ERASMUS-EDU-2023-CBHE
Project number: 101129032

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(01/01/2024 – 31/12/2026)

LESLIE
LAND MANAGEMENT
ENVIRONMENT &
SOLID-WASTE

MICRO-CREDENTIAL

CLIMATE CHANGE FOR SUSTAINABLE LAND MANAGEMENT IN CENTRAL ASIA

6. – Agriculture, Food Security and Rural Livelihoods

Climate-Smart Agriculture and Circular Practices

CC-W06-V24

Co-funded by the European Union

Bukhara State Technical University
(***prev. "TIIIAME" NRU BINRM***)

Learning objectives

1. Integrate the lessons from crops, rangelands and soils into one climate-smart agriculture framework
2. Explain the three CSA objectives: productivity, adaptation and mitigation where possible
3. Identify circular practices that close nutrient, water, biomass and energy loops in farming systems
4. Assess why CSA options must be locally adapted to Central Asian water, soil and livelihood conditions

→ **V24 is the integrative lesson of Week 6: it connects crop yields, livestock systems, soil health and resource efficiency.**

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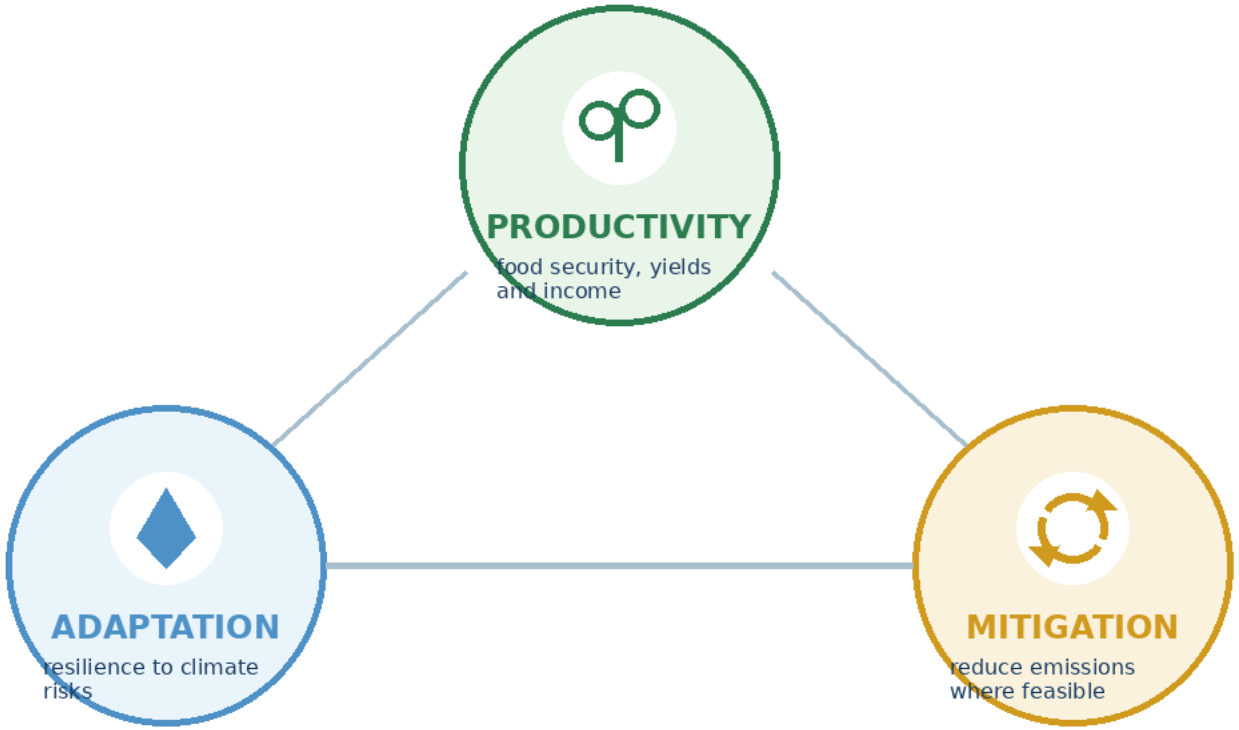
Climate-smart agriculture: an integrative framework

CSA is a decision framework for managing trade-offs under climate change — not a fixed list of technologies.

