Transdisciplinary Conference

Peak Perspectives: Navigating Challenges and Shaping Sustainable Futures in Nepal's Mountain Landscapes

Converting Slash and Burn Land to Productive Agroforestry

October 4, 2023, Kathmandu

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SGP The GEF Small Grants Programme

Content

Background

- Slash and burn Agriculture
- Chepangs and Tamang- Khoriya

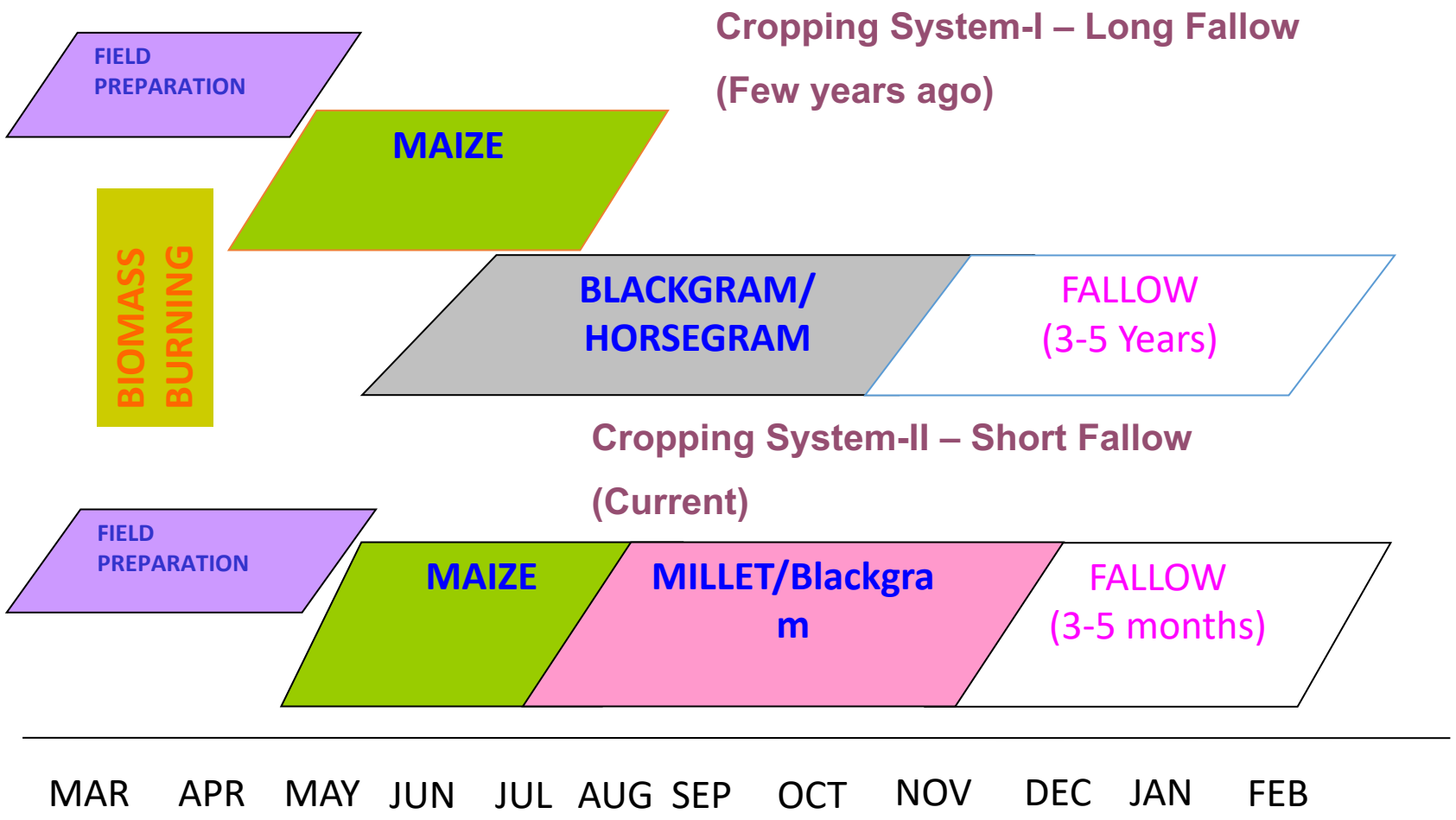
Intervention

Results

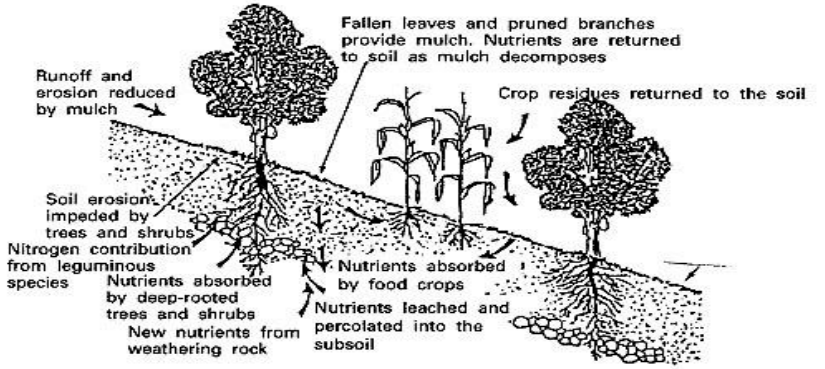
Background

- Chepangs and Tamangs Predominately practices Slash and burn agriculture
- Slopping land
- Unregistered land but handed over to present generation from their ancestor

- Unproductive due to less fallow period
- Prone to landslide

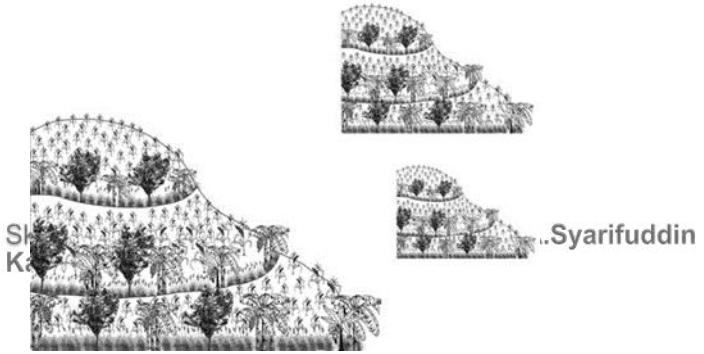


Intervention



Intervention started from 2006 to 2014 and provided grants in three occasions

- **Introducing Sloping Agriculture land techniques**
- **Extensive discussion with locals**
- **Choices of species as per farmers priority and soil management and nutrient recycling**
- **Banana, pineapple, broomgrass and nitrogen fixing** Leucaena
- **Broomgrass as hedgerow**
- **Promotion of Social Enterprenure**
- **Further added fish ponds in river bank and Honey (**Diploknema butyracea, Chiuri)



Results

More than 1600 ha converted to productive agroforestry benefitting 3,000hh

250 Carp-sis ponds benefitting 133 hh in 30 ha

Apiculture-105 households






Results

2 Social entrepreneurs Ram Krishna Praja and Dinesh Chepang from the very Chepang community
1 Fishery cooperatives in Maccha Gaun, Handikhola-Chepang, Tamang, Bankariya

Annual Average sale:
Honey:10m
Broomgrass 7m
Banana:2m
Fishery:18m

Awards & recognitions

The initiatives won several awards including, UNEP Sasakawa Award 2011, Ryutaro Hashimoto APFED Award 2008, Adaptation to scale Award and Environment Conservation Awards

Thank you!

Business Model based on Sustainable Land Use

(Forest, Water and Energy Nexus)

Resilient Forest and Communities: Unlock Economic Opportunities

October 4, 2023, Wednesday (2080 Asoj 17)

Pradeep Budhathoky
Center for People and Forest-RECOFTC Nepal

Center for people and forests
RECOFTC

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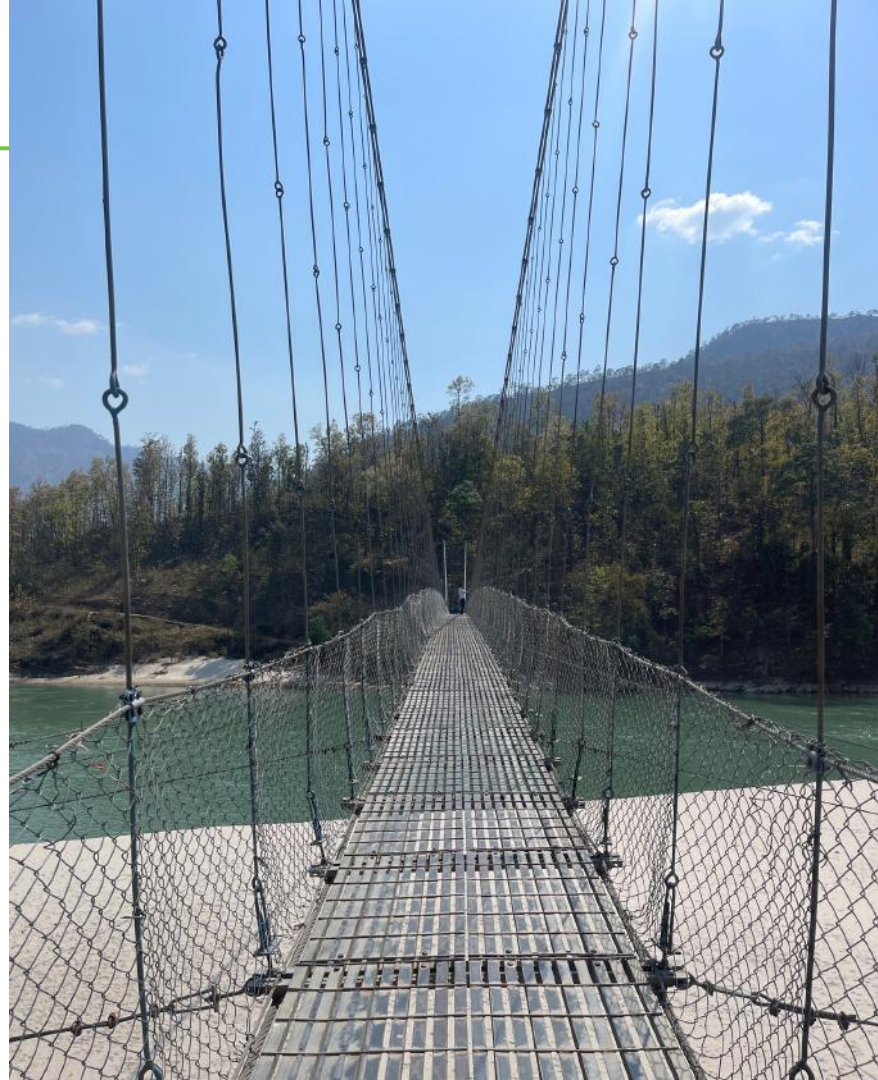
Contents

