PEOPLE LED PREVENTION | TRAINING PACK

Landcare
New South Wales

Landscaping for Landslips - Utilising Soft Techniques to Stabilise Soil and Reduce Risks

This training pack aims to cover the importance of nature-based interventions for managing landslips. Focusing on soft techniques like deep-rooted vegetation and bioengineering methods, these approaches stabilise soil, prevent erosion, improve resilience and reduce risks.

Nature-Based Interventions to Mitigate Risk and Manage Landslips

In recent years, the importance of nature-based interventions to mitigate risks and manage landslips has gained significant recognition. Utilising natural methods to stabilise soil and prevent erosion promotes regenerative practices and provides cost-effective solutions.

Unlike hard engineering techniques, nature-based approaches, or 'soft techniques' such as planting deep-rooted vegetation and employing bioengineering methods, work in harmony with the environment, enhancing biodiversity and resilience. These interventions not only stabilise the soil but also offer additional benefits such as improved water quality, enhanced habitat for wildlife, and increased aesthetic value of landscapes.

Strategies that Landcare have used include:

- **Vegetation Cover:** Planting a mix of mat and deep-rooted vegetation, such as grasses, shrubs and trees which can help anchor soil and reduce erosion.
- **Soil Bioengineering:** Creating buffer zones with native plants to help protect vulnerable areas from the impacts of heavy rainfall and surface runoff
- **Water Management/Diversion:** Restoring wetlands and reforesting areas that can improve water absorption and decrease the likelihood of landslips.
- **Slope Stabilisation** and a focus on soil health
- **Fencing Areas off From Stock:** helps maintain soil stability by preventing overgrazing and soil erosion, ultimately safeguarding against potential landslide hazards.
- **Hydromulching:** spraying a mixture of water, seeds, mulch and sometimes fertiliser onto soil to quickly establish vegetation and prevent erosion.

Soil Bioengineering:

- **Bio-engineered Structures:** Use live plant materials to create retaining structures like fascines, which are long bundles of sticks and wood to strengthen embankments, brush layers/swales, and vegetated material to reinforce soils and prevent erosion.
- **Ground Cover Vegetation:** Establish ground cover plants to protect soil from erosion and enhance water infiltration.
- **Hydromulching** with grass seed that stablises the soil and allows for planting of native tube stock. The grasses are annuals and die off and help promote growth to the tube stock. Landcare has a great video demonstrating this: https://www.youtube.com/watch?v=-r7Z22PGJWo

Water Management/ Diversion:

- **Constructed Wetlands:** Develop wetlands to manage runoff and improve water retention in the landscape.
- **Rain Gardens and Bioswales:** Create these features to capture and slowly release stormwater, reducing soil saturation and erosion.

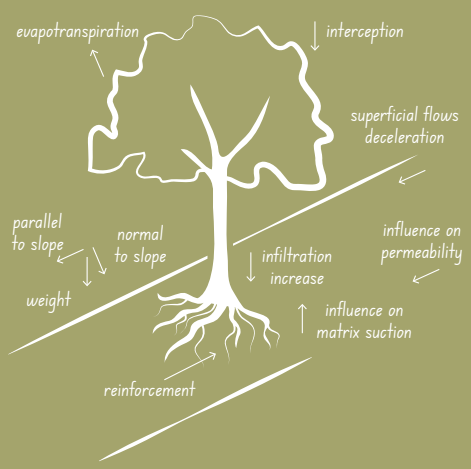
Slope Stabilisation and Soil Health:

- **Terracing:** Construct terraces to reduce slope angle and create flat areas for vegetation growth.
- **Contour Planting:** Plant along contour lines to slow down water flow and reduce soil erosion.
- **Focus on soil health:** The high organic matter can absorb water during high rainfall events and release it during low rainfall events.

Vegetation Cover

Plantings - species that have a range of different root systems - that can help capture the soil and prevent further loss (include deep-rooted trees)

- Reforestation and Afforestation: Plant native grass, shrub and tree species to increase root strength and soil cohesion.
- Agroforestry: Integrate trees with crops and livestock to stabilise the soil and diversify land use.



