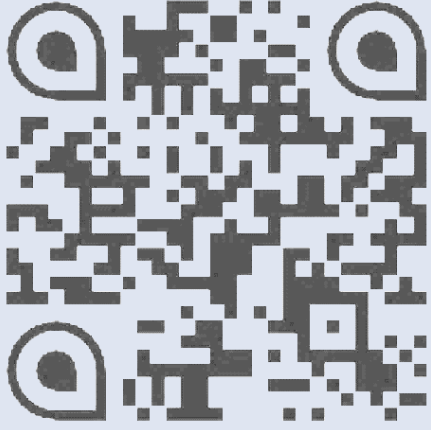


The Phenomenon Explained:

How does the static Giant Sequoia build 1,300 tons of solid mass? It does **NOT** build its mass from the dirt.

The Truth:

The overwhelming majority of the tree's **immense weight** is constructed entirely from **invisible molecules of Air** (Carbon Dioxide) and **Water**, chemically welded together by the **energy of the Sun** to create solid sugars.



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Module (1): Matter in Ecosystems

02

Second Lesson:
Interactions of Living Things

Unseen Connections Drive the Natural World

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Science | Study Masterclass

Field Note

What is the true relationship between these ants and the leaves?

Did You Know?

These ants DO NOT eat the leaves. They use them to farm their own underground food.



An ant can lift 50 times its own body weight to sustain its ecosystem.

Ecosystems Are Overlapping Networks of Matter



An Ecosystem is a complex network made up of all living and nonliving things interacting in a specific environment.



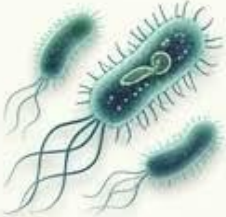
Living things depend on one another for food, shelter, and balance.



Living things depend on their physical environment for basic survival materials.



Every Ecosystem Balances Biotic and Abiotic Factors

Biotic Factors	Abiotic Factors
The living components of an environment.  Plants (Trees, Grasses)  Animals (Insects, Mammals)  Fungi  Bacteria	The nonliving components of an environment.  Air (Oxygen, Carbon Dioxide)  Water (Rain, Rivers)  Soil  Rocks & Minerals  Light & Temperature

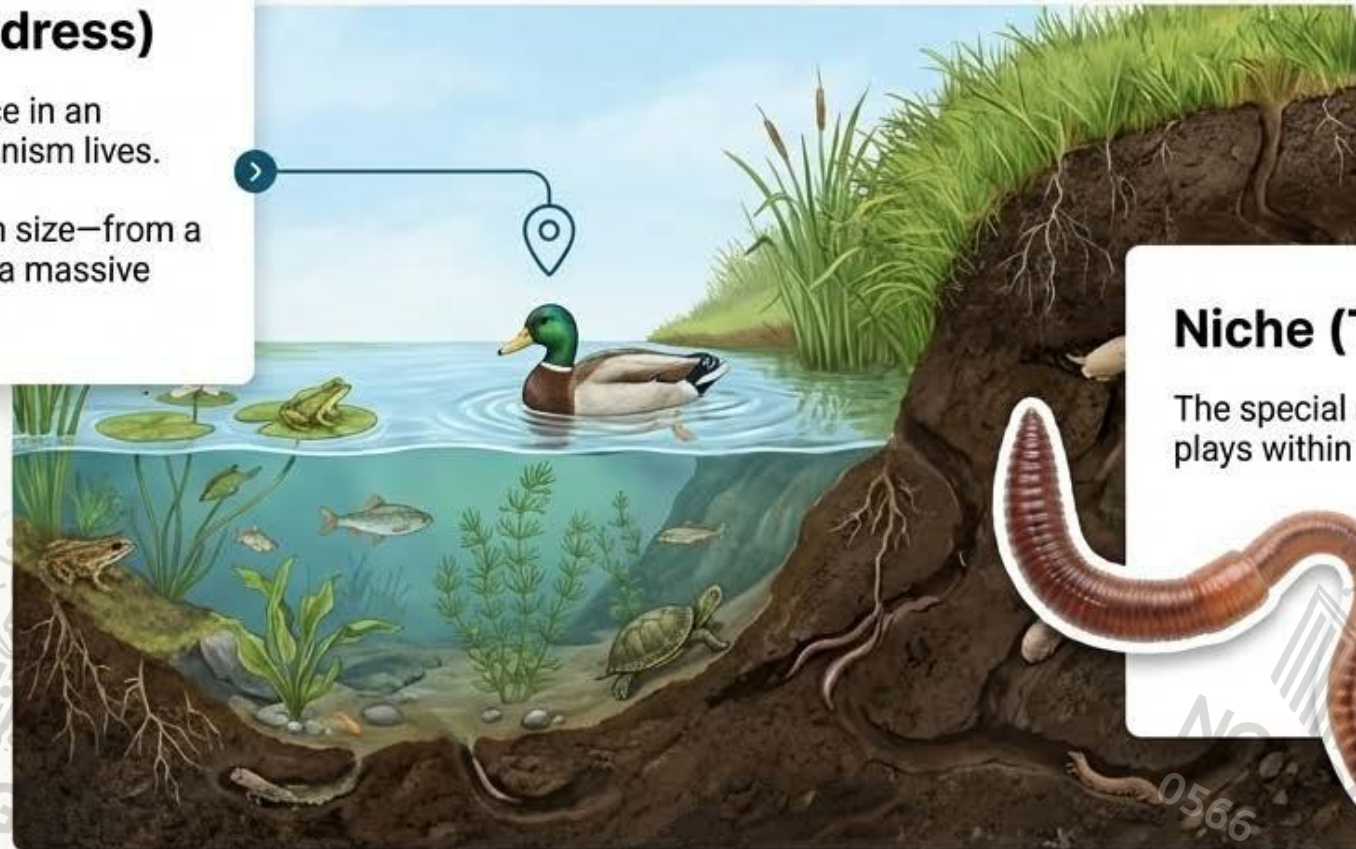
Interaction: Both factors must interact constantly to sustain life.

Organisms Have Specific Addresses and Unique Jobs

Habitat (The Address)

The specific physical place in an ecosystem where an organism lives.

- Habitats vary greatly in size—from a single decaying log to a massive freshwater river.



Niche (The Profession)

The special role or job an organism plays within that ecosystem.

Earthworm's Niche:
To break down dead plant matter in the soil and recycle nutrients.

Survival Dictates How Organisms Source Their Energy

Producers



Make their own food using abiotic factors (like light).

Plants, Algae, Trees

Consumers



Must consume other sources for food.



Herbivores

Eat only plants.

Examples: Deer, Rabbits, Gazelles.



Carnivores

Eat only other animals.

Examples: Hawks, Lions, Cheetahs.



Omnivores

Eat both plants and animals.

Examples: Bears, Raccoons, Humans.

Predation Prevents the Exhaustion of Resources

NOLOGIA Science | Population Control

Predator: The organism that hunts for its food.



The Ecological Mechanism

Why are predators essential?

Why are predators essential? They provide vital population control. If prey populations grow unchecked, they will consume all the producers (plants), causing the entire ecosystem to collapse.

Prey: The organism being hunted.

Predator and Prey Populations Form an Infinity Loop

1. Plentiful Rabbits (Prey) provide abundant food for Foxes (Predators).



2. Fox population increases and consumes a massive number of Rabbits.



3. Rabbit population drops dramatically, leaving Foxes without enough food.



4. Starving Foxes die off. With fewer Predators, the Rabbit population recovers.



The Math of Survival

- Fox survival requires catching 3+ rabbits.
- Surviving foxes produce exactly 1 offspring.
- Remaining rabbit population multiplies by 0.3.

Introduced Species Can Overwhelm Native Habitats

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Science | Ecosystem Disruptors

An **Invasive Species** is an organism moved from its natural ecosystem to a new area where it causes harm.

The Root Cause:

Spread primarily by intentional or unintentional human activities (travel, shipping, agriculture).



No Natural Predators:

They face no native animals equipped to hunt them.



Explosive Growth: Without biological limits, they reproduce and spread incredibly quickly.



Severe Harm: They outcompete native life, crash economies, and threaten human health.

The Cane Toad Experiment Resulted in Ecological Disaster



1. The Introduction (1930s)

Farmers intentionally move Cane Toads from South America to Australia to eat beetles destroying sugar cane crops.

2. The Unseen Variable

The toads possess highly toxic skin. Australia has no native predators equipped to hunt them safely.

3. Population Explosion

Without predators to control their numbers, the toad population rapidly explodes into the millions.

4. The Devastation

Instead of saving crops, the toads begin outcompeting native animals for food and fatally poisoning native predators.



What is an Entomologist? A specialized scientist who studies insects.

Profile: Dr. Edward O. Wilson

Lifespan of Work

50+ years traveling from the Arctic Circle to dense tropical rainforests.

Scale of Study

Analyzing massive ant colonies containing up to 20 million individual members.

Research Goal

To understand how the highly specific job (niche) of every single ant contributes to the future survival of the entire species.

The Delicate Balance of Survival

Make Your Claim



All living things absolutely rely on a continuous interaction with both biotic (living) and abiotic (non-living) factors for survival.



- **Resource Dependency:** Plants require abiotic light and soil; animals require biotic producers.

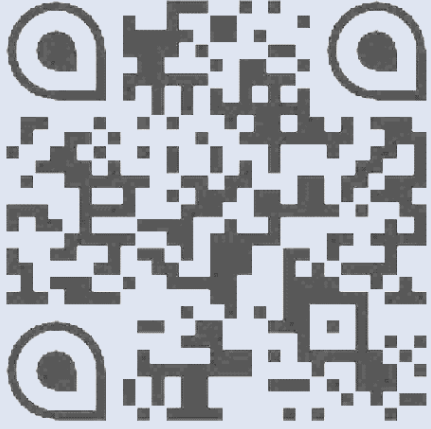


- **Population Balance:** Predators and prey are locked in a mathematical cycle that prevents the total exhaustion of ecosystem resources.



- **Vulnerability:** Introducing a single invasive variable (like a toxic toad with no natural predators) can break this network entirely.

An ecosystem is not just a place—it is an active, ongoing system of interactions.



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Module (1): Matter in Ecosystems

03

Third Lesson: Role of Decomposers



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NOLOGIA Field Guide • Module 01-03

The Hidden Heroes: The Role of Decomposers

A Comprehensive Living Lab Guide to Ecosystems, Phenomenon, and Nutrient Recycling.



“Encounter the Phenomenon” in Space Grotesk

**What is the relationship
between the mushroom
and the log?**



NOLOGIA Field Task: Look closely at the ecosystem. The log is dead, yet life is thriving upon it. What do you observe? What questions do you have about this phenomenon?

The Great Recyclers: What is a Decomposer?

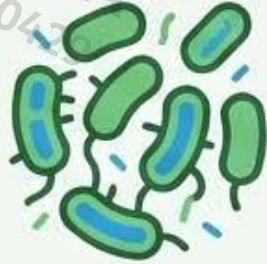


Decomposers are organisms that break down (decay) plant and animal matter.

The Transformation: They turn complex dead material into simpler substances.



The Main Characters: Bacteria vs. Fungi



→ Bacteria →

Structure: Made up of a single cell.

NOLOGIA Example:

Root bacteria that change nitrogen gas into a form that growing plants can use.



