

A BRIEF REVIEW OF
I-WATERSHED AND HILL TORRENT MANAGEMENT
IN
DG KHAN REGION, SULAIMAN RANGE:
&
II - WATER USE EFFICIENCY OF LOCAL TREE
SPECIES IN ARID CLIMATE


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History of Rod Kohi System

- Rodkohi system records back to history 330BC,
- Also the forces of Alexander the Great marched in Suleiman Piedmont [Anonymous, 2001]
- Scientific Studies and Records [not much organized database available]

Background of SW Region of Punjab:

Mithawan Watershed Management Project

- Annual rainfall 200-300 mm,
 - **Ephemeral flashfloods in 200 hill torrent creeks originating from Suleman Range**
 - Steep Slopes, traditional agriculture & grazing, with complete removal of trees,
 - Sheet, rill and gully erosion, with havoc in downstream areas
 - Low living standard of local residents [poverty and illiteracy]
 - There is scope of conservation measures
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Catchments, Basin Area & Runoff Studies

- Hill Torrents Encompass 65% of Total area in Pak.
- Potential command area in Pachad 0.41 m ha. Spate Irrigation in Pakistan covers 1.5 m ha. [Nawaz & Han, Unpublished].
- Perennial [Kalapani in Jampur] and non-perennial hill torrents [Vehoa, Sangarh, Kaha]
- Available Discharge of perennial stream; 20-30 L per 100 ha. @ rotation of every 7-10 days. [Anonymous, 2001]
- Note: there is need to prepare a map of the catchments



Soil Physical and Chemical Characteristics, Productivity & Bioeconomics

- From Base of Sulaiman Mountains to Indus River, year after year deposits of clay & gravel/ pebbles are found in [Pachads], some rich loams with gentle slopes [Anonymous, 2001]
- No reliable data is available on soil chemical properties, C-pool etc.
- Crop yields [Kg/acre] are low; [Wheat 360], [Sorghum, 298], [oilseeds 204]




Physiographic Features in D.G. Khan Division

- ✦ Poor OM, Hard clayey infertile soils,
- ✦ Extreme Weather conditions [Scorching hot summer & severe cool dry winter]
- ✦ Ground Water Hydrology in DG Khan has not been monitored and discharge is more than recharge, with poor drainage and high pan evaporation
- ✦ Mutt on soil surface reduces infiltration

Inventories of Flora and Fauna

- Perennial grasses, rice, wheat, vegetables, dates, oilseeds, cotton, water melon, and fruit trees
- Punjab Wildlife Department may have some data on Fauna and Wildlife species,
- **but no organized national scientific database system is available.**

FAQs

- ◆ Sustainability of Ecosystem- How Long?
 - ◆ Alternative Land Uses
 - ◆ Water balance of the ecosystem w/o forest cover?
 - ◆ Changing land use pattern and associated problems of erosion, salinity and nutrients rundown/ quality of runoff?
 - ◆ Can cropping and grazing w/o trees be managed sustainably with minimal site impacts
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- A stylized, dark teal silhouette of a mountain range is positioned in the bottom right corner of the slide, partially overlapping the bottom edge of the text area.

ISSUES

No data of total rainfall, its distribution,

Torrential Sporadic Rains, Hard Clayey Soils, High Radiation and Temperature, Poor Drainage, Little Recharge, Deep Groundwater, Sparse Vegetation, overgrazing, Policy issues

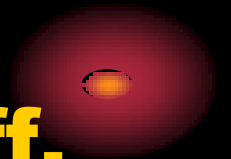
- **Implications: on Productivity, Hydrology and Water Quality not monitored regularly**
- **On site research studies, involvement of target groups, and continuity of policies are negligible**
- **Ignorance/ irresponsible to any state law, illiteracy and poverty, and concentration of wealth in the hands of few people is leading the masses towards terrorism in South Punjab even in whole country**

