Instructions Worksheet for Module 1 HOA A
Grouping: Pairs or small groups (3–4)
Time: 40-45 minutes (Day 1), with DAY 2 (Optional) for Gallery Walk (15–25 minutes)

Purpose of This Activity

In this Hands-On Activity, you will work as a team to **map the global agri-food system** and visualize how food connects to major environmental challenges and the United Nations **SDGs** (**Sustainable Development Goals** to protect people and the planet). You'll use systems thinking (looking at how parts of a system affect one another over time) to understand **why food systems matter** and how they push or protect Earth's **planetary boundaries** (Earth's environmental safety limits like climate, biodiversity, and water use).

By the end, you should be able to **explain how food production, distribution, consumption, and waste affect people and the planet**, and where solutions can make the biggest impact.

What You Will Be Doing

Working in small groups, you will:

1. **Identify major components** of the food system
   Examples: farming, water use, transportation, labor, packaging, consumption, waste.
2. **Connect each component to at least one planetary boundary**
   Examples: climate change, freshwater use, land-system change, biodiversity loss, nitrogen & phosphorus cycles.
3. **Link each part of your map to relevant SDGs**
   Examples: Zero Hunger (SDG 2), Responsible Consumption & Production (SDG 12), Climate Action (SDG 13), Life on Land (SDG 15).
4. **Show cause-and-effect pathways** using arrows, labels, or colored strings
   Example: "Fertilizer Use → Nitrogen Runoff → Water Pollution → Biodiversity Loss."
5. **Create a large system map poster or visual systems map** showing the full network.
6. (Optional Day 2) Participate in a **Gallery Walk**, where each group presents their system and explains the most important connections, risks, and solutions.

GLOBAL AGRI-FOOD SYSTEM & PLANETARY BOUNDARIES
Google Gemini, 2025

Why This Matters

Food systems use **40–50% of Earth's land**, consume **70% of global freshwater**, and produce **~25% of greenhouse gas emissions**.

This activity helps you *see* these connections instead of just hearing about them.

You'll discover "hotspots" where small changes could create big sustainability benefits - one of the goals of Module 1.

Materials (Per Group)

Your teacher will provide:

- Poster paper or butcher paper
- Colored markers
- Sticky notes
- Pre-printed icons/photos (food system stages, SDGs, planetary boundaries)
- Tape or glue
- (Optional) Colored yarn or string for system connections

You will provide: Creativity, Collaboration, and Curiosity about how food connects to the planet

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Activity Timeline

DAY 1 – Build Your System Map (45–55 minutes)

STEP 1 – Brainstorm (10 minutes)

Each group will **choose one food item** and trace *everything* it needs across the entire food system.

One idea per sticky note allows you to move them around later.

Google Gemini, 2025
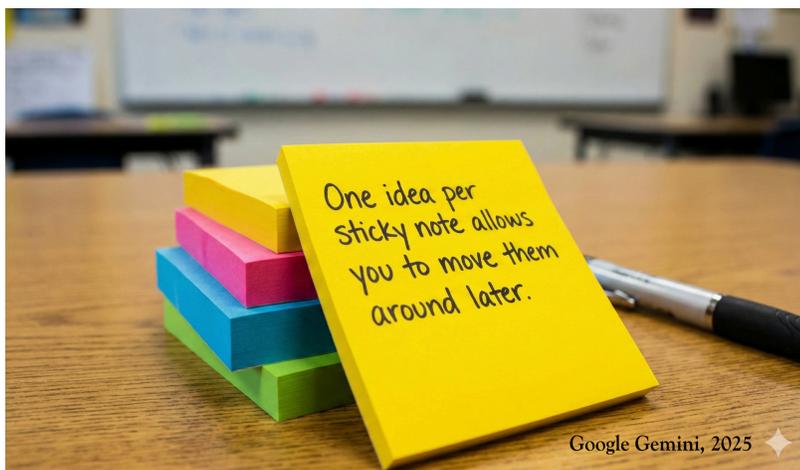
- Choose one food (examples: **a hamburger**, **a tomato**, **rice**, **pasta**, **orange juice**, **salad**, **sushi**, **grilled cheese**, **lentil soup**). Your goal is to capture all the inputs, processes, people, and systems required to get that food from origin → plate → waste.

