1st ANNUAL LEADERS COURSE IN FLOOD BASED FARMING AND WATER HARVESTING

RWH Design for FBFS in the Drylands

ENGINEERS
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Part 1

Nexus between FBFS & RWH

Our Definitions of FBFS & RWH

Conventionally,
RWH is the intentional harnessing (capture, diversion & storage) of precipitation / runoff water mostly for future all round applications.

FBFS is the intentional harnessing (capture, diversion & storage) of runoff water for immediate agricultural based application

FBFS & RWH Continuum

RWH

Pre-conveyance	Storage	Abstraction	Post-conveyance	Application
Waterways Mitre drains Silt traps	In structural reservoirs	By pump	Using irrigation infrastructure	Via plant growth

FBFS

Pre-conveyance	Storage	Post-conveyance	Abstraction	Application
Waterways Diversion drains Silt traps	In the soil	Osmotic root pressures via soil voids	By plant roots	Via plant growth

Comparison between FBFS & RWH_{cv}

- **Components:** Both have similar components
- **Blue-Green water fluxes:** RWH_{cv} uses blue and green waters while FBFS mainly uses green waters.
- **Technocracy:** RWH_{cv} has distinct components and thus more technocratic than FBFS whose components are all fused within one platform.
- **Catchment/command area size:** FBFS deals in large catchments and command areas as cf'd to conventional RWH_{cv}.
- **Challenges.** The technical, policy & implementation challenges are massive in FBFS cf'd to conventional RWH_{cv}.

So…

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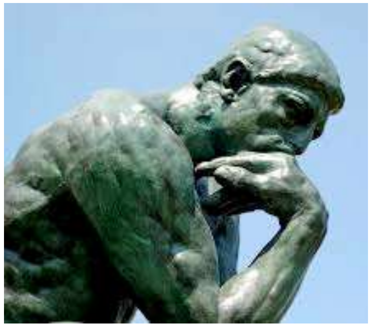
what would FBFS Leaders be thinking about

in respect to RWH designs?

FBFS CUM RWH DESIGN CONTEXTS



Areas of Concern
For an FBFS/RWH Leader

- The biophysical contexts
- The socio-economic contexts
- The policy & managerial contexts
- The customary, cultural & religious contexts

Biophysical contexts

- Rainwater partitions
- Topography & related features
  - DEM
  - Slope
  - Catchments/watersheds
- Temperature & evaporation
- Vegetation cover

Socio-economic contexts

- Poverty indices
- Demography
- Literacy levels

The policy & managerial contexts

The customary, cultural & religious contexts

The ICRAF-UNEP

Options by Context Tool for the Design of RWH in FBFS

Use & benefits of the (OxC) tool

- Precise siting & mapping of components
- Quantification of hotspots (denudation)
- Quantification of resources & green spots (areas with good productive potential)

OxC vs Conventional Approach

O x C Design Process	Conventional Design Process
Inclusive from the onset	Multiple disciplines working in Isolation
Multi-criterion approach	Uni-criterion linear approach
Seeks synergies	Diminished opportunities for synergies
Decision influenced by broad team	Decision influenced by isolated teams
Less time consuming	More time consuming
More cost effective	Expensive venture
Higher precision esp. if geo-spatial based	Often less precise

The OxC Process Using Engineering in GIS Environment

- Have a visioning consultative meetings with partners, stakeholders & beneficiaries
- Agree on priority outcome (e.g. attainment of food security)
- Identify and list down a menu of technologies and enterprises required to meet the outcome.
- For each of the technologies or enterprises, list and highlight on the parameters (Contexts) (See examples in the tables below).

RWH technological options for FBFS:

