Pakistan – Lal Sohanra Biosphere Reserve

Project title: Rehabilitation of degraded dryland rangelands through scientific management of land, water and vegetation resources and grazing systems in Lal Sohanra Biosphere Reserve

Case study site: Lal Sohanra Biosphere Reserve, Cholistan desert
Partner institution: Pakistan Council of Research in Water Resources (PCRWR)

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Introduction

More than 40 percent land of Pakistan is used as rangeland for grazing of livestock. The dryland ranges occur in the main deserts, i.e. Cholistan, Thar, Thal and Kharan. The case study site selected under the SUMAMAD project is Lal-Sohanra Biosphere Reserve in the Cholistan desert area. The site is located about 65 kilometers from Bahawalpur City. The climate of the site is hyper-arid and rainfalls are scarce ranging between 100 and 250 mm annually. The groundwater is mostly highly saline. The system of livestock grazing is uncontrolled, and as a result, the rangelands are highly degraded. The livestock health is poor due to non-availability of fodder as per natural requirement of animals. People are poor due to low income deriving from livestock rearing in the absence of other income opportunities. Due to shortage of water and fodder, people migrate with their livestock towards irrigated areas in search of water and fodder until the rangelands recover by the monsoonal rainy season. The migration causes loss of billions of rupees annually. Therefore, there is an urgent need to manage the rangelands on a scientific basis to provide fodder for livestock for the whole year, to support more livestock, and to train pastoralists on controlled grazing systems. In Cholistan, the major problem is scarcity of drinking water for humans, livestock and wildlife, as there are no rivers, lakes or streams in this area. The main source of drinking water is provided by rainfall, which is collected in man-made small ponds. The water in the ponds last for about three months.

The main stakeholders are Cholistani people, the Pakistan Council for Research in Water Resources (PCRWR), and Cholistan Development Authority (CDA) which are working for the development of dryland resources. PCRWR and CDA have excavated and constructed some 200 big earthen reservoirs. In total, about one thousand small and big reservoirs exist in the area. Evaporation causes huge water loss from these water bodies estimated at about 40 per cent of the storage capacity of the ponds. Therefore, this project has been selected for the second phase of the SUMAMAD project to use existing land and water resources in order to develop excellent rangelands in Cholistan and Lal-Sohanra Biosphere Reserve. The overall aim is to introduce controlled grazing systems and to manage these systems sustainably. The free grazing pattern and land use will be converted in to controlled rotational grazing system. This will generate many livelihood sources for local people in the form of; labour for livestock farms, milk, meat and leather products. The increase in vegetation cover as a result of project activities i.e. reseeding of ranges and application of irrigation during dry period will enhance overall green cover. It will help in reducing temperature and increasing oxygen in the air and absorbing carbon dioxide gases making regional environment more friendly for human and livestock population. Properly developed rangeland will increase economic value of drylands. The experiments to be carried out with the support of SUMAMAD project on management of rangelands and controlled grazing systems will play role of model for the Cholistan Development Authority (CDA) to be adopted by her on large scale. The CDA is a semi-autonomous body to deal with the desert and is independent to formulate a policy for themselves. Therefore, range management and development for the Cholistan desert will be adopted easily.

Justification

About 14 per cent of Pakistan's land area consists of deserts and drylands. These lands are used for grazing of livestock which is the primary source of income for the people. Agriculture is not practiced due to the lack of irrigation water from rivers, dams or lakes. Little and erratic precipitation is a problem, and its distribution does not match crop growing seasons and crop water requirement periods. To increase livestock production, good drinking water and good rangelands are needed, but they are in poor condition due to mismanagement and lack of scientific knowledge. These issues need to be addressed by the scientific community to find out solutions regarding degraded rangelands and water loss due to evaporation. There is an urgent need to increase the carrying capacity in rangelands and to enhance the water storage capacity of ponds in the dryland of Cholistan. It is hoped that the degraded rangelands can be converted into excellent grassland as a model for adoption on different scales by the farmers and CDA.

Achievement/Lesson Learned from 1st Phase of SUMAMAD

The SUMAMAD project studies carried out at Lal Sohanra Biosphere Reserve during the first project phase pointed out specific problems which are directly linked to societal patterns and drought impacts. Economic resources and aspirations of the people have been identified. The people's views to resolve their economic and environmental issues were enlisted to understand the project area more realistically. The studies helped policy-makers to identify and initiate better development projects in the area in the fields of water resources, roads, education, electricity supply etc. The projects on income generating activities, i.e. saline fish farming as an alternative livelihood option and income opportunity for dryland people, vegetable production using saline water, and moisture conservation techniques provided new concepts to policy-makers to invest in

development projects that may bring dryland dwellers at par with the society in the developed parts of the country. The lessons learned from the SUMAMAD project phase-1 is that priority should be given to address community problems and to solicit the cooperation of dryland people so as to implement innovative techniques for the management of dryland resources.