- **On sticky notes, brainstorm every component involved in your food's journey.** Think across the full chain - see the Food-System Components Table below:

Food-System Components Table:

Category	Components
Inputs	Seeds / seedlings / animal genetics, water for irrigation and processing, soil or hydroponic growing media, fertilizers, soil amendments, pesticides / crop-protection inputs, livestock feed, energy and fuel, machinery, tools, equipment
Production	Farms (crop producing), ranches & livestock operations, greenhouses & vertical farms, aquaculture & fisheries, community gardens
Processing & Distribution	Food manufacturing & processing plants, slaughterhouse/butcher, packaging operations, transportation (trucks, ships, trains), warehousing & cold storage, wholesalers, distributors, retail (grocery stores, markets, cafeterias)
Consumption	Households & home kitchens, restaurants, cafes, school cafeterias, institutional kitchens (hospitals, universities), food preparation, cooking, serving, purchasing
Waste & End-of-Life	Unused food (spoiled, expired), food scraps from prep & leftovers, packaging materials (plastics, cardboard), agricultural byproducts, composting & recycling programs, landfills, waste hauling services
Influencers (Cross-cutting)	Human labor at every stage, policies & regulations, economic systems (pricing, wages, markets), environmental conditions (climate, water availability), social & cultural factors (traditions, demand, food access)

STEP 2 – Sort, Cluster, and Select a Focus Category (5 minutes)

After brainstorming, organize all sticky notes for your chosen food by grouping them into categories.

Cluster your notes into:
1. **Inputs**
2. **Production**
3. **Processing & Distribution**
4. **Consumption**
5. **Waste & End-of-Life**
6. **Influencers**

Then, choose *one* category to analyze more deeply. Take turns explaining part of your food's journey (your chosen category) to your group. What surprised you most? Reflect on which category seems to cause the most problems - or offer the biggest opportunity for change?

Your group will focus on **your chosen category** when adding:
1. Planetary Boundaries
2. SDGs
3. Key impacts
4. Cause-and-effect arrows

This keeps the system map **deep and meaningful**, rather than shallow and overwhelming.

Examples:

- If your food is **a hamburger**, you might focus on:
  - *Production:* cattle ranching, feed production, water use
  - *Inputs:* fertilizer, feed, energy, labor
- If your food is **pasta**, you might focus on:
  - *Processing:* milling, extrusion, drying, packaging
- If your food is **a tomato**, you might focus on:
  - *Distribution:* cold chain, transportation, storage losses