- Understanding Sustainable Land Use (SLU)
- Forest, Water and Energy Nexus under Landscape Approach
- Prominent Challenges in SLU
- Unlock Potential Economic Opportunities of SLU
- Prominent Challenges in SLU
- NTFP-Dhatelo (Prinsepia utilis): Potentiality for Commercialization and Optimum SLU
- Dhatelo (Prinsepia utilis): Business Model base SLU



Understanding Sustainable Land Use (SLU)

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SLU ensures a **fair and balanced distribution** of land, water, biodiversity and other environmental resources between the various **challenging rights**, in order to **secure human needs now and in the future.**

Source: Sustainable Land Use - WUR

Forest, Water and Energy Nexus under Landscape Approach

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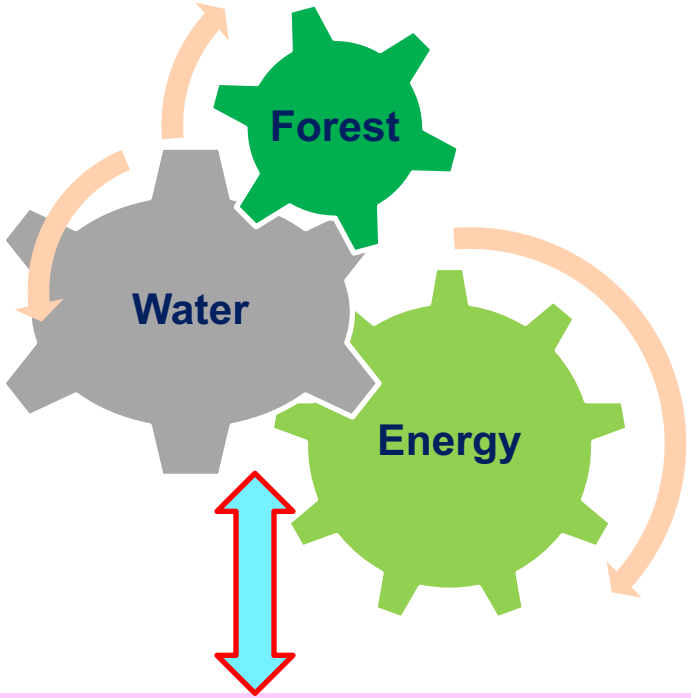

Sustainable Livelihoods

Forest and Ecosystem Services:

Supply forest products and forest-based income generation,
Sustain water recharge and resilient watershed
Climate and disaster risks reduction

Water Availability:

Water for drinking, agriculture
Aquatic ecosystem
Sustained water volume for energy generation

Energy:

Resilient energy infrastructure,
Optimum electricity generation,
Reduced firewood consumption,
Productive use of energy for economic opportunities

Prominent Challenges in SLU in Project Site

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Unsustainable cutting of forest trees: *Deviation in implementation of forest operation plan and excess trees cut from outside Community Forest*

Improper wood use: *Round wood & green biomass used in fuel*

Unplanned infrastructure dev.: *Road in the forest area, ignored EIA/IEE, infrastructure over infrastructure caused disaster and damage property*

Immature harvesting of NTFPs: *Resource depletion year by year, price down due to poor quality and low productivity*

Forest fire: *Caused by underutilized of fuel loads*

Prominent Challenges Contd…

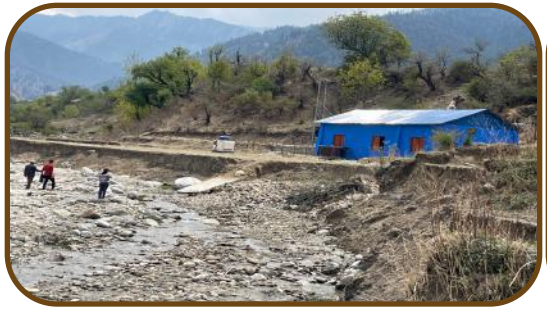
Open and heavy grazing in the forest area: *Accelerate in soil erosion and damage regeneration*

Flash flood and water course: *Energy infrastructure and settlement exposure to high vulnerability state*
Changing from concave to convex shape caused to damage rudely agriculture land and settlement

Subsistence agriculture practices

Ignorance in value addition: *Low quality and no grading resulted low price for Apple, bean, potato, walnut, rice*

Under utilized of electricity: *DE promotion of enterprises*



Unlock Potential Economic Opportunities from SLU

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Promotion and Value Addition of NTFP *i.e. Dhatelo, Walnut , Deodar*

Fisheries Promotion and Marketing *i.e. Rainbow Trout and Asala fish*

Manufacture of Processed Himalayan Spring Water and Supply

Value Addition in Agri-products *i.e Apple, Bean, Walnut, & Marshy Rice*

NTFP-Dhatelo (*Prinsepia utilis*): Potentiality for Commercialization and Optimum SLU

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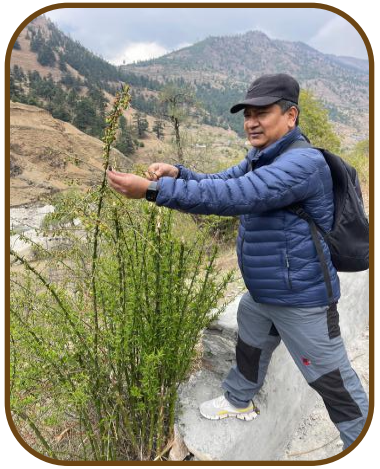
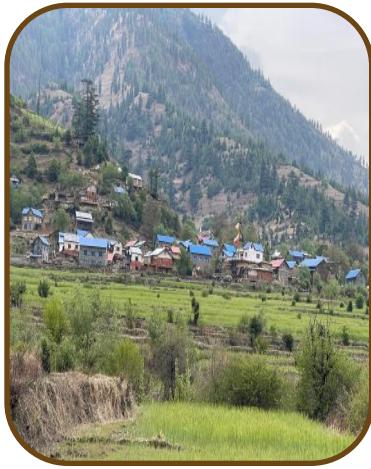
Introduction *(source Khilendra Gurung)*

Deciduous shrub native to Nepal
Growing up to 3 m.
Flowering- Feb to Mar,
Fruiting-Apr to May
Fruit is a drupe, oblong, purple when ripe
Propagation: Seeds or branch cutting
Grows in forest, scrub and hedges at an altitude of 1300-3000 m. in central to western Nepal;
Grows in open areas exposed to sun light on dry hillsides near water sources





Dhatelo (*Prinsepia utilis*): Benefits for SLU

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Socio-economic benefits	Medicinal benefits	Environmental/ecological benefits
- Edible oil used in cooking and fuel for lamps in rural communities - Raw fruit eaten by children	- Treatment for rheumatism and muscular pain including massage in forehead for the treatment of coughs and colds,	- Dhatelo hedge fencing around agriculture land
- Residue can be used for washing clothes - Deep purple dye from the fruit can be used as paint	- Heated oil cake used in bandage to the abdomen for the treatment of stomachache	- Plant along the riverbank able to protect river cutting
- Income generate and create rural employment	- Used as hair serum to increase shine and strength	- Stabilize landslide Soil conservation and retard water current
- Fodder for cattle		

Dhatelo (*Prinsepia utilis*): Benefit Cost Analysis (BCA)

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Rural Practices of Collection and Sales

Inputs	Cost/KG	Income/ KG	Per ha. cost	Per ha. income
Collection cost/KG	15		6562.5	
Processing (cleansing, drying) cost	6		2625	
Packaging	3		1312.5	
Royalty/kg	5		2187.5	
Total	**29**	**37**	**12687.5**	**16187.5**

BC Ratio: 1.28

KTM Market price of Dhatelo oil NRs 652.00/120ml pet

Average 250 shrubs per ha. in mid hill of Western Nepal
Average 1-2.5 kg seed per plant can be collected *(437.50 kg seeds per ha.)*
Local practices 20-25 kg oil can be extracted from fully ripe and dried 100 kg seeds (65.62 kg oil per ha.)