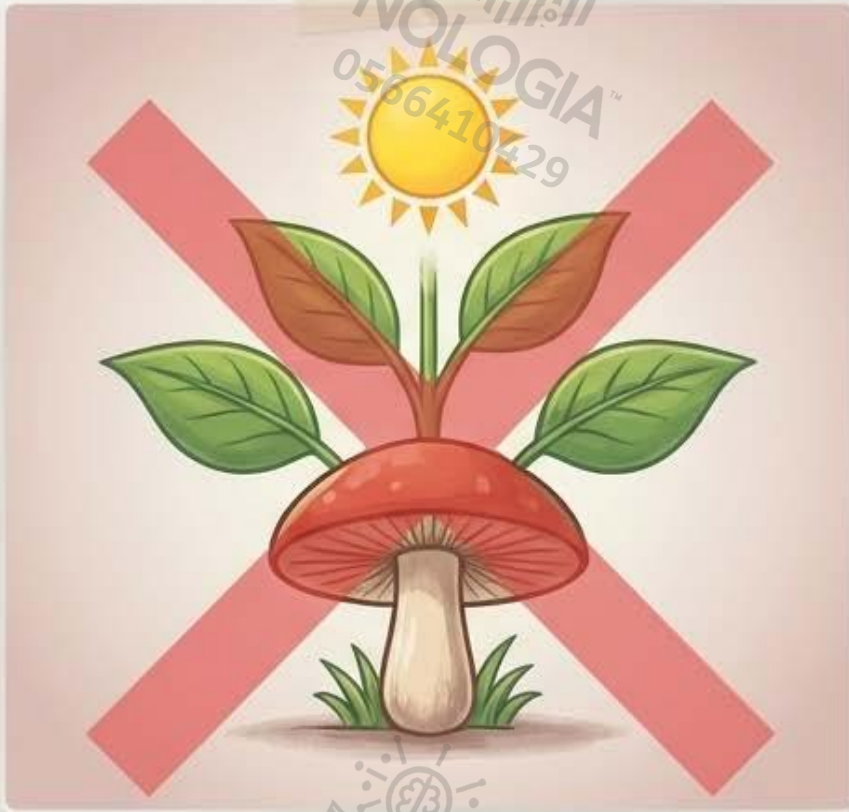
→ Fungi →

Structure: Appear in many shapes and sizes.

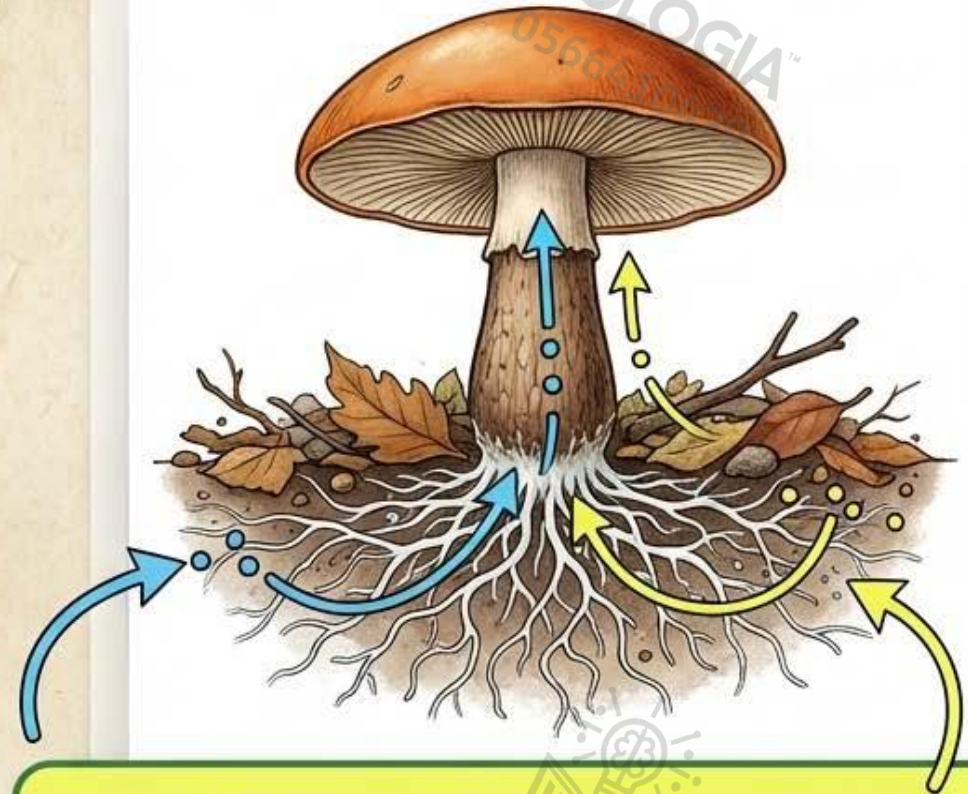
NOLOGIA Examples:

Yeast (makes holes in bread as it rises), fuzzy mold (warns us not to eat old food), smelly mildew, and forest-floor mushrooms.

Spotlight on Fungi: Busting the Plant Myth

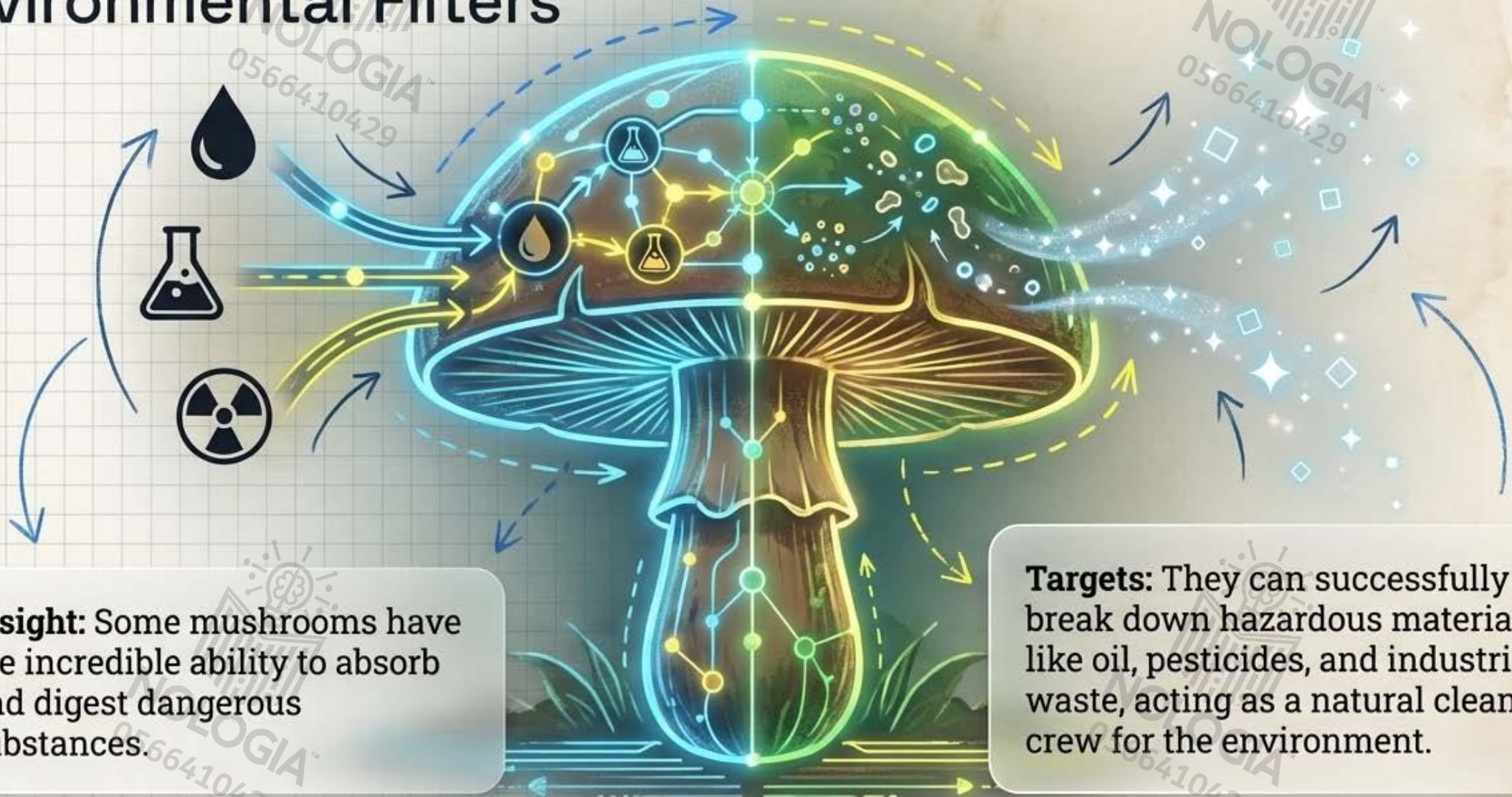


The Myth: For many years, scientists classified fungi as plants because they sprouted directly from the soil and didn't move.



The NOLOGIA Fact: Fungi are completely different from plants. Unlike plants, fungi cannot make their own food! They must feed by breaking down other materials.

Fungi Superpowers: Environmental Filters



Insight: Some mushrooms have the incredible ability to absorb and digest dangerous substances.

Targets: They can successfully break down hazardous materials like oil, pesticides, and industrial waste, acting as a natural cleanup crew for the environment.

Lab Investigation 1: Yeast & Bananas



LAB DASHBOARD

The Question:

How will yeast (a fungal decomposer) affect a banana over time?

The Setup:

Two sealed environments.

Control Group:

Banana slice without yeast.

Experimental Group:

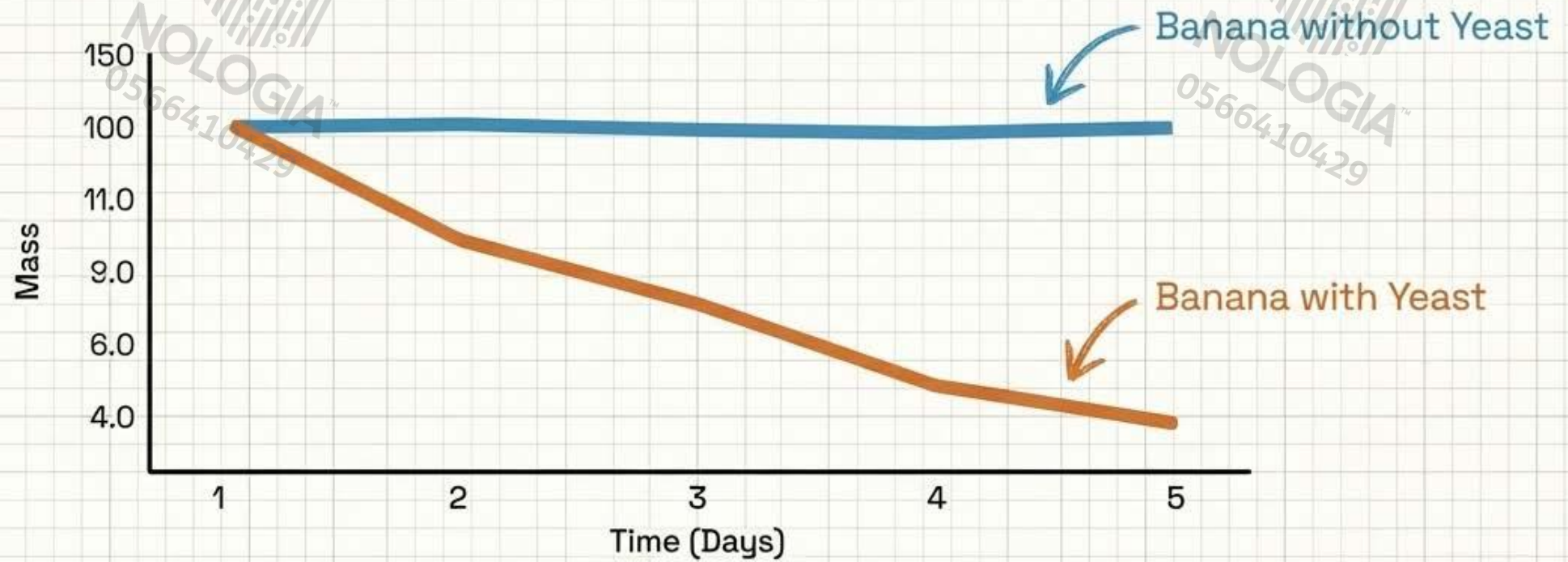
Banana slice with a sprinkle of yeast.

