Climate Smart Technologies to Build Community Resilience under the Intensive Rainfall Patterns in Northern Pakistan

by

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Mother well of the water resources of Pakistan (South Asia)

Area: 3.50 million km² (Myanmar to Afghanistan)

Originating Rivers: Indus, Ganges, Brahmaputra, Irrawaddy, Salween (Nu), Mekong, Yangtse, Yellow, Amu Darya, and Tarim

Dependent population: 210 million in catchment area whereas 1.3 billion people are dependent

Highest Peaks: 10 highest peaks of the world including Everest (8848 m) and K2 (8611 m)

Glaciers: 5,500 Nos. (Highest snow reserves outside the poles)
**Indus Basin Irrigation System (IBIS)**

- **IBIS**: The world’s largest contiguous Irrigation System encompassing 19 M ha.
- 3 large Dams - Mangla, Tarbela and Chashma (15 BCM)
- 33 small and medium storage dams
- 19 barrages, 45 Main Canal Commands and 14 Inter River Link Canals (142 – 624 m$^3$/s).
Climate change – an established fact and Pakistan is not an exception

- Deforestation (28,000 ha/year)
- World’s highest coal and fuel power production (Pakistan, India and China)
- Rising number of vehicles (3.6 million mostly fuel inefficient)
- Large consumption of natural gas (43 BCM), coal (4.67 MT) and oil (517 Kbbl)
- Population growth and urbanization (200 million, 1.45%, 36%).
- Improper architecture requiring high energy for indoor climate control
- Lack of wastewater management (less than 3% treated)
- Extensive use of insecticides and pesticides (50,000 tons/year)
Climate Change Impacts

- Rise in Temperature particularly in northern Pakistan
- Accelerated snow and glacier melt
- Increased rainfall (20%) but in intensive – short duration pattern with extended gaps
- Rainfall and extended span between two events both damages the crops (just like 2016).
- Frequent heat waves, droughts and floods
- Floods are occurring almost every year since 2009 in different parts of the country.
- Heat waves only affect the crops but also the urban population (2000 reported deaths in Karachi, 2015).
Climate Smart Sustainable Technologies

- Simple
- Affordable
- Replicable
- Socially acceptable
- Environmentally friendly
- Economically viable
Why Climate Smart Sustainable Technologies?

- Simple having least O&M issues
- Affordable & Replicable - substantial benefits can be gained at the regional level
- Socially acceptable - owned by the communities
- Environmental friendly - does not have any GHG emissions, resilient to climate change
- Economically viable having short term and long term benefits for the communities
Why Climate Smart Sustainable Technologies?

- Community identified and participated
- Sustainably increase cultivated area, agricultural productivity and livelihood
- Offer both short term and long term benefits
- Increased resilience of the communities to climate change
Lack of community consultations for the need assessment

Conventional projects (afforestation) offered no short–term benefits

Efforts mostly concentrated on approachable areas

Devoid of proper share of beneficiaries in the development

Emphasis on mega programs thus undermining impact of micro programs

Opportunity cost of the off-seasonal agriculture
Identifying climate smart sustainable technologies:

- Need Assessment
- Community consultation
- Technological feasibility
- Offering short-term and long-term benefits

Pilot Interventions:

- Solar-powered drip for raising apple/vegetables orchards
- Piped water supply from glacier for irrigation on the foothills
Implementation Modes

- Socio-economic survey before implementation of the interventions
- Detailed consultations with the beneficiary Communities, site selection and agreements
- Engineering / baseline survey and design
Physiographic/Socio-economic aspects:

- Multi-stakeholders for erosion-prone barren land
- Modest lift involved for irrigation (100 ft)
- Average availability of 6-hours good sunshine
- Moderate temperatures during summer (under 25 C)
- Fertile river water abundantly available
- Technological suitable for solar-powered drip
- Active CBO for area development
Challenges and Solutions

- No hydraulic conductivity to build sump and river water carries high sediment load, damaging for pump
- High river flow and wind pressure making the system vulnerable
- Choking of the drip system emitters due to sediments.
- An outer filter (10 in dia porous UPVC pipe wrapped with finely meshed green net) placed transverse to the direction of flow
- Tying the filter with the tree and proper panels foundations
- Line filter and increased operating pressure for the drip: 100 ft
Solar-Powered Drip for Apple Orchard

- Lorentz DC submersible pump: 1 HP
- Discharge: 6 gallons/minute
- Solar Panels: Canadian solar poly-crystalline (500 watts)
- Storage tanks (1000 gallons) at 100 ft height
- Operational hours: 6 hrs/day
- Daily pumping: 2000 gallons/day
- Water availability: 1 gallon/plant/day
Solar-Powered Drip for Apple Orchard

- Drip line (main & lateral): 20 mm (control valve for each lateral)
- Simultaneous Operation: 4 laterals (4/shareholders)
- Emitter: PC type (1 No./plant) having discharge 2-5 gal/hour
- Peak water requirement: 1 gallon/day/plant
- Alternate supply: Yes
- No. of plants: 2000 (15 ft x 15 ft)
- Short term income: growing vegetables in the same bowl
- Long term income: Rs. 25000 (US$ 220)/plant/year
Physiographic/Socio-economic aspects

• Multipurpose water conveyance system (pipe and open) emanating from Passu glacier

• Broken down due to glacier retreat and landslides checking agricultural and drinking water supplies

• Endangered downhill communities due to erosion and landslides (Shahabad)

• Active CBO for area development
Challenges and Solutions

- Highly steep slopes making transportation very difficult
- Landslide prone area
- Non-availability of power for jointing
  - A group of volunteers were arranged for transportation
  - Continuous monitoring of landslide area and emergency warning if so
  - Diesel powered jointer was transported by volunteers
Piped water supply from glacier

- Rehabilitation and extension of piped water supply for irrigation by 4500 feet (1.5 km)
- 4 inch dia HDPE pipe joined through butt-fusioning giving out a discharge of 1.5 cusecs (continuous during summer)
- Improved the open watercourse to reduce seepage losses
- Vegetation started to regrow at the watercourse banks as well as irrigation started to reduce erosion and landslides
First trial of solar powered drip in the region

90% survival rate of the plants indicating community ownership

Beneficiary communities do own and satisfied

Short term income started at both sites

Reduced occurrence of land sliding

Community ownership likely to be sustainable due to long term benefits

IFAD has launched similar project on solar-powered drip for the area