Fence Areas off from Stock:

- Install sturdy fencing structures around vulnerable areas to restrict livestock access and prevent overgrazing.
- Implement vegetative buffers along fence lines with native plants and grasses to enhance soil stability and reduce erosion risks, further mitigating landslide potential.

Plant Characteristics Best Suited for Landslip-Prone Areas

The best native plants to revegetate slopes are a variety of species that already grows in remnant native vegetation in the location or was originally in the area. This provides a complexity of plants and root structures suited to the site. However, there are some plant characteristics that may assist in soil stabilisation particularly if slopes need to be revegetated quickly. Some plants that are suited for landslip-prone areas include the following growth features:

- Deep and extensive root systems
- Rapid growth
- Root strength and flexibility
- Resilience to local conditions
- High root density
- Multiple root types

By selecting and planting species with these characteristics, land managers can enhance soil stability and significantly reduce the risk of landslides in vulnerable areas. Please see the table for more detailed information and examples of species.

*Please note, the list of species provided in this training pack is intended as a general guide and suggestion. It is crucial to take into consideration the specific conditions and requirements of your local area, including soil type, climate, and ecosystem characteristics, when selecting plants for soil stabilisation and landslip prevention. Consulting with local experts, such as horticulturists, ecologists, or local agricultural extension services, is highly recommended to ensure the selected native species are suitable and will thrive in your specific environment.

CHARACTERISTICS/FEATURES OF PLANTS

Characteristic	Description	Examples of plants
Deep and Extensive Root Systems	Trees with longer and more extensive root systems anchor the soil more effectively, reducing the risk of landslides by holding the soil together and increasing its cohesion.	• She-Oaks *(Casuarina spp.)* • Wattles *(Acacia spp.)* • Eucalyptus *(Eucalyptus spp.)* • Silky Oak *(Grevillea robusta)* • Illawarra Flame Tree *(Brachychiton acerifolius)* • Kurrajong *(Brachychiton populneus)*
Rapid Growth Rates	Species that establish roots and grow quickly protecting the soil from erosion and increasing its stability.	• She-Oaks *(Casuarina spp.)* • Wattles *(Acacia spp.)* • Tussock Grass *(Poa labillardierei)*
Root Strength and Flexibility	Trees with strong, flexible roots are particularly effective in reinforcing soil structure, even under stress from moving earth or water.	• Blackwood *(Acacia melanoxylon)* • Blueberry Ash *(Elaeocarpus reticulatus)* • Eucalyptus *(Eucalyptus spp.)*
High Root Density	Plants that develop dense root mats effectively bind soil particles, reducing the likelihood of surface erosion and shallow landslides.	• Lomandra *(Lomandra spp.)* • Fig *(Ficus spp.)* • Sedges *(Carex spp.)*
Multiple Root Types	Species with both fibrous and taproot systems provide comprehensive soil stabilisation by anchoring soil at different depths and preventing both surface and subsurface erosion.	• Fig *(Ficus spp.)*

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Monitoring and Maintenance

Monitoring and maintenance are crucial in reducing the possibility of landslides because they ensure that soil stabilisation measures remain effective, allowing for early detection and correction of potential issues before they escalate into more severe problems.

1. Regular Monitoring:

- Implement a monitoring program to regularly assess vegetation health, soil stability, and hydrological conditions.
- Use remote sensing technologies and on-ground inspections to detect early signs of instability.

2. Adaptive Management:

- Adapt management practices based on monitoring data to address any emerging risks or challenges.
- Engage the community in maintenance activities to ensure long-term sustainability and ownership.

3. Maintenance Activities:

- Conduct regular maintenance of vegetation, such as pruning, replanting, and controlling invasive species.
- Maintain bio-engineered structures to ensure their effectiveness over time.

By following these steps, it is possible to effectively mitigate landslip risks using nature-based solutions that enhance ecological resilience and provide sustainable benefits to communities.

Remediation Strategies Post-Landslips:

Large Scale:

- Drone seeding
- Earth moving machinery
- Hydro mulching

Small Scale:

*Many of the small scale or 'soft techniques' used to stabilise the soil are similar to the pre-disaster planning. Please see previous information in the document or for further information, scan the QR code for a landslip video that covers this.

