Bioengineering with Miyawakis, Landslide Victories

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Abstract

Slopes are susceptible to rainfall triggered land movements, in this paper a project plan to use slopes, not traditionally cultivable, towards agroecology, as practiced in the region, based on a timeless Miyawaki afforestation technique, in combination with synthetic approaches called Bioengineering.

A new form of engineered primary growth, using Mapillary based plant groups and ecological datasets, to create Miyawaki pockets, or small plots of afforestation based bioengineering for sub surface water drainage and better soil stability is presented.

Risk assessment calculations are presented for Landslides, Factor of Safety provided, and are proven to be mitigated in planned afforestation as bioengineering on slopes.

Several case studies are presented of successful DRR or disaster risk reduction by bioengineering in the Indian Himalayan Region, other regions of India and worldwide.

Keywords: *Landslide Management, Bioengineering, Structures, FOS, Soil Stability, Sub Surface Drainage.*

1. Introduction

The successful use of Bioengineering in DRR, resilience and community involvement, agroecological practices, slopes not arable are brought under afforestation, with a dual purpose of slope stability though bioengineering practices and agroecology with proposed automated and manual harvesting and maintenance.

Several case studies and new pioneering technologies of flower shell for seed dispersal using traditional firearms, and rope rappelling on slopes are presented with greener alternatives to traditional firepower , like combustion light gas guns, with the advent of hydrogen fuel cell based automobiles, hydrogen as a fuel is dispensed in fuel

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stations and cost effective oxygen available, to lead a new era of biometrically safe, gas combustion firearms based on hydrogen and oxygen, used for seed propagation. Other bioengineering techniques use a combination of trees, shrubs and grasses with structural engineering ranging from slope nailing to check dams and wall structures, rendered natural with Miyawaki Pockets. Miyawaki pockets, a terminology coined by the author to a design of a minimal landscape of primary growth, based on selected plant groups, with three or more layers, with the purpose of increasing the drainage of subsurface water and mitigating the risk of a natural disaster, by increasing soil cohesion.

Engineered structures alone, in a vicious loop of increased natural disturbances further worsen the disaster risk, mostly caused by land degradation and development, farm runoff products and soil contamination issues. Bioengineering and the Miyawaki effect, restores a natural balance in a combined natural and synthetic approach, with social involvement in combined agroecology and bioengineering.

The philosophy was propounded by several leading scientists and naturalists, with Akira Miyawaki, the most prominent, with a universal adoption of the Miyawaki technique as one with the force, the very natural force that causes a disaster risk. Hence Miyawaki Pockets engineer primary forests, a return to the natural, supported by structural engineering.

1.1 Summary

Main Points:

1. Landslide models and risk assessment technologies, described, with FOS or factor of safety estimation, with soil testing, sub surface water drainage measures and land use remote sensing data mining.
2. DRR or disaster reduction measures, defined with structural engineering and bioengineering measures.
3. Case studies of successful bioengineering in DRR are presented, with Miyawaki Pockets and native species based bioengineering for DRR measures.
4. Introduction of Gas combustion fire power, using hydrogen and oxygen for rapid seed dispersal on slopes, for slope afforestation.
5. Agroecology and automated harvesting and maintenance for bioengineering measures, makes the technology cost effective and remunerative.

Afforestation decreases the risk of a landslide by precipitation, by a FOS, ranging from 120% to over 200% *(Document Card, n.d.)*
The design of a five or more layer Miyawaki with deep rooted and horizontal rooting is presented.

A mixture of deep rooted and horizontal rooted species is proven to decrease the risk of landslides.(Vasistha et al., 2011)

In a Miyawaki defined by n layers, with an average estimable, root size, r and a root ball size, s. And an oblique factor o, that defines the obliqueness of the root ball.
1 being a highly horizontal spread and 0 being deep rooted.

We develop a model for the distribution of tree line based contour afforestation on slope afforestation. Called Miyawaki Pockets, Sloping agricultural land technology guidelines suggest, deep rooted plants as a contour placed 3 to 5 meters apart,(Forbes et al., 2013; Joshi, et al.)

Detection of degradation of vegetation and reforestation is the most cited technique (Joshi, et al.)

The Miyawaki Technique is particularly effective at natural disaster mitigation, given the nature of primary growth restoration.("Tsunami Mitigation in Japan after the 2011 Tōhoku Tsunami," 2017) and afforestation for resilience.(*Document Card*, n.d.) Is a FAO report on afforestation, social agroecological approaches to disaster risk reduction, or DRR.

2. Methodology: The Flower Shell

Figure 1: Flower Shell – A New Way to Seed, 2019

Figure 1. Reproduced from *(Flower Shell – A New Way to Seed, 2019)* is an example of seeding using common household equipment, translated to slope afforestation, this would translate to the use of 'Miyawaki Shells', a technology of the reuse of unused rounds to afforestation, by the recalibration of explosive charge and the addition of the right seed mix, predigested by farm ungulates and covered in a binding agent of biomass derived from manure.

