# Land characteristics and management factors involved in gully and tunnel erosion.

| Processes | Land characteristics affecting processes | Factors affected by land characteristics | Management factors that modify land characteristics |
|---|---|---|---|
| Gully and tunnel erosion occur when the forces due to rainfall, flowing water and gravity overcome the cohesion and weight of the soil particles/aggregates | Vegetation<br>• structure, percent surface cover (including litter) | • Exposure of surface soil<br>• Intensity of raindrop impact<br>• Velocity of channelised flow and hence particle detachment and transport | All aspects of the vegetation are affected by selection of species and control of biomass by practices such as cultivating clearing trafficking fertilising grazing trampling harvesting burning |
| | • leaf area, rooting depth and perenniality | • Transpiration and hence infiltration rate and volume of surface and subsurface flow | |
| Processes involved are:<br>• detachment of exposed surface soil by<br>- raindrop impact<br>- channelised overland flow<br>- cracking | Climate<br>• rainfall intensity/duration | • Intensity of raindrop impact | |
| | | • Volume of surface and sub-surface flow | |
| | • seasonal rainfall/ evapotranspiration regime | • Volume of surface and sub-surface flows via regulation of soil water content | |
| • detachment of subsoil by<br>- subsurface flow in permeable strata and along cracks and tunnels<br>-cracking | Geology<br>• perviousness of rock or unconsolidated sediments | • Soil water content and hence infiltration rate and volume of surface and subsurface flow<br>• Lateral or vertical movement of water | |
| • transport of particles/ aggregates by<br>- channelised overland flow<br>- subsurface flow<br>- gravity collapse | Topography<br>• microrelief (both of channel and catchment to a site) | • Infiltration/run-off ratio<br>• Velocity of surface flow | Contour and diversion banking, strip cropping and contour cultivating reduce catchment slope length and catchment area; they also affect microrelief |
| | • channel slope degree and length | • Infiltration/run-off ratio<br>• Velocity of surface flow | |
| | • position in landscape and catchment area | • Volume of surface and sub-surface flows reaching site | |
| • deposition | • catchment slope degree and length | • Infiltration/run-off ratio<br>• Velocity of surface flow | Contour and diversion banking, strip cropping and contour cultivating reduce catchment slope length and catchment area; they also affect microrelief |
| | • slope and land-form shape | • Tendency to concentrate surface flow | |
| Gully erosion is regarded as having occurred when the channel is too deep to be crossed or cannot be obliterated by tillage | Soil<br>• profile permeability | • Infiltration rate and hence volume of surface and sub-surface flow<br>• Lateral or vertical movement of soil water | Type and amount of biomass production will affect soil organic matter content, which will in turn affect most listed soil characteristics |
| | - depth and water-holding capacity | • Volume of surface and sub-surface flow | Soil disruption and compaction by trampling, burrowing, cultivating and trafficking will affect profile permeability, water-holding capacity and size/weight and cohesion of soil particles/aggregates |
| Off-site effects include increased sedimentation and | - size/weight of soil particles/aggregates | • Detachment and transport | |
| run-on in streams and on | - cohesion of particles/ | • Detachment | |
| lower lands | aggregates, including tendency to crack, slake and disperse | | |
| | - differential permeability within a horizon due to the presence of cracks and channels | • Movement of water along preferred channels | |
| | - percent stone cover | • Volume surface flow | |

Baxter & Robinson (2001). A Land Resource Assessment of the Glenelg Hopkins region. Agriculture Victoria – CLPR.

# Land characteristics and management factors involved in mass movement

| Processes | Land characteristics affecting processes | Factors affected by land characteristics | Management factors that modify land characteristics |
|---|---|---|---|
| Landsliding occurs when the shear forces exceed soil/regolith strength; this generally occurs when soil/regolith strength is reduced by an increase in water<br><br>Processes involved are:<br><br>infiltration ofwater<br><br>wetting of basal plane<br><br>saturation of soil (mudflow)<br><br>shearing and movement of soil mass by gravity<br><br>Other processes that may be involved include:<br><br>- loading of soil mass resulting in an increase in shear strength<br><br>- removal of material from slope toe resulting in reduced slope support<br><br>Types of landslides covered by this table are:<br>- rock and earth slides<br>- earth flow (downslope movement of unsaturated soil and weathered rock on a lubricated basal shear plane)<br>- mudflow (movement of saturated soil and rock)<br>-combination slide/flows | Vegetation<br>- leaf area, rooting depth perenniality<br>- total leaf area and canopy type<br><br>- root depth and mass<br><br>Climate<br>- seasonal rainfall/ evapotranspiration regime<br><br>Geology<br>- perviousness of rock or unconsolidated sediments<br>- wet strength of rock/ regolith<br>- angle of dip<br><br>Topography<br>- slope degree<br><br>- microrelief and position in landscape<br><br>Soil<br>- topsoil permeability<br>- presence of slowly permeable layer<br>- cohesion of particles/ aggregates including tendency to slake and disperse<br>- depth<br>- clay mineralogy | • Transpiration and hence soil water content<br>• Volume of water held by canopy and hence volume available for infiltration<br>• Anchorage of soil by roots harvesting<br><br>• Soil water content<br><br>• Soil water content<br><br>• Shearing tendency<br><br>• Shearing tendency<br><br>• Lateral gravitational component<br>• Run-on, site drainage and hence soil water content<br><br>• Infiltration/run-off ratio<br>• Water content of soil immediately above layer<br>• Soil strength<br><br>• Soil water content<br>• Soil strength | All aspects of the vegetation are affected by selection of species and control of biomass by practices such as cultivating clearing trafficking fertilizing grazing trampling burning<br><br><br><br><br><br><br><br><br><br><br><br>Compaction and soil disruption by stock and vehicles, and by cultivating, will affect profile permeability |

Baxter & Robinson (2001). A Land Resource Assessment of the Glenelg Hopkins region. Agriculture Victoria – CLPR.