Objectives

1. To rehabilitate degraded rangelands of Cholistan dryland by scientific management of land, water and vegetation resources.

2. To halt degradation of rangelands by adopting protective measures to enhance carrying capacity.

3. Introduction of a new concept of rangeland irrigation through a sprinkler system during the dry season using rainwater storages or groundwater to increase biomass production.

4. To enhance livestock production in drylands by providing more fodder per unit area.

5. To increase income of livestock owners residing in the dryland to improve their living conditions.

6. To investigate the most economical, sustainable and site specific ways to minimize water evaporation loss from rainwater-fed earthen ponds.

Measures and activities

An area of about twenty hectares will be selected in Cholistan desert for the management of rangeland. Before starting the research activities, data about the range will be collected for the parameters (1) soil texture up to 60 cm, (2) infiltration, (3) WHC, (4) EC, (5) pH, (6) ESP, (7) vegetation canopy, (8) vegetation species, (9) palatable and un-palatable vegetation, (10) grass species, (11) vegetation biomass, (12) palatable biomass, (13) un-palatable biomass, and (14) carrying capacity. There are two sprouting seasons in Cholistan which occur during the spring and summer monsoon. It is a general trend in Pakistan's deserts that if winter rainfall occurs in the months of January and February, the grass sprouts from the middle of February and matures until the end of April. Similarly in the summer monsoon season, the grass again sprouts in August and matures in the month of November. Keeping in view the above trend, a study has been designed to apply irrigation supplements in both sprouting seasons to compare the biomass obtained with and without irrigation. To fix a benchmark for optimum application of irrigation, different numbers of irrigation schemes will be applied. At the end, water productivity and monetary value of water will be calculated to choose the best fit quantity of water application. The study will be based on three major experiments:

Experiment-1

There will be eight different treatments:

(1) T_1 Natural grazing land
(2) T_2 Fencing of natural grazing land
(3) T_3 Fencing and reseeding of grasses in the rainy season

(4) T_4 Reseeding of open grazing land without fencing
(5) T_5 Fencing plus reseeding plus spray irrigation during sprouting season
(6) T_6 Fencing plus reseeding plus irrigation on monthly basis
(7) T_7 Fencing plus reseeding plus irrigations with interval of two months
(8) T_8 Fencing plus reseeding plus irrigation with interval of 3 months.

The following data will be collected:

- Soil: Texture, EC, pH, ESP of soil profile up to 60 cm infiltration.
- Water quality: EC, pH, SAR, RSC.
- Irrigation: Depth of irrigation (mm)
- Climatic data: Temperature, humidity, wind speed, evaporation, ET, rainfall.
- Vegetation data before and after each six months: Wet biomass per unit area;
- Dry biomass per unit areas, vegetation species, vegetation canopy cover, palatable vegetation biomass wet and dry
- Carrying capacity
- Cost of irrigations and other practices
- Production and income of rangeland in the form of animal units.

Experiment-2

(1) T_1 Uncontrolled grazing by sheep
(2) T_2 Uncontrolled grazing by goats
(3) T_3 Uncontrolled grazing by cattle
(4) T_4 Uncontrolled grazing by camels
(5) T_5 Controlled rotational grazing by sheep
(6) T_6 Controlled rotational grazing by goats
(7) T_7 Controlled rotational grazing by cattle
(8) T_8 Controlled rotational grazing by camels.

Data to be collected:

(1) Canopy
(2) Biomass
(3) Vegetation species
(4) Palatable species
(5) Un-palatable species
(6) Carrying capacity

Experiment-3

Evaporation will be controlled by using different local, economical and sustainable materials. The following treatments will be adopted.

(1) T_1 100% seepage control without control of evaporation
(2) T_2 100% seepage control with evaporation control by thermopore grains
(3) T_3 100% seepage control with evaporation control by green net
(4) T_4 100% seepage control with evaporation control by ceiling with tinsheet
(5) T_5 100% seepage control and evaporation control by ceiling with local material, i.e. bamboo or wood and vegetation etc.

Data to be recorded:
(1) Climate
(2) Pan evaporation
(3) Water depth
(4) Water loss
(5) Water quality analysis.

