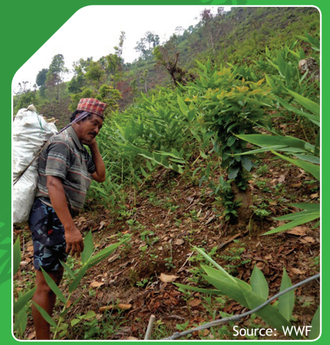
Long Term Plan for Ecosystem Restoration

For long term plan (4 – 5 years), the detail study of watershed with several (EbA, EO and Hybrid) adaptation measures can be implemented. For example: Peatland construction, pond construction, livestock management, fire management, logistic support and monitoring, establish Knowledge park, agro-forestry, bio-engineering options, etc transforming it into model watershed and set a approach that can be replicated.

Adaptation Measures

Livestock Management (Field based Trainings)
Fire Management (Trainings + Tools – promote local enterprises for tools)
Logistic Support (ICS, Biogas plant, etc) n = 300 (HHs)
Pond Construction (Structural and Natural)
Knowledge Park (Pond - fishery + Agro-forestry + Medicinal plants + hybrid seeds + vegetables + flowers + demo plot of EbA, Hybrid options, etc)
Nursery Promotion (Local enterprises)
Conservation of water resources
Vegetable Promotion
Agro-forestry
Plantation (Grass + Tree + Bamboo)
Promote local enterprises (Juice + sisnoo +herbal tea)
Promote NTFPs


Source: WWF

The short term plan will be implemented in financial support of MSFP with active contribution of local community, local organizations and stakeholders. To implement long term plan, resources will be further explored locally, regionally, nationally and internationally to make this watershed an ecosystem restoration model.

Outcome

- Ecosystem based adaptation and Engineering Option model will be established in Manma Watershed (Megar River sub watershed and Sunar River sub watershed)
- Greenery promotion in the watershed following the EbA options and Hybrid options.
- Local community will be aware of adaptation options (EbA, EO and Hybrid) and will participate actively for Greenery promotion in Manma watershed and beyond.

Concept Visualization and Guidance

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GREENERY PROMOTION AND ECOSYSTEM BASED ADAPTATIONS (EbAs)

LEARNING FROM KALIKOT DISTRICT, NEPAL

Overview

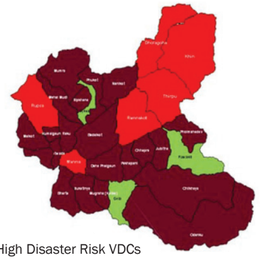
Nepal's forestry sector contributes to inclusive economic growth, poverty reduction and also minimizes the adverse effect of climate change. Majority of people are dependent on forest resources for firewood, fodder, grass, medicine, etc leading to increase in forest degradation and deforestation. In Kalikot district, 98% of the Household depend on forest for energy (District Profile 2009). Due to geographical structure, unrestricted grazing in forest area, high incidence of human induced forest fire and lack of awareness for forest protection, the greenery is diminishing rapidly. Decrease of greenery in an area increases the runoff of river which results in flood, soil erosion and landslides.

Kalikot's altitude ranges from 738 to 4,790 meters above the sea level. It has a temperate climate with average annual rainfall of 730mm. The topography of the district is characterized by rough high hills partially covered by snow, mid hills and low lands. The temperature varies according to the season from an average of 19°C in summer to 6°C in winter (District Profile, 2009). Kalikot is vulnerable to many hazards, predominantly landslides and soil erosion and almost all VDCs are vulnerable to one or more types of disaster. Six VDCs, namely Dhaulagaha, Khina, Thirpu, Rupsa, Ramnakot and Manma, are at high risk of multiple hazards. The District Disaster Response Committee (DDRC) prepared a Disaster Preparedness and Response Plan in 2011, which identifies landslide, flood, fire, earthquake and epidemics as the main hazards of the district.

In this context, the main objective of this project is to design and implement Ecosystem-based Adaptations (EbAs) and Engineering Options (EOs) in Manma Watershed (Megar and Sunar River Sub - watershed) for restoration of ecosystem services and to minimize impact and implication of flood and landslides. It also aims to enhance capacity of local communities on adaptation (EbAs, EOs and Hybrid options) to reduce vulnerability.

This Green Kalikot – EbA project will be conducted by IDS Nepal with financial support of MSFP.

Risk Assessment of Kalikot District



- High Disaster Risk VDCs
- Medium Disaster Risk VDCs
- Low Disaster Risk VDCs

Negative Impact of Extreme Events in Manma Watershed

(Source: IDS-Nepal)

EbA, EO and Hybrid Options

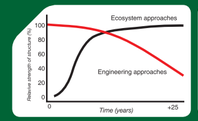
EbA: Ecosystem-based Adaptation (EbA) integrates the use of biodiversity and ecosystem services into an overall strategy to help people adapt to the adverse impacts of flood and landslides. It includes sustainable management, conservation and restoration of ecosystems to provide services that help people adapt to both, current climate variability, and climate change. EbA is formulated/designed involving a wide range of ecosystem management measures to increase resilience and reduce vulnerability of people and environment (Colls et al, 2009) For example: Re-vegetation/Re-plantation, Agro-forestry, Fire management, crop rotation, peat bog management, slope management, etc.

Bamboo plantation in river bed and Bamboo Wattle
(Source: IDS-Nepal)

EO: The adaptive Engineering Options (EO) are controlled disruption of natural processes by using man-made structures. For example: reinforce, embankment, dikes, storage area, increase drainage, etc.