Dhatelo (*Prinsepia utilis*): Business Model base SLU in Pilot Phase

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Local collectors

Collectors Network

Local Buyers

District based Buyers

Value Addition
Quality assurance of raw seeds
Grading of raw seeds
Packaging
Sale

Piloting Phase

- Promotion
- Value *Addition- Cleaning, Drying, Grading Branding & Packaging*
- Sale raw seeds

Dhatelo (*Prinsepia utilis*): Business Model base SLU in Pilot Phase

Center for people and forests RECOFTC

Local collectors

Collectors Network

Local Buyers

District based Buyers

Regional Buyers

Inter/National Buyers

Value Addition
Quality assurance of raw seeds
Grading of raw seeds
Packaging
Sale

Retailers

Full Phase

- Promotion
- Enterprise Dev.
- Value *Addition- Cleaning, Drying, Grading Branding & Packaging*
- Market & Marketing

Enterprise/Business Model
Individual Company/Supplier
Cooperative Institutions
Public Company (PPP)
Local Government under-taking Company in lease


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Thank You !
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Government of Nepal
नेपाल सरकार

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Swiss Agency for Development and Cooperation SDC
स्वीस सरकार विकास सहयोग एसडिसि

Farmers managed small irrigation systems: Governance and organizational aspects for improving resilient livelihoods

SIP Small Irrigation Programme

Arya Sarad Gautam, Team Leader
Programme Management and Implementation Support Consultant (PMISC)
Joint venture of GEOCE, AVIYAAN and TMS

KEY TAKEAWAY

- For an irrigation system to enable disadvantaged groups to achieve their livelihood objectives, the group/structure operating and managing it has to be **social and gender inclusive**,
- Maintaining and operating small irrigation systems a collective effort; **sustainability of the system** is dependent on the **sustainability of the user groups**,
- Irrigation management should be **multi-dimensional**;
- **Role of local governments crucial** in improving the livelihoods of farmers

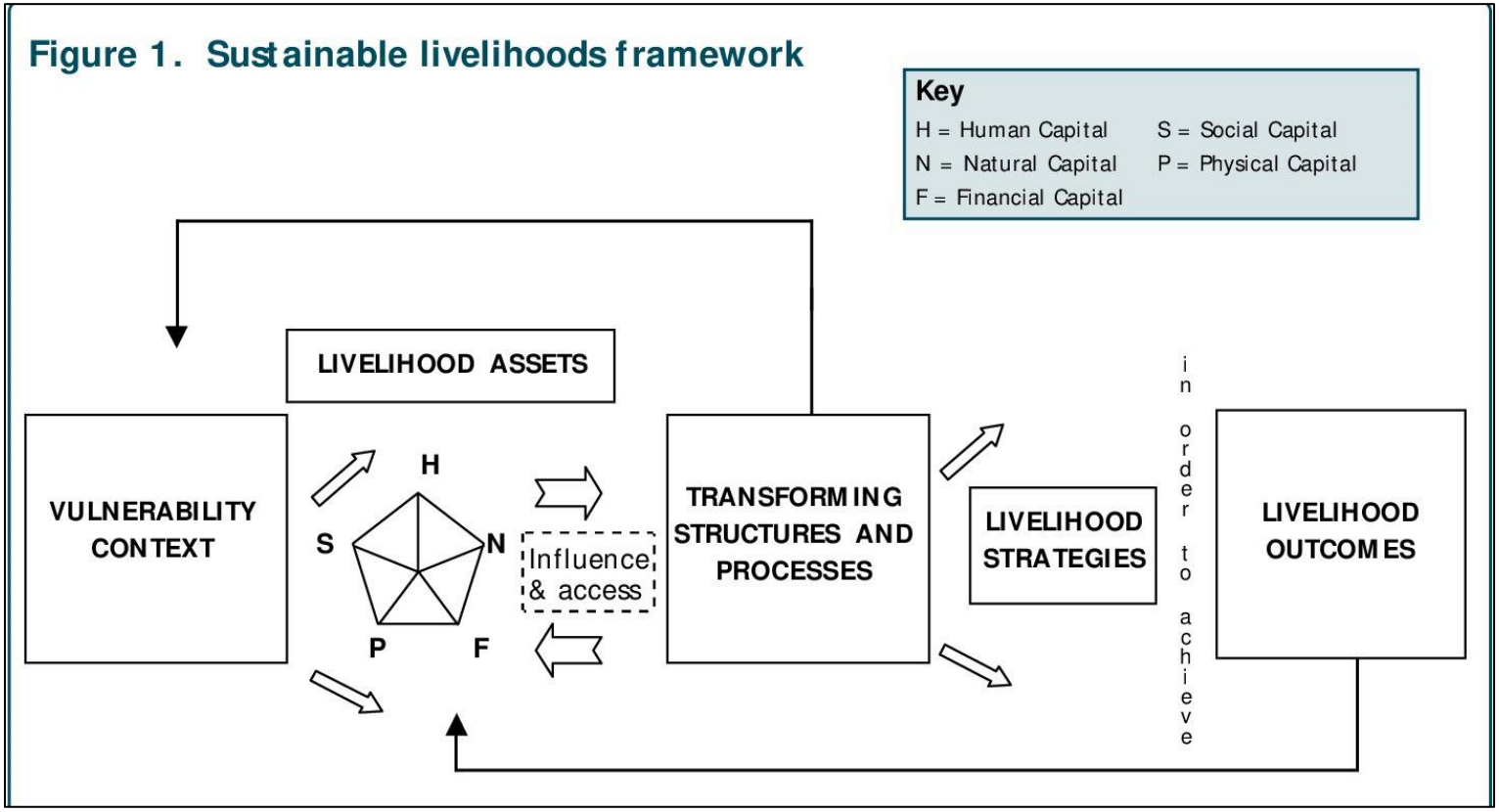
UNDERSTANDING SMALL IRRIGATION & FARMERS MANAGED IRRIGATION SYSTEMS (FMIS)

- Small Irrigation: systems covering less than 50 ha in the hilly area and less than 200 ha in the terai *(Unbundling report 2073, National Planning Commission, 2076).*

- Approximately 40% of the total agricultural lands in Nepal currently have irrigation facilities *(DWRI, 2019)*
    - around 70% of the irrigated agriculture is undertaken through over 15,000 FMIS
    - Among total surface water irrigated agricultural lands, FMIS covers nearly 371,394 hectares of agriculture lands
- Symbolizes grass root democratic institution where community takes responsibility for natural resource management and allocation *(FMIS Trust, Nepal; Pradhan, 2000)*

- Self-initiated, self-governed; responsible for all management activities:
    - water acquisition from the source to delivery to the field and operation and management of the system including resource mobilization for operation and maintenance (O&M).

FMIS THROUGH THE SUSTAINABLE LIVELIHOODS FRAMEWORK

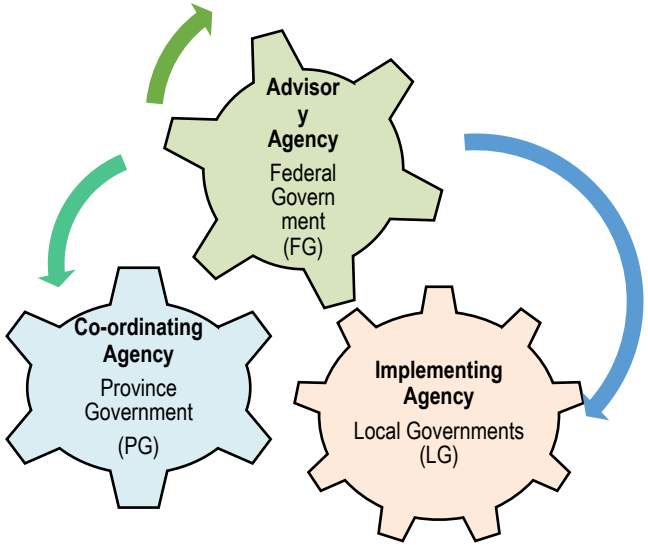


Source: DFID, 1999

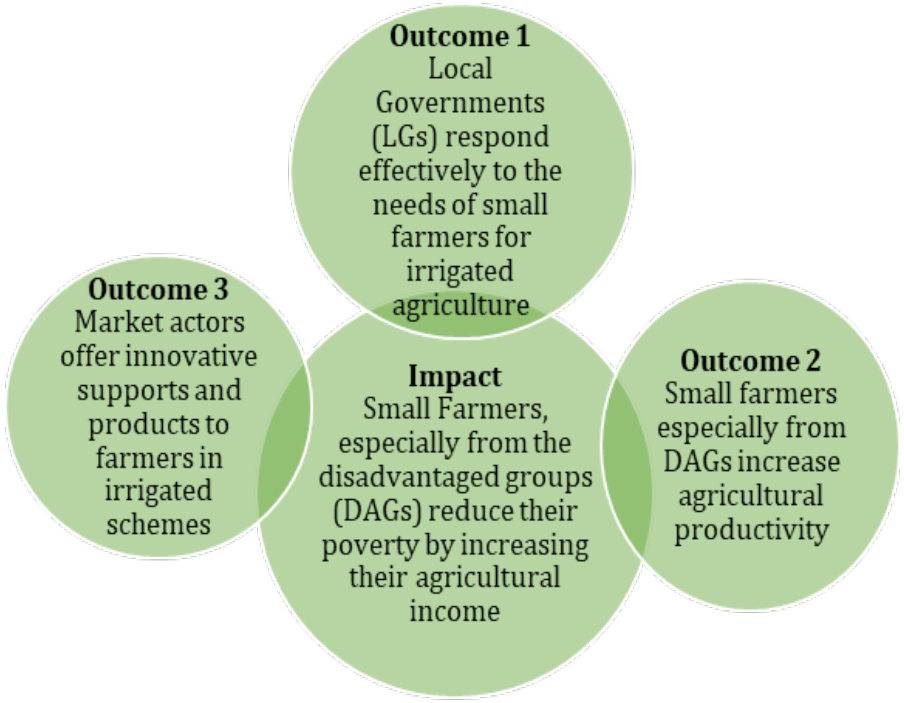
Community institutions such as WUAs mobilize social, human, and financial capitals to (re-) construct the physical capitals that enable the community to transform its physical land, water, and forest capitals into multifaceted livelihood benefits.