STEP 3 – Add Planetary Boundaries (10 minutes)
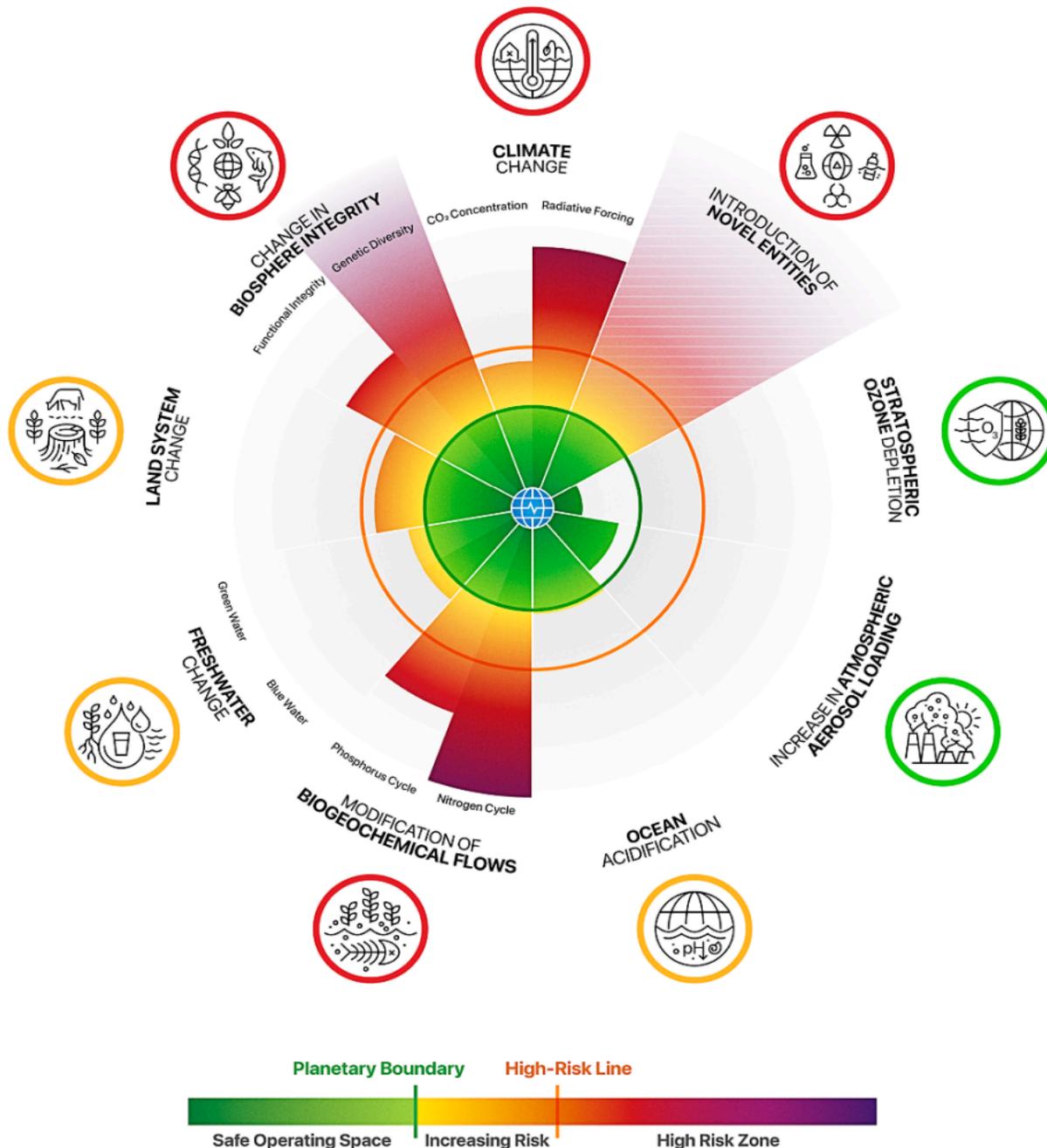
Source: Planetary Health Check 2025

Now that you've selected **one food** and mapped its components, you will add all **Nine Planetary Boundaries** to your systems map - focusing especially on how these boundaries connect to **your chosen category** (Inputs, Production, Processing & Distribution, Consumption, Waste, or Influencers).

A. **Place icons or labels for ALL Nine Planetary Boundaries:**
    1. **Climate Change** ⭐
    2. **Biosphere Integrity (Biodiversity Loss)** ⭐
    3. **Land-System Change** ⭐
    4. **Biogeochemical Flows (Nitrogen & Phosphorus)** ⭐
    5. **Freshwater Use** ⭐
    6. **Ocean Acidification**
    7. **Atmospheric Aerosol Loading**
    8. **Stratospheric Ozone Depletion**
    9. **Novel Entities (plastics, chemicals, pesticides, microplastics)**

⭐ **These boundaries** are the ones most strongly linked to global food production, distribution, and consumption. Agriculture is currently the main driver of land-use change, N & P pollution, biodiversity decline, rising water demand, and ~25% of global greenhouse gas emissions.

B. Match each Planetary Boundary to your food's system processes

Use **arrows, string, colored markers, or labels** to connect boundaries to components in your selected category.

Examples of what food system elements you might connect:
● **Production:** irrigation, fertilizers, feed, land use, pesticides
● **Processing:** energy use, packaging, chemical additives, cold storage
● **Distribution:** fuel use, refrigeration, transport distances
● **Consumption:** food choices, portion sizes, cooking energy, food waste
● **Waste:** methane from decomposition, plastic packaging, nutrient pollution

C. Guiding examples (adapt as needed for your chosen food):

● *Climate Change → Production, Waste:* CH_4 from cattle, N_2O from fertilizers, CO_2 from processing.
● *Biodiversity Loss → Production:* habitat conversion, pesticide impacts, monocropping.
● *Land-System Change → Production:* clearing land for grazing or crops.
● *N & P Flows → Production/Waste:* fertilizer runoff → water pollution.
● *Freshwater Use → Production:* irrigation for water-intensive crops.
● *Ocean Acidification → Waste:* CO_2 emissions from the food system.
● *Aerosol Loading → Production/Processing:* soil dust, smoke, industry.
● *Stratospheric Ozone Depletion → Processing:* refrigerants in cold storage.
● *Novel Entities → Waste/Processing:* pesticides, plastics, packaging chemicals.