Spur and Soil Embankment (Source: Paudel R.)

Hybrid Option: In controlling flood and landslide, we may have a choice of constructing engineering structures or ecosystem based approaches. The strength of a structure declines with course of time needing replacement after certain time period, whereas vegetation takes a few years to reach maximum strength and lasts for a longer time but to have instant result, engineering measures are effective. As the relative strength of engineering structure decreases, the relative strength of bio-structure increases. Thus in the long run, function of the engineering structure is handed over to the Ecosystem. EbAs alone or EOs alone may not achieve all the intended results. Therefore combinations of both EbAs and EOs are required to reduce the impacts of flood i.e. Hybrid Option.



Life Span of EO and EbA and example of hybrid option
(Source: DoR and IDS-Nepal)

Glimpse of Manma Watershed

Manma is the district headquarter of Kalikot District of Karnali Zone. The Manma watershed is located at 29°8'60N 81°37'0E, at an altitude from 1000 to 2000 meters. The two main rivers of this watershed are: Megar and Sunar River. The total households residing within this watershed are 687 including 326 HHs belonging to Dalit. This watershed houses 3615 people comprising 1850 male and 1765 female within its area of over 5 sq. km (CBS 2011). People cultivate paddy, maize, potato, wheat and vegetable in monsoon and they leave land barren in dry season. Valuable medicinal plants including marsh orchid (*Dactylorhiza hatagirea*), figwort (*Picrorhiza scrophulariiflora*), spikenard (*Nardostachys grandiflora*), snakeroot (*Rauwolfia serpentina*), East Himalayan fir (*Abies spectabilis*) etc. available in Manma watershed can generate local revenue, if properly managed.

- Pancha dev CFUG – Manma 3, 4 and 5
- Nainalmandu CFUG – Manma 1, 2, 3 and 4
- Kot durbar CFUG – Manma 5
- Mastamandu CFUG – Manma 1, 2, 3 and 4

Manma Watershed (Source: IDS-Nepal)

The vegetation coverage in public as well as private land of this watershed is minimal due to overgrazing and human induced forest fire. In addition to this, road construction and urbanization further accelerate deforestation. Local community is also unaware of importance and implications of ecosystem, conservation and sustainable resource management. This accelerates vulnerability of flooding, landslide and soil erosion. The local people reported, flooding in Sunar River affecting agricultural land, mobility through Karnali highway and occasional loss of human life, one human loss reported in 2014. Likewise in year 2013 (one human loss reported in 2014), flooding in Megar River effecting agricultural land and Karnali highway, loss of 2 human lives and swept away 4 water mills.

Highlights of Proposed Activities and Cost of Implementation (Short Term)

For mitigation of adverse impact of flood, landslide and soil erosion, EbAs and EOs will be implemented in Manma watershed. The field survey of Manma watershed (Megar and Sunar Rivers Sub - watershed) identified both long term and short term planned measures in 45 locations (19 in Megar River sub watershed and 26 in Sunar River sub watershed) for adaptation options. Options include EBA, EOs or hybrid which will reduce the the watershed's vulnerability and mitigate adverse impact. Summary of the EbA options and estimated cost (1 – 2 years) are shown in Table 1.

Locations to implement EbA, EO or Hybrid option in Manma Watershed, Short term plan.

Ecosystem based Adaptation options	Unit	Area	Seedling	Total Cost (NRs.)
Bamboo Rhizome plantation	ha	6.3	2522	498,000
Amriso plantation	ha	10.2	101970	1,259,520
Tree plantation (Bakaino, Chiuri, Bains, etc)	ha	8.09	12955	553,430
Grass plantation (Napier, Kans, etc)	ha	0.17	2798	42554
Private land plantation (provide seedling)			58057	664,129
Grand Total (NRs.)				3,018,633

The plantation season of Manma watershed is in monsoon (July/ September) as other seasons are not favorable for the plantation due to arid condition. This cost includes: cost of seedling, seed, transportation, plantation and protection.

The identified Engineering Options are: Gabion embankments in either side of river, River check dam and Gully check dam. The detail activities in engineering options (1-2 years) are listed in Table 2.

Engineering options	Short Term Plan		
	Unit	Quantity	Amount
Site clearance	m2	1008	19706.40
Earth work excavation in hard GBM soil	m3	450	181228.50
Supply of heavy coated 8swg gabion boxes (mesh size 10cm * 10 cm with 2 way knot)	m2	11648	5396643.2
Boulder filling in gabion boxes	m3	1966.5	2289743.44
Total (NRs.)			7,887,321.54

The cost to implement the engineering options in watershed will be NRs. 7,887,321.54, using district rate provided by District Development Committee, Kalikot. The detail cost estimation is provided in the final report. Loss due to flood and landslide were estimated for Manma watershed and benefit –cost ratio was calculated for EbA and EO integrating benefit. The b/c ratio was positive (EbA – 7.7 and EO – 2.9); hence these measures to prevent flood and landslide would be economically efficient. EbA options have higher benefit-cost ratio which receive more benefit for each rupees spent.

The concept of EbA, EO and Hybrid option is an emerging issue and the local community should be aware of this issue and its function for sustainability. Therefore to familiarize the implementing community 5 days training will be provided to LRP as well as community leaders to implement the adaptation options with their active participation and ownership.