(Pradhan, P., Khadka,M., GC, R. Koppen,B., Rajouria, A. and Pandey, V.P; *Community institutions in water governance for sustainable livelihoods,* Waterlines, 41:3, 1-14, 2022)

Small Irrigation Program



Institutional Setup



Institutional Strengthening and Capacity Development of Local Governments

Improved Irrigation Infrastructures

Water Users Associations Managed Irrigation system

Agriculture and Market Linkages

AN INCLUSIVE SOCIAL CAPITAL

Water User Associations (WUAs):

- 40% women in executive committee
- At least one woman or a representative of discriminated group in the leadership position,
- Proportionate representation from head, middle and tail reach

Beyond the WUA

- equal pay for equal work of equal value regardless of gender, ethnicity or caste, and
- Practice of social accountability and transparency tools such as public hearing and public audit

Towards an effective WUA:

- Collective choice arrangements; individuals affected by a decision are part of the decision-making (Ostorm, 1994)
- Proportionate distribution of stakes among head, middle and tail-end farmers minimize the occurrence of conflict,
- Transparency of activities: rules, regulations, statements of income and expenditures publicly shared
- **Beyond affirmative actions:** number of women in WUAs doesn't determine the degree to which women can exercise their agency
- Need for enabling women and disadvantaged to meaningfully engage in decision-making and leadership functions

CASE STUDY 1: Leguwa Khola Beltar Irrigation Project

- System in operation for the last 68 years; Benefits 107 households, 41% from disadvantaged groups, 87% small landholders
- **Prior to SIP:**
  - Unregistered, governed by social norms and collective decisions
  - Water acquisition and distribution on community decisions, however, upstream users had first access causing inadequate structures to control water flow
  - Ad-hoc operation and maintenance (O&M), lack of an operational plan for canals, payment to O&M work in kind (rice, wheat, maize), no records of payment
- **Current Scenario**
  - Registered at Mahalaxmi Municipality,
  - Collective decision-making during the design of the infrastructures (multiple outlets for water distribution and management)
  - Transparency and accountability are institutionalized through regular meetings and audits
  - A project-specific water management and O&M plan for equitable water distribution from head to tail
  - Regular collection of O&M fund (NPR 150 per ropani/year), O&M worker paid in cash

- Autonomy of the WUA to create their own rules and attain freedom to revise them over time
- Sustainable system operation required for equitable water distribution from head to tail.
- Water share arrangement should ensure that each member has a legitimate access to water,
- O&M should be adapted to the local context;
- WUAs should be encouraged to continue their current maintenance and traditional practices in combination with innovative SIP practices.

CASE STUDY 2: POKTING SURKE IRRIGATION SCHEME

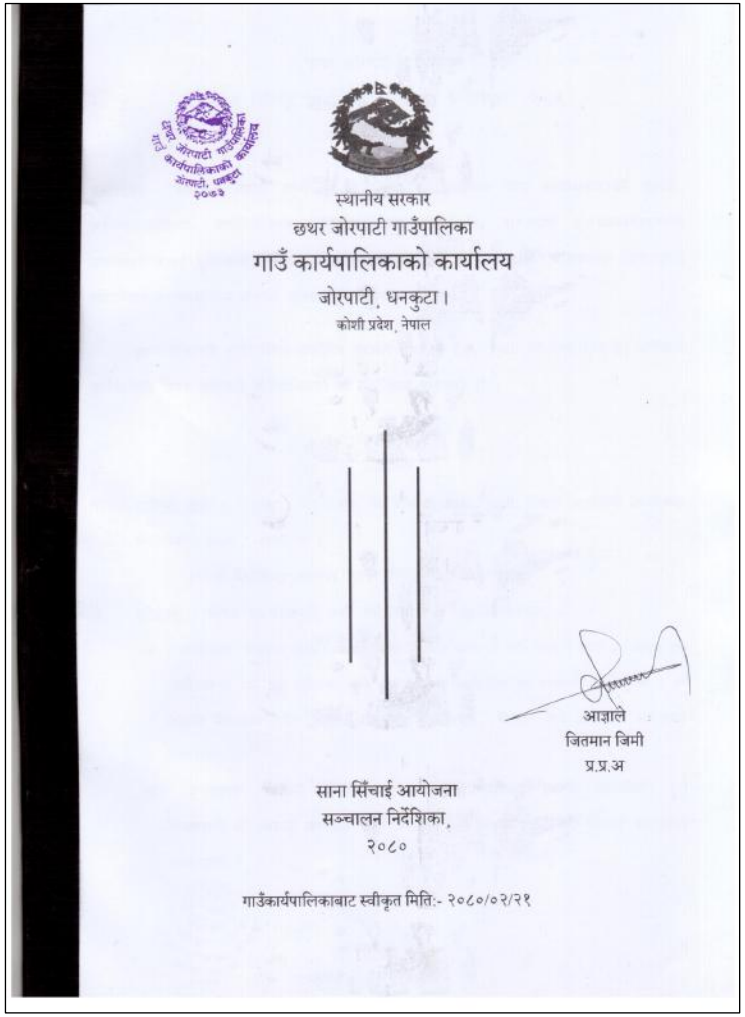
- System defunct for five years, few (4) farmers planted millet and maize which was rain-fed, much of the land remained fallow
- After the rehabilitation of the system, 17 households have transformed their land for paddy production in rainy season and vegetable production in winter season.
- A women led proactive WUA has received financial and technical support from Siddhicharan Municipality and the Agriculture Knowledge Center (500 Kg of ginger seeds, 28 earthen ginger storage ditches, training on production of organic pesticides, 25 plastic drums, exposure visits).
- With WUA's initiation, 40 farmers have received training on commercial farming and marketing of ginger,
- Linkages with traders from Udaypur

CASE STUDY 2: POKTING SURKE IRRIGATION SCHEME

- Farmers supply ginger to Kathmandu and tomatoes to Solukhumbu.
- Farmers are selling cabbage, tomato, potato, cauliflower, radish, green beans, cucumber and other vegetable in local market twice a week.
- Farmers like Sushila Rai and Tapsara BK are selling vegetable worth NPR 7000-8000 every week.
- WUA has now established *Surke Paribartan Krisak Samuha* to promote commercial vegetable farming

ROLE OF LOCAL GOVERNMENTS

- Small irrigation, an exclusive right of the local governments as per the Constitution of Nepal, 2015
- Small Irrigation Guideline, a one window system for the implementation of small irrigation schemes.
- A variety of services to be provided to farmers including construction/rehabilitation irrigation facilities, targeted support for minor intervention to solve specific problems in the systems, pro-active support for development of irrigated agriculture and facilitate the development or expansion of agriculture value chains.


स्थानीय सरकार
छथर जोरपाटी गाउँपालिका
गाउँ कार्यपालिकाको कार्यालय
जोरपाटी, धनकुटा।
कोशी प्रदेश, नेपाल

आज्ञाले
जितमान जिमी
प्र.प्र.अ

साना सिँचाई आयोजना
सञ्चालन निर्देशिका,
२०८०

गाउँकार्यपालिकाबाट स्वीकृत मितिः- २०८०/०२/२१

THANK YOU

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Alternative Energy Promotion Centre (AEPC)
Renewable Energy for Rural Livelihood (RERL)

Grid Interconnection of micro hydro in Nepal

Presented by:

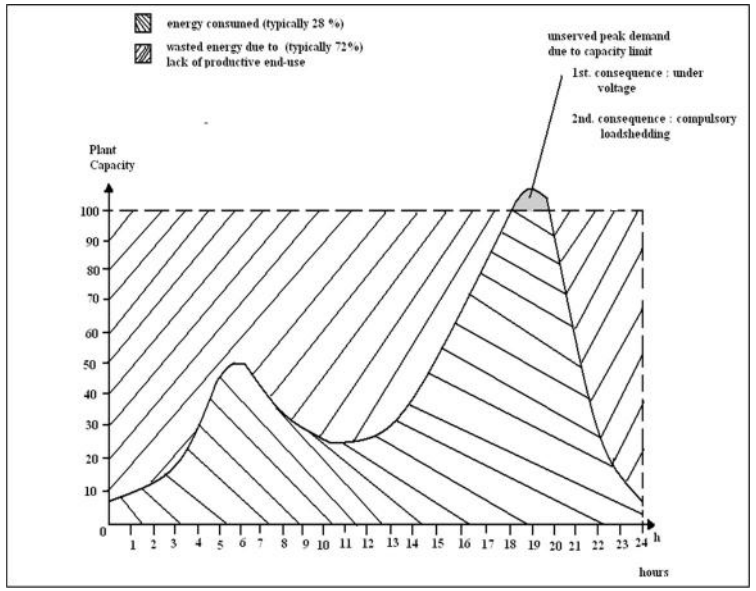
Satish Gautam/Maryam Khatoon

AEPC/RERL

4 October 2023

Situation of Micro Hydropower in Nepal

- There are 1800+ Micro Hydropower Projects (MHPs) developed with AEPC support so far
  - 622 MHPs of >20kW
  - 203 MHPs >50kW



- Status of MHP is mixed
  - Generation is less than half of installed capacity
  - Used mainly for lighting purpose
  - Revenue hardly covers operating cost
  - Cost of repair and maintenance mainly covered by local government
  - Still MHP are operating unless grid is supplying or there are major damages

MHP Status

- Typical load curve varies 7% (Malekhu MHP) to 61% (Ghandruk MHP)- study by AEPC/RERL 2016
- Average PLF is 25%

- Koshi and Sudurpaschim 35 MHP out of 434 i.e. 8% MHPs are shut down due to grid encroachment- AEPC/RERA Study, 2020
- Lumbini & Karnali 24 out of 170 i.e. 14% MHPs shut down due to grid encroachment - AEPC/NREP Study, 2022
- Community perceive MHP as stop-gap solution and migrate to grid or come back to MHP as national grid in rural area is unreliable.