Macro-catchment criteria

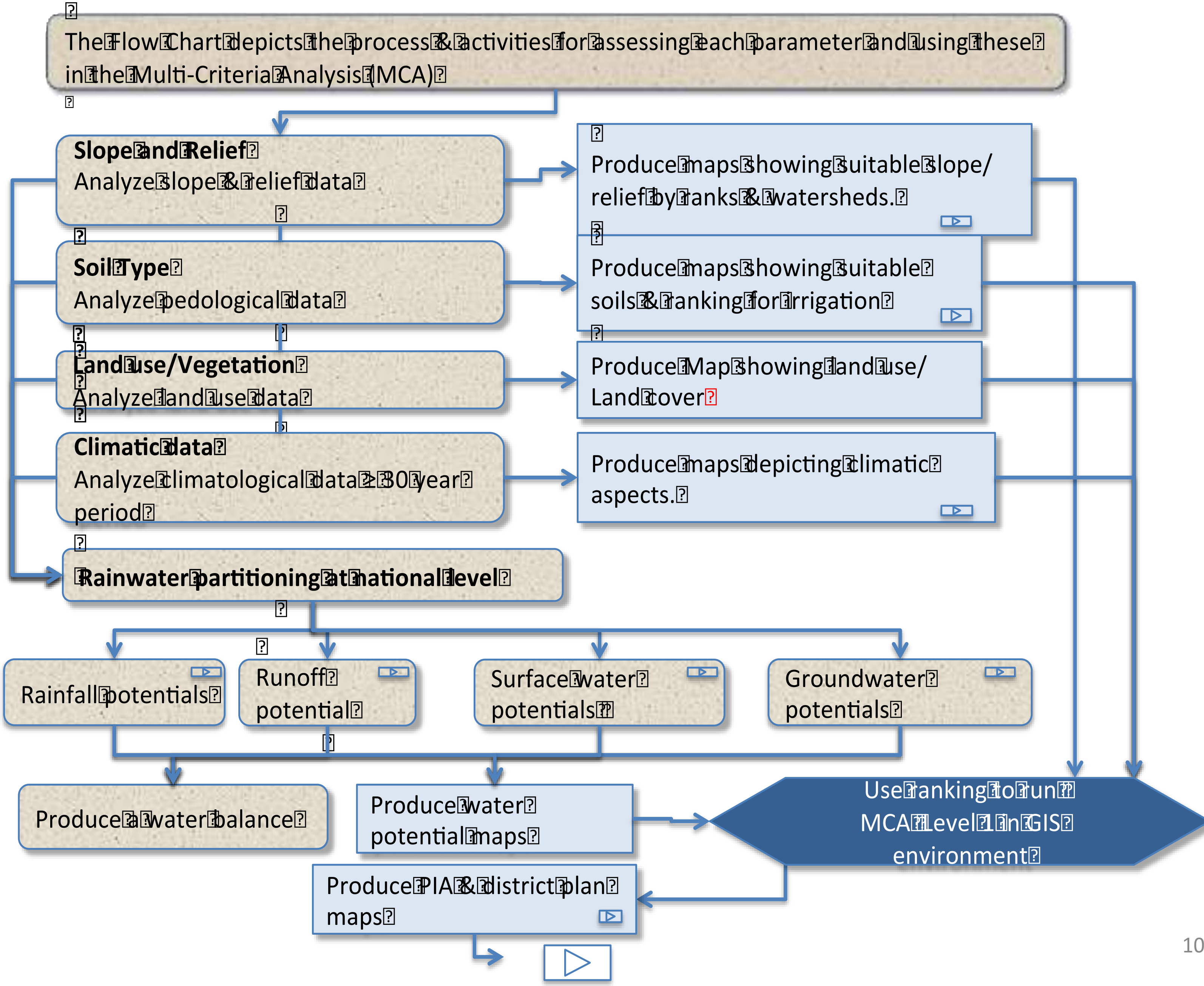
RWH intervention	Rainfall (mm per annum)	Soils	Slopes	Topography	Main Uses
Trapezoidal bunds	250 - 500	Agricultural soils with good constructional properties	0.25% - 1.5%, but most suitable below 0.5%	Even	Crops
Contour stone bunds	200 - 750	Agricultural soils	< 2%	Need not be completely even	Crops
Permeable rock dams	200 -750	All agricultural soils	< 2%	Wide, shallow valley beds	Crops
Water spreading bunds	99 - 350	Alluvial fans or floodplains with deep fertile soils	<= 1%	Even	Crops & rangeland
Cascading Retention/ infiltration ditches	> 150	>0.5 m deep	>5 to 40%	Need not be even	Crops & rangeland

RWH technological options for FBFS:

