1 Title

Eco-technological approach to erosion and mass wasting assessment and management.

2 Context and rationale

Human interactions with landslides, landslips, earth-flows and erosion have become more frequent and lethal as populations have expanded. Climate change, road construction, urban expansion, forestry and agriculture are major contributors, all increasing the occurrence of anthropogenic mass wasting events over the last few decades.

The high incidence of shallow landslide or landslip events has meant geotechnical rehabilitation solutions may not always be fiscally or environmentally suitable. Also, conventional methods of attempting to predict landslip events using probabilistic approaches have resulted in wide error limits.

3 An overview of the contribution

3.1 Eco-technology (Ecotech) is an emerging approach working with nature by assessing and harnessing the biological systems. The biological protection of soil on slopes, the re-establishment of optimal slope drainage densities and the restoration of native species composition, food webs and ecosystem processes help to achieve long term slope stability and arrest ecological breakdown. Compared with man-made solutions biological systems have been shown to be more resilient, however, it is recommended that geotechnical solutions are considered before engaging eco-technology.

3.2 An ecotech assessment of hillslopes is an additional tool to the conventional geotechnical method of calculating physical forces in order to predict hillslope failure. An empirical ecotech assessment of obvious ecological, arboricultural and hydrological signs offers a comprehensive picture of landslide pre-determining factors including antecedent moisture, slope-creep speed and rates of erosion.

4 How the contribution leverages living natural systems as a solution to avert climate change?

Ecotech engineering creates microenvironments for the re-establishment of native species of trees, plants, fungi and microbes, supporting a higher successional eco-systems on hillslopes.


Photograph 1 & 2 – example of terracing using coir logs on a landslip.

4.1 On active landslides the physical restraint of slope sediments using log erosion barriers (LEB) creating self-supporting planting terraces can be employed. A LEB can be made from manufactured coir logs, waste timber, bundles of sticks (fascines) and fire damaged logs. Where landslides have not occurred invasive trees can be felled across contour and pinned to create native planting beds. Where possible the wood from invasive trees should be used to retain the carbon, minerals and nutrients within the eco-system on hillslopes as it decays, also reducing the need for forest clearance machinery. A continuous canopy cover should be retained while felling invasive trees, allowing time for new native trees to take root.

4.2 Spraying hillslopes with compost teas produced from local highly successional forest floors rapidly generates a thriving biological food soil web for native species. With the addition bio-char, the increase in mycorrhizal fungi hyphae and associated aerobic microbes increases soil carbon retention, locking carbon in the soil for approximately 100 years.

4.3 Wicking or draining of hillslopes can be achieved by using fascines (tight bundles of sticks) along contours allowing water to take the path of least resistance downslope. By positioning fascines in a herring-bone shape on a slope, surface runoff and subsurface flow can be directed away from highly erosive surfaces, allowing plants to succeed. Ephemeral springs can be targeted to allow all year round drainage reducing the hillslope antecedent moisture levels, a pre-determining factor for climate change related landslips.

Photograph 3 & 4 – example of fascine drains on a landslip.

5 How might the contribution support both climate, mitigation and adaptation as well as other important co-benefits and social, economic and environmental outcomes in coming years? They may include:

5.1 *Reduction in carbon emission and carbon capture (GTonnes)* - The capture of carbon in microbes, plants and trees.

5.2 *Increasing climate resilience* **-**Ecotech is 'antifragile' in character becoming more resilient as it grows and the more stressed it gets. Trees can strengthen root structures in response to wind movement and increased hydrological channel flow creates more established drainage densities.

5.3 *Social impact (job increase; poverty reduction; Just transition, etc*.) – The creation of local eco-tech businesses networks including nurseries, landscapers and arborists (scalers). Planting of food species on bare slopes can help food poverty.

5.4 *Net economic impact (total in US$; how was it achieved?)* - Approximately US$5 to US$20 per square metre to install which is achieved by working with local nursery products, available material and local training of ecotech techniques. Economic gains will vary, overall disaster clearance costs will reduce when hillsopes are more stable.

5.5 *Impact on realization of the 2030 Agenda for Sustainable Development (in particular SDGs 1,2,6,12,13,14,15,16)* **-** The establishment of ecotech businesses using ecotech tools and methods will increase natural resources and biodiversity while reducing degradation creating a more sustainable environment.

5.6 *Food* security – Ecotech systems have biodiverse soil food webs reducing plant and tree susceptibility to pests and diseases while increasing biosecurity.

5.7 *Minimising species extinction and ecological losses and fostering an increase in biodiversity*. **-** Utilising locally sourced compost teas rich soil biologies can be shared creating a biodiverse soil supporting native species.

6 Which countries and organisations are involved in the contribution?

GeoArb Ltd (New Zealand) and New Zealand Transport Agency.

7 How have stakeholders (for example local communities, youth and indigenous peoples, where applicable) been consulted in developing the contribution?

At all times local iwi and communities are included and consulted with before any works are carried out.

8. Where can the contribution be put into action?

Ecotech tools and methods can be used on any hillslope. Its greatest benefit is in areas with large amounts of erosion like landslips, deforestation and forest fires.

9. How will different stakeholders be engaged in its implementation? What are the potential transformational impacts?

Ecotech is predominantly a local co-operative initiative with an expert resource providing oversight.

10. Is this initiative contributing to other Climate Action Summit workstreams (industry transition; energy transition; climate finance and carbon pricing; infrastructure, cities and local

action; resilience and adaptation; youth and citizen mobilization; social and political drivers; mitigation strategy)?

Ecotech can be linked to carbon pricing, infrastructure, cities and local action, resilience and adaptation, you and citizen mobilisation and mitigation strategy.

11. How does this contribution build upon examples of experience to date? How does the contribution link with different ongoing initiatives?

Ecotech increases carbon capture and the resilience of infrastructure, engages local citizens into action, and mitigates ecological breakdown.

12. What are the mechanisms for funding (with specific emphasis on potential for partnerships)?

Private and government funding at all levels from local to global.

13. What are the means of stewardship, metrics for monitoring?

Monitoring by academic institutes and co-operatives.

14. What is the communication strategy?

Sharing of information via social media, online training, site visits.

15. What are the details of proponents (indicating the degree of commitment among the countries and organizations that are named).

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