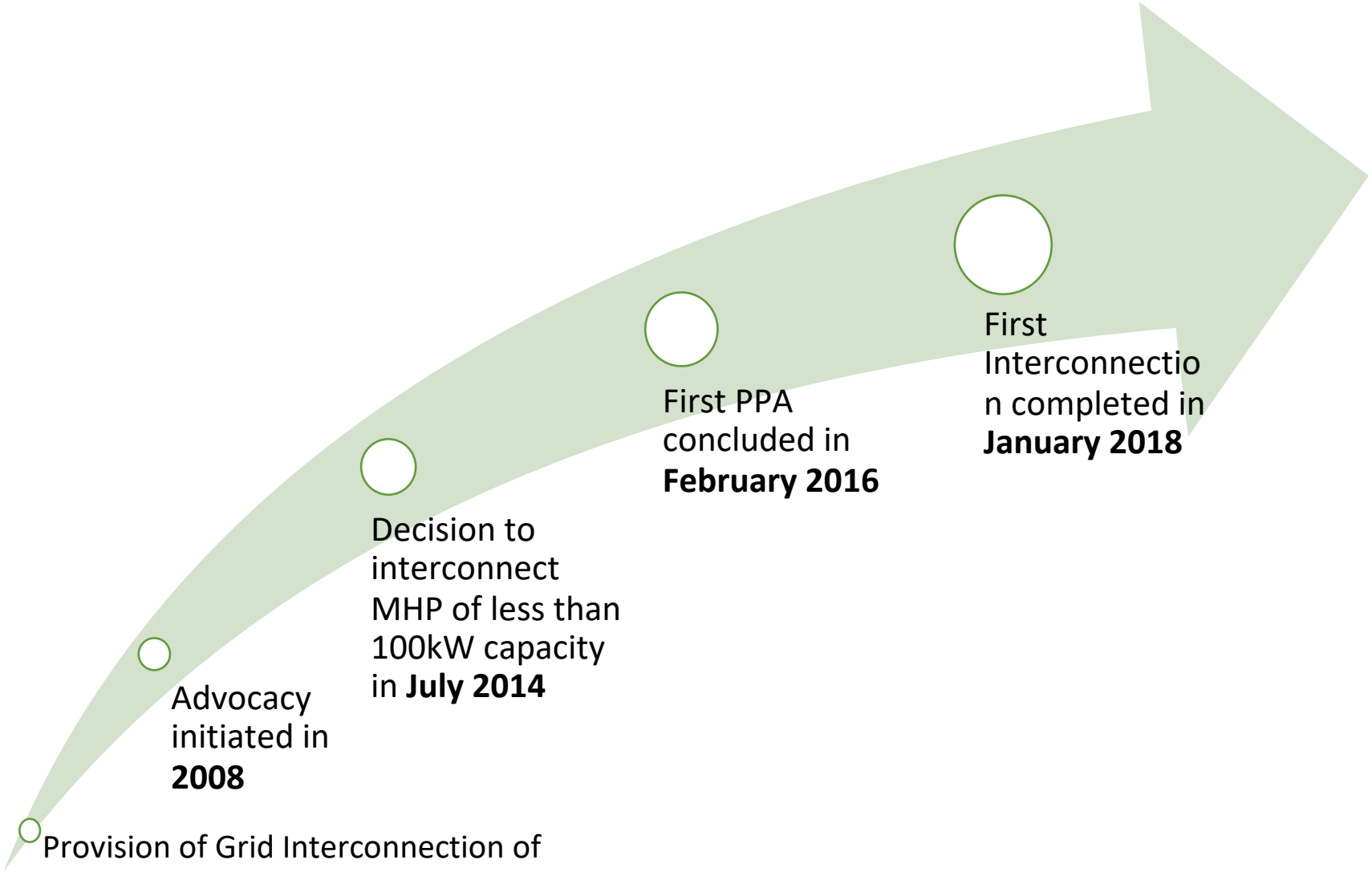
Why Grid Interconnection of MHP

- Utilization of the national resources
- Maximize the Plant Load Factor
- Additional revenue generation
- Loss reduction- generation is closer to point of consumption
- Reduction in cost of systems- less investment in long transmission line and S/S
- Greening the grid- reduce emissions of CO2

Why Grid Interconnection of MHP

- Enhanced reliability and quality of electricity
  - Local power injection in the grid boosts the grid voltage
  - Unusual fault in the distribution line is cleared by MHP operator to get uninterrupted interconnection
  - Community shall have supply even during grid outage
- Retention of skills gained from off-grid MHP operation and maintenance
- Support GoN effort on “Sustainable Distributed Generation and Grid Access to All by 2022”-SUDIGGAA report 2018 by NPC

Policy Breakthrough of Grid Interconnection of Micro Hydropower(MHP) in Nepal



Grid Interconnected MHPs

S.No.	Name of Project	District	Capacity (kW)	Connection Type	Rate (NPR)		Interconnection Year
					Dry	Wet	
1	Syaurebhumi	Nuwakot	23	PPA	8.4 for 4 month	4.8 for 8 months	Jan-18
2	Leguwa Khola	Dhankutta	40	PPA	8.4 for 4 month	4.8 for 8 months	Jun-18
3	Midim	Lamjung	100	PPA	5.73 for 4 month	3.28 for 8 months	Dec-18
4	Chimal	Taplejung	90	PPA	8.4 for 4 month	4.8 for 8 months	Oct-18
5	Haluwa Khola	Dolkha	400	Net Metering	8.4 for 6 month	4.8 for 6 months	44197
6	Jhakre Khola	Dolkha	630	Net Metering	8.4 for 6 month	4.8 for 6 months	Feb-21
7	Tara Khola	Baglung	380	Net Metering	8.4 for 6 month	4.8 for 6 months	Jul-21
8	Putpute Khola	Syangja	98	Net Metering	8.4 for 6 month	4.8 for 6 months	Jun-21
9	Phawa Khola	Taplejung	500	Net Metering	8.4 for 6 month	4.8 for 6 months	Apr-22
10	Khamari	Surkhet	53	Net Metering	8.4 for 6 month	4.8 for 6 months	Nov 2023*
	Total (kW)		2314				

Exchange rate: 1 USD=NPR 132

Impact of grid interconnection of first ever 23kW MHP in Nepal

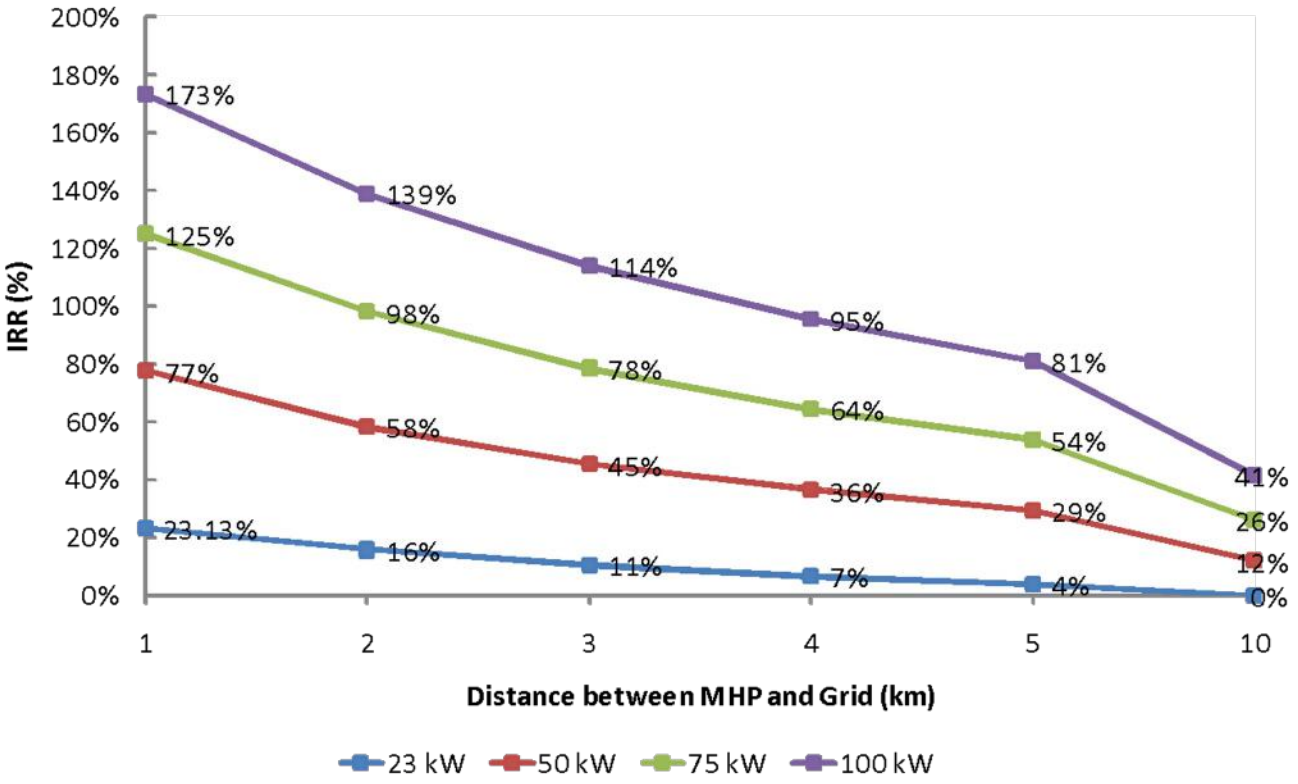
- By injecting just 23kW in 11kV feeder line, voltage increased from 370V to 382V.
- Plant Load Factor increase from merely 25% to 77%.
- Revenue increased by 3 folds