Micro-catchment criteria

RWH intervention	Rainfall (mm per annum)	Soils	Slopes	Topography	Main Uses
Negarim	≥ 150	>1.5 m -2 m deep	0 ≤ 5.0%	Need not be even	Trees & grass
Contour soil bunds	≥ 200	>1.5 m -2 m deep	0 – 40%	Even	Trees & grass
Semi circular bunds	200 - 750	All soils which are not too shallow or saline	5 – 10 %,	Even	Crops; pasture & fodder (also trees)
Oduorims	200 - 750	All soils which are not too shallow or saline	< 2%, modified bund up to *5%*	Even	Crops; pasture & fodder (also trees)
Contour ridges/trenches	349 - 750	All soils which are suitable for agriculture	0< =5.0%	Even	Crops, pasture; Trees
Zai pits	200 -750	Agricultural soils	0 < 2%	Even	Crops (can be done in between soil /stone bunds)
Retention/ infiltration ditches/ Fanya Chini	> 150	> 0.5 m deep	> 5 to 40%	Need not be even	Crops & pasture
Terraces	> 350	>1 m deep	> 5 to 40%	Need not be even	Crops; pasture & fodder (also trees)
Conservation Tillage	> 350	> 0.5 m deep	0 < 40%	Need not be even	Crops; rangeland & fodder (also trees)

