Keep productive soil in place

Sustainable agriculture supports food production while protecting the resources needed for future harvests. Soil conservation prevents erosion: the removal and transport of soil by wind or water.

1. SIX SOIL-CONSERVATION METHODS

Contour plowing	Follow lines of equal elevation across a slope rather than running rows directly downhill. Ridges slow surface flow and reduce the movement of soil.
Windbreaks	Rows of trees or shrubs reduce wind speed near the ground. This lowers the ability of wind to lift and carry exposed soil particles.
Perennial crops	Plants live for more than two years. Persistent roots and longer-lasting cover help hold soil in place and reduce periods when the field is bare.
Terracing	Reshape a slope into shorter, flatter sections or build embankments across it. Terraces interrupt long downhill flow paths and manage runoff to limit erosion.
No-till agriculture	Plant into residue from the previous crop without plowing the whole field. Less disturbance preserves soil structure; retained residue shields the surface from rain and wind.
Strip cropping	Alternate strips of erosion-prone crops with denser, soil-protecting crops. Across a slope, protective strips slow runoff and intercept sediment moving from the neighboring crop strips.

2. MATCH THE METHOD TO THE PROCESS

Windbreaks mainly target wind erosion. Contour rows and terraces mainly address water moving downslope. Perennial cover, crop strips and retained residues protect the soil surface. These methods can be combined; they are not interchangeable fixes for every field. Keeping topsoil on the farm helps retain organic matter and nutrients while reducing sediment carried into streams.

Required methods and soil-conservation goal: College Board, STB-1.E.1.
No-till, crop strips and vegetation: USDA NRCS, Conservation Activity Descriptions.
Soil cover, structure and erosion: USDA NRCS, Soil Health on Cropland.

Scope: College Board AP Environmental Science CED, Topic 5.15, p. 111.

Maintain fertility, not just soil depth

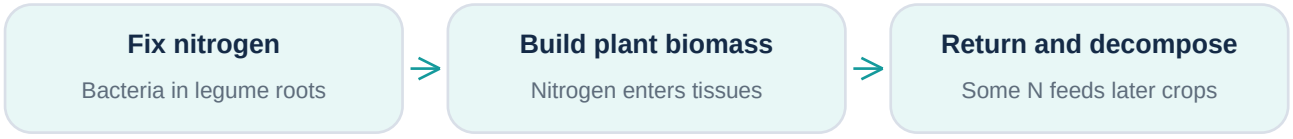
Preventing erosion and improving soil fertility are related but different goals. A field may retain its soil yet still have nutrient shortages or a pH that limits crop growth.

1. CROP ROTATION: CHANGE CROPS OVER TIME

Grow a planned sequence of different crops in the same field. Different crops have different rooting patterns and nutrient demands. A rotation that includes legumes can contribute nitrogen through their association with nitrogen-fixing bacteria. Rotating crops is not the same as growing alternating strips at one time, and simply changing crops does not manufacture every nutrient removed at harvest.

2. GREEN MANURE: RETURN PLANT MATERIAL

Green manure is plant biomass grown to be returned to the soil, commonly incorporated while still green. Decomposition adds organic material and releases nutrients. This is not animal manure. A legume green manure can add biologically fixed nitrogen; a nonlegume mainly captures and recycles nitrogen already in the soil.



Extension: nitrogen becomes available over time, not all immediately after incorporation.

3. LIMESTONE: CORRECT EXCESS ACIDITY

Agricultural limestone neutralizes acidity and raises soil pH. On an overly acidic soil, this can improve conditions for roots and microbes and change nutrient availability. It is not a nitrogen fertilizer and is not needed equally by all crops or soils. Use soil tests and crop requirements to determine whether liming is appropriate; raising pH beyond a suitable range can create new nutrient-availability problems.

Legumes and nitrogen cycling: University of Minnesota Extension, Soil Biology.
Green manure and nutrient release: University of Maryland Extension, Soil Fertility and Cover Crops.
pH and soil testing: University of Minnesota Extension, Lime Needs in Minnesota.

Scope: College Board AP Environmental Science CED, Topic 5.15, p. 111.

Give pasture time to recover

Rotational grazing regularly moves livestock between pastures or smaller paddocks. The aim is to avoid repeatedly removing vegetation from the same area before plants can recover.

1. GRAZE ONE AREA; REST THE OTHERS

Paddock A	Paddock B	Paddock C
Grazing now	Rest and regrow	Rest and regrow

Illustrative snapshot, not a fixed timetable: the herd is in A while B and C rest. Move animals to a suitable recovered paddock before A is overgrazed; then allow A to regrow. Recovery depends on plant growth, weather and grazing pressure, so an identical number of days is not appropriate in every season.

2. THE BENEFIT COMES FROM RECOVERY

Retained leaves support photosynthesis, and a rest period allows plants to rebuild growth and maintain a protective cover. Roots and cover help resist erosion. Rotation alone does not guarantee success: too many animals or a return before adequate regrowth can still degrade pasture. Check available forage and adjust livestock numbers or grazing duration to the land and season.

3. EXTENSION: CHECK THE OUTCOME

Soil conservation	Track bare ground, rills or sediment loss. Less erosion supports a soil-retention claim, not proof that all nutrients are adequate.
Fertility management	Check soil nutrients and pH alongside crop growth. More limestone is not automatically better, and legume nitrogen does not replace phosphorus.
Grazing management	Track cover and regrowth before returning livestock. Healthy pasture, not simply a rotation schedule, is the goal.

Rotational grazing definition and purpose: College Board, STB-1.E.3.
Rest, regrowth and seasonal timing: University of Minnesota Extension, Managing Horse Pastures.
Cover and grazing impacts: USDA NRCS, Soil Health on Cropland.

Scope: College Board AP Environmental Science CED, Topic 5.15, p. 111.