Expected Annul Revenue:
NRs 10.94 lakh

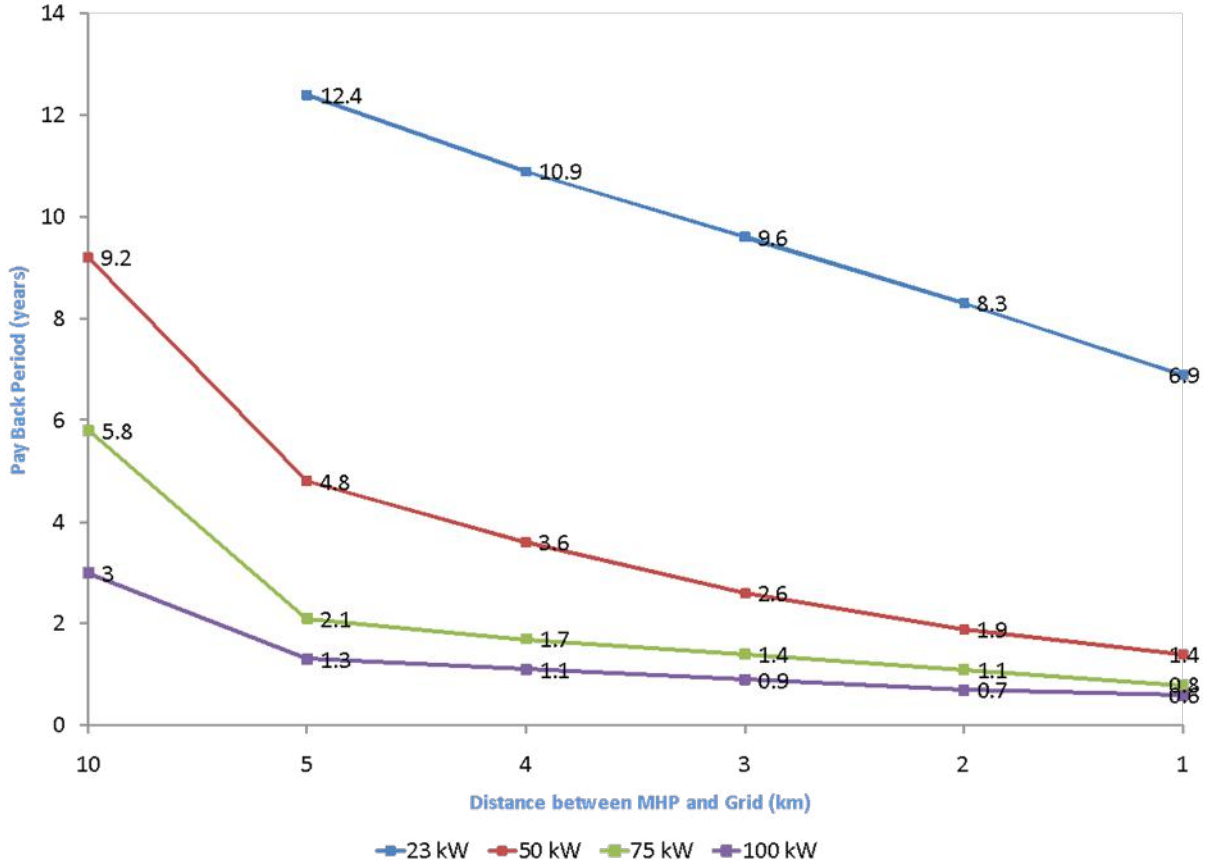
Less revenue due to unavailability of utility feeder

Annual Earned Revenue:
NRs. 7.93 lakh

Financial aspect



Internal Rate of Return (IRR) vs Interconnection Distance



Payback Period vs Interconnection Distance

CAPEX- only interconnection cost has been considered for existing MHPs

Way forward

- AEPC and NEA are preparing **Integrated Master Plan for Minigrid (IMPM)**
  - Identification of MHPs (already built) suitable for grid interconnection based on distance from the grid, age of plant, capacity, functional status etc
  - Feasibility study of 100 MHPs for grid interconnection
- Compensation of MHP distribution line if NEA uses that for electrification
- Rehabilitation of most MHPs required before net metering
- Capacity building of installer, consultants, engineers, MHP operator/manager, local DCS manager etc.
- O&M support for 1 year

Way forward

- Subsidy for Interconnection until the technology is mature
- Sustainability – Involvement of the Private Sector
- Technical standard for net metering- Interconnection Standard including SLDs prepared by AEPC and NEA EC needs to be finalized
  - 20kW to less than 85 kW, and
  - 85 kW to less than 1000kW
- Single Line Diagram: MHP Grid Interconnection

Thank You

Nature-based Solutions (NbS) for the Resilience of Water and Road Infrastructures

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Managing Director-FEED (P) Ltd
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Oct. 2023

NbS for Resilient Communities

- Eco-Safe Roads (or green roads) are the roads operational around the year with minimum blockage, bring economic activities, and provide access to resources, education, and health to the communities and protect the water sources;

- Nature-based Solutions (NbS) leverage nature and the power of healthy ecosystems to protect people, optimize infrastructure and safeguard a stable and biodiverse future (IUCN);

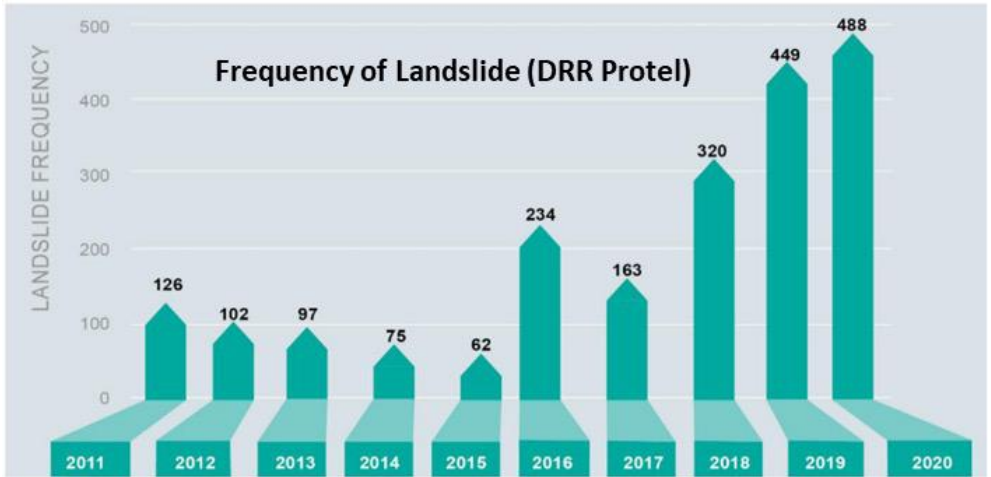
Effects of roads in mountain landscape

Modification of local hydrology:

- change surface runoff,
- reduce infiltration,
- increase concentrated runoff,

- soil erosion,
- gullying,
- landslides,
- damage of cropland
- degradation of ecosystem