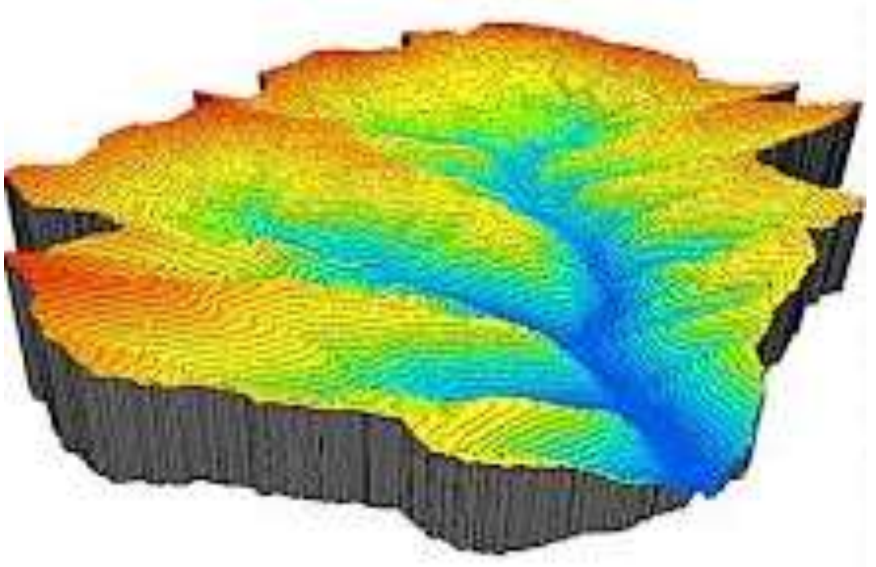
OxC FLOW CHART FOR MCA



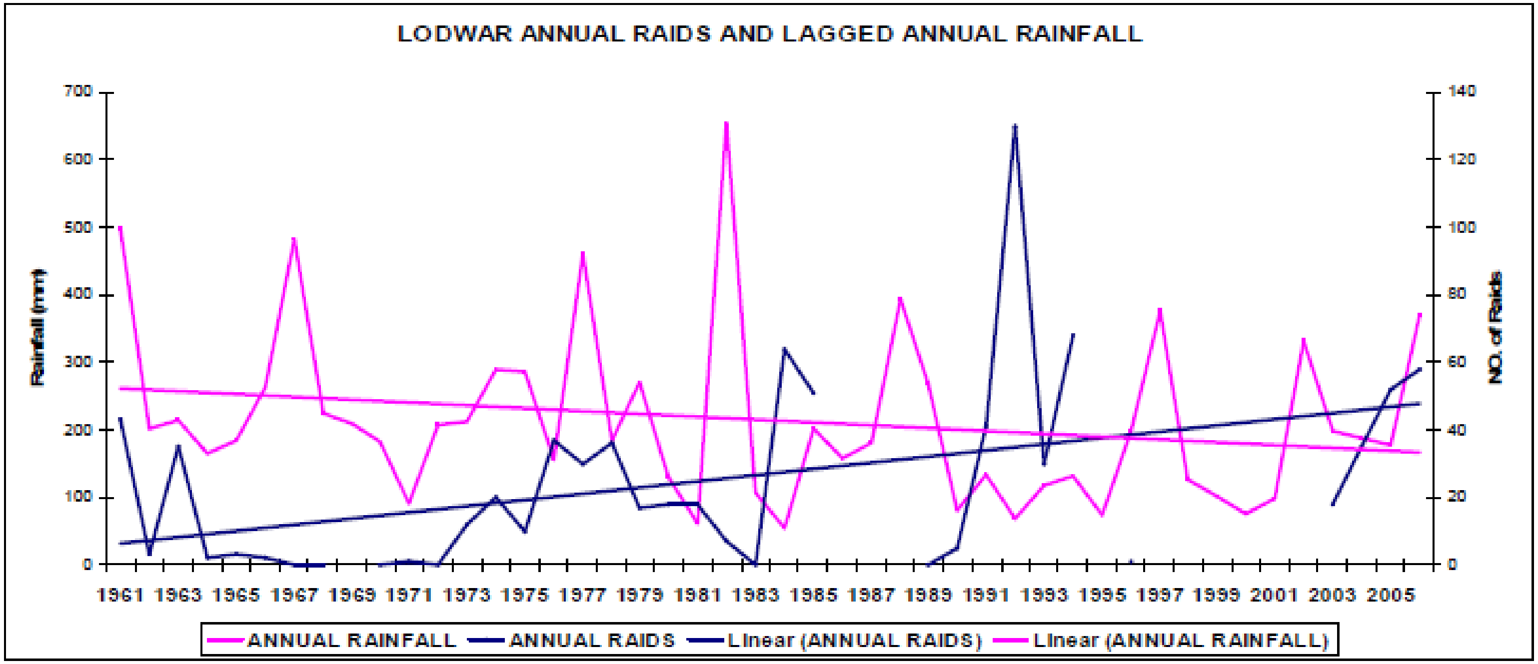
Part 2

Example of Products from
Singular criterion analysis & MCA

The case of Turkana County



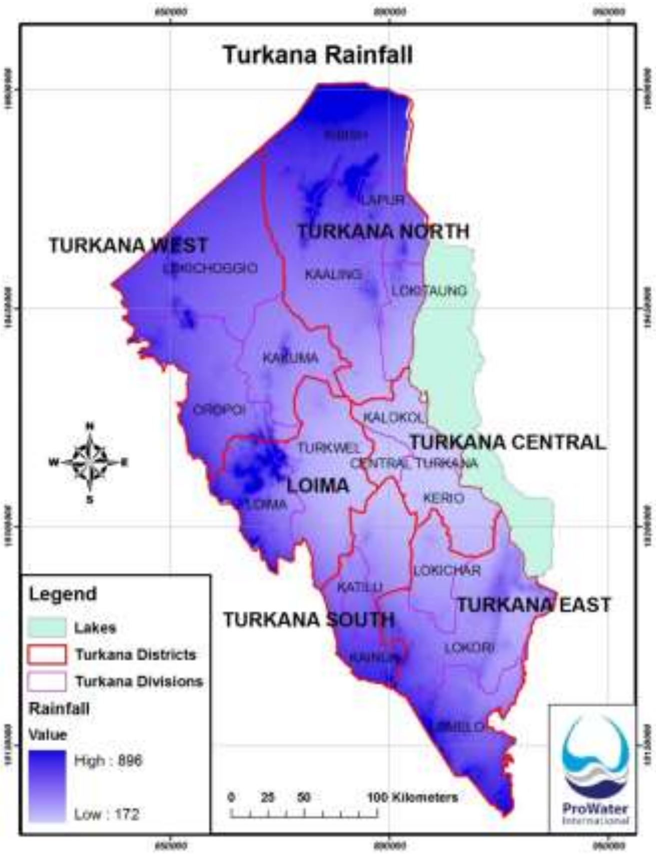
Rainwater Resources

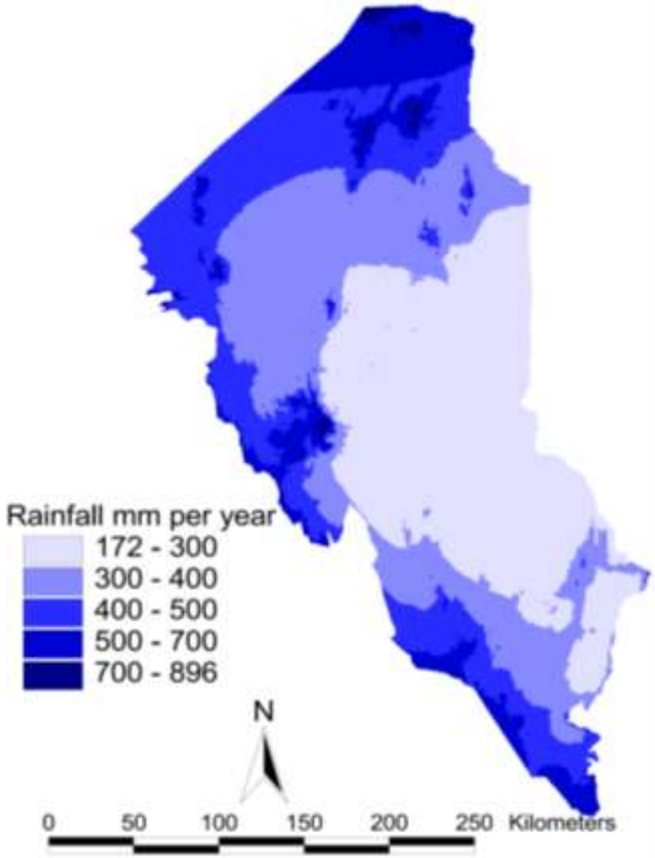


Rainfall contributes 24 Billion m^3 (24 km^3) of water into Turkana
However, this has been on a decline, depicting rising resource conflict

In 1962, annual average rainfall was 250mm with 15 conflicts
In 2012 (Half a century lator, average annual rainfall had decreased to 200mm with > 50 number of raids.

