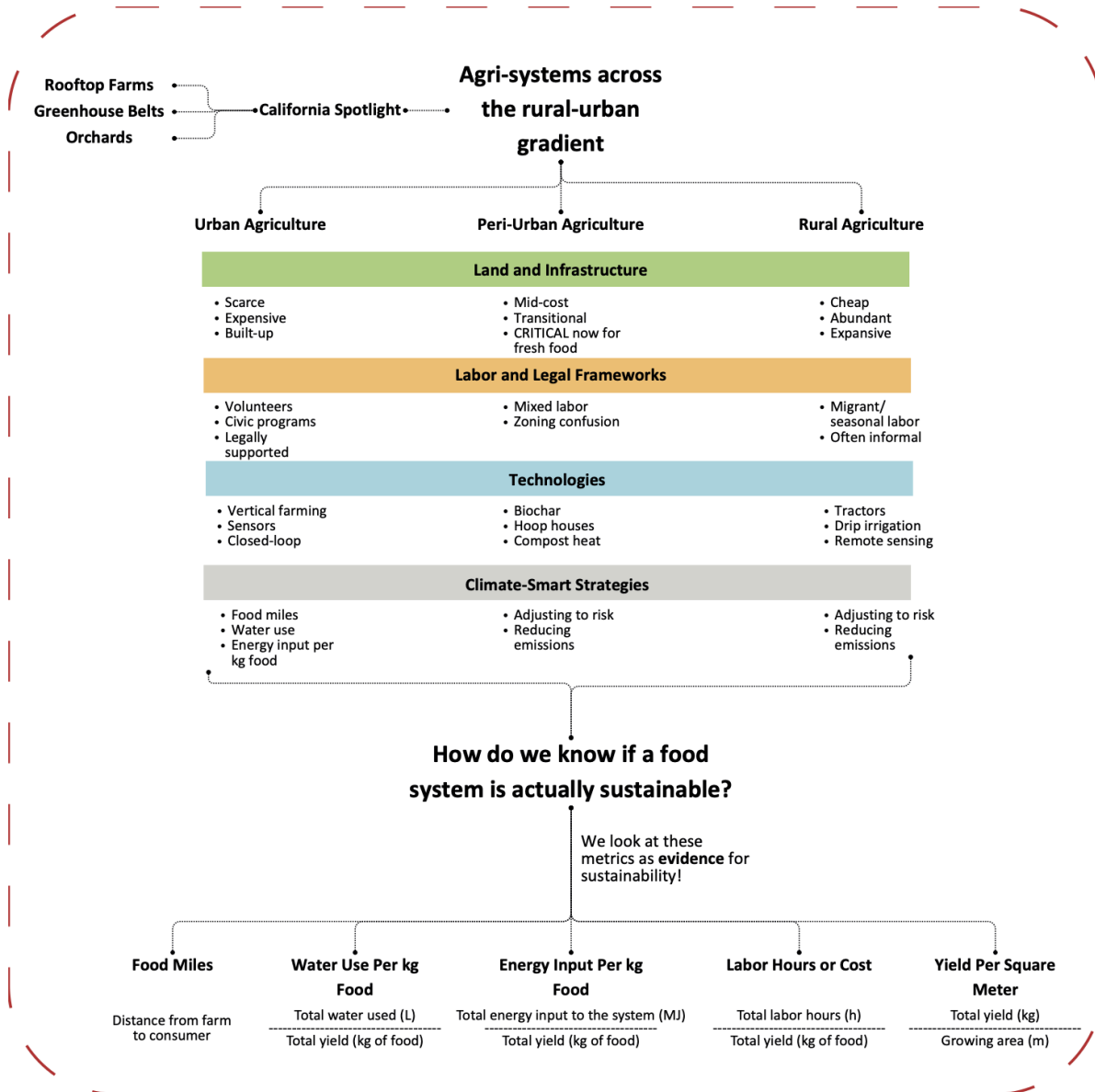




Module 6 – Agri-Systems Across the Rural-Urban Gradient

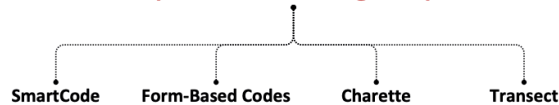
What You'll Learn

Comprehensive Mindmap



By understanding how different zones operate and by measuring key sustainability metrics, we gain the **insight** needed to **design** food systems that are **sustainable, equitable, and climate-resilient**.