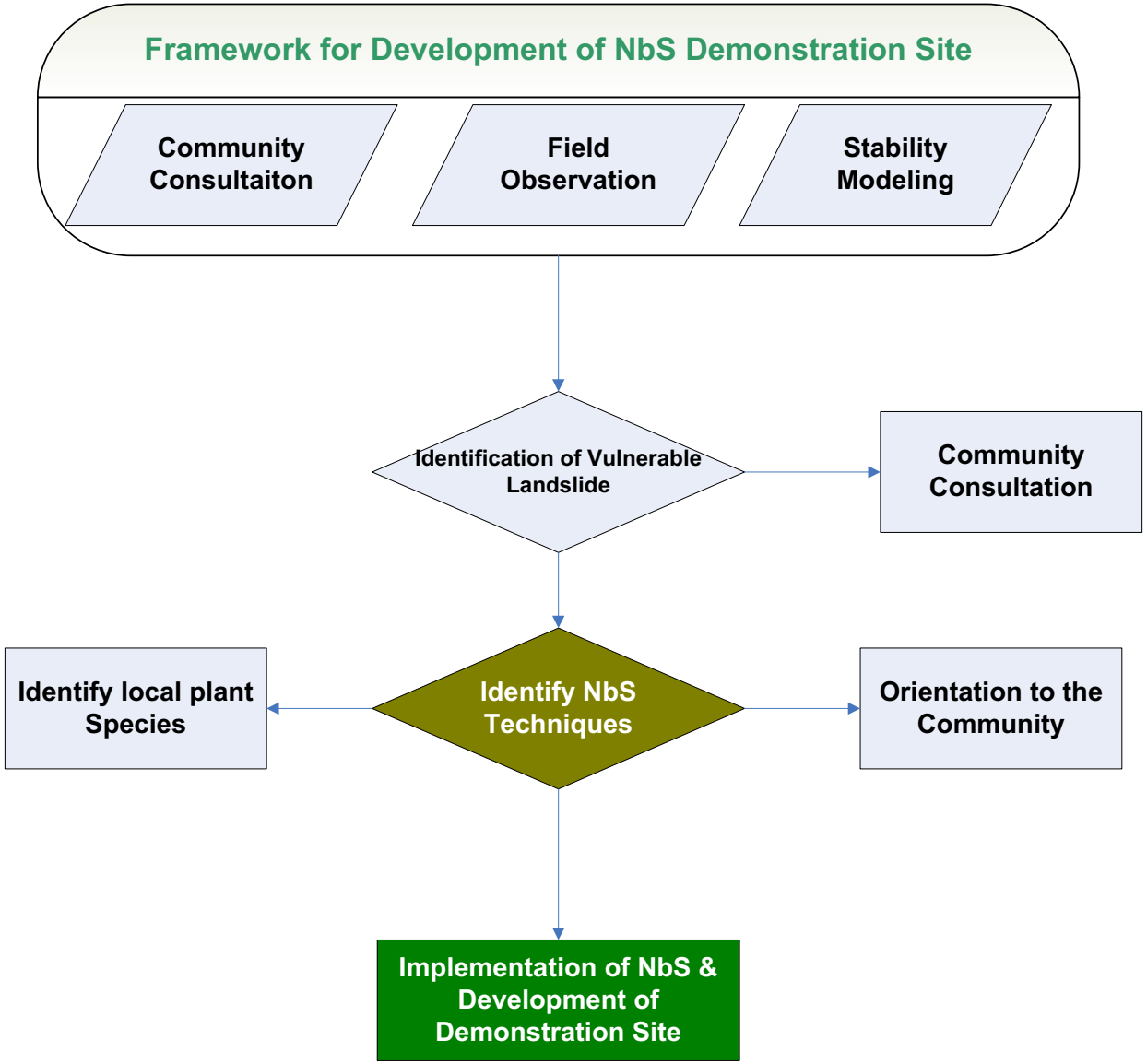
- Conventional engineering measures often costly, and their strength is reduces over time turning the slope unstable;
- NbS aims for sustainable solutions of landslides caused by developing infrastructures, conserving water resources and ecosystem services;



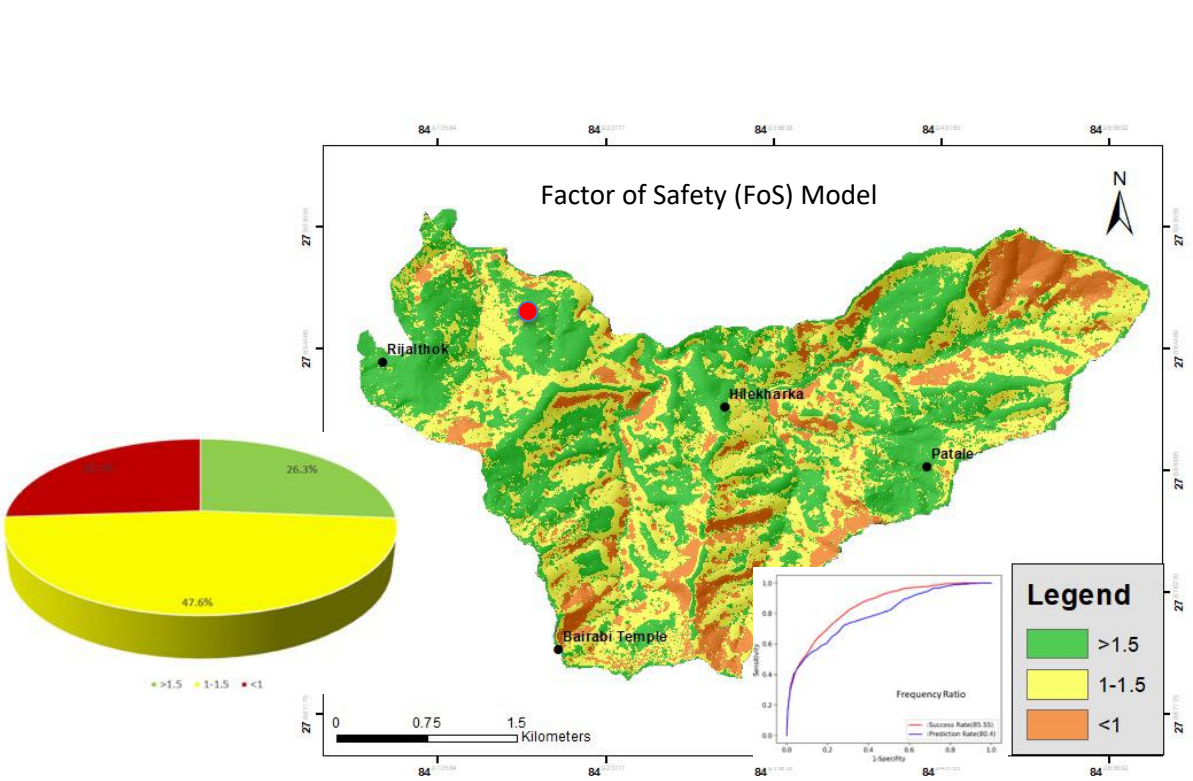
NbS approach for sustainable slope stabilization!

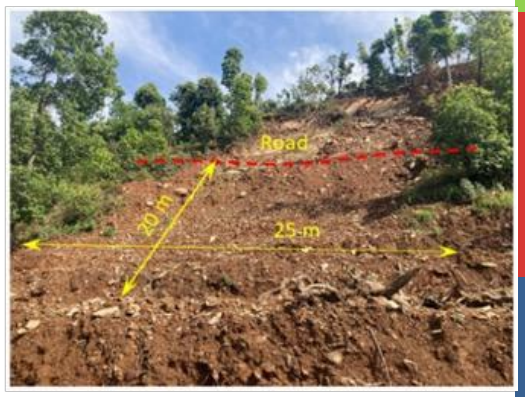
Objective:

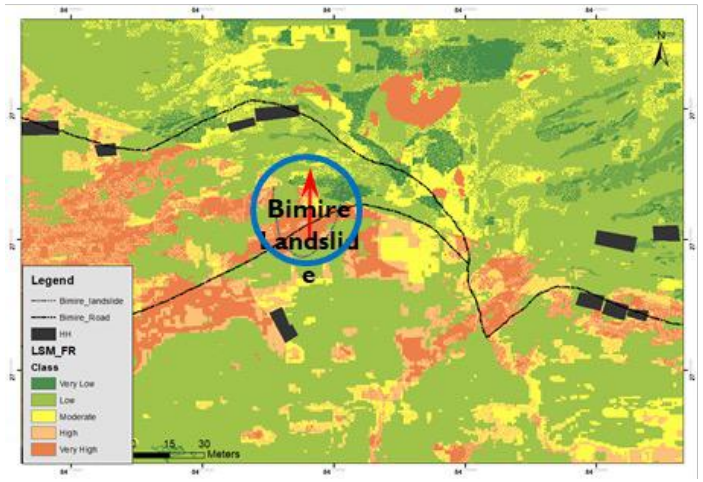
- To establish NbS Demonstration Site in collaboration with the local Government and community people in Neelakantha Municipality, Dhading District, Nepal.



NbS approach for sustainable slope stabilization – Case Study Bimire







Bimire landslide:

Area = 500 m^2 (L=20m, B=25m)
Slope = 35-40 degrees
Failure depth = ~1.5-2m
Soil Type = Loamy soil

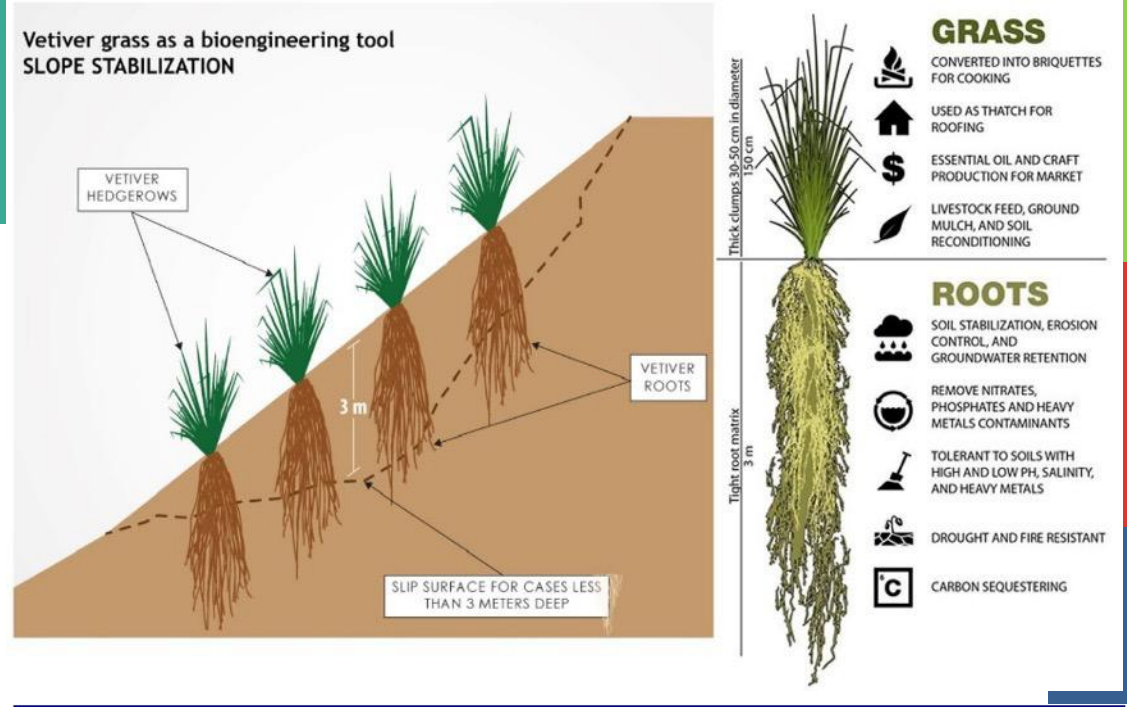
Casual Factor – Slope, Soil, forest clearance & Road
Triggering Factor – rainstorms
Damage – 1 ha of cultivated land and threat to the HHs
Cost of Restoration – ~500 thousand (NPR)