Gravity of Problems

- **Government plays nominal role to control water in hill torrent area**
- **Lack of Funds for conserving Hill torrent water and soil conservation practices**
- **Water is distributed on 'first come first served' principle.**
- **Water rights controlled by users only; Social and political conflicts by left, right and upstream, downstream users**
- **Quiet low Precipitation 100-300 mm**
- **Unpredictable Flash floods; 67000 cusec in Sanghar, Taunsa in 2004 and 80000-100000 cusecs in 2008, in Rajanpur.**
- **No headworks, weirs and storage basins for emergency floods, rather destroyed by users in Anambar (Bal.)**
- **Due to high amount of sediments and poor cover, storage is not viable**

Conserving Hill torrent water: Methodology

- **To develop a viable strategy we need to:**
- **Measure total rainfall**
- **Measurements of: total runoff, quantity used for water spreading, consumptive use, evaporation losses, groundwater recharge,**
- **Need to budget the demand and supply of water resources for various uses.**





Combining conservation and production at 'Moora Plains'



The 'Moora Plains' Biodiversity Stewardship project was negotiated in 2005 with the Lawrie family, with the contract signed in May 2006. The area covers 1000 ha, including 'Lagoon' and 'Runner' (see map). 'Runner' is somewhat of a new area, cleared most recently in 1995.

Biodiversity values include:

- Wetlands
- Elements of original riparian vegetation.

The management agreement allows for cattle grazing with a limit of 1500 kg/ha at the end of each dry season. The Lawrie family is in their rotational grazing scheme.



Fitzroy Basin Association's Biodiversity Stewardships:

- FBA recognises that managing land to improve biodiversity is a valuable use of land.
- Funding is available to landholders to encourage and reward conservation.
- FBA Stewardships do not involve a covenant on Land Title.
- Some landholders regard the FBA scheme as a 'wapping' arrangement with EPA (which involves a covenant on Title).

Stewardships target:

Results

'Lagoon' paddock



Sept 06



Oct 07



Sept 06



Oct 07

Management possibilities include:

- Grazing at levels that don't damage the environment.
- Using fire as a management tool.
- Controlling weeds and feral pests.
- Thinning vegetation to maintain or improve biodiversity.

How does it work?

1. Landholders are identified as part of the Priority Neighbourhood Conservation Program or sub-regional groups.
2. Biodiversity values are assessed (by field inspection and desktop research).
3. Proposals are negotiated with landholders, payments are calculated within limitations of FBAs funding agreements with Government.
4. Assessment/Approval is done by a panel (i.e. sub-regional group).
5. If approved, contract is drawn up and signed. A small number of photo-monitors are placed at end of each dry season when pasture or ground cover targets are met.
6. Payments are provided in accordance with the contract (typically an initial payment).

For Further Information:

Contact the Biodiversity Coordinator 4999 2811



CONSEQUENCES OF FOREST CLEARING IN WATERSHED REGION - A CASE STUDY IN AUSTRALIA

- ✦ **Reduction in wheat yield by 60% over 20 years**
- ✦ **Reduction in Pasture availability by 50% after 3 years**
- ✦ **Decline in cattle live-weight 4Kg/ha/yr over a period of 7-years**
- ✦ **Leaching of nutrients 60% in root zone 0-1.5m within 16 years**
- ✦ **Denser re-growth of suckers and invasion by weeds retarding grazing & cropping**
- ✦ **Reduced infiltration & Ground cover**

Source: Cowie *et al.* [Personal Communication].