Context-specific
No universal CSA package

Landscape-based
Crops, livestock, water and soils interact



Evidence-based
Options must be monitored and adjusted

Equity-sensitive
Benefits and costs differ among farmers

Central idea
CSA seeks synergies and manages trade-offs. A practice is climate-smart only in relation to a specific place and objective.

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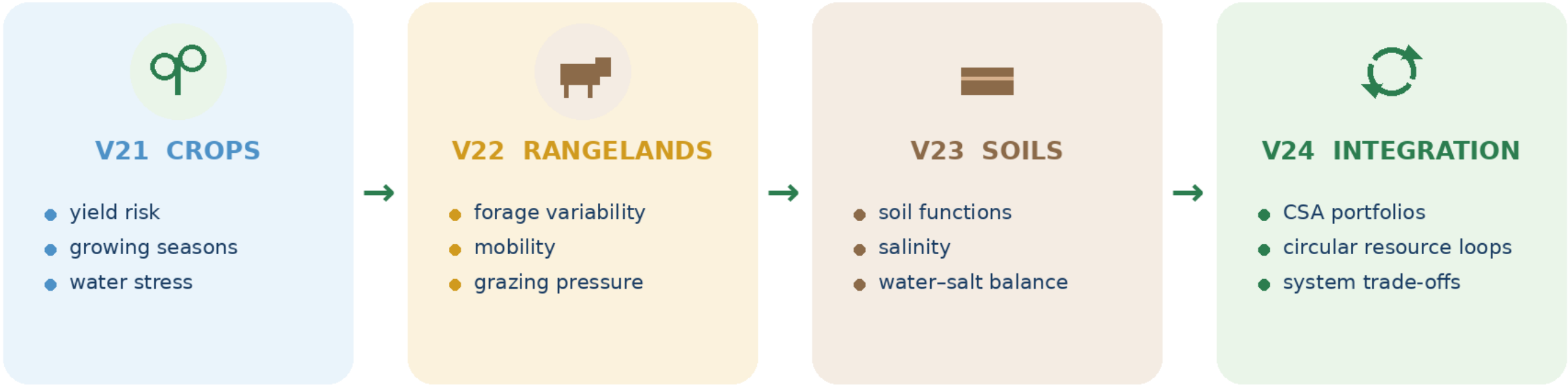
From diagnosis to integrated practice

V24 uses the previous three videos as inputs for designing coherent farm and landscape responses.



Design question

Which combination of practices improves productivity and resilience without worsening water scarcity, salinity, soil degradation or greenhouse-gas emissions?

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Water-smart and salinity-aware agriculture

In Central Asian irrigated drylands, climate-smart practice must be water-smart and salt-aware at the same time.

Core water decisions



Allocate
Match water to priority uses



Apply
Time and dose irrigation efficiently



Drain
Maintain salt-export pathways



Reuse safely
Use fit-for-purpose water where appropriate

Goal **Increase water productivity while preventing salt accumulation and downstream impacts.**

Irrigation scheduling
Match applications to crop stage, soil moisture and weather demand

Efficient delivery
Reduce avoidable conveyance and field losses where technically and economically feasible

Drainage control
Maintain pathways for salts to leave the root zone without uncontrolled pollution

Crop choice
Match varieties and crops to water availability and salinity constraints

Trade-off to check
Improving irrigation efficiency can reduce field-scale withdrawals, but basin-scale benefits depend on return flows, drainage and allocation rules.

