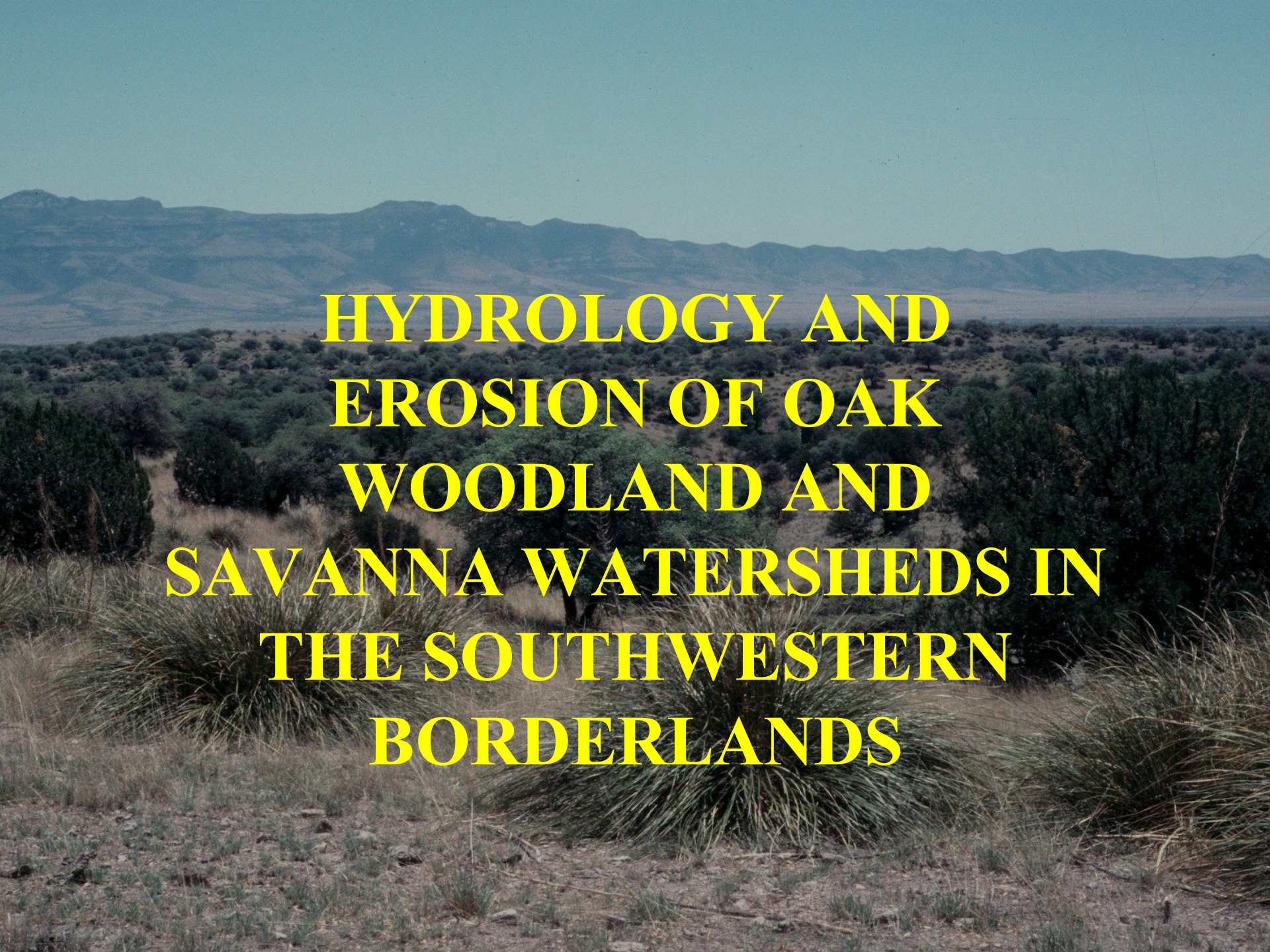

HYDROLOGY AND EROSION OF OAK WOODLAND AND SAVANNA WATERSHEDS IN THE SOUTHWESTERN BORDERLANDS


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OAK WOODLANDS
ARIZONA
TUCSON
SIERRA VISTA
PACIFIC OCEAN
GULF OF CALIF.
N
0
100km
OAK WOODLANDS
STUDY AREA