# Land characteristics and management factors involved in sheet and rill erosion.

| Processes | Land characteristics affecting processes | Factors affected by land characteristics | Management factors that modify land characteristics |
|---|---|---|---|
| Sheet and rill erosion occur when the forces due to rainfall, flowing water and gravity overcome the cohesion and weight of the soil particles/aggregates | Vegetation<br>- structure, percent surface cover (including litter)<br><br><br>- leaf area, rooting depth and perenniality | <br>• Exposure of surface soil<br>• Intensity of raindrop impact<br>• Infiltration/run-off ratio<br>• Velocity of surface flow<br>• Transpiration and hence infiltration rate and volume of surface flow | All aspects of the vegetation are affected by selection of species and control of biomass by practices such as cultivating clearing trafficking fertilising grazing trampling harvesting burning |
| Processes involved are:<br><br>detachment of exposed soil by<br>- raindrop impact<br>- surface flow | Climate<br>- rainfall intensity/duration<br><br><br><br>- seasonal rainfall/ evapotranspiration regime | <br>• Intensity of raindrop impact<br>• Volume of water exceeding infiltration rate and hence volume of surface flow<br>• Soil water content and hence infiltration rate and volume of surface flow | |
| transport by<br>- rain splash<br>- surface flow | Geology<br>- permeability of rock or unconsolidated sediments | <br>• Soil water content and hence infiltration rate and volume of surface flow | |
| deposition<br><br><br>Surface flow occurs on any sloping surface when the rainfall rate exceeds the infiltration rate | Topography<br>- microrelief<br><br>- slope degree and length<br>- slope and landform shape<br>- position in landscape | <br>• Infiltration/run-off ratio<br>• Velocity of surface flow<br>• Volume and velocity of surface flow<br>• Tendency to concentrate surface flow<br>• Volume of run-on | Contour cultivating, contour banking and strip cropping reduce slope length and affect microrelief |
| <br><br><br>Of site effects include increased sedimentation and run-on in streams and on lower lands | Soil<br>- profile permeability<br><br>- depth and water-holding capacity<br>- size/weight of surface particles/aggregates<br>- cohesion of surface particles/aggregates, including tendency to slake and disperse<br>- tendency to surface seal and hydrophobicity<br>- percent stone cover | <br>• Infiltration rate and hence volume of surface flow<br>• Infiltration/run-off ratio<br><br>• Detachment and transport<br><br>• Detachment<br><br><br><br>• Infiltration rate and hence volume of surface flow<br>• Infiltration/run-off ratio and velocity of surface flow | The above management practices controlling biomass affect soil organic matter content, which in turn affects all listed soil characteristics except surface rock<br><br>Direct soil compaction and disruption by trampling, trafficking and cultivating affect soil permeability, water-holding capacity and size/weight and cohesion of aggregates |

## Land characteristics and management factors involved in wind erosion

| Processes | Land features affecting processes | Factors affected by land characteristics | Management factors that modify land characteristics |
|---|---|---|---|
| Wind erosion occurs when the force due to wind is sufficient to overcome the cohesion and weight of the soil particles and to allow their movement<br><br>Processes involved are:<br><br>detachment by abrasion and suction<br><br>transport by creep, saltation and suspension<br><br>deposition by entrapment and reduced wind velocity | Vegetation<br>- structure, percent surface cover (including litter)<br>- leaf area, rooting depth and perenniality | • Exposure of surface soil<br>• Depth of zero velocity layer<br>• Transpiration and hence soil moisture content and particle cohesion | All aspects of the vegetation are affected by selection of species and control of biomass by practices such as grazing trampling harvesting burning cultivating clearing trafficking fertilising |
| | Climate<br>- rainfall/evapotranspiration regime<br>- wind strength<br>- wind direction | • Soil moisture content and hence particle cohesion<br>• Detachment and transport<br>• Site exposure | |
| | Geology<br>- perviousness of rock or unconsolidated sediments | • Soil moisture content and hence particle cohesion | |
| | Topography<br>- microrelief slope degree and position in landscape | • Surface wind strength<br>• Run-on, site drainage and hence soil moisture content and particle cohesion | Retention or construction of wind-breaks, cloddy cultivation and ridging affect microrelief |
| | Soil<br>- percent stone cover<br>- size/weight of surface particles/aggregates<br>- aggregate stability (influenced by factors such as presence ofcarbonates, iron oxides and organic matter, clay mineralogy and biological activity)<br>- profile permeability, depth and water-holding capacity<br>- size/weight of surface | • Surface wind strength<br>• Detachment and transport<br><br>• Detachment<br><br><br><br><br>• Soil moisture content and hence particle cohesion and weight or particles/aggregates | Soil disturbances such as trampling cultivating affect aggregate stability<br><br>Any practices affecting biomass alter the organic matter content of the topsoil |

Source: Aldrick, J.M. et. al. (1988) A study of the Land in the Catchment of the Gippsland Lakes. Department of Conservation Forests and Lands, Victoria.