Metric:

Measuring physical mass using a pan balance over 5 days.

Masking tape

Lab 1 Data Story: The Disappearing Mass



The Observation

The banana with yeast visibly changes, breaking down into a softer, different form.

The Science

As the yeast decomposes the banana, it breaks down the plant matter into simpler substances. The physical mass of the solid banana decreases over the 5-day period as matter is transformed.

Lab Investigation 2: Soil Decomposers

The Question: Are decomposers more active in damp or dry environments?

The Setup: Testing different environmental factors by altering moisture levels in soil over a 10-day period.

LAB DASHBOARD

Carrot Specimen

Soil Type: Organic

Specimen Card

Specimen Card
Soil Type: Organic

1

Soil + 30 mL water
(Dampest)

2

Soil + 15 mL water
(Damp)

3

Soil + No water
(Dry)

4

No soil + carrot only
(Control)

Lab 2 Data Story: The Moisture Dependency

Rate of Decay over 10 Days



Specimen Card

The Result: Different environmental factors dramatically affect how decomposers work.

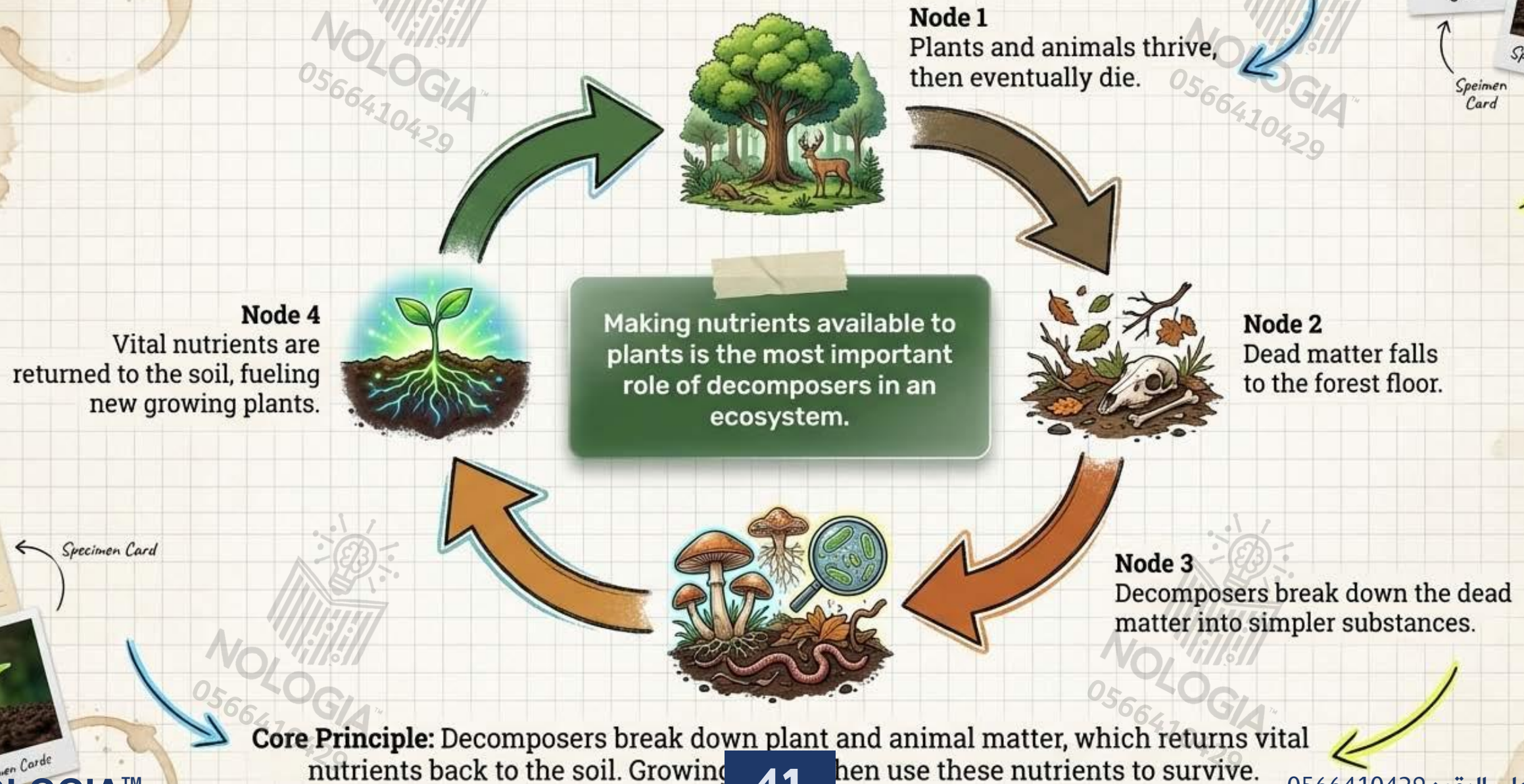


NOLOGIA Conclusion: Soil decomposers are significantly more active in damp environments than in dry environments.

Without moisture, the breakdown of dead matter stalls.



The Synthesis: The Nutrient Recycling Loop



Human Impact: Three-Dimensional Thinking



Positive Application

Working Together: Humans harness the power of decomposers to manage food waste by building compost heaps, allowing nature to break down our scraps into fertilizer.

Decomposer Advantage

Humans use decomposers to reduce landfill waste.



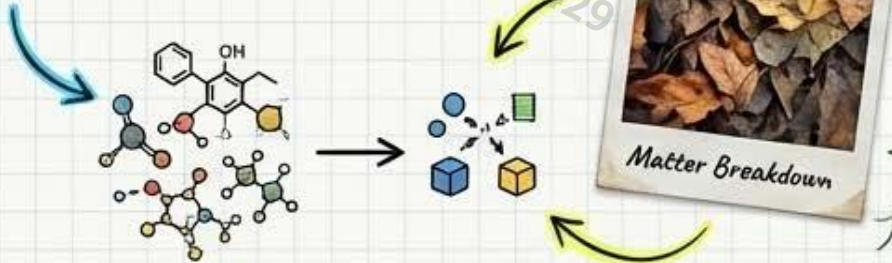
Interference Risk

Interference Risk: Human activities that change forests (like pollution or extreme drying) can severely interfere with the moisture and environments these crucial decomposers need to survive.

The NOLOGIA Master Cheat Sheet

What They Do

Break down dead plant and animal matter into simpler substances.



Who They Are

Bacteria

single-cell, root nitrogen fixers



Fungi

mushrooms, yeast, fuzzy mold; strictly feed on broken-down materials and cannot make their own food.



How They Work

Reduce the physical mass of dead matter over time. They are highly dependent on moisture and thrive in damp environments over dry ones.



Moisture is Vital for Activity.



Moisture is Vital for Activity.

Why It Matters

Return vital nutrients to the soil for growing plants. This nutrient recycling loop is their most important role in keeping global ecosystems completely balanced.

Nutrient Recycling Loop: Essential for Ecosystem Balance

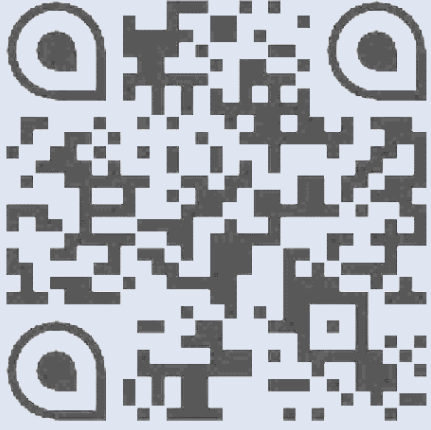


NOLOGIA
Field Guide

Module (2): Energy in Ecosystems

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2-2	Cycles of Matter in Ecosystems	60
2-3	Energy Transfer in Ecosystems	76

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Module (2): Energy in Ecosystems

01

First Lesson:
Earth's Major Systems

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Earth's Major Systems

A Complete Visual Guide to the
Geosphere: Terracotta Brown
Hydrosphere: Deep Ocean Blue
Atmosphere: Sky Blue
Biosphere: Vibrant Leaf Green

The Phenomenon of Yosemite

What types of matter do you see in Yosemite National Park?



Geological Fact: Look at the massive U-shaped valley in the background. U-shaped valleys are usually formed by the movement of giant sheets of ice called glaciers.

Instruction: Look closely at the photo. Everything you see—the rock, the water, the trees, the invisible air—belongs to one of four major categories of matter.



Earth is a Collection of Interacting Components

System:

A collection of different components that all work together.

The parts that make up Earth are incredibly diverse, from molten magma to soaring eagles. To understand how our planet works, scientists organize all this matter into four main systems.



- Geosphere
- Hydrosphere
- Atmosphere
- Biosphere

The Geosphere: Earth's Solid Foundation

The geosphere includes the solid and molten rock inside Earth, as well as the features at Earth's surface.



Soil and dirt



Rock pieces and boulders



Land features (hills and mountains)



Erupting volcanoes

The Hydrosphere: A Planet of Water

All of Earth's liquid and solid water.



The hydrosphere covers more than 70 percent of Earth's surface.



Water exists in two forms: salt water and fresh water.

Most of Earth's salt water is in the ocean. Most of Earth's fresh water exists as ice.



Oceans



Lakes



Rivers



Glaciers



Ice Caps

The Atmosphere: The Invisible Shield

A layer of gases surrounding Earth.



Also Contains:
Water vapor, carbon dioxide, and other trace gases.

Mostly: Nitrogen and Oxygen.

The Biosphere: The Web of Life

All of Earth's living things.



Organisms that make up the biosphere are found from the lower atmosphere all the way down to the depths of the ocean floor.

The biosphere does not exist on its own; all living things rely on and live within the other three spheres.

System Diagnostic Matrix

	 Geosphere	 Hydrosphere	 Atmosphere	 Biosphere
Core State of Matter	Solid & Molten Rock	Liquid & Solid Water	Gas	Living Organisms
Key Composition	Soil, Mountains, Core	>70% Surface, Oceans, Ice	Nitrogen, Oxygen, CO2	Plants, Animals, Microbes
Scope / Location	Inside Earth to surface	Oceans to mountain glaciers	Surrounding Earth's surface	Ocean floor to lower atmosphere

The Language of Science: Word Origins

How can parts of words help us understand the whole meaning? All four systems share the suffix **-sphere**, meaning a round solid figure or layer around the Earth.



Geo- (Earth)

+

-sphere

=

Geosphere



Hydro- (Water)

+

-sphere

=

Hydrosphere



Atmo- (Vapor/Air)

+

-sphere

=

Atmosphere



Bio- (Life)

+

-sphere

=

Biosphere

Systems in Action: Ecosystem Interactions

Earth's systems are not separated by walls; they are deeply connected within every ecosystem.