Expected Outputs

After improving degraded rangelands of Cholistan, the carrying capacity should increase up to ten times more than natural degraded ranges. It will increase livestock production in the form of milk, meat, leather etc. It will increase income of the people as well as stop land degradation and control desertification for future generations. The reduction of evaporation losses from ponds will increase water quantity to be used for irrigation. Further fodder requirement for livestock will be reduced and pressure on the ranges will be decreased to stop their degradation and it will help for controlling desertification. The study falls under SUMAMAD scientific studies relating to the following key subjects.

- Improvement of dryland agriculture including rangelands and livestock, with biodiversity and sustainable use of natural resources as a minor component.
- Restoration/rehabilitation of degraded drylands including sustainable water conservation and harvesting practices.

Work Plan

The experiments on rangeland management and grazing systems will be carried out in the first three years. This part of the study will be completed in all respects by covering all steps, i.e. site selection, application of field treatments as per layout, data collection, data compilation, data analysis and report writing. The 2nd part of study, i.e. experiment-3 control of evaporation, will be carried out at the start of the 4th year and will be completed by the end of the 5th year covering all steps, field experimentation, data collection, compilation and report writing.

S.No.	Project Activities	Period (Years)				
		1	2	3	4	5
1	Rangeland development					
2	Grazing systems					
3	Evaporation control					

Work Plan for 1st Year

S.No.	Activities	1st Year (Months)											
		1	2	3	4	5	6	7	8	9	10	11	12
1	Site selection and surveys												
2	Fencing of the area												
3	Reseeding												
4	Irrigation												
5	Data collection												
6	Data analysis												

7	Report preparation												

Team Composition

S.No.	Name	Designation	Field Expertise	Experience (Years)
1	Dr. Muhammad Akram Kahlown, Chairman, PCRWR, Islamabad	National Coordinator (Team Leader)	Water Resources Management	32
2	Ch. Muhammad Akram, Chief Research (Desertification), PCRWR, Islamabad	Deputy Team Leader	Rainwater Harvesting Rangeland, Saline Agri. Desertification Control	30
3	Mr. Zamir Ahmed Soomro, Regional Director, PCRWR, Bahawalpur.	Senior Researcher	Water Resources Management and Desertification Control	15
4	Mr. Muhammad Tahir Saleem, ARO, PCRWR, Bahawalpur	Junior Researcher	Agronomy	10

Role in the project

S.No.	Name	Role in Project
1	Dr. Muhammad Akram Kahlown, Chairman, PCRWR	Overall guidance as per SUMAMAD instructions.
2	Ch. Muhammad Akram, Chief Research (Desertification)	• To develop concepts of research proposals considering needs and necessity of the local people and project site beneficial to project site to uplift the socio-economic conditions of the area. • To plan, design and write up the research proposals to be submitted to the SUMAMAD. • To prepare layout of the proposals to be implemented in the field and list out parameters to be recorded during the period of study. • To provide guidance to the research team for collection of data and process the same to be reportable in the final report. • To finalize research data of the study to be incorporated in the report. • To write up report about the research results obtained from project study.

		• To prepare technical paper from the study report to be presented in the SUMAMAD seminars by the National Coordinator.
3	Mr. Zamir Ahmed Soomro, Regional Director, PCRWR, Bahawalpur.	Data collection and compilation
4	Mr. Muhammad Tahir Saleem, ARO, PCRWR, Bahawalpur	Field data collection

Estimated Budget for 5 Years

S.No.	Particulars	Estimated Costs (in US$)
1	Fencing material and its installation	10,000
2	Reseeding of ranges	15,000
3	Irrigation system installation	15,000
4	Excavation small pits and material for seepage and evaporation control.	15,000
5	Transport charges	5,000
6	TA/DA of technical experts	15,000
7	POL for irrigation system	5,000
8	Stationary, Laptop and contingencies	10,000
9	Seminars	20,000
	Total	**110,000**

Expenditure from local sources for 5 years

S.No.	Item	Estimated costs (in US$)
1	Deep tubewell installation	30,000
2	Fencing material and installation	20,000
3	Filed staff salary	50,000
4	Reseeding of ranges	20,000
5	Excavation of pits and seepage + evaporation control materials	20,000
6	Miscellaneous	10,000
	Total	**150,000**

Counterpart contribution per year (in US Dollars):

	2009	2010	2011	2012	2013	Total
SUMAMAD Member State	30,000	30,000	30,000	30,000	30,000	150,000