

APES Handout: How to Control Soil Erosion¹

1. PREVENTION methods - involve techniques that can be applied before a parcel of land is prepared for agricultural land use.

Land Classification - Starts with the identification of areas that should not be planted. Considerations to be included are slope, soil type, existing waterways, critical endemic plant and animal habitat.

2. COVER methods - These methods all protect the soil from the damaging effects of raindrop impact. Most will also improve soil fertility.

Conservation tillage - is any method (**no-till**, **strip-till**, **ridge-till** and **mulch-till**) of soil cultivation that leaves the previous year's crop residue (such as corn stalks or wheat stubble) on fields before and after planting the next crop, to reduce soil erosion and runoff. This method is especially suitable for erosion-prone cropland. To provide these conservation benefits, at least 30% of the soil surface must be covered with residue after planting the next crop. Some conservation tillage methods forego traditional tillage entirely and leave 70% residue or more.



- **No-till** and **strip-till** involve planting crops directly into residue that either hasn't been tilled at all (no-till) or has been tilled only in narrow strips with the rest of the field left untilled (strip-till).
- **Ridge-till** involves planting row crops on permanent ridges about 4-6 inches high. The previous crop's residue is cleared off ridge-tops into adjacent furrows to make way for the new crop being planted on ridges. Maintaining the ridges is essential and requires modified or specialized equipment.
- **Mulch-till** is any other reduced tillage system that leaves at least one third of the soil surface covered with crop residue.

Minimum cultivation - Each time the soil is dug or ploughed, it is exposed to erosion. In some soils it may be possible to sow crops without plowing or digging, ideally among the crop residue from the previous crop. This is most likely to be possible in a loose soil with plenty of organic matter.

Crop residues - After harvest, unless the next crop is to be immediately replanted, it is a good idea to leave the stalks, stems and leaves of the crop just harvested, lying on the soil. They will give some cover protection until the next crop develops.

Mulching - Bare soil between growing plants is covered with a layer of organic matter such as straw, grasses, leaves and rice husks - anything readily available. Mulching also keeps the soil moist, reduces weeding, keeps the soil cool and adds organic matter. If insects are a problem, keep the mulch away from the stems of crops.

Crop Rotation - besides improving the overall efficiency of nitrogen uptake and utilization in the soil, planting certain cover crops in the winter, during traditionally unplanted or fallow periods, prevents erosion and runoff when the ground thaws, traps nutrients in the soil that are released to the spring crops after being cut and left as "green manure".

Green manures - also usually legumes - are planted specially to improve soil fertility by returning fresh leafy material to the soil. They may be plants that are grown for 1-2 months between harvesting one crop and planting the next. The leaves may be cut and left on the surface of the soil as a mulch or the whole plant dug into the soil. Green manures may also be trees or hedges which

¹ For a definitive list of methods used in the Midwest check out

http://www2.mda.state.mn.us/webapp/cpdt/cfaTableSql_new.jsp?prac_type_id=0&env_id=0&land_use_id=0&practice_id=0&fund_pr og_id=0

may grow for many years in a cropping field from which green leaves are regularly cut for use as mulch (alley cropping).

Cover crops and green manures - Cover crops are a kind of living mulch. They are plants - usually legumes - that are grown to cover the soil, also reducing weeds. Sometimes they are grown under fruit trees or taller, slow maturing crops. Sometimes they also produce food or fodder. Cowpeas, for example may be used both as a cover crop and a food crop.

Mixed cropping and inter-cropping - By growing a variety of crops - perhaps mixed together, in alternate rows, or sown at different times - the soil is better protected from rain splash.

Early planting - The period at the beginning of the rainy season when the soil is prepared for planting, is when the damage from rain splash is often worst. Sowing early will make the period when the soil is bare, as short as possible.

Alley Cropping (Agroforestry) - Planting trees among agricultural crops helps to protect the soil from erosion, particularly after crops are harvested. The trees will give some protection from rain splash. Fruit, trees, legume trees for fodder or firewood and alley cropping all help reduce soil erosion.

3. BARRIER methods - Barrier methods all slow the flow of water down a slope. This greatly reduces the amount of soil which run-off water can carry away and conserves water. Any kind of barrier should work. To be effective any barrier must follow the contour lines.