Decoding the Yosemite Phenomenon



Atmosphere:

Atmosphere: The gases and water vapor floating above the valley.



Geosphere Brown

Geosphere: The solid rock formations shaped by ancient ice.



Hydrosphere

Hydrosphere: The liquid fresh water carving through the landscape.



Biosphere

Biosphere: The dense forests and unseen wildlife living in the park.

Knowledge Check

Which of the following is NOT part of Earth's geosphere?

- A. mountains
- B. soil
- C. rivers ✓
- D. volcanoes

The biosphere contains all of the nonliving things on Earth.

True

False ✓

You are walking through Yosemite National Park. What would you see that are all part of the biosphere?

D. dragonflies, Pacific tree frogs, black bears ✓

Note: Clouds, rocks, and ponds belong to other spheres!

Earth's Systems Around the World

The four systems exist everywhere on Earth, but they look very different depending on where you are.



Antarctica

The Hydrosphere here exists almost entirely as massive, solid ice sheets. The Biosphere is limited to highly adapted coastal animals.



Sahara Desert

The Geosphere dominates with vast seas of sand dunes, while the Hydrosphere is extremely scarce, dramatically changing how the Biosphere survives.



Think about your own region. What does the geosphere or hydrosphere look like outside your window?

The NOLOGIA Summary



1. Four Interacting Systems

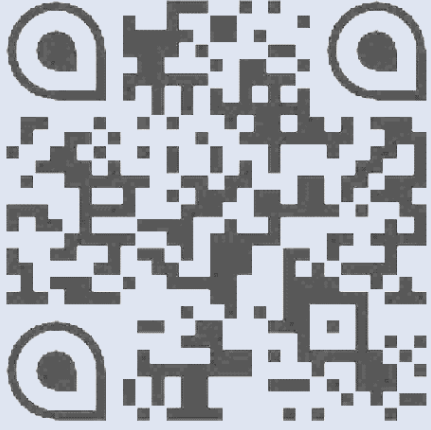
Earth is not just a rock; it is a complex collection of interacting components that work together as the Geosphere, Hydrosphere, Atmosphere, and Biosphere.

2. Distinct Matter

Each system is defined by its core matter—solid and molten rock, liquid and solid water, invisible gases, and living organisms.

3. The Web of Life

The biosphere does not stand alone. All living things rely entirely on the continuous overlap and interaction of the other three spheres to survive.



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Module (2): Energy in Ecosystems

02

Second Lesson: Cycles of Matter in Ecosystems

Cycles of Matter in Ecosystems

The NOLOGIA Blueprint:
Nature's Infinite Loop





The Phenomenon: The Yellowstone Mystery

The Question

Where does the water in this boiling hot spring actually come from? And where does the steam go?

The Fact

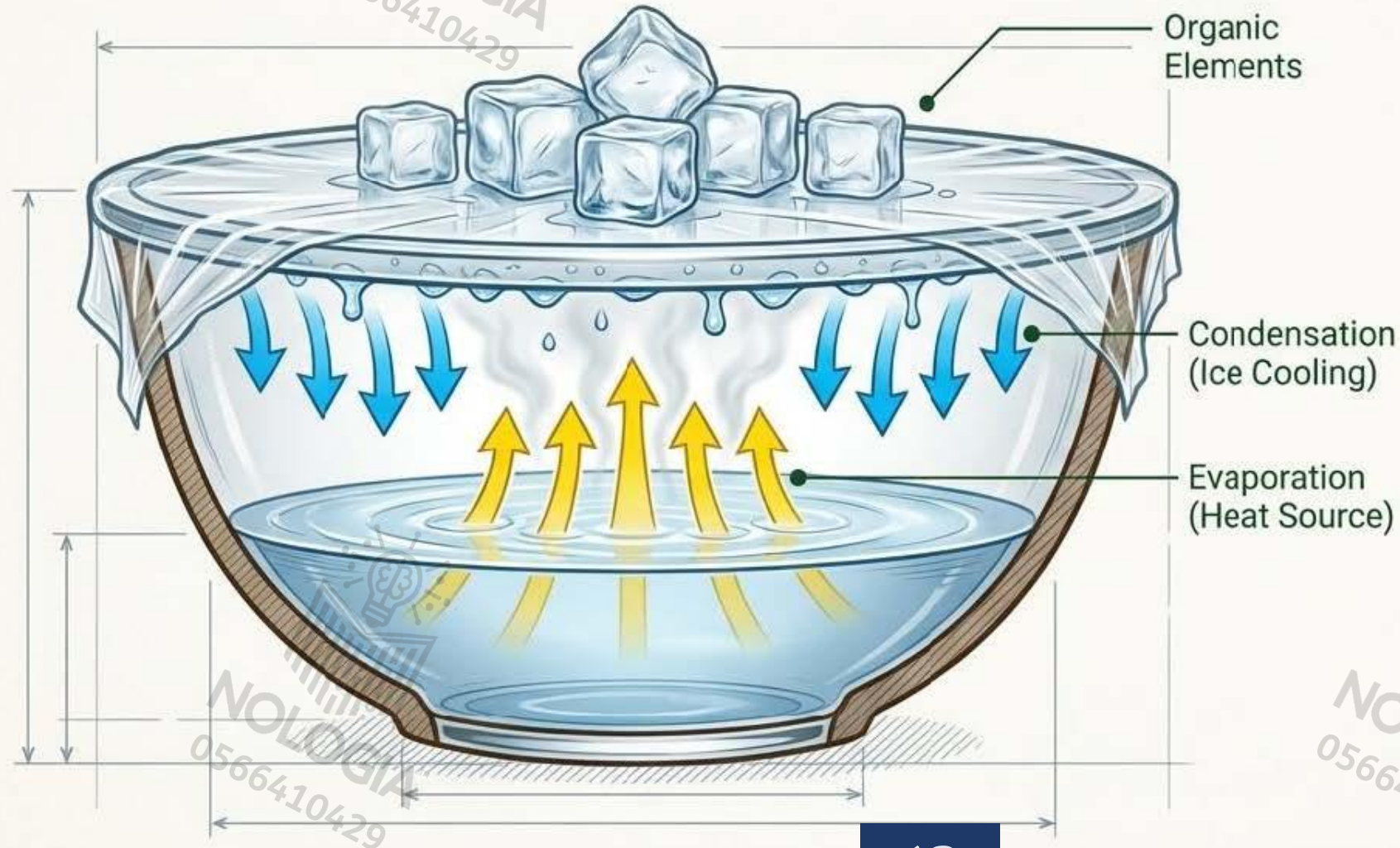
Yellowstone National Park is home to more than half of all the geysers in the world.

The Core Concept

Matter isn't magically created here; it is constantly moving. To understand this spring, we have to understand how the Earth recycles.



The Golden Rule: Matter is Conserved



The Law:

Matter cannot be created or destroyed, only transformed.

The Micro-Ecosystem:

In a closed system (like a bowl covered in plastic wrap), water changes states from liquid to gas and back to liquid. No water is lost.

The Macro-Ecosystem:

The Earth operates exactly like this bowl. Every drop of water and breath of air you use has been recycled for billions of years.

Pillar 1: The Water Cycle

The continuous movement of water between Earth's surface and the air, changing forms among the three states of matter.

1. Evaporation: Sun's energy turns liquid water into gas (water vapor).

2. Condensation: Cooling vapor turns back into liquid, forming clouds on dust particles.

3. Precipitation: Droplets combine, freeze, or fall as rain, sleet, snow, or hail.

4. Runoff: Water flows over Earth's surface, gathering in lakes, oceans, and streams.

The Hidden Water: Transpiration & Groundwater

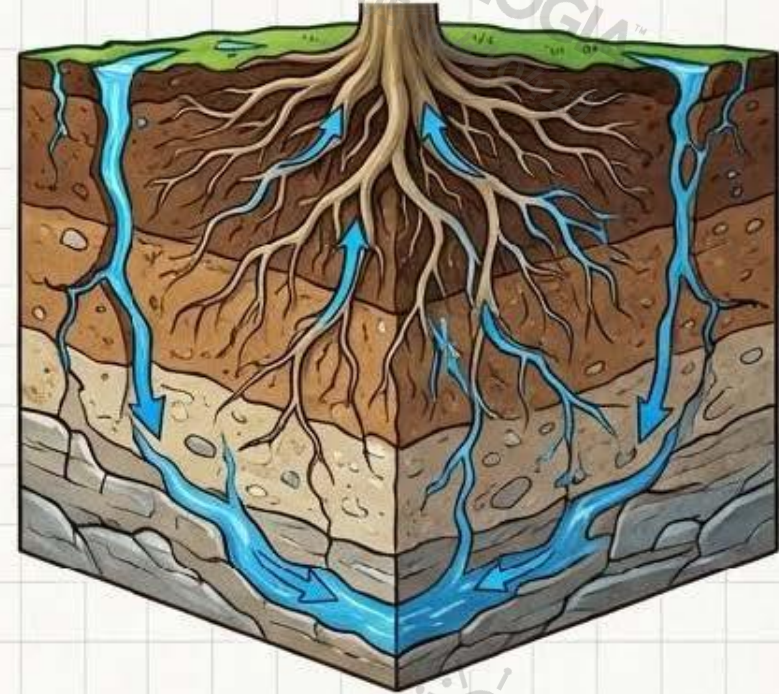
The Canopy



Transpiration

Water doesn't just evaporate from oceans. Plants constantly "breathe out" water vapor from their leaves, acting as living water pumps returning moisture to the atmosphere.