D. Add short labels explaining each connection. Examples:

● "Feed crop fertilizers → N & P runoff → water pollution"
● "Beef cattle → methane → climate change"
● "Tomato cold chain → refrigerants → ozone depletion risk"
● "Single-use packaging → microplastics → novel entities boundary"

STEP 4 – Integrate SDGs (10 minutes)

Attach the below **Sustainable Development Goal (SDG)** icons to show where your chosen food system:

A. Creates positive contributions

(e.g., sustainable sourcing → **SDG 12 Responsible Consumption & Production**)

B. Causes negative pressures

(e.g., emissions or land use → **SDG 13 Climate Action**, **SDG 15 Life on Land**)

Suggested SDGs to consider (depends on your chosen food):

- **SDG 2 – Zero Hunger** (crop production, nutrition)
- **SDG 6 – Clean Water** (irrigation, pollution)
- **SDG 7 – Affordable & Clean Energy** (processing, storage)
- **SDG 8 – Decent Work** (labor in agriculture)
- **SDG 12 – Responsible Consumption & Production** (waste reduction)
- **SDG 13 – Climate Action** (GHG emissions)
- **SDG 14 – Life Below Water** (nutrient runoff, fisheries)
- **SDG 15 – Life on Land** (biodiversity, land-system change)

Mark the SDGs **directly onto the category you selected**, showing where your food impacts sustainability.

STEP 5 – Connect Everything (10-15 minutes)

Now build the **systems-thinking web** showing how your food impacts multiple parts of the planet.

A. Use arrows or string to show:

- Cause-and-effect relationships
- Feedback loops (reinforcing or balancing)
- Where one change creates another
- Where improving one part helps or harms another

B. Add short labels to explain each arrow

Examples:

- "More fertilizer → higher yield → more runoff → worse water quality"
- "Long transport distance → more fuel use → more CO_2 → climate change"
- "Food waste → methane → climate change → extreme heat → crop stress"
- "Agroecology → more biodiversity → healthier soils → better yields"