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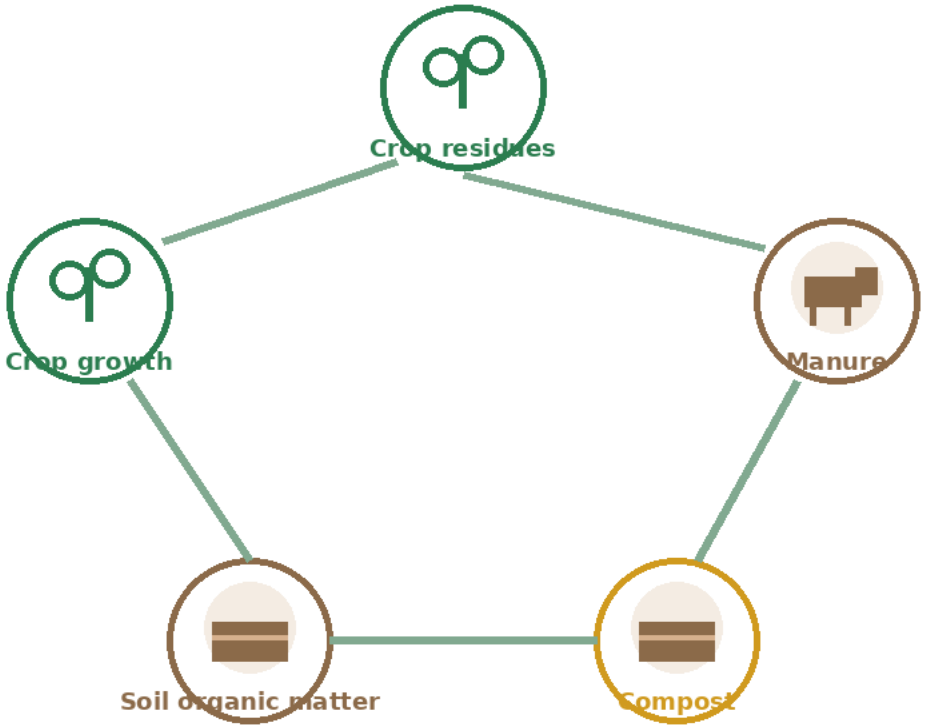
Circular organic-resource management

Circular practices can return biomass and nutrients to production — but only when material quality and application are controlled.

Potential benefits

- return nutrients and organic matter
- improve soil structure and water retention
- reduce open burning and uncontrolled disposal
- substitute part of mineral fertiliser demand



Quality controls

- pathogen and weed-seed reduction
- salinity and heavy-metal checks where relevant
- balanced nutrient application
- avoid over-application near water

Circular does not mean uncontrolled.

Recovered biomass and nutrients must be agronomically useful, hygienically safe and environmentally sound.

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Crop-livestock integration

Circular integration links crop and livestock subsystems by reusing biomass, nutrients and feed resources while protecting soil and water.

Crop residues → feed / bedding

- Use residues as feed or bedding where appropriate
- Retain enough cover to protect soil and reduce erosion

Fodder crops → feed security

- Diversify rotations and improve feed availability
- Reduce exposure to drought and seasonal feed gaps

INTEGRATED FARM SYSTEM



close resource loops

Manure → soil nutrients

- Return nutrients according to crop demand
- Avoid local nutrient accumulation and water pollution

Managed grazing → land use

- Use crop aftermaths or designated grazing areas carefully
- Avoid compaction and pressure on fragile soils

Design principle

The same residue can be feed, bedding, fuel or soil cover. Climate-smart integration requires choosing the use that addresses the limiting resource without creating a new environmental pressure.