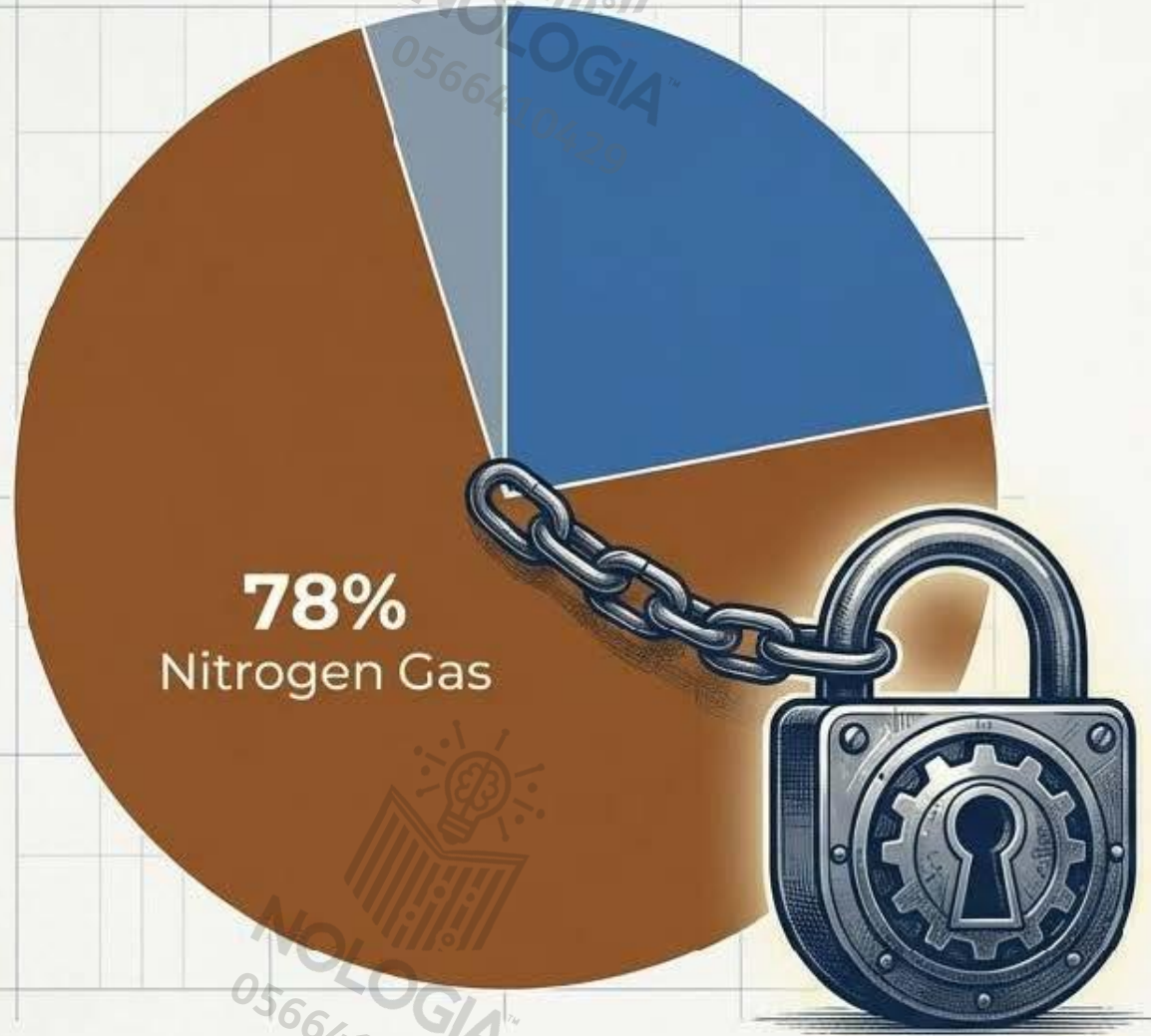
The Underground



Groundwater

Not all precipitation becomes runoff. Water that soaks downward into the ground through small cracks is stored as groundwater. Plants pull this water back up through their roots, continuing the cycle.

The NOLOGIA Blueprint



Pillar 2: The 78% Nitrogen Paradox

The Definition: The nitrogen cycle is the continuous circulation of nitrogen from air to soil to organisms and back.

The Problem: Air is predominantly made of nitrogen (78%). However, almost zero living things can use nitrogen in its gas form. It is essentially 'locked' away from the plants and animals that desperately need it to survive.

The Solution: Nitrogen must be 'fixed' (changed into a usable form).

Unlocking the Vault: Nitrogen Fixers

The NOLOGIA Blueprint

Key



Bacteria:

Live on plant roots (nodules) and convert gas into usable forms. (primary natural engine).

Key



Volcanic Activity:

Earth's internal heat releases fixed nitrogen.

Key



Lightning:

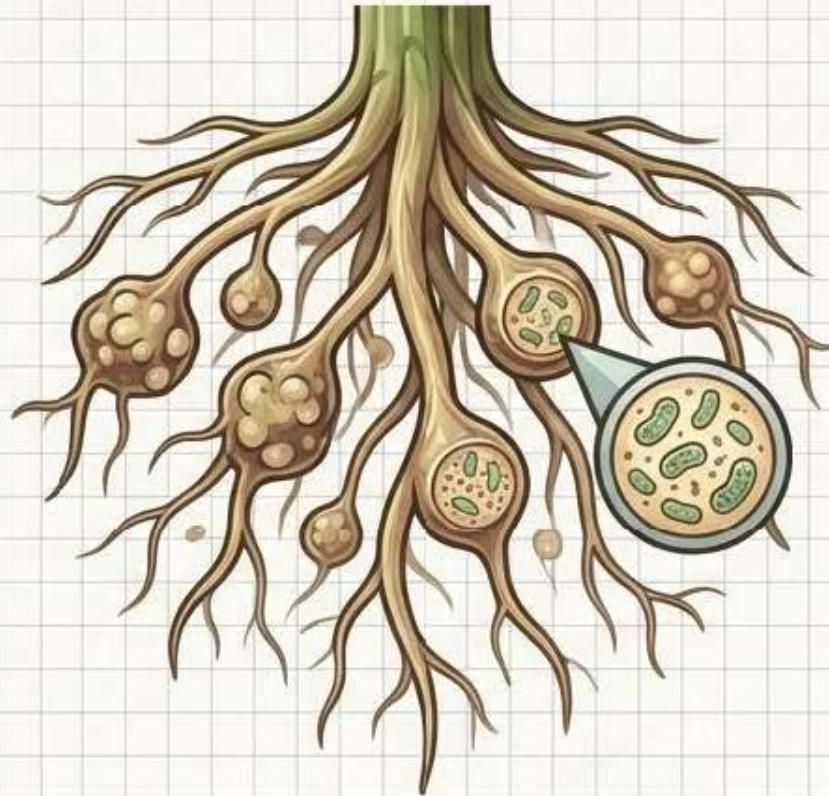
Atmospheric energy splits nitrogen molecules.

Key



Fertilizers:

Human-added chemical nitrogen for agriculture.



The Food Web Loop:



Once fixed, plants absorb nitrogen to make proteins.



Animals eat plants to store nitrogen.

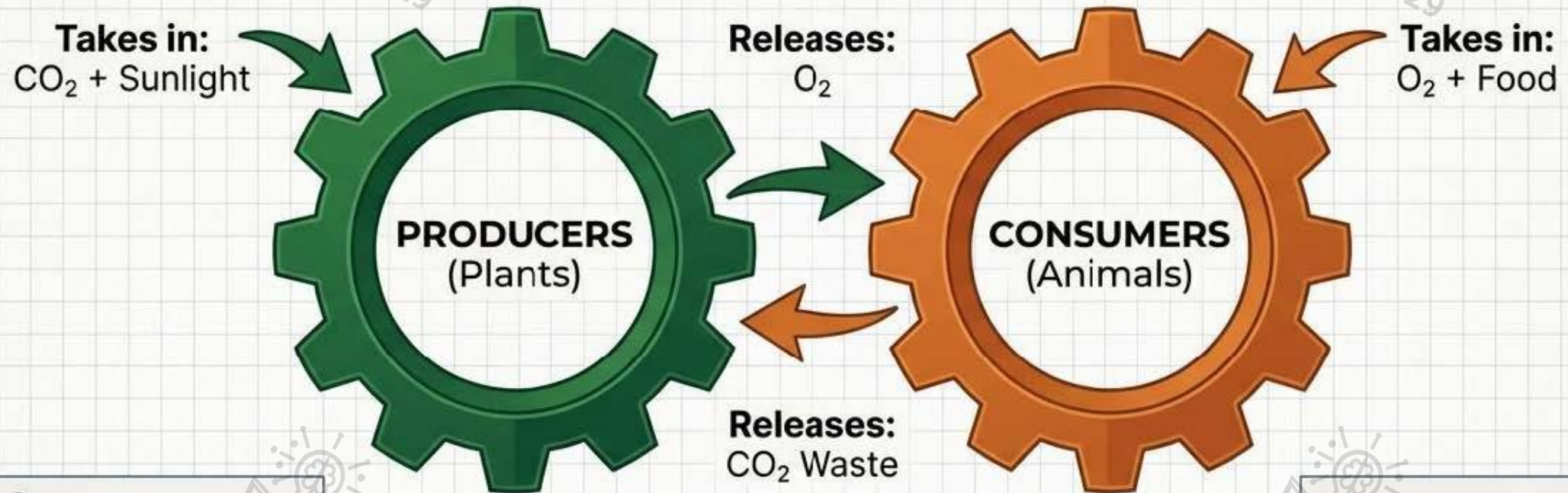


Decomposers break down waste/decay, returning nitrogen back to the soil and air.



Pillar 3: The Oxygen-Carbon Engine

The Mutual Exchange: The oxygen-carbon cycle is the ultimate biological partnership. Millions of years ago, early producers created Earth's breathable atmosphere.



Producers

Take in **Carbon Dioxide** to make food (energy from the Sun) and give off **Oxygen** as a byproduct.

Consumers

Take in **Oxygen** to process energy, and release **Carbon Dioxide** back into the atmosphere as waste.

Disrupting the Carbon Balance

1 The Anthropogenic Impact:

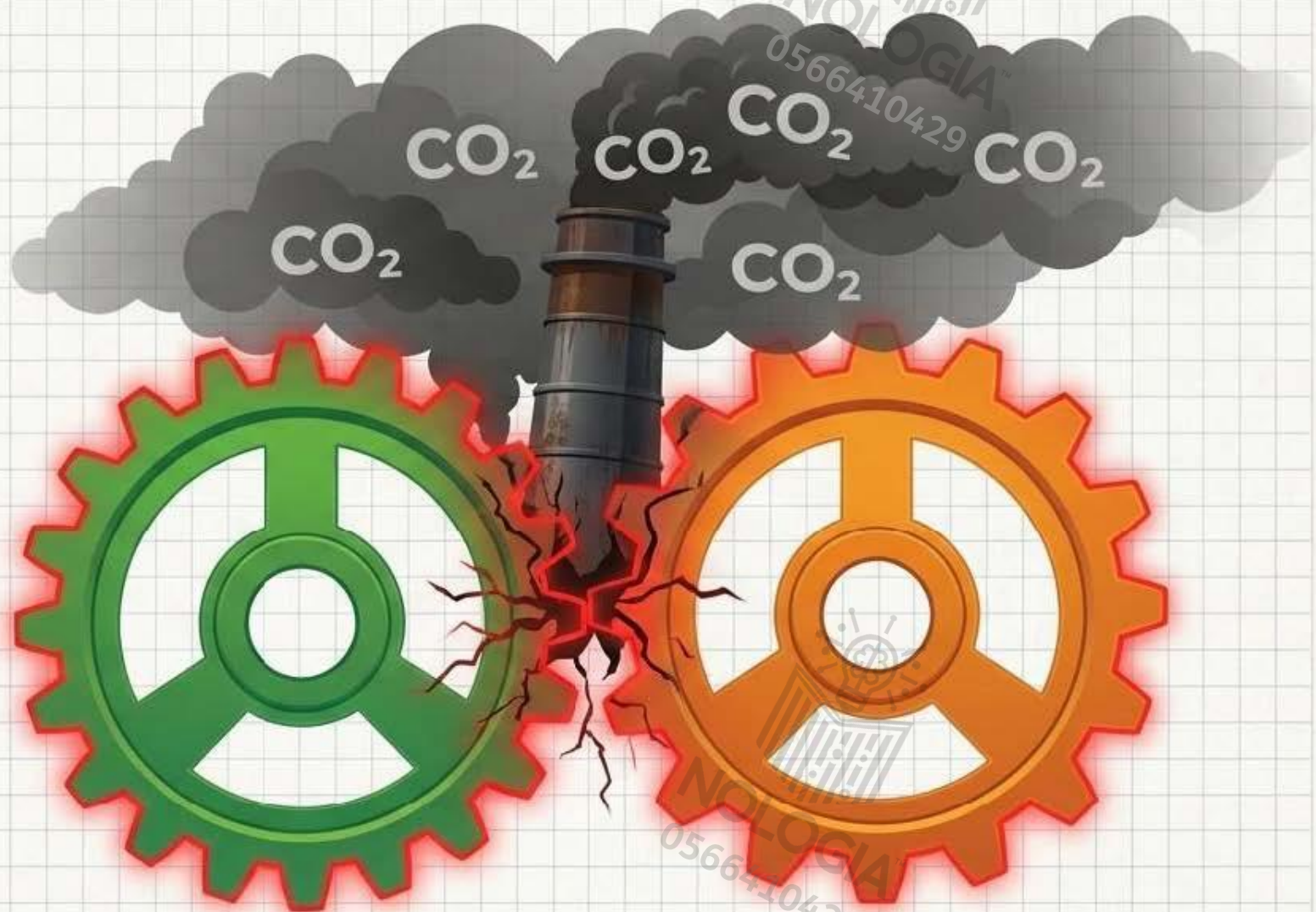
For millennia, the cycle of carbon and oxygen was perfectly balanced between producers and consumers.