Solutions of Problems



- Establishment of Pastures and Suitable Grass Species
- Improve drainage using soil chloride
- Target audience - Landholders, grazers, and general public? Is it here?
- Establishment of an autonomous National Catchments (or Soil) Conservation Authority and national level database system
- Recording data for total rainfall, frequency, distribution over area and 25-yrs, 50yrs, and 100-yrs peaks for better management
- A private national organization of Catchments Conservationists [OCC]
- Enhancing breadth & quality of returns by sharing other successful long term studies
- Studies on market forces to enhance profitability & resource condition





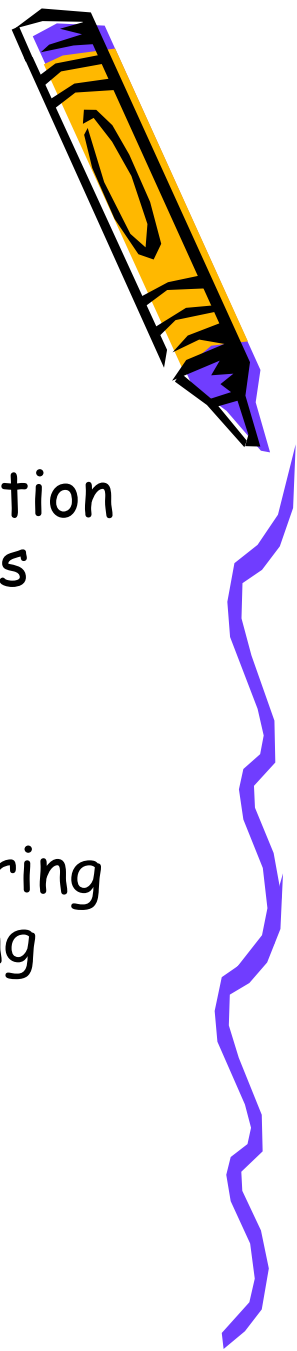
Solutions of Problems; continued

- Participatory Approach
- Free education at all levels [Primary to Graduate] with specialization in Forestry, Range and Watershed Management, stipends & free boarding of local people in other cities in Pakistan
- Special Emphasis on Women Education in Madrasas
- Social and Cultural Mobilization by "Think Tank" of the country
- Income generation Activities for locals





Solutions of Problems; continued



- Modeling such structures which ensure conveyance, diversion, distribution and application of water acceptable by all end users [PARC has done this to some extent]
- Storage is must otherwise we can not manage what is not there.
- Constructing silt retention ponds before entering into main reservoir which can be cleaned during dry period
- Applying sprinkler and drip irrigation system







Knowledge Gap

- Studies required on:
 - temporal & spatial salinity processes
 - Reduction in soil organic matter
 - Build up of pollutants in soil
 - Resource accounting
 - Production intensification & environmental protection
 - Seasonal and monthly flow data record





II- WATER USE EFFICIENCY OF LOCAL TREE SPECIES IN ARID CLIMATE

- ❑ Water demands for various uses exceed supply
 - ❑ Australian government & many others don't allow any exotic species into their borders
 - ❑ Water consumption by Eucalyptus is twice than Albizzia, and three times than that of Acacia and Azadirachta, which may lead to desertification and depletion of aquifer.
 - ❑ Transpiration coefficient [L Kg^{-1}] is lower than evaporation losses
 - ❑ Evaporation rate is high [75% of precipitation], so irrigation should be minimized during 8am -6 pm in summer
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Morphological Response of On-yr Old Different Hardwood Tree Species in Relation with WUE

Parameters	Acacia	Albizzia	Azadirachta	Dalbergia	Eucalyptus
Air-dry Wt (g) / plant	56	95	24	195	203
Amount of water applied [mm m ⁻²]	2369	2706	2267	-	3616
Pan evaporation [% of applied water]	66	58	69	-	44
Transpiration Coefficient [LKg ⁻¹]	1042	873	1951	119*	739
WUE [g L ⁻¹]	0.32	0.48	0.16	0.95	0.77

CONCLUSION

We need a committed and honest leadership, equity and justice and genetic shift for vision and wisdom at all levels

We need educating people in rodkahi areas and enforcement of law and order

- **whether we are focused on more C assimilation or more water conservation? Which priority is more challenging? We have to chose one**
- **There is also a need to focus more on minimizing C releases and using alternate energy resources rather than merely emphasizing vegetation as a C sinks at the cost of higher water use. Or**
- **We must increase water availability [storage] and its conservation practices**

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Thank you very much