WATER BUDGET EQUATION

$$ET = P - Q - \Delta S - \Delta 1$$

Where:

ET = evapotranspiration (mm)

P = precipitation over time period (mm)

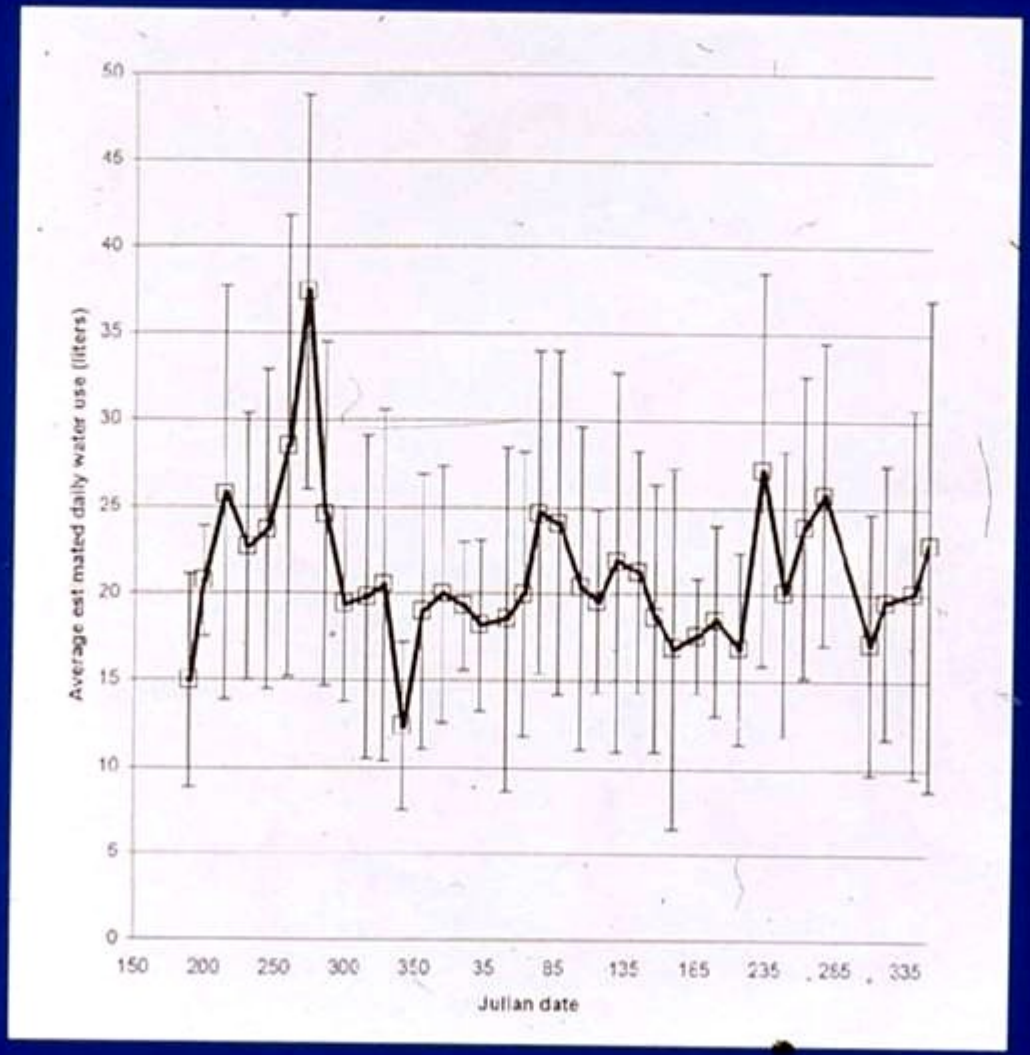
Q = streamflow (mm)