2 Fossil Fuels:

Modern human activities, primarily the burning of fossil fuels (coal, oil, gas), inject massive amounts of ancient, trapped carbon back into the atmosphere as extra Carbon Dioxide.

3 The Result:

The natural producers (plants and oceans) cannot absorb the excess CO₂ fast enough, leaving the atmospheric cycles out of balance.

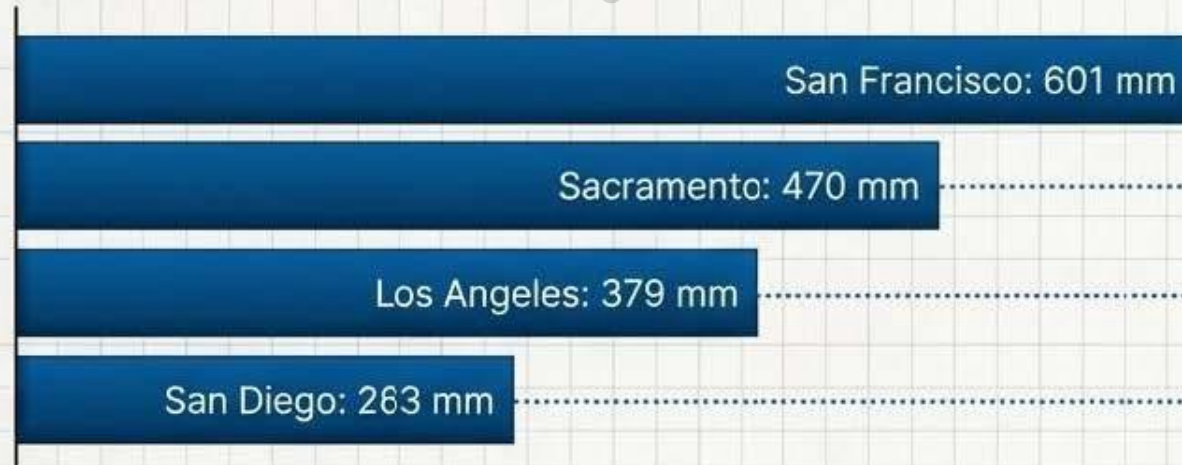


The NOLOGIA Master Matrix

Ecosystem Cycle	Primary Energy Driver	Key Process / Mechanism	Major Sinks / Storage	Required By
Water	Sun	Evaporation & Condensation	Oceans & Groundwater	All living cells
Nitrogen	Bacteria / Chemical	Fixation & Decomposition	Atmosphere (78%)	Proteins in plants/animals
Oxygen-Carbon	Sun / Biological	Photosynthesis & Respiration	Plants & Fossil Fuels	Producers & Consumers

Interpreting Ecosystem Data: California Rainfall

Average Annual Rainfall (1981-2010) in Inter



Analysis: Geographic Variance

The water cycle does not distribute precipitation equally. Northern coastal areas (San Francisco) receive significantly more rainfall than southern regions (San Diego), dictating the types of local ecosystems that can survive there.



STEM in Action: The Landfill Manager

The Job:

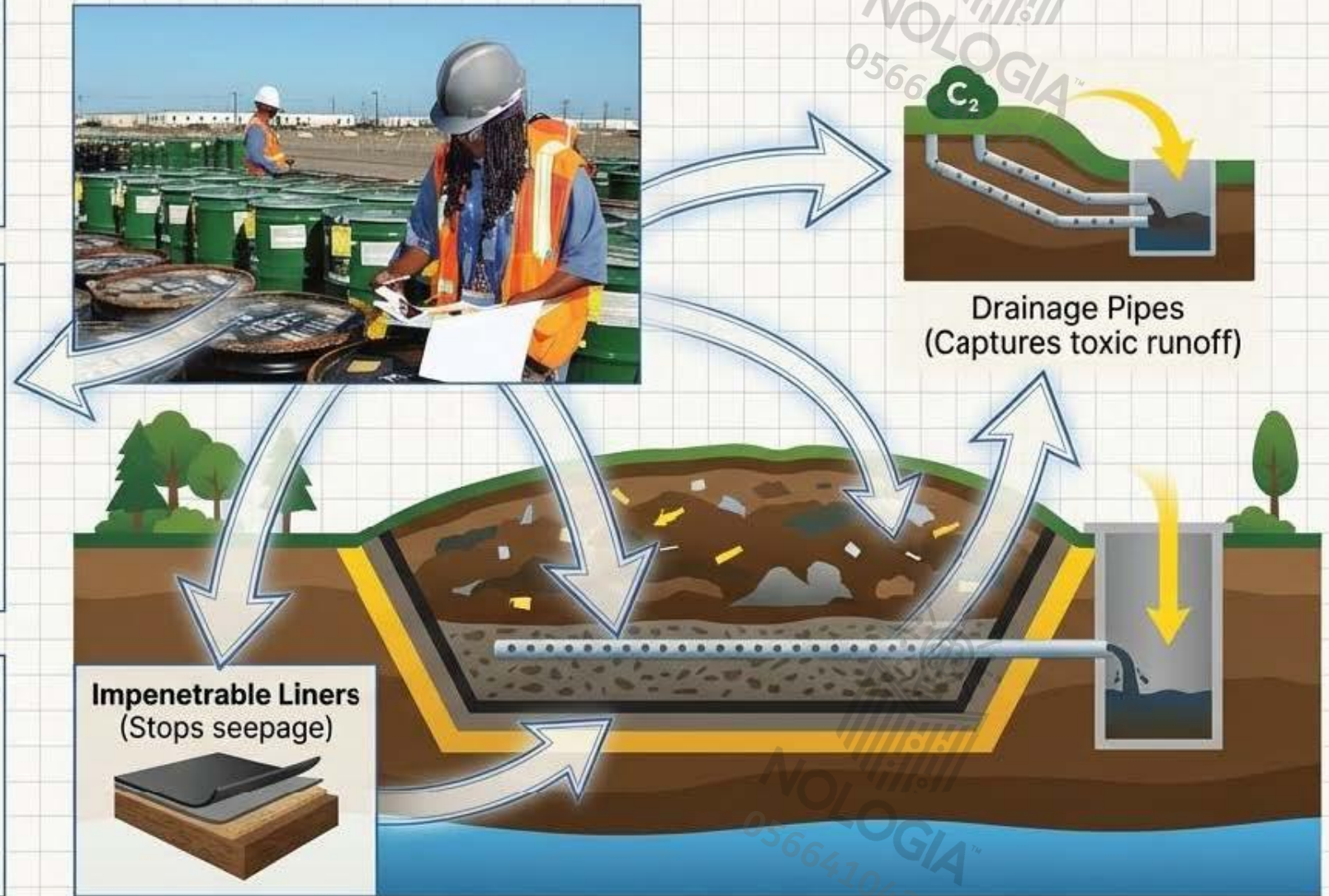
Landfill managers are responsible for cycling matter that humans throw away, ensuring it doesn't break local ecosystems.

Protecting the Cycles:

Because everything cannot be recycled, managers must use complex machinery and engineering to prevent toxic materials from leaching into the Water Cycle (groundwater) or releasing harmful gases into the Carbon/Nitrogen Cycles.

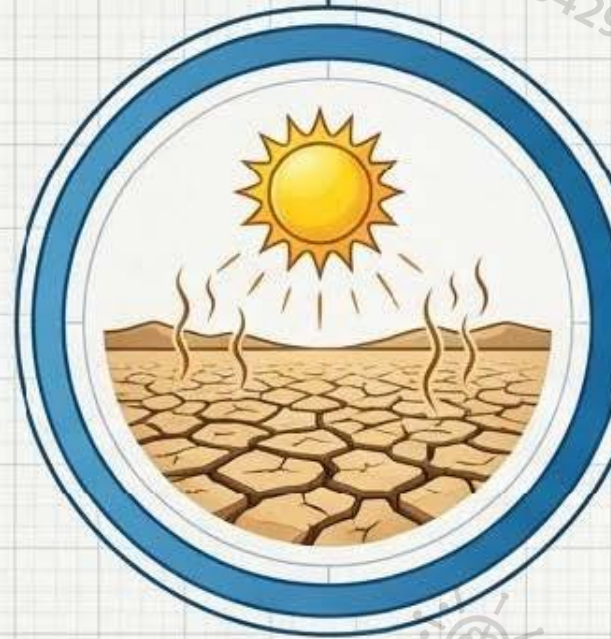
Certification:

Monitored by the Environmental Protection Agency (EPA) to ensure nearby land, habitats, and waterways remain unpolluted.



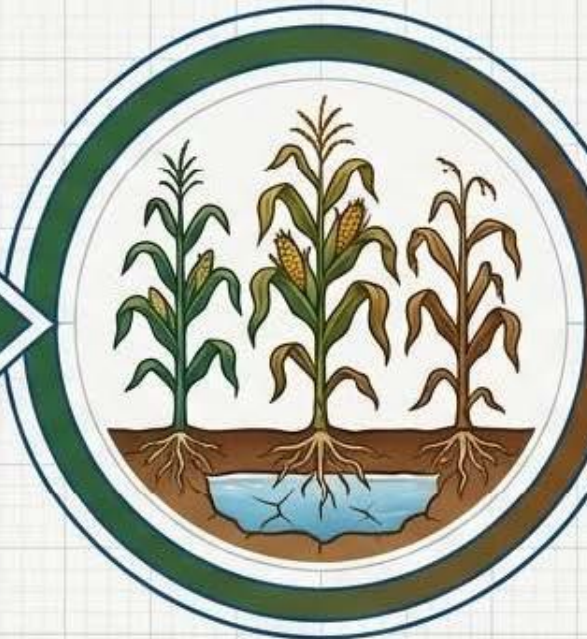
Ecosystems Under Stress: The Impact of Drought

Cause and Effect



The Trigger:

A drought occurs when an area receives significantly less precipitation than normal over an extended period.



Biological Impact:

With the water cycle stalled, groundwater depletes. Plants cannot perform transpiration or photosynthesis effectively.



Economic Impact:

Agriculture fails, leading to food shortages. Local economies that rely on farming or water-heavy industries suffer severe financial losses. Human conservation becomes strictly necessary.



The Grand Synthesis: The Rainforest Interconnection.

Water Cycle: Massive canopy trees draw immense groundwater, releasing clouds of vapor via transpiration, generating their own local weather and precipitation.

Nitrogen Cycle: Millions of insects and decomposers rapidly break down fallen organic matter on the humid forest floor, instantly returning fixed nitrogen to the soil.

Oxygen-Carbon Cycle: The dense concentration of producers (plants) acts as the "lungs of the planet," absorbing staggering amounts of CO_2 and pumping out fresh Oxygen.

NOLOGIA Quick-Review Checklist.