Steps to Managing a Landslip and Erosion Risk Post Disaster (What to Do and What Not to Do)

What to Do:

1. **Safety Assessment:** Immediately assess the safety of the affected area to ensure no further risks to human life.
2. **Secure the Area:** Cordon off the affected zone to prevent access by people and livestock. Use caution tape or barriers to deter entry.
3. **Consult Experts:** Seek advice from geological and engineering experts to evaluate the extent of damage and devise a plan for stabilisation.Talk to your local Landcare group for assistance.
4. **Stabilisation Measures:** Implement stabilisation measures such as installing retaining walls, planting vegetation, or redirecting water flow to prevent further erosion and landslips.
5. **Monitor:** Regularly monitor the area for any signs of continued instability or erosion. Set up monitoring equipment if necessary.
6. **Community Awareness:** Educate local communities about the risks of landslides and erosion, and train them in emergency response procedures.
7. **Emergency Response:** Establish emergency response protocols in case of further landslides or erosion events, including evacuation plans and communication strategies.

What Not to Do:

1. **Ignore Warning Signs:** Disregard warning signs such as cracks in the ground, tilting trees, or sudden changes in water flow. These could indicate impending landslides or erosion.
2. **Disturb the Area:** Avoid unnecessary disturbance of the affected area, as this could exacerbate instability and increase the risk of further landslides or erosion.
3. **Delay Action:** Delaying action can worsen the situation and increase the likelihood of additional damage or loss of life. Act promptly to address the risks.
4. **Take Action without Expert Guidance:** Refrain from implementing stabilisation measures without expert guidance, as improper interventions could be ineffective or even harmful.

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How Landcare Can Help Before and After a Landslip

Landcare plays a crucial role in landslip prevention and mitigation through various activities and initiatives: They can help both in pre and post-landslip situations.

Pre-Landslip

1. **Risk Assessment and Mitigation:** Landcare groups can conduct assessments of landscapes to identify areas prone to landslides and erosion. They can then work with landowners and communities to implement mitigation measures such as revegetation, soil stabilisation, and water management strategies to reduce the risk of landslips.

2. **Education and Awareness:** Landcare organisations can raise awareness among landholders and the broader community about the factors contributing to landslides and erosion. They can provide information on best land management practices to minimise these risks, including responsible land use, vegetation management, and sustainable farming techniques.

3. **Community Engagement:** Landcare fosters community involvement in environmental stewardship. By mobilising local volunteers and stakeholders, Landcare groups can facilitate collaborative efforts to address landslide and erosion risks collectively. This might involve organising workshops, field days, or training sessions on soil conservation and land management practices.

Post-Landslip

1. **Rehabilitation and Restoration:** After a landslip event, Landcare groups can assist in the rehabilitation and restoration of affected areas. This may include revegetation projects to stabilise soil, erosion control measures such as the installation of erosion barriers or check dams, and the establishment of riparian buffers along watercourses to prevent further erosion.

2. **Monitoring and Maintenance:** Landcare volunteers can contribute to the ongoing monitoring and maintenance of landslide-prone areas to ensure the effectiveness of mitigation measures implemented post-disaster. Regular inspections and maintenance activities, such as repairing erosion control structures or replanting native vegetation, help to sustain the long-term stability of the landscape.

3. **Community Resilience Building:** Landcare organisations can play a vital role in building community resilience to future landslide events. This may involve providing support and resources for community-led recovery initiatives, developing emergency response plans, and offering training in disaster preparedness and response strategies.

Joining or collaborating with your local Landcare group is a great way to receive assistance and additional information. Landcare can connect people with groups, support and funding. You can find and contact your local Landcare coordinator here: https://landcare.nsw.gov.au/groups

Disclaimer

The information provided in this training pack, though well researched is general in nature and it should be recognised that every situation has different circumstances and requirements. Landcare NSW provides this information with the understanding that you exercise reasonable care when using it. If you are uncertain about applying this information to your specific situation, seeking further professional advice is advisable. By using the information in this training pack, you agree that the authors who have compiled this information and original sources cannot be held liable for damage or loss incurred due to any emergency situation.

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PEOPLE LED PREVENTION PROJECT

Landcare NSW's People Led Prevention project empowers communities across regional NSW in developing disaster resilience and preparedness skills. Jointly funded by the Australian and NSW Governments.