Schematic used to represent Hallouf watershed in WEPP: including hillslopes and stream channels

	Runoff Volume (m^3/year)	Sediment Yield (kg/year)
Gabion 3	9015.2	1277.3
Gabion 2	6682.8	159.1
Gabion 1	2798.8	43.0

Table 1: This table represents the annual runoff volume and sediment yield delivered to each Gabion

WEPP Design Process

Used to determine sediment loss and runoff for the watershed.

- Generated climate profile specific to Hallouf watershed area, including:
  - Storm events and cumulative rainfall between 1999 and 2002
  - Daily temperature data
  - Supplementary data from Tucson, Arizona
- Generated specific soil properties for each WEPP hillslope by method of weighted averages
  - Soil properties: % sand, silt, clay and rock,
  - 7 total soil layers represented in WEPP based on 6 different soil types and varying soil depths
- The 17 GIS-generated sub-basins are represented in WEPP by 14 hillslopes with specific soil composition, area and slope
- WEPP calculates:
  - the average annual sediment yield
  - the annual soil loss
  - and the annual volume of runoff

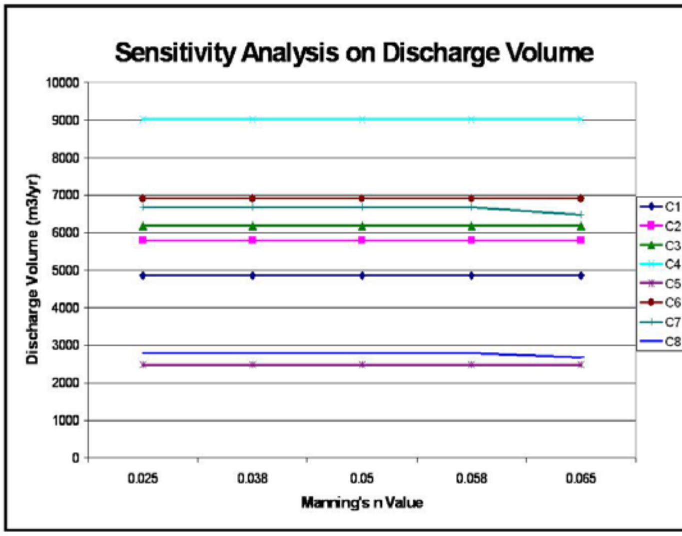
per hillslope and across the overall watershed

WEPP Results

- Gabions will collect the majority of runoff and sediments traveling with the stream
- Area including hillslopes H1-H8 and H12 upstream will be collected by Gabion 3
- Area between Gabions 2 and 3 including hillslopes H9-H10 and H13-H14 will be collected by Gabion 2
- Lastly, the area for hillslope H11 will be collected by Gabion 1 at the outlet

**see table 1 (above)

- A sensitivity analysis for WEPP was also performed to evaluate the effect of changing the manning's roughness coefficient of the channel on the sediment yield per channel
  - The graph to the right indicates the results- increasing the roughness coefficient has little effect on the overall results – there is minimal error associated with this input parameter



Economic Analysis

111.4 mm storm					
Gabion	Volume of water stored (m^3)	Total Time of Storage (hours)	Amount of Infiltrated Water (m^3)	Profit from one storm (DT)	Profit from one storm (US)
One	226.5	6.79	214.65	$ 70.42	$ 61.81
Two	271.9	6.24	259.96	$ 89.02	$ 77.62
Three	1365.3	10.57	1326.09	$ 526.67	$ 449.62
30 mm storm					
Gabion	Volume of water stored (m^3)	Total Time of Storage (hours)	Amount of Infiltrated Water (m^3)	Profit from one storm (DT)	Profit from one storm (US)
One	3.8	0.88	3.60	$ (16.21)	$ (11.83)
Two	11.9	1.31	11.38	$ (13.02)	$ (9.12)
Three	31.3	1.38	30.40	$ (5.21)	$ (2.48)

The chart above shows there considerable monetary benefit from the gabions with large storms, therefore reinforcing the necessity for the water harvesting structures in these regions.

Economic Analysis

- The two variables considered in the cost-benefit analysis are the following:
  - The economic value of water that was stored for increased infiltration upstream of the gabion
  - The cost of the gabion structure itself
- The cost of the gabion structure was calculated considering the cost of materials and the man-hours required to implement and maintain the structure.
- The value of the water was determined using the initial volume of water. With the volume of water lost to evaporation subtracted, the remaining water was said to be infiltrated. This infiltration volume was used to determine the monetary value of retained water.
- Based on the price of water and the calculated cost of the gabion, any storm that produces 43 cubic meters of infiltrated water per gabion will recharge enough ground water to equal the yearly cost of the gabions.

Acknowledgements:
International Coordinators:
Fethi Abdelli--Institue for Arid Regions(IRA)
Adriana Bruggeman—ICARDA
Mohamed Ouessar—IRA
Jim Frankenburger-USDA-NSERL

PURDUE UNIVERSITY
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ABE: Nicole Macaluso, Toni Trepanier
April 20, 2006

Technical Advisor- Dr. Rabi Mohtar
ABE 485 Coordinator - Dr. Klein Ileleji