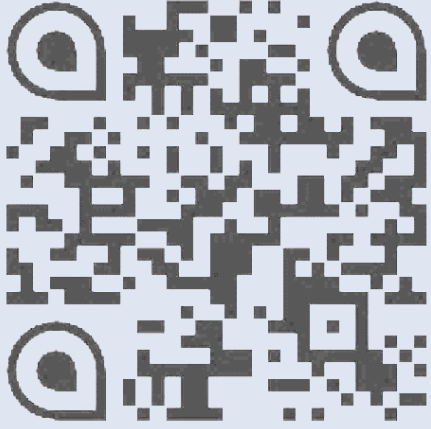
Vocabulary Definitions to Master

- ☐ **Evaporation:** Liquid water turning to gas (driven by Sun).
- ☐ **Transpiration:** Water vapor released directly from plant leaves.
- ☐ **Condensation:** Gas cooling into liquid (forming clouds).
- ☐ **Runoff:** Water flowing over the earth's surface.
- ☐ **Nitrogen Fixation:** Changing unusable nitrogen gas into a form living things can absorb (done mainly by bacteria).

Core Concepts

- ☐ **Matter** cycles through ecosystems; it is never destroyed.
- ☐ The **Oxygen-Carbon** cycle requires a perfect balance between Producers and Consumers.





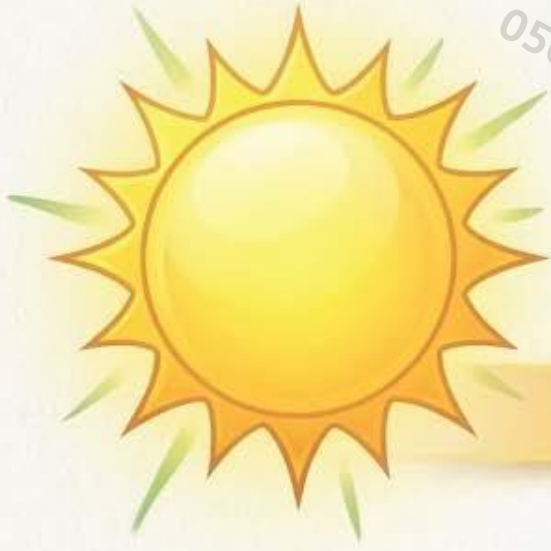
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Module (2): Energy in Ecosystems

03

Third Lesson: Energy Transfer in Ecosystems



**SOLAR ENERGY
SOURCE**



**PRODUCERS:
PHOTOSYNTHESIS**



**CONSUMERS:
HERBIVORES**



**CONSUMERS:
TOP PREDATORS**

Energy Transfer in Ecosystems

A NOLOGIA Master Guide to Food Chains, Webs, and the Flow of Life



The Core Phenomenon: Fueling Life

How do birds like the Sanderling get energy from their ecosystem?

All living things require a continuous flow of energy from their environment to survive and function.



Did You Know?

Sanderlings breed in the Arctic region and migrate as far south as Australia. When escaping predators in flight, they may dive directly into the water.

The Ultimate Source and Purpose



The Sun is the ultimate source of all energy in a food chain.



Growth



Motion



Body Repair



Warmth

Ecosystem Organisms: Producers

Terminology Card

Organisms that use energy from the Sun to make their own food. Every organism in an ecosystem relies on them as the foundational energy source.



Land Producers

Green plants such as grasses, trees, and Indian clover.



Aquatic Producers

Algae are the main producers in lakes and oceans.

Ecosystem Organisms: Consumers

Organisms that cannot make their own food and must eat other organisms to survive.



Featured Example: The Quail. Quails are consumers (omnivores) that eat mostly seeds, plants, and small insects.

NOLOGIA Classification Grid



Herbivores: Animals that eat only plants.



Carnivores: Animals that eat only other animals.



Omnivores: Animals that eat both plants and animals for energy.

Ecosystem Organisms: Decomposers

Definition: Organisms that break down dead or decaying plant and animal materials. Examples include mushrooms and fungi.

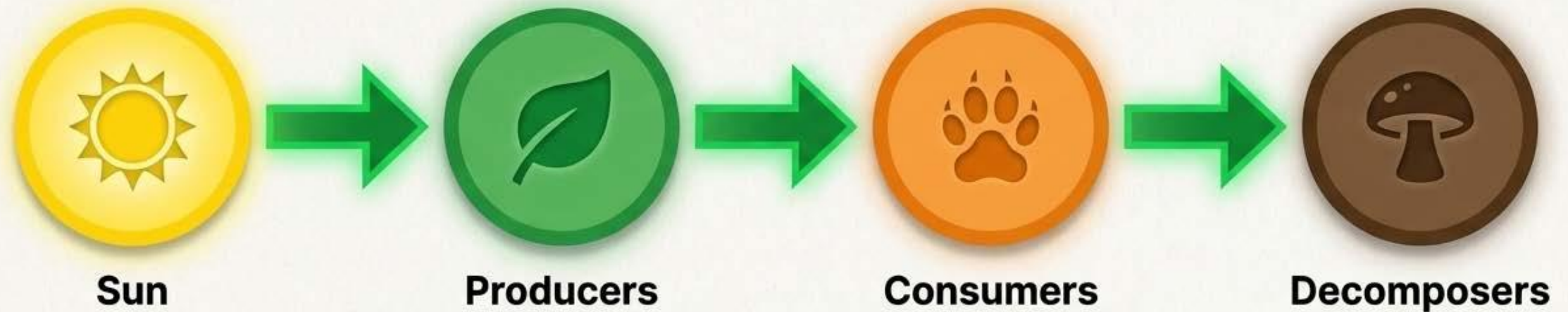
Ecological Role: Decomposers are nature's recyclers. They are essential for completing the complex nutrient cycles within all ecosystems, ensuring no energy or matter goes to waste.

SYNTHESIS: The NOLOGIA Organism Matrix

	Producers	Consumers	Decomposers
Energy Source	The Sun	Other Organisms	Dead/Decaying Matter
Makes Own Food?	Yes	No	No
Textbook Examples	Grasses, Trees, Algae, Indian Clover	Quail, Sanderling	Mushrooms, Fungi

Linear Energy Flow: The Food Chain

A model showing a series of feeding relationships among organisms in an ecosystem.



THE GOLDEN RULE: Energy flow in a food chain goes in **ONLY ONE DIRECTION.**

Case Study: The Pond Food Chain

5. **Blue Heron:** Top Consumer. Eats the sunfish.

2. **Algae:** The Producer. Absorbs solar energy.

3. **Mayfly:** Consumer (Herbivore). Eats the algae.

4. **Sunfish:** Consumer (Carnivore). Eats the mayfly.

1. **The Sun:** The starting energy source.

Takeaway: All energy currently inside the Blue Heron was originally energy from the Sun.



Systemic Energy Flow: The Food Web

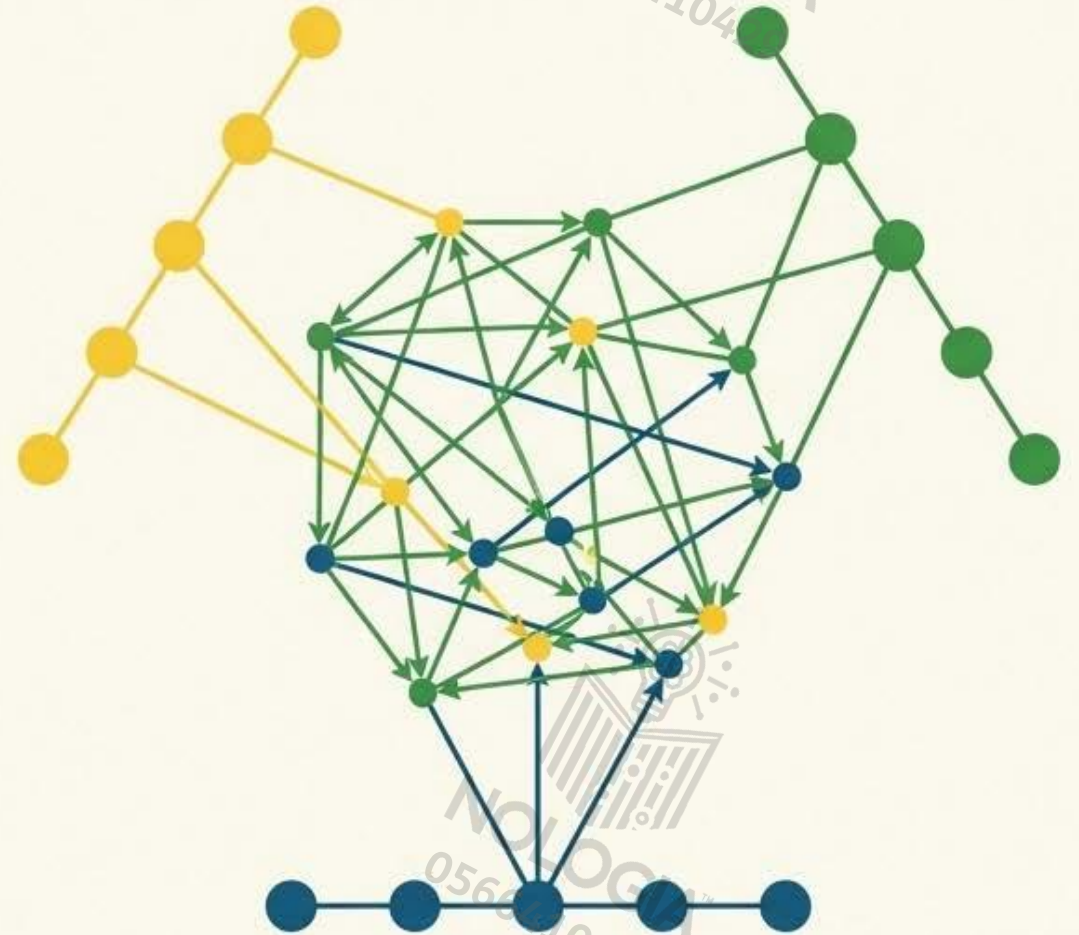
A model that shows how multiple food chains are linked together within an ecosystem.