Designing Food Systems (Gradient Planning Tool)



This module explores how agricultural systems vary across the urban–rural gradient and how climate-smart technologies, circular resource loops, and efficiency metrics can make food production more sustainable, resilient, and equitable.

Lesson A: From Balcony to Back-Forty

- **Define:** Urban, peri-urban, and rural food-system contexts, and describe how food miles, land cost, and labor differ across the gradient.
- **Classify & Analyze:** farming systems from visual/text examples, noting trade-offs in productivity, sustainability, and logistics.
- **Create & Evaluate:** Design and justify a modified city-region food layout that optimizes space and labor under real-world constraints.

Lesson B: Climate-Smart Growing Spaces

- **Identify & explain:** climate-smart techniques used in each zone (urban, peri-urban, rural) and how they conserve water, reuse waste, or minimize energy.
- **Apply & Analyze:** Match and deconstruct techniques to zone-specific conditions, showing how they form circular resource loops.
- **Create & Evaluate:** Design and defend a hybrid system that integrates strategies from at least two zones to close resource loops and increase long-term sustainability.

Lesson C: Tech & Metrics That Matter

- **Define & explain:** key efficiency metrics (e.g., L/kg, biomass per kWh, input–output ratio) and their purpose.
- **Apply & Analyze:** Calculate and interpret resource-use metrics from provided or classroom data to compare systems.
- **Evaluate & Create:** Recommend and justify a food production model using sustainability metrics, clearly defending trade-offs and resource constraints.

Important Vocabulary/Terms

Term	Definition	Example
Agri-System	A network of people, processes, and places involved in producing, distributing, and consuming food.	A local farm growing vegetables, delivering them to markets, and composting food waste.
Urban Agriculture	The practice of growing food in cities, often in small or repurposed spaces.	A rooftop garden in Los Angeles supplying herbs to a nearby restaurant.
Peri-Urban	Areas on the edge of cities where rural and urban land uses mix.	A farm just outside Sacramento that uses city compost for fertilizer.
Rural Agriculture	Farming that takes place in the countryside, often on larger plots of land.	A wheat farm in the Central Valley that exports grain nationwide.
Rooftop farm	A farm located on the roof of a building, often in cities, that grows vegetables, herbs, or other crops.	A grocery store in New York grows fresh lettuce on its roof and sells it directly downstairs.
Greenhouse belt	A region or cluster of greenhouses built close together to maximize food production, usually near cities.	In Southern California, a greenhouse belt outside the city provides fresh tomatoes year-round.
Orchard	A piece of land planted with fruit or nut trees.	An apple orchard in Washington State supplies apples for local farmers' markets.
Rooftop kale beds	Small, raised planting beds on rooftops	A school in Chicago uses rooftop kale