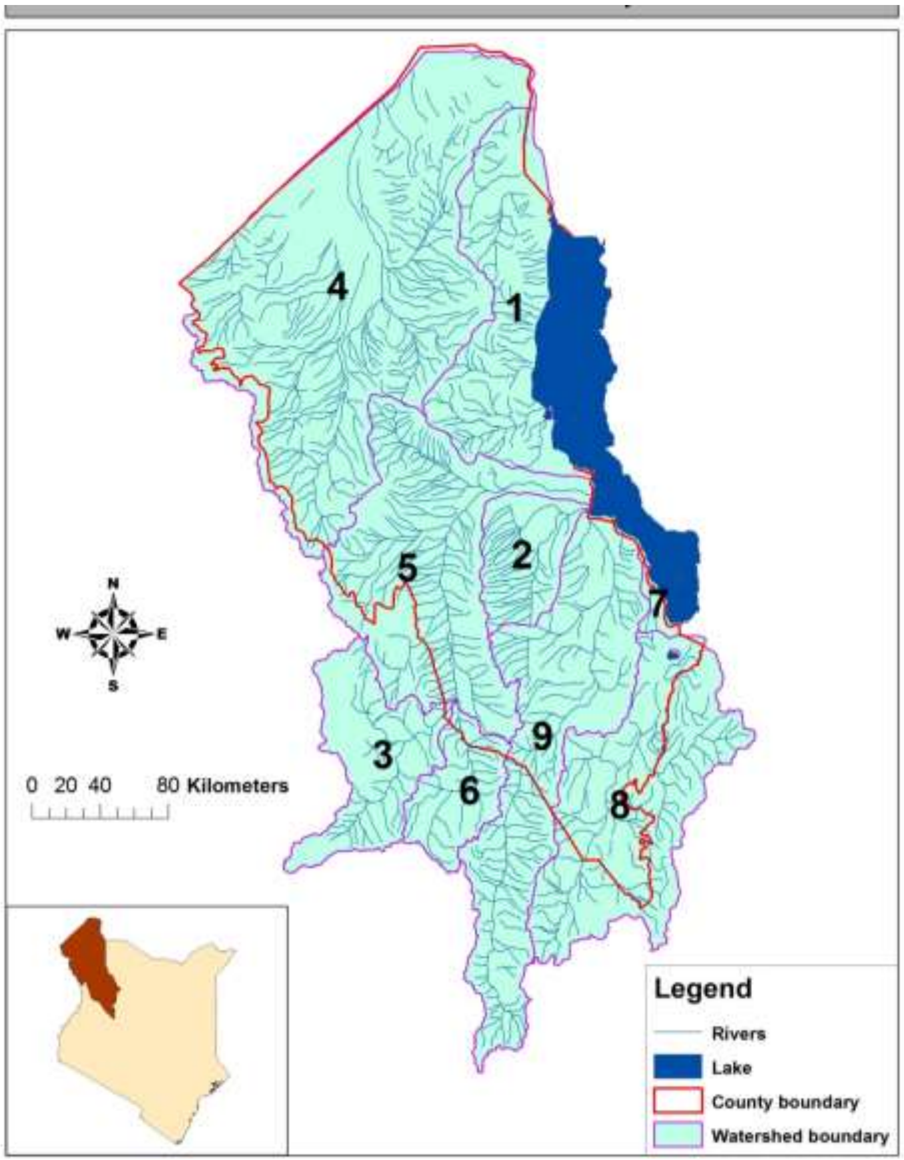
Mean annual rainfall





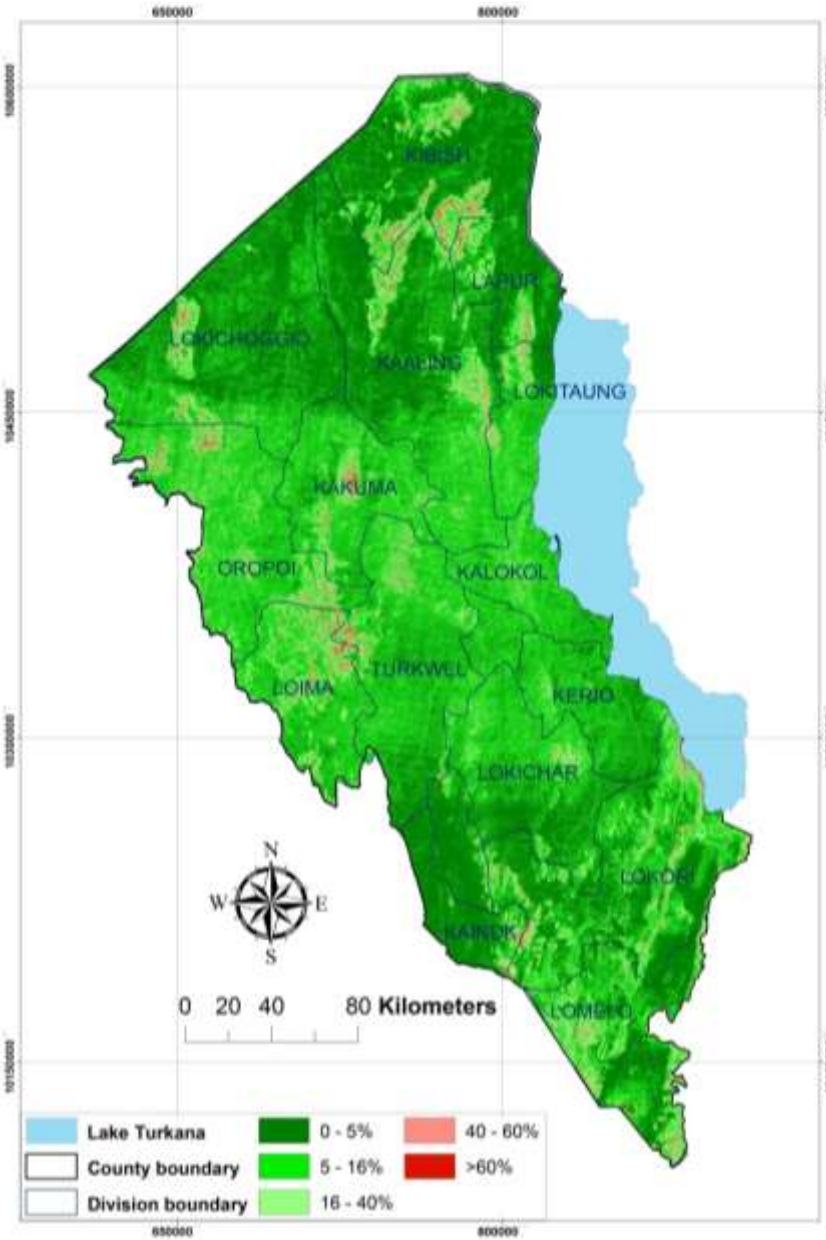
- Bimodal
- Mean annual rainfall 263mm
- Intra-annual variation >50%
- The drier the area the more unreliable it is.
- Rainfall Influences livestock movement and cattle rustling hotspots