Why Webs Matter

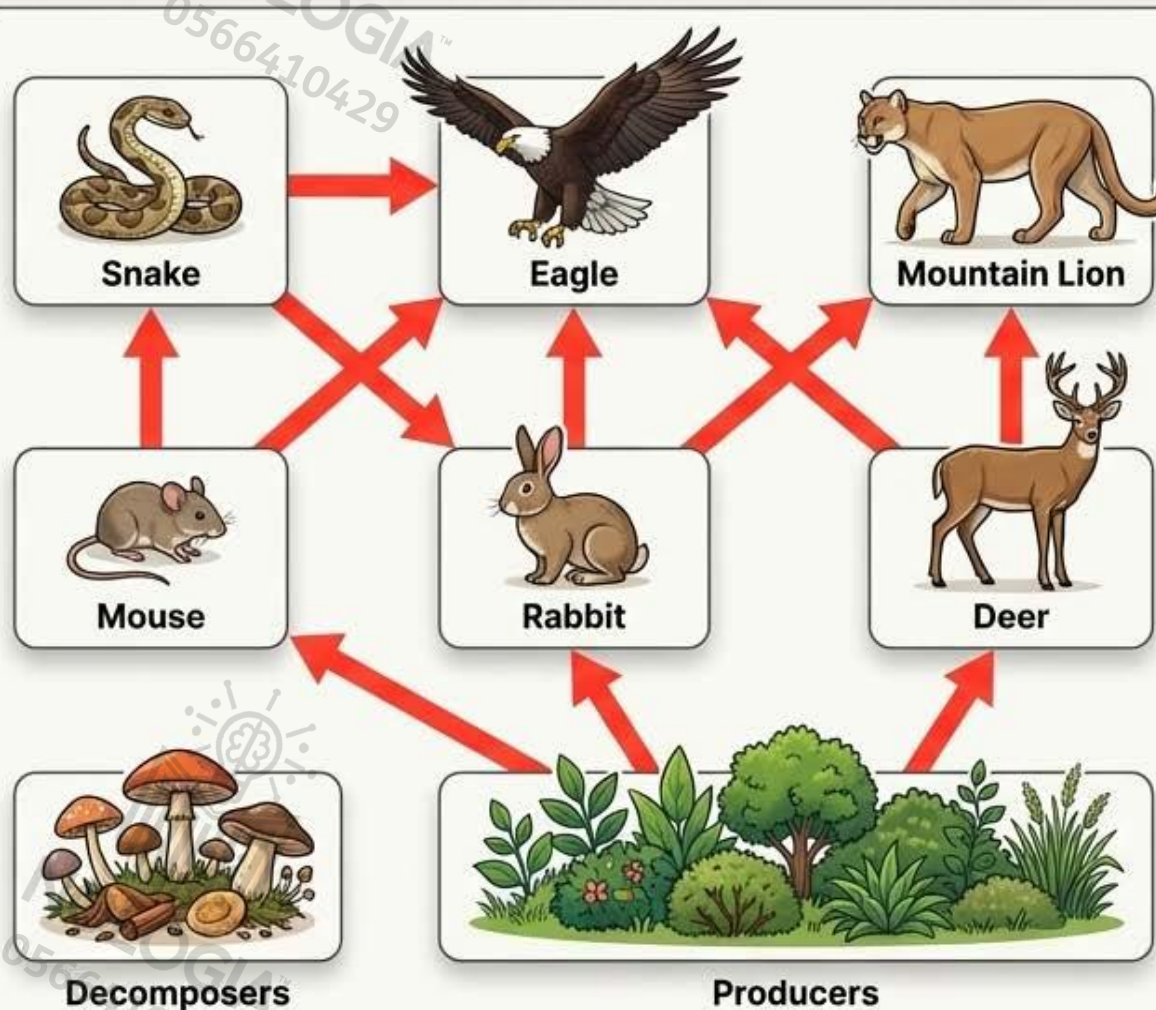
Predators usually feed on more than one type of prey.

Prey usually have more than one type of predator.

This complex interconnection keeps the ecosystem balanced and allows living things to survive.



Case Study: The Land Food Web



Analytical Focus:
Notice how the mountain lion and the eagle act as top predators connected to multiple food sources, creating a stable web rather than a fragile chain.

SYNTHESIS: Chain vs. Web

NOLOGIA

The Food Chain



Shows a single path of energy.

A simple, linear model.

Useful for tracking one specific sequence of energy transfer from producer to final consumer.

The Food Web



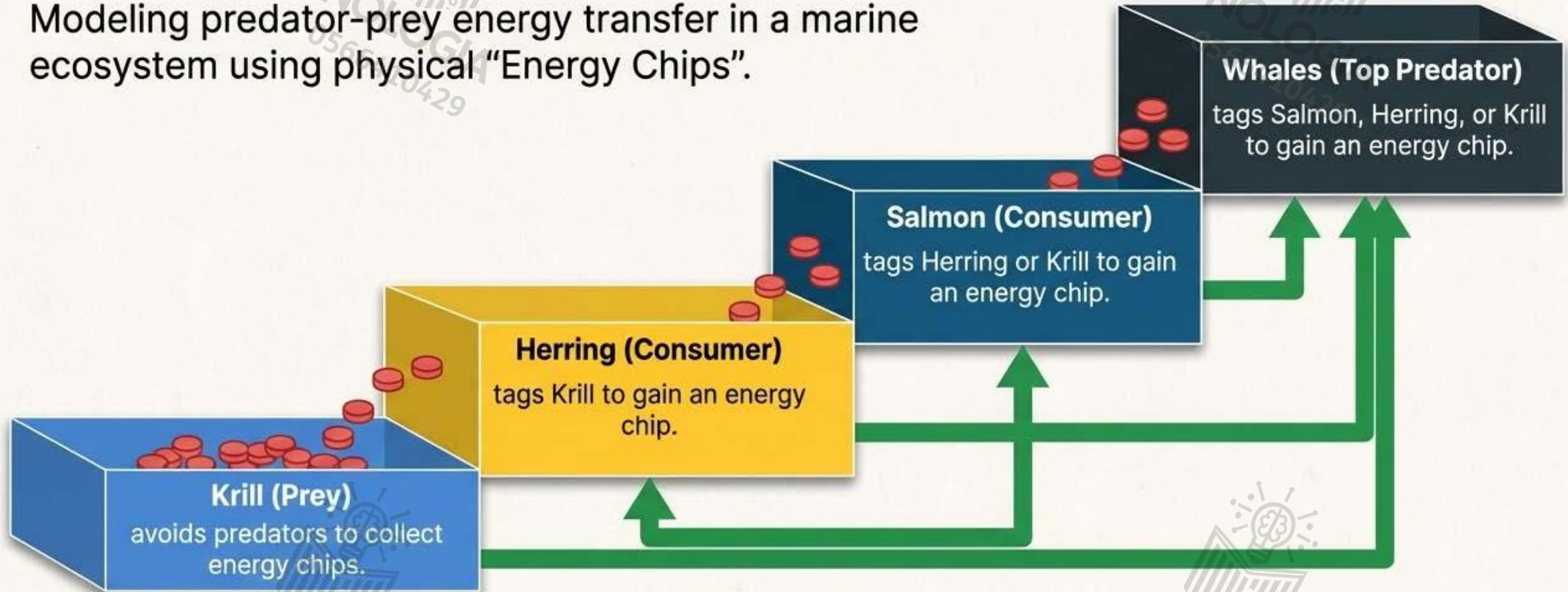
Shows multiple linked paths of energy.

A complex, systemic model.

Reveals the true balance and interconnected survival strategies of a complete ecosystem.

Simulating the System: Ecosystem Tag

Modeling predator-prey energy transfer in a marine ecosystem using physical "Energy Chips".



Rule of Transfer: When a predator catches prey, the prey's "energy chip" is transferred to the predator, modeling real-world energy flow.

The Web of Life: Conservation Connection

NOLOGIA

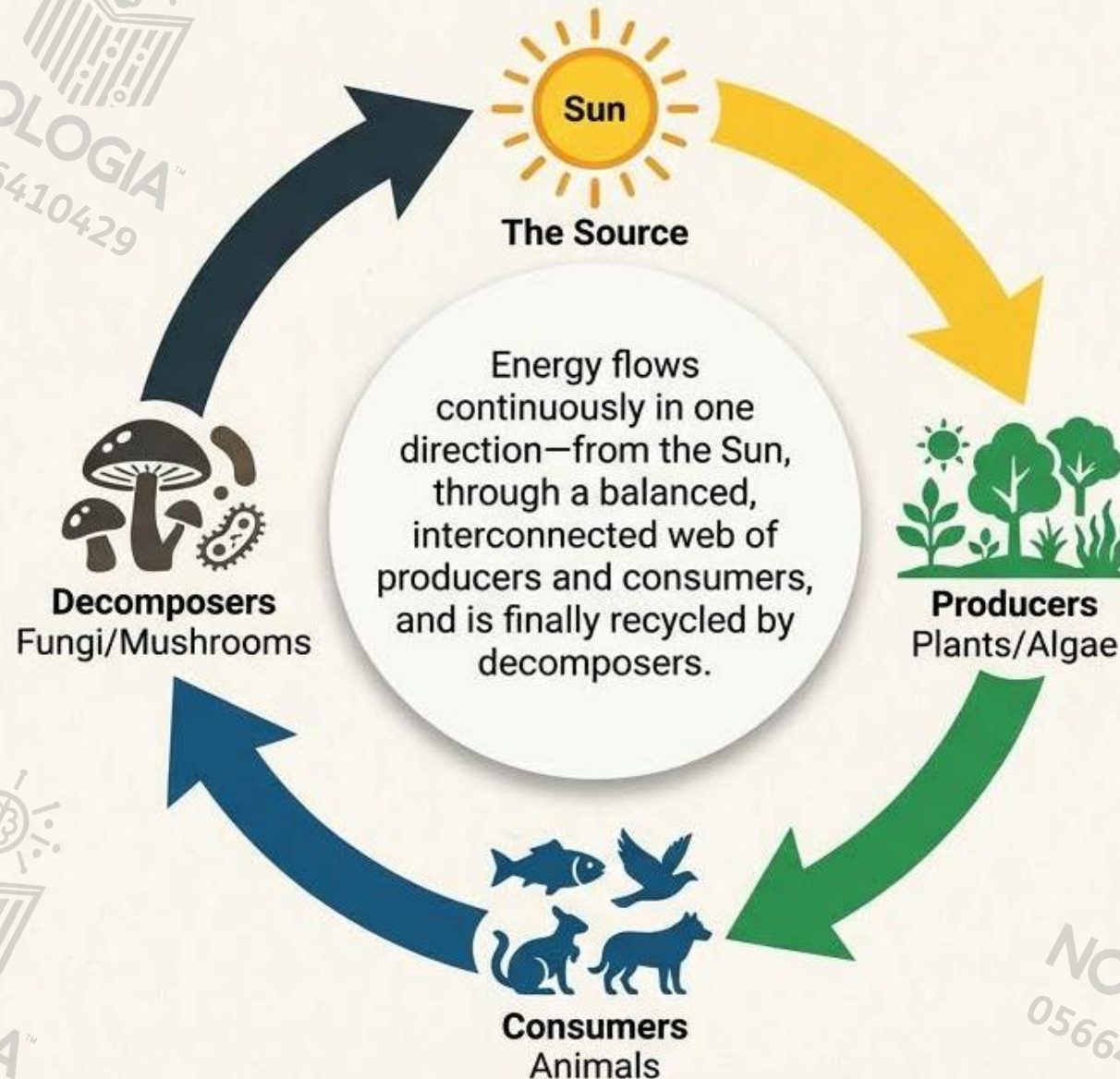


The Science of Saving Species: Ullas Karanth

Every species on the planet is connected in the web of life. Humans depend on tigers just as we depend on all species to maintain balanced ecosystems.

“ If people destroy the Taj Mahal, it could be rebuilt. But once we destroy all these intricate ecological webs, there's no bringing them back! ”

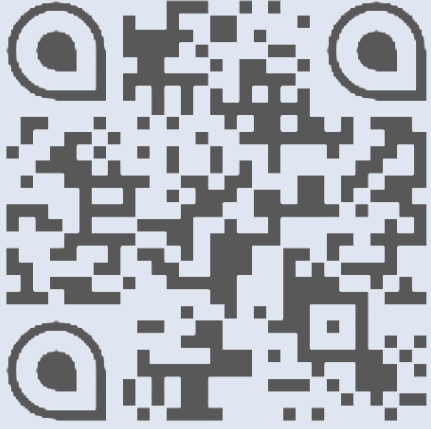
NOLOGIA Master Summary



NOLOGIA

NOLOGIA Educational
Blueprint Complete.





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تكون هذه الملزمة قد حققت
الفائدة المرجوة ♥



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