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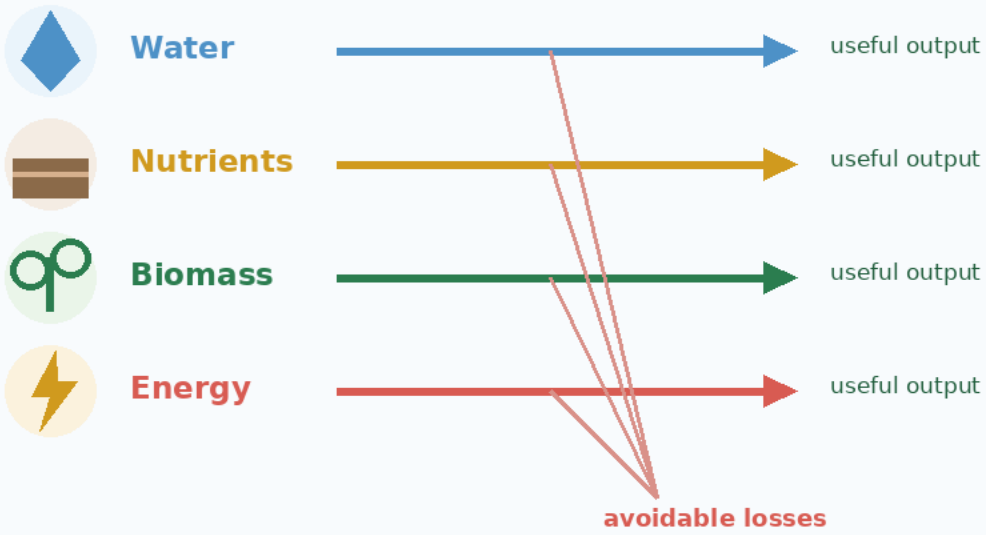
Nutrient, energy and waste-efficiency practices

Circular agriculture reduces avoidable losses when material flows are quantified and managed safely.

Farm resource flows



Precision nutrient management

Match source, rate, timing and placement of fertilisers and organic amendments

Safe composting and reuse

Stabilise organic residues and control pathogens, odour and contamination risks

Biogas where feasible

Recover energy from suitable wet organic residues under controlled conditions

Loss prevention

Reduce food, feed and post-harvest losses before treating material as waste

Key condition

Circular practices must reduce net environmental pressure. Transferring pollution from soil to water, air or products is not circularity.

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Climate services and farmer decision support

CSA requires information that farmers can use at the moment when management decisions are made.

Decision calendar

Before season
- seasonal forecasts
- crop and variety choice
- input and water planning

During season
- soil moisture tracking
- irrigation scheduling
- pest and heat warnings

Before extremes
- early warning
- feed and water reserves
- risk-reduction actions

After harvest
- yield review
- residue use
- soil and salinity checks

Useful services combine:

Climate data
weather stations, forecasts, drought indices

Local knowledge
field observation and farmer experience

Advisory delivery
extension, mobile messages, cooperatives

Feedback loops
what worked, what failed, what changed

Key point

Information becomes climate-smart only when it changes decisions: sowing dates, irrigation, grazing, inputs or risk management.

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Enabling conditions for CSA and circular practices

Technical practices are implemented through institutions, incentives, infrastructure and knowledge systems.

Secure access and tenure

Farmers need enough security to invest in soil, water and long-term resilience.

Finance and risk tools

Credit, insurance and grants can reduce barriers to adopting new practices.

Infrastructure

Irrigation, drainage, storage and roads determine whether practices are feasible.

Extension and training

Advisory services translate climate and soil information into farm decisions.

Markets and value chains

Demand for resilient crops, compost, feed or bioenergy affects viability.

Rules and safeguards

Reuse of wastes, manure and water requires quality control and environmental protection.

Implementation message

CSA adoption depends as much on enabling conditions as on the technical performance of individual practices.

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Assessing co-benefits and trade-offs

A CSA portfolio should be assessed against multiple outcomes, not only yield improvement.

Multi-criteria assessment

Productivity
yield stability, income, food supply

Adaptation
drought, heat, salinity and pest resilience

Mitigation
emissions intensity and carbon benefits

Water
withdrawals, return flows and drainage quality

Soil
organic matter, structure, erosion, salinity

Equity
access, labour, gender and distribution of benefits

Avoid maladaptation

A practice can improve one outcome while worsening another, for example saving labour but increasing water demand, or raising yields while exporting salts downstream.

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Practical CSA portfolio for Central Asian farms

Portfolios should combine low-regret measures with targeted investments adapted to local constraints.