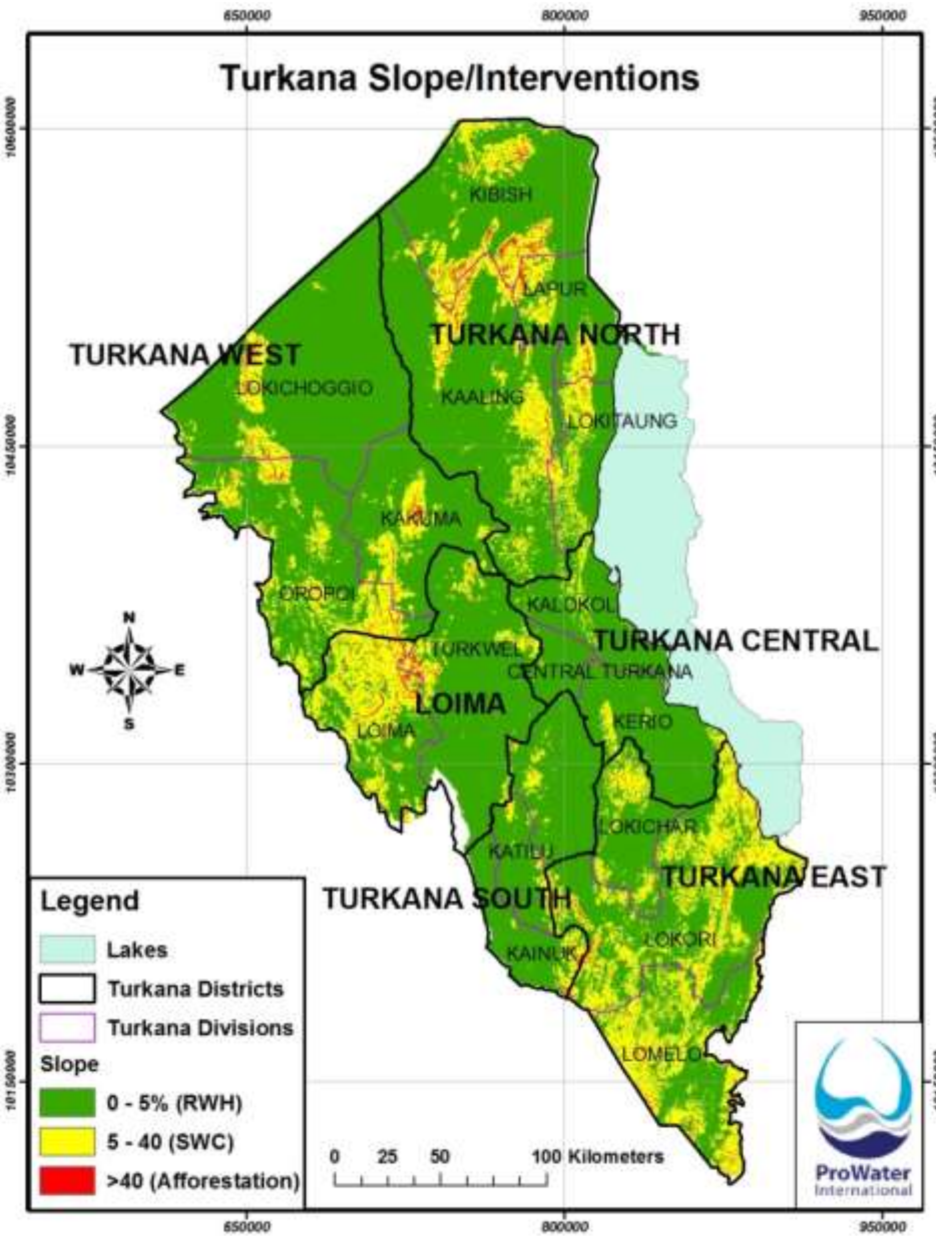
Runoff Potential at watershed level



Sub-Basin	Area (Km^2)	Potential Runoff (Mm^3)
1	10,035	527
2	3,599	121
3	6,065	1,006
4	29,833	2,261
5	14,284	961
6	3,429	608
7	543	27
8	13,205	1,197
9	14,137	1,465
Total	**95,129**	**8,172**

Linking Slope factor to Soil & Water Based Interventions





% Slope	Base bund (m)	Wing Length (m)	Distance between tips (m)	Earth work per bund (m^3)	Cultivated area per bund	
					(m^2)	Acres
0.5	40	114	200	355	9600	2.4
1.0	40	57	120	220	3200	0.8
1.5	40	38	94	175	1800	0.4