Man-made terraces - In some countries terracing has been successfully practiced for centuries - the Philippines, Peru and Nepal, for example. Well-built terraces are one of the most effective methods of controlling soil erosion, especially on steep slopes. However, terraces require skill and very hard work to build. Each terrace is leveled - first by leveling the sub-soil, then the top soil - and firm side supports are built, often of rock. Man-made terraces are unlikely to be an appropriate method in countries with no tradition of terrace building.

Contour plowing - Whenever possible all land should be ploughed along the contour line (perpendicular to the slope) never parallel or with the slope since this simply encourages erosion. In some situations this may be very difficult due to the pattern of land ownership. Soil conservation programs may need to consider land redistribution schemes, or neighboring farmers will have to work together.

Contour stripcropping - crop strips alternate down a slope on the contour (across or perpendicular to the slope) to reduce soil erosion and runoff. **Stripcropping** on flat land is growing strips of row crops such as corn and soybeans alternate in a planned rotation with equal-width strips of close-growing crops such as forages, small grains or sod, all arranged systematically across a field.

Contour barriers - Almost any available material can be used to build barriers along the contours. Here are some examples: old crop stalks and leaves, stones, grass strips, ridges and ditches strengthened by planting with grass or trees.

Grass waterways - are a type of conservation buffer; they downhill grassed channels, generally broad and shallow, designed to prevent soil erosion while draining runoff water from adjacent cropland. As water travels down the waterway, the grass vegetation prevents erosion that would otherwise result from concentrated flows. Grass waterways also help prevent gully erosion in areas of concentrated flow.

Natural terraces - David Stockley encourages the use of grass strips. He writes... 'Why do so much hard work (building terraces) when nature can do it for less? Let us make use of natural erosion. We planted grass along the contour lines. We used fibrous grasses with a dense root system such as Napier grass, Guatemala grass and Guinea grass. The strips of land in between were cultivated. As the soil is cultivated, nature moves the soil to form a natural terrace. The rainwater passes through

the grass strip, depositing any soil carried behind the grass. In our experience in Bangladesh and Brazil, rains formed natural terraces within five years. Once well established, the grass barrier can be planted with banana, pineapple, coffee, fruit or firewood trees.'

Medias lunas - This is a helpful system for reclaiming badly eroded land that has been used successfully in Bolivia. *Medias lunas* or crescent shaped depressions are built on sloping land. The crescent shapes are built at the end of the rainy season so the ridges made can be compacted well. The crescent collects the rainwater and soil. Trees - usually legumes - are planted when the next rainy season begins and protected by thorn branches from grazing animals. After 3 or 4 years each media luna will be covered with vegetation. Later, as the soil continues to improve, crops may be grown in the medias lunas.

Drop structures - also known as a *grade control, sill, or weir*, is a manmade structure, typically small and built on minor streams, or as part of a dam's spillway, to pass water to a lower elevation while controlling the energy and velocity of the water as it passes over. Unlike weirs and dams, drop structures are usually not built for water impoundment, diversion or raising the water level. Mostly built on streams and rivers with steep channel gradients, they serve the other purposes of water oxygenation and erosion prevention.

Diversion Structures - channel and re-route excess runoff across a slope to a desired outlet or storage facilities during wet periods, for later use during dry periods. Flood diversion structures, such as dikes, are also useful methods for mitigating the adverse effect of torrential rains and at the same time capturing the excess water for later use. Diversion structures include transverse dikes, water traps, homemade diversion structures (*ex. Toroba, or curari and cuji* in Venezuela).

Gully Reclamation - planting gullies with soil-retaining plants, small dams, and building divergent channels

Gully grade stabilization - the creation of structures that serve as embankments and spillways built across a drainage way to prevent soil erosion. Grade stabilization structures are especially important in areas where sediment loading from gully erosion is a major water quality concern.

Planted Windbreaks (Shelter belts) - are windbreaks designed to protect farmsteads and livestock from wind and blowing snow. They can also be used to protect wildlife wintering areas. One or more rows of trees/shrubs are planted around the area to be protected, surrounding it partly (often in an L-shape) or more completely, like a squarish belt.

Riparian Strips - buffer strips of grass, shrubbery, trees, and other vegetation (that can grow up to and on the banks of the waterway) are planted strategically between fields and surface waters (rivers, streams, lakes and drainage ditches) to protect water quality. They slow runoff from fields, trapping and filtering sediment, nutrients, pesticides and other potential pollutants before they reach surface waters. They can also be planted around drainage tile inlets for the same purpose.