ΔS = change in the amount of storage in the watershed

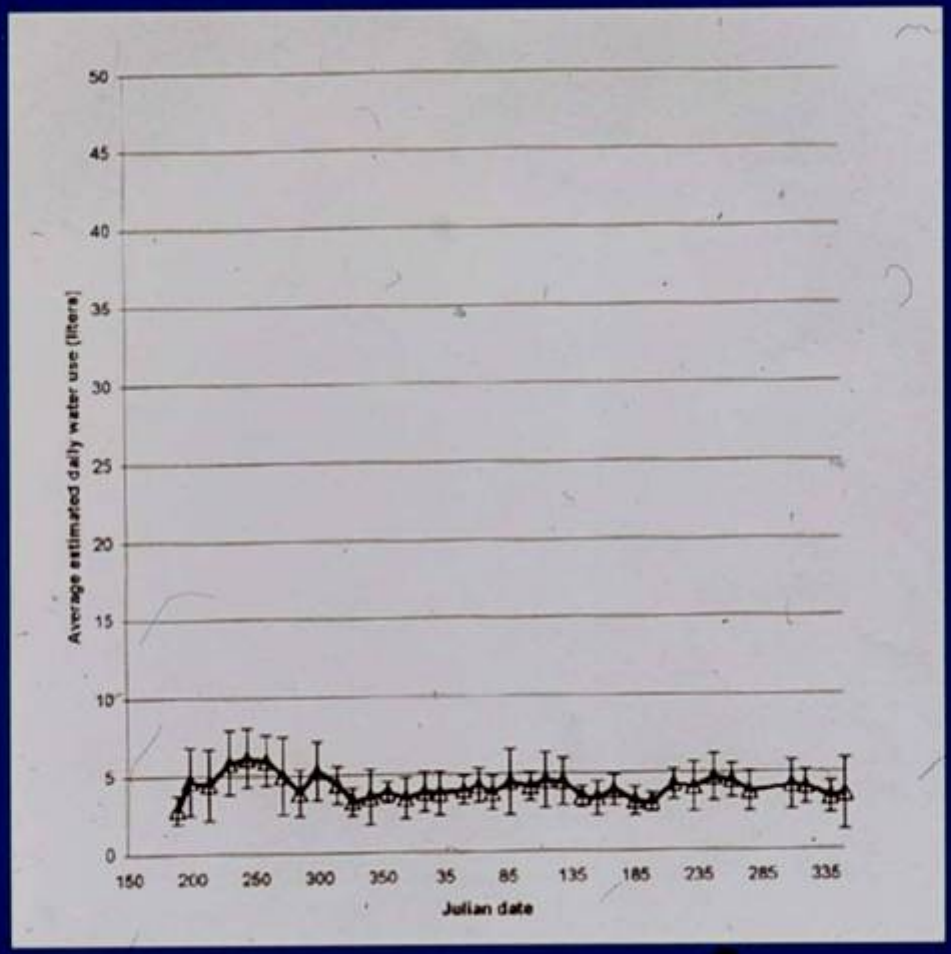
$\Delta 1$ = change in deep seepage


INTERCEPTION

Estimated daily water use of mature trees on the uncut area



Estimated daily water use of coppice on the cut area



ANNUAL WATER USE PER HECTARE BY EMORY OAK (*Quercus emoryi)* AT THE SAN RAFAEL VALLEY SITE IN SOUTHERN ARIZONA

Harvested Area:

Standards	2,310 m^3
Sprouts	858 m3
Total	3,168 m3

Unharvested Area:

Mature Trees	1,900 m3

ANNUAL TRANSPIRATON

	One Sprout	Two Sprouts	Three Sprouts	Control
Daily Annual Transpiration (L)	7.48 ± 0.31	17.7 ± 0.86	23.7 ± 1.12	35.3 ± 1.72
Total Stand Transpiration (mm/yr)	181	273	328	433
Annual Ppt. transpired (%)	33.5	50.5	60.7	80.2