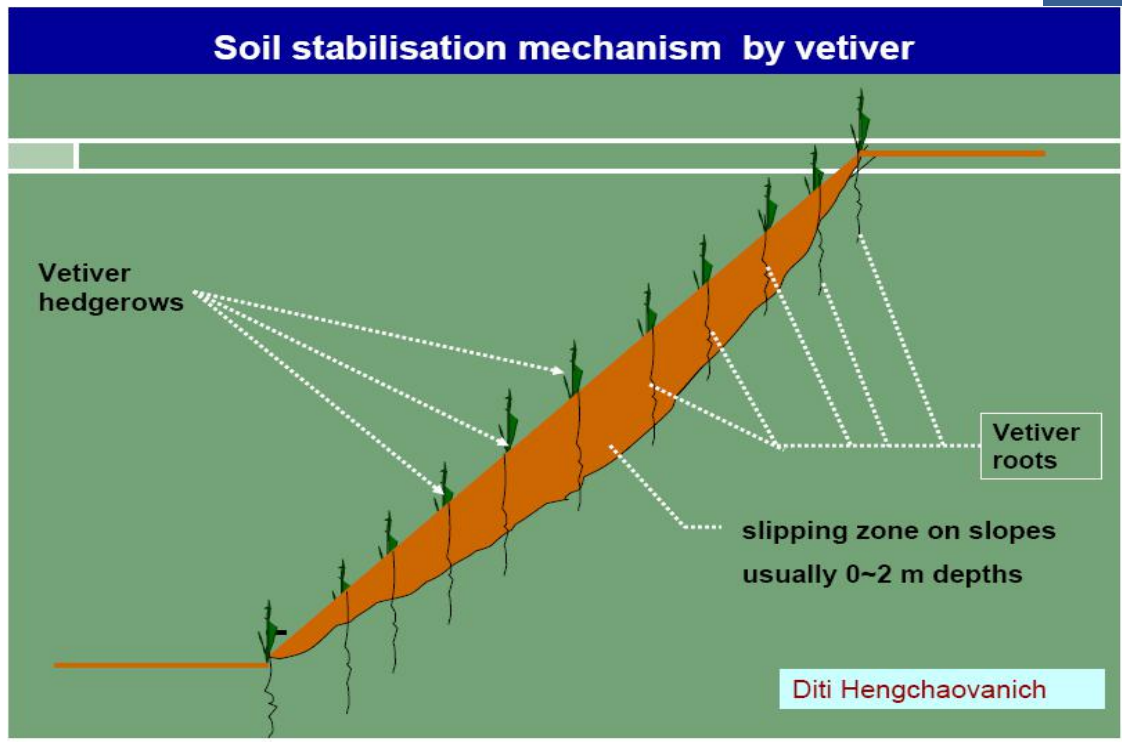
Plant species selection

- Key features of grass:

- longer, finer & stronger root system – increase soil cohesion;
- High above-ground biomass – reduce splash erosion;
- Fast growing - ground coverage (grass species);
- High survivor rate – grass species resilient ;
- Co-benefits - fodder, fuel wood, ecosystem restoration, erosion control, protect water sources, etc.;
- Non-invasive - no seeds;
- Climate resilient;

- **Immediate Protection & Water Management:**
  - Bamboo Crib walls
  - Water management (e. g. roadside drainage);





NbS for Resilient Mountain Community and landscape!

Selection of Plant Species- Key Performance Indicators (KPI) of Plant Species:

- Plant Species KPI

- Root Depth & Density;
- Root-Shoot Biomass;
- Canopy Coverage;
- Root Strength;
- Survivorship;
- Maintenance;
- Climate resilient;
- Rate of Growth;

$$T_r = \frac{F_{\max}}{\pi\left(\frac{D^2}{4}\right)}$$

- *Tr* is the Root tensile strength
- F_{max} is the maximum force (N) applied to break the root and
- *D* is mean root diameter (mm) at the point of rupture.

$$RAR = \frac{A_r}{A}$$

- *RAR* is the Root-Area-Ratio
- A_r is the area of the root of the particular plant species on the given vertical soil profile of the Rhizotorn and
- *A* is the total vertical surface area of the soil profile on the Rhizotorn allocated for species as of A_r.

$$c_r = 1.2T_r\left(\frac{A_r}{A}\right)$$

- C_r *is the root-cohesion*
- *Tr* = Average tensile strength of root, and
- *Ar/A*= RAR

NbS approach for sustainable slope stabilization – Combination of techniques

1. Roadside Drainage ~50 m

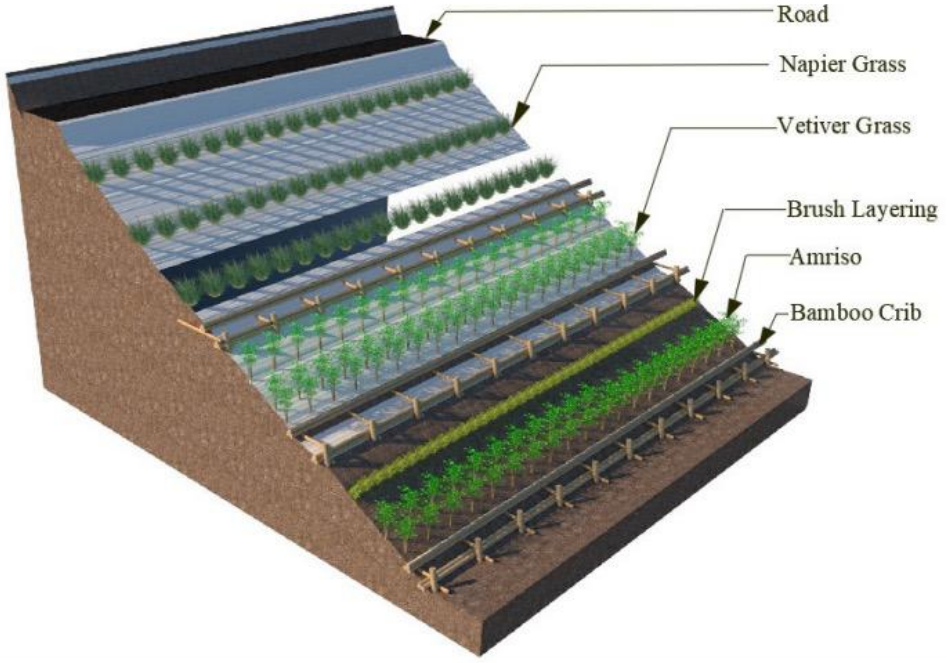
2. Bamboo (*Bambusa vulgaris*) Crib Walls – 3*25 m

3. Amriso (*Thysanolaena maxima*) Plantation – 50 cm spacing, contour line, 2 rows

4. Brush Layering – 1 row, 25 m (Simali (*Vitex negundo*) and Napier Grass (*Pennisetum purpureum*))

5. Vetiver (*Chrysopogon zizanioides*) Plantation – 10 cm spacing, contour line, 4 rows (~4000 saplings)

6. Napier Plantation – 10-15 cm spacing, contour line, 4 rows



Case Study Bimire

Case Study Bimire

NbS for Resilient Mountain Community and landscape!

1. Co-benefits (e. g. brooms & fodder from Amriso, fodder from Napier & Vetiver grass, handicrafts from Vetiver grass;

1. Ecosystem Protection & Restoration of degraded ecosystem;

2. Protection of Water sources, reduce contamination, increase infiltration thereby groundwater;

3. Reduce soil erosion/losses & and improve land productivity;

4. Additional livelihood activities from the Nursery;









Helping Communities to be Resilient

NbS for Resilient Mountain Community and landscape!

Further Reading:

1. https://metameta.nl/the-work-we-do/green-roads-for-water;
2. https://thewaterchannel.tv/thewaterblog/roads-for-water-looking-for-a-better-match/
3. https://www.iucn.org/press-release/202211/egyptian-cop27-presidency-germany-and-iucn-announce-enact-initiative-nature
4. https://www.unep.org/unep-and-nature-based-solutions
5. Devkota S.; Shakya, NM; Sudmeier-Rieux K.; (2019). Framework for Assessment of Eco-Safe Rural Roads in Panchase Geographic Region in Central–Western Nepal Hills;
6. Devkota, Sanjaya; Sudmeier-Rieux, K.;Penna, I. ; Eberle, S.; Jaboyedoff, M.; Adhikari, A. ;Khanal, R. (2014). Community-based bioengineering for Eco-safe roads in Nepal; the University of Lausanne, International Union for Conservation of Nature, Nepal and Department of Soil Conservation and Watershed Management, Government of Nepal;

Thank You!