Irrigated drylands

- water scheduling and drainage maintenance
- salinity diagnosis and salt-tolerant options
- nutrient recycling with quality control

Rainfed cereal areas

- soil-cover protection and reduced erosion
- drought-tolerant varieties and sowing dates
- crop diversification where feasible

Mixed crop-livestock systems

- residue allocation between feed and soil cover
- manure nutrient management
- fodder security and risk planning

Portfolio logic

Start with the limiting factor. In Central Asia this is often water, salinity, soil cover, feed availability or access to knowledge and finance.

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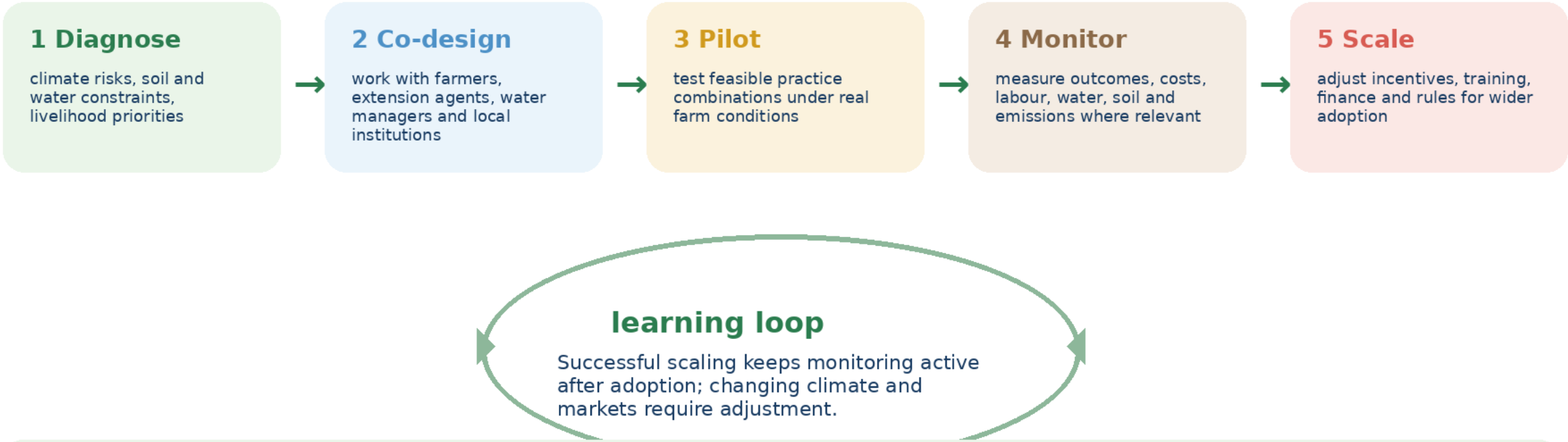
Implementation roadmap: from pilot to scaling

Scaling CSA requires an iterative process: diagnose, test, adapt, monitor and institutionalise.



Practical rule **do not scale a practice before its trade-offs and maintenance requirements are understood.**

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Key Messages

The final lesson integrates the four components of agriculture, food security and rural livelihoods.

1. **CSA integrates productivity, adaptation and mitigation, but always in a specific local context.**
2. Water-smart and salinity-aware management is essential for irrigated drylands in Central Asia.
3. Circular practices can close resource loops, but only with quality control and safeguards.
4. Soil health, crop productivity and livestock resilience are connected through water, biomass and nutrients.
5. **Implementation depends on institutions, finance, extension and fair access to benefits.**

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Check your learning

1. Why is climate-smart agriculture not simply a list of recommended technologies?
2. How can a circular practice create environmental risk if quality control is weak?
3. Which trade-offs should be checked before promoting more efficient irrigation?
4. How would you design a CSA portfolio for a farm affected by water scarcity and salinity?

Closing thought



Climate-smart and circular agriculture is not about adding more practices. It is about combining the right practices for the right constraint, at the right scale.

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