Parameters, including the seed mix, and the density of shots on a slope surface, are determined based on the slope dynamics, required afforestation and hydrology factors, including previous history of landslides and rainfall precipitation data.

3. Methodology: Combustion Light-gas Gun (CLGG), the Ulton Case Study

Hydrogen Oxygen CLGG, auttomated weaponry revives a peace movement in the addition of higher safety standards to lethality, in a pioneering innovation at biometric ignition and non lethal options in propulsion kinematic controls. Given the origins of automatic weapons in agriculture, lethality in AI is conquered , with the use of a H2-O2 weapon with flower shells demonstrating non-lethal afforestation of slopes for improved percolation and a restoration of the Qi of the Earth element in Miyawaki pockets.

Resilience is in the return of nature, by Akira Miyawaki's demonstrated work, the return of the natural forest, as an engineered forest eliminating a natural disaster.

Despite the incompleteness of the Landslide Models, a shallow model in slope hydro dynamics, indicates percolation efficiencies of Miyawaki Pockets, while further research in better risk assessment and landslide models is required for all other Landslide Dynamics.

4. Analysis: Afforestation based LandSlide Management Case Studies

(Chetan R S at al 2021) Land usage models for landslides are primarily advocated, with a primary reason for landslides cited as deforestation, development and faulty development models, with constrained percolation water movement. With a comprehensive analysis of landslide risk in the Indian subcontinent.

The landslide model uses a plasticity index in soil analysis, categorizing soil plasticity with a linear relation and measuring shear modulus of soil. This combined with water accumulation and land use metrics predicts the F.O.S or factor of safety , the pertinent quantitative criteria are.

“Plasticity index = liquid limit – plastic limit

$Ip = Wl - Wp$ (1)

Soil descriptions based on PI:
0 – Non-plastic, < 7 – Slightly plastic, 7–17 – Medium plastic, > 17 – Highly plastic”

Factor of Safety (F.O.S):

F.O.S = C+γ′cos2(i)*tanϕ*γsat*

cos(i)sin(i) (2)

Where, ϕ = internal friction of soil in degree
i = Original slope angle of hill in degree
C = Cohesion in kg/cm^2
γ′ = Submerged unit weight of soil in kg/cm^3
γsat = Saturated unit weight of soil in kg/cm^3

(Amashi et al., 2019) describe a soil nailing technique at Mahabaleshwar in Maharashtra, India, with the use of Slope W and Praxis software applications for an analysis of FOS factors.

(Vasistha et al., 2011) scribe a bioengineering approach as a hybrid structural and afforestation intervention methodology, studied at Varunavat Landslide, Uttarkashi. Three regions are identified and 10 common native plants, which are fast growing, deep rooted and stable are chosen. The result of a hybrid approach with intermixed stabilizing structures, afforestation and jute mesh, resulted in positive results. Table 1 and 2 reproduced from the publication lists the species used.

(Hostettler et al., 2019) initiative in Honduras for community led disaster risk reduction and resilience using bioengineering techniques is described over a 10 year period with positive results with continuous maintenance, possible through agro ecological efforts.

(Bryaane & Tewari, 2015) recommends bio engineering with Quercus leucotrichophora, Alnus napelensis, Pinus spp. and Cedrus spp for tree based slope afforestation, and shrub/grass afforestation with Eriophorum comosum, Saccharum spontanum, Pogonatherum spp. and Woodfordia fruticosa, at Mussoorie Hills, India.

(Singh, 2010) iciency and the highest cost-benefits measure for bioengineering in disaster risk reduction and curtailing erosion.

(Ghosh & Bhattacharya, 2018) on vetiver grass, lists several successful case studies of the use of vetiver grass in bioengineering and phytoremediation, based on indigenous practices of the use of the grass. The Roots have a tensile strength of 75 MPa.

5. Methodology: Miyawaki Pockets

Table 1 and 2, in the addendum, provide a list of natural species in a case study in Uttaranchal India, consisting of plants with deep roots and grasses with horizontal spread, a near zero and near 1 oblique factor.

For a n layer miyawaki consisting of at least three layers of trees, shrubs and grasses, provides sub surface drainage and soil binding increased stability, based on shear measures and a higher F.O.S.

The measure of the root ball size r over all the bioengineering flora, leads to mass of root net in the three layers.

6. Discussion

Bioengineering is proven to be a preferred approach to structural engineering, several case studies have been presented from the Indian Himalayas and other parts of the world. The approach remains a timeless science, still practiced in most parts of India, and hence free from natural disasters. The investigation into the query of why a bridge science called compensation sciences by the author does not exist for technology practiced in the post colonial era, leads to the conclusion that natural disasters are a response by the planet to the onslaught of technology and that truer druidatic sciences were eliminated in the colonial regime, with the onus on the present governments to restore the druidatic sciences and technologies and reduce disaster risks.

Future work with case studies in the HP, India area, would delineate species of plants for the creation of Miyawaki pockets for Disaster Risk Reduction, DRR.

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