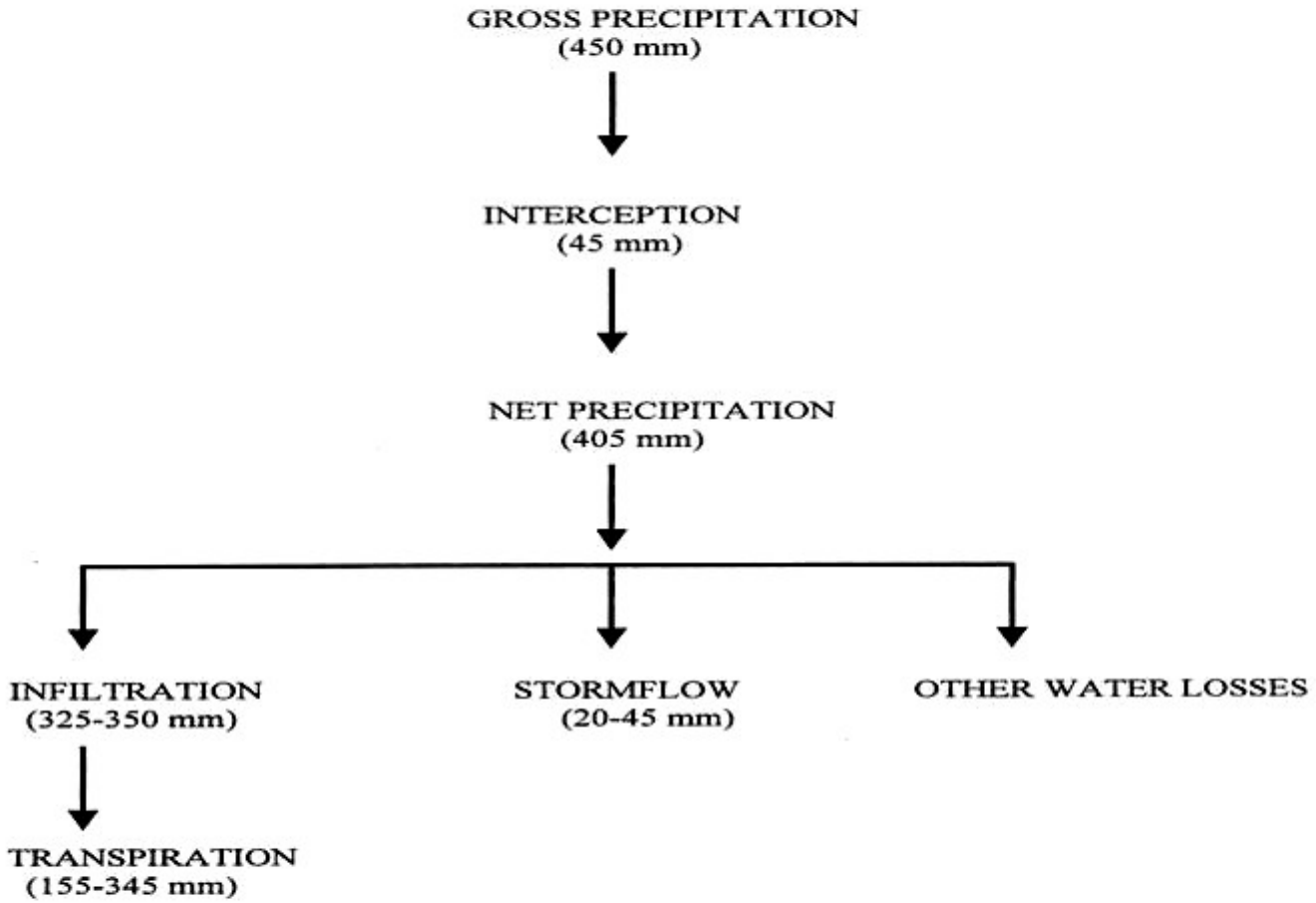
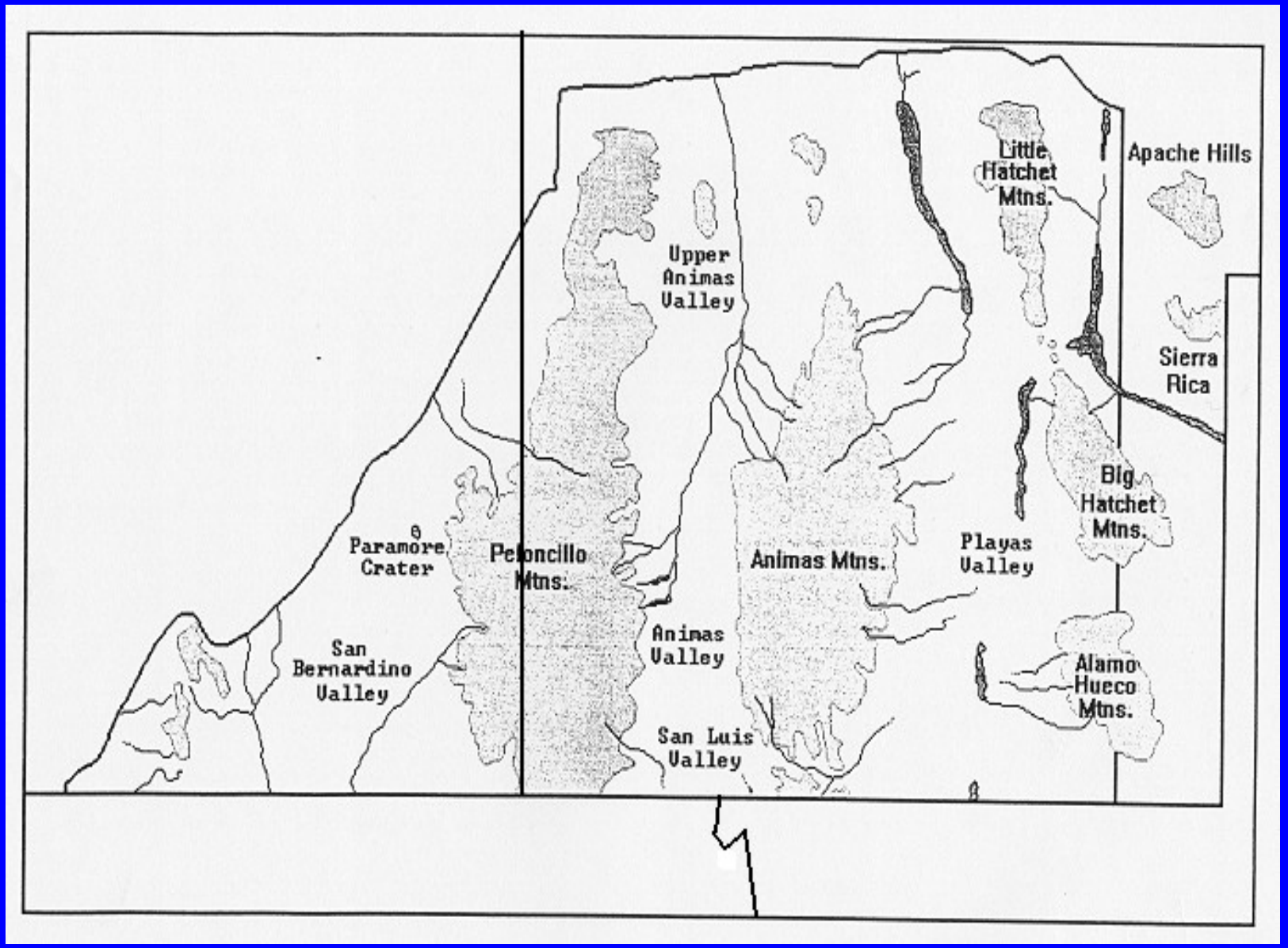
