

LAND DEGRADATION WITHIN L. BARINGO - L. BOGORIA – KERIO VALLEY BASIN, RIFT VALLEY SYSTEM OF KENYA

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INTRODUCTION

- Land degradation refers to the decline in the productive capacity of an ecosystem due to processes induced by human activity
 - Processes: erosion, salinization, sodication, waterlogging, flooding, drought, sealing and crusting, compaction/pulverization, sedimentation and siltation
- reduce quality of surface and underground water

INTRODUCTIONCONT'D-

- soil and water mgnt strategies that reduce/protect land from these processes -> surface and underground water quality and quantity

-understanding interaction of Cl, PM/Geo, Topo, Org & T in soil formtn impornt in utiliz and mgnt land resources

INTRODUCTIONCNT'D

- ◆ setting guidelines to help in decision making for sustainable management of water and other land resources in the Rift System
- ◆ Leading to economic empowerment of inhabitants for resources (water, soils and vegetation) utilization and management

OBJECTIVE

To assess the type, causes, extent and distribution of land degradation within the L. Baringo-Bogoria-Kerio Valley Basin and recommend appropriate management intervention measures.

WORKING METHODS

Location and environmental characteristics

- ◆ Area located between Lat. $0^{\circ} 15'$ & $0^{\circ} 50'N$; long. $35^{\circ} 45'$ & $36^{\circ} 15'E$
- ◆ Covers ACZ II – V i.e semi-humid-semi-arid & r/E_0 0.25 – 0.65; low – high potential for plant growth; land use-agro-pastoralism; ACZ V covers most of the area

Data collection

- ◆ Collection of existing information & Field information eg erosion indicators
- ◆ Standard analytical lab methods
- ◆ Interpretation of field and lab data for land degradation

RESULTS

SOILS

- ◆ Mountains and major scarps - somewhat excessively drained to well drained, very shallow to very deep, dark red to strong brown, friable, stony and gravelly sandy loam to clay; (Humic Nitisols and Cambisols)
- ◆ Hills and minor scarps – somewhat excessively drained, very shallow to shallow, dark reddish brown, very stony, friable to firm, clay (Humic Cambisols)

- ◆ Footslopes- well drained, shallow to deep soils of varying colour and texture; in places rocky and stony (Eutric Regosols and Chromic Luvisols)
- ◆ Uplands - well drained, shallow to moderately deep, dark red to brown, friable sandy clay to clay (Humic Ferralsols, Haplic Luvisols and Calcaric Regosols)

RESULTSCNT'D

- ◆ Plateaus- well drained, moderately deep to deep, reddish brown to dark reddish brown, clay loam to clay (Eutric Fluvisols; Haplic Solonchak)
- ◆ Floodplains - well drained, moderately deep to very deep, dark reddish brown to brown, friable to firm, silt loam to clay: in places calcareous and cracking (Calcaric and Eutric Fluvisols, sodic and/or saline phase)

EROSION SUSCEPTIBILITY/HAZARD

Topography	Erosion Suscep	Erosion Hazard
Mountains	Moderate-high	Moderate
Hills	Moderate	Moderate
Footslopes	Moderate-high	Severe
Uplands	Low-high	Moderate-severe
Plateaus	Low-moderate	Moder-severe
Floodplains	Low to moderate	Moder-severe

SUSCEPTIBILITY TO SEALING AND CRUSTING

- ◆ All the soils indicate moderate to high susceptibility to surface sealing and crusting
- ◆ Weak-moderate, 2-10mm thick crusts observed on bare soils due to high Si/Cl, low SOM and high ESP in topsoils
- ◆ Use of the locally available and abundant livestock manure to improve structural stability and hence surface sealing & crusting recommended in addition to supplying plant nutrients

- ◆ Adherence to selective clearing when opening new areas for cultivation by conserving indigenous vegetation.
- ◆ Adoption of appropriate soil and water conservation practices (cultural and agronomic).
- ◆ Adoption of integrated land management incorporating agro-forestry necessary.

SILTATION/SEDIMENTATION

- ◆ Dispersed/eroded soil particles deposited on land, rivers, dams, water pans and lakes.
- ◆ Receding level of Lakes Bogoria & Baringo noted and alluvial deposits noted on shores.
- ◆ Brown colour of L. Baringo and R. Waseges an indicator of erosion from catchment area and deposition of sediments in the water.
- ◆ A belt of adaptable vegetation along shoreline needed to act as a sieving/filtering and buffering zone.
- ◆ *Prosopis Juliflora* (Mathenge) found to be effective in sediment trapping and sieving along L. Baringo

SOIL STRUCTURE DESTRUCTION

- ◆ **Compaction** leads to increased BD, reduced moisture holding capacity, conductivity and infiltration rates => increased runoff and erosion.
- ◆ **Puddling and pulverization** destroys topsoil structure.
- ◆ **Causes:** overstocking, vegetation depletion, use of heavy machinery, untimely tillage & pedogenic processes (natural)
- ◆ **Management:** Use of FYM, timely tillage/ploughing, deep tillage, proper carrying capacity and maintenance of good soil cover => improved soil productivity, quality and quantity of surface and groundwater.

NUTRIENTS DEPLETION AND SOIL ACIDIFICATION

- ◆ naturally occurs due to leaching of nutrients (Ca, Mg and K) leading to acidification and Al toxicity => ACZ II&III
- ◆ soils are strongly acid (pH 4.7) to strongly alkaline (pH 8.8)
- ◆ low pH soils indicate low %BS (<50%), CEC (<24 cmol/kg) and are deficient in N, P and K
- ◆ due to nutrients mining resulting from harvesting of crops and fodder.

- ◆ continuous planting with no rotation/fallow or reduced fallow
- ◆ no nutrients replenishment due to high costs of inorganic fertilizers.
- ◆ Limited use of FYM despite its availability.
- ◆ Use of inappropriate inorganic fertilizers.

SALINIZATION AND SODICATION

- ◆ Could be naturally occurring or human induced.
- ◆ Vulnerability high in ACZ IV & V on cultivated land under irrigated agriculture and on soils of floodplains with sodic and/or salic phases.
- ◆ Use of sodic/saline irrigation water; rise in saline/sodic groundwater level through seepage, overflow and over-irrigation.
- ◆ Occurring in Pekerra, Mukutan & Lobo irrigation Schemes due to use of saline and sodic water
- ◆ Use of gypsum & FYM; efficient application of water (avoid over-irrigation); deep ploughing

BIOLOGICAL DEGRADATION

- ◆ Controlled by climate, texture, lime, moisture & sodium content
- ◆ SOM decomptn governed by => microbial activity=>temp & moisture
- ◆ SOM decreases ACZ II-VVegtn clearing for cultivt, fuel wood , charcoal & overgrazing
- ◆ Colonization by *Juliflora prosopis*

CONCLUSIONS AND RECOMMENDATION

- ◆ Selective clearing to conserve indigenous vegetation
- ◆ Adoption of appropriate S&W conservation practices
- ◆ Use of FYM recommended and N fertilizers
- ◆ Deep ploughing necessary
- ◆ Maintenance of livestock carrying capacity important
- ◆ Res on use of Juliflora prosopis in reclamation of saline and sodic soils necessary

CONCLUSIONS AND RECOMMENDATIONS CNT'D

- ◆ integrated land Mangnt in the catcment is necessary
- ◆ Increased relationship between research-extension-stakeholders crucial and participatory
- ◆ Detailed work on trend of degradation in the basin important