Trapezoidal bunds in

Trapezoidal bunds in Turkana

Community participating in the construction of a Trapezoidal bund

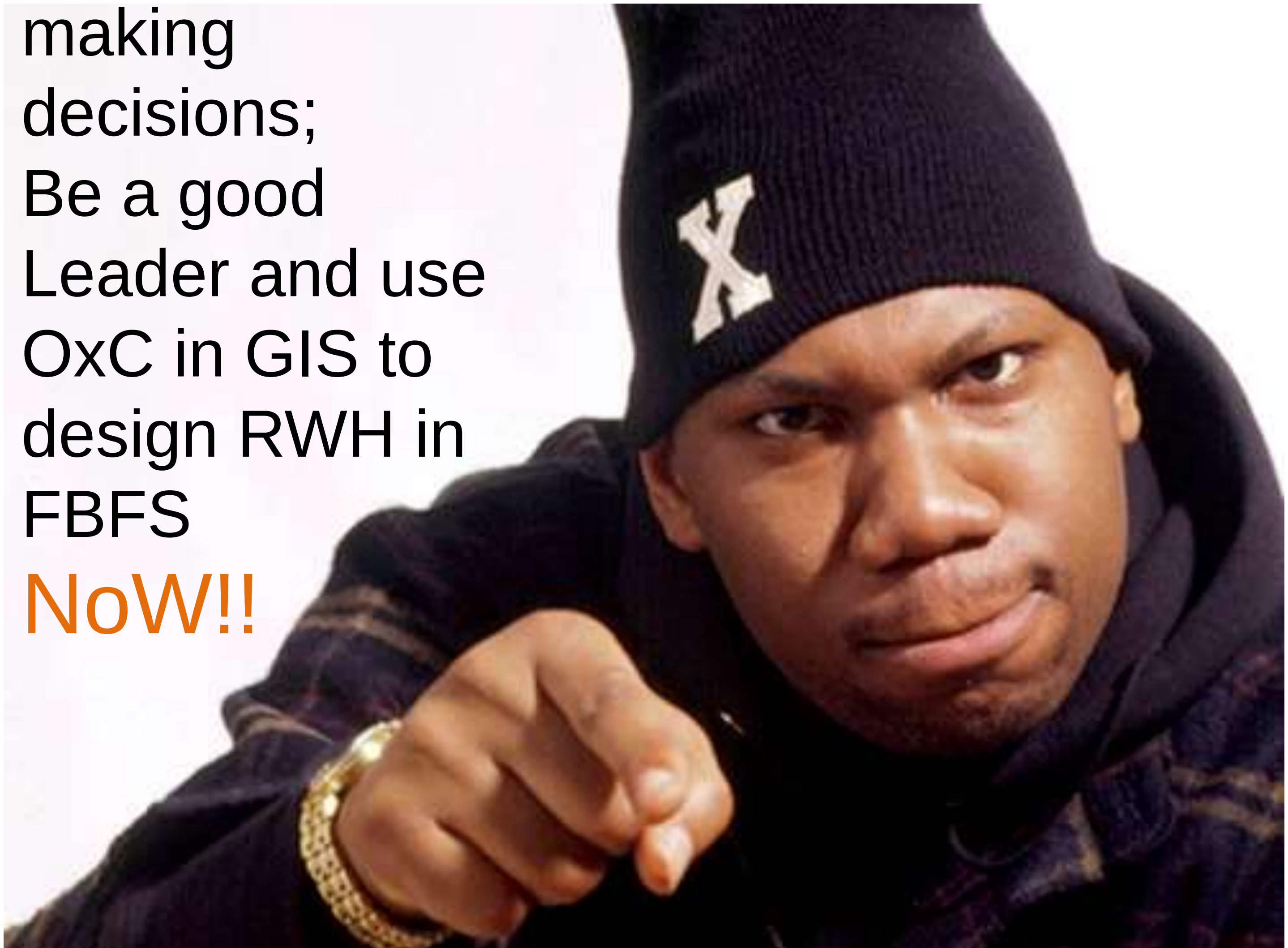
Trapezoidal bunds in

Trapezoidal bunds in Turkana

Machinery constructed TBs

Thanx for your attention

Don’t fret in making decisions;
Be a good Leader and use OxC in GIS to design RWH in FBFS
NoW!!



Conclusion

We told you our design story

Tell us yours…

The.....End