Which Planetary Boundary is most affected by your food system? → Add a ⭐ sticker or mark it on your system map poster. This step will create a gallery-wide visual pattern helpful for the presentation. See the example below:
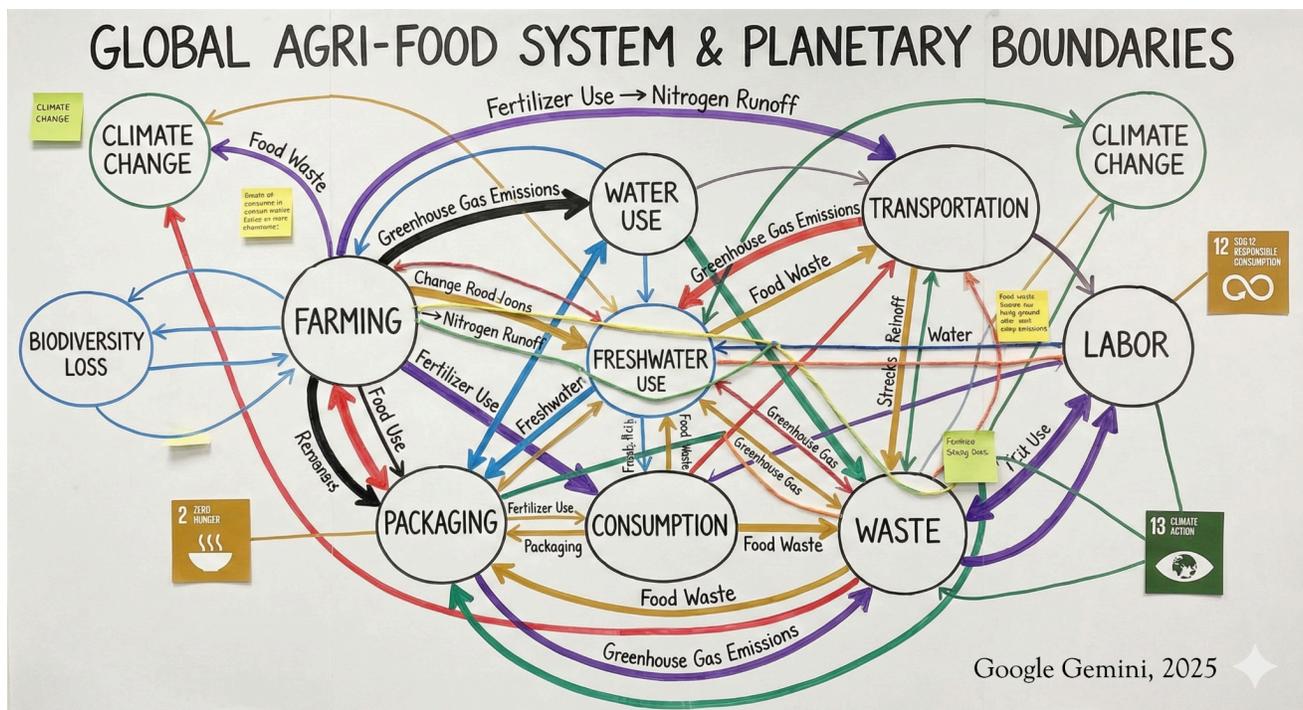
C. Final Check

Your system map poster should now show:

- A **network**, not a list
- Clear links between your **chosen food**, **its system category**, **planetary boundaries**, and **SDGs**
- At least one **feedback loop**
- At least one **leverage point** where a change can create big improvements

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DAY 2 (Optional) – Gallery Walk (15–25 minutes)

Today you will share and compare your systems maps. Each group will guide classmates through the story of **one food** and how it connects to planetary boundaries, SDGs, and sustainability challenges.

Each group will:

- **Stand by their system map poster** and act as "system guides" for their chosen food.
- **Explain 2–3 major insights** from their map.
  Examples: unexpected impacts, powerful connections, surprising hotspots.
- **Identify one leverage point** - a small change in the system that could create a large positive impact.
- **Describe a real-world solution** (or multiple solutions) connected to relevant SDGs.
  Examples: regenerative grazing (SDG 15), sustainable packaging (SDG 12), improved cold-chain efficiency (SDG 13).

Student rotation:

Students rotate between groups, ask questions, compare maps, and observe how different foods create different sustainability challenges and opportunities.

What You Need to Turn In

Each student will submit **two items**:

1. A photo of your group's systems map

This photo should clearly show:

- Your chosen food
- The focus category
- Planetary Boundary connections

- SDG labels
- Clear arrows, loops, and explanations

2. Your individual reflection sheet, answering:

1. **Which Planetary Boundary was most affected by your food's system, and why?**
2. **Which SDG is most relevant to your system map, and what part of the system connects to it?**
3. **What surprised you when mapping the system's components, impacts, or feedback loops?**
4. **Identify one leverage point where redesigning or improving the system could create meaningful sustainability benefits. Explain your idea.**
5. **Imagine this food system 20 years from now. What would it look like if we made your change? How might it affect you or your community?**

Safety & Clean-Up Notes

- Use materials carefully - no climbing or unsafe stretching to hang system map posters.
- Keep walkways clear of yarn, string, tape, or paper.
- Return all markers, icons, tape, and supplies to the materials table.
- Recycle scrap paper and unused paper when possible - **practice circularity** in this activity too!

Success Tips

- Keep explanations concise but evidence-based.
- Help your classmates understand your **chosen food's story**, not every detail of the map.
- Use visuals, arrows, symbols, and color - you're communicating a system, not writing a paragraph.
- Invite questions. Different foods reveal different system pressures - learning comes from comparison.
- Base claims on evidence from **Lesson A** and your mapping work, not guesses.
- Speak clearly: you are modeling the communication skills of real sustainability analysts.