	specifically designed to grow kale and other leafy greens.	beds to teach students about healthy food and sustainability.
Shipping container farms	Farms built inside repurposed shipping containers, often using hydroponics or LEDs to grow crops in controlled conditions.	A shipping container farm in Detroit grows basil and spinach year-round, even in winter.
Wind-powered pump	A pump that uses wind energy (via a windmill or turbine) to move water for irrigation.	A farm in Texas uses a wind-powered pump to water cattle and irrigate corn fields.
Vertical LED	Indoor vertical farming systems that use LED lights to help plants grow in stacked layers.	A vertical LED farm in Singapore grows strawberries in towers inside a warehouse.
Field crops	Crops grown on open land in large areas, usually for staple foods or raw materials.	Corn, wheat, and soybeans are common field crops grown across the Midwest.
Composting piles	Heaps of organic waste (like food scraps, leaves, and plant matter) that break down naturally into nutrient-rich compost for soil.	A community garden keeps composting piles to recycle food waste into fertilizer for their vegetables.
Food Desert	A place where residents have limited access to affordable, nutritious food.	A low-income neighborhood with no grocery store within 5 miles.
Food Miles	The distance food travels from where it's grown to where it's eaten.	Bananas flown from Ecuador to California have high food miles.
Zoning	City rules that determine how land can be used (e.g., residential, commercial, agricultural).	A law that prevents farms from being built in a housing area.
Climate-Smart Agriculture (CSA)	Farming methods that boost productivity, adapt to climate change, and reduce emissions.	Installing drip irrigation and solar panels on a small farm.
Closed-loop system	A farming or production system where outputs (like waste or water) are reused as inputs, reducing waste and creating a self-sustaining cycle.	In aquaponics, fish waste provides nutrients for plants, and plants clean the water for fish — a closed-loop system.
Resource loops	The reuse and recycling of resources such as water, nutrients, and energy within a farming system to minimize waste.	A farm that collects rainwater to irrigate crops and composts food scraps to fertilize soil is using resource loops.
Wicking Bed	A garden bed with a water reservoir at the bottom that draws moisture up through the soil.	A self-watering box filled with vegetables on an apartment balcony.
Compost-Heat Greenhouse	A greenhouse heated using the natural heat from decomposing compost.	A winter greenhouse growing tomatoes using warmth from compost piles.
Pulse Drip Irrigation	A method where water is delivered in timed pulses to avoid overwatering.	A tomato field where short bursts of water reduce runoff.
Soil Moisture Probe	A tool that measures how much water is in the soil.	Farmers use it to decide when to water crops.
Variable-Frequency	A system that adjusts motor speed to	A pump on a farm using VFD to save

Drive (VFD)	reduce energy use.	power when less water is needed.
Circular Agriculture	Farming that reuses waste and closes resource loops.	Feeding food scraps to animals and using their manure as fertilizer.
Biochar	Charcoal-like material made from plant waste used to improve soil and store carbon.	A farmer adds biochar to the soil to help it retain water and nutrients.
Gentrification	When wealthier people move into an area, often displacing lower-income residents.	A community garden is removed to make way for high-end apartments.
Liters per Kilogram (L/kg)	A measure of water used to produce one kilogram of food.	It takes about 15,000 L/kg to produce 1 kg of beef.
Biomass per kWh	The amount of organic matter used to generate 1 kilowatt-hour of energy.	Burning 1.5 kg of wood chips to produce 1 kWh of heat.
Input-Output Ratio	A comparison of resources used to the results gained in production.	A farm that uses 2 units of water to grow 1 unit of food has a 2:1 ratio.
Efficiency trade-off	A situation where improving one part of a system's efficiency causes a decrease in another area.	A farmer installs high-efficiency LED lights that save energy, but they cost more upfront, creating a trade-off between energy savings and financial investment.
Design optimization	The process of adjusting and improving a system or technology so it performs at its best while using the least resources.	Engineers optimize a drip irrigation system by adjusting pipe size and water pressure to deliver just the right amount of water with minimal waste.
Hydroponics	Growing plants without soil using nutrient-rich water.	Basil grown indoors in a water tank with LED lights.
Vertical Farming	Growing crops in stacked layers, often indoors with artificial lighting.	A warehouse in New York stacked with shelves of leafy greens.
Controlled Environment Agriculture (CEA)	High-tech indoor farming with controlled temperature, humidity, and light.	A sealed greenhouse growing strawberries year-round.
Electrical Conductivity (EC)	A measure of how salty or nutrient-rich a water solution is.	High EC means nutrient solution is strong—good for tomatoes, bad for lettuce.
pH	A scale (0–14) showing how acidic or basic something is; affects plant growth.	Soil with pH 6.5 is ideal for most vegetables.