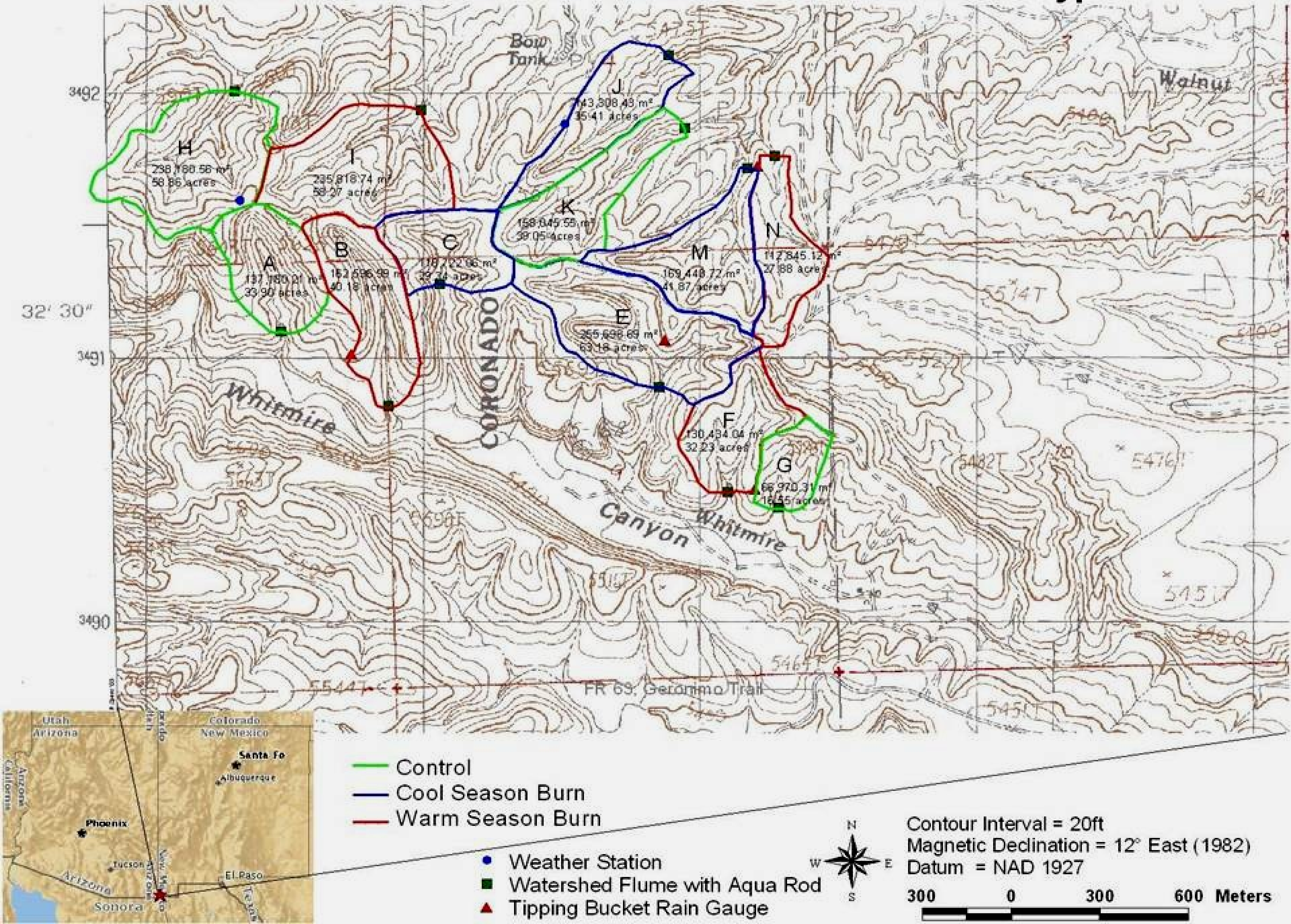


Figure 1. Annual water budget for selected management practices in the Emory oak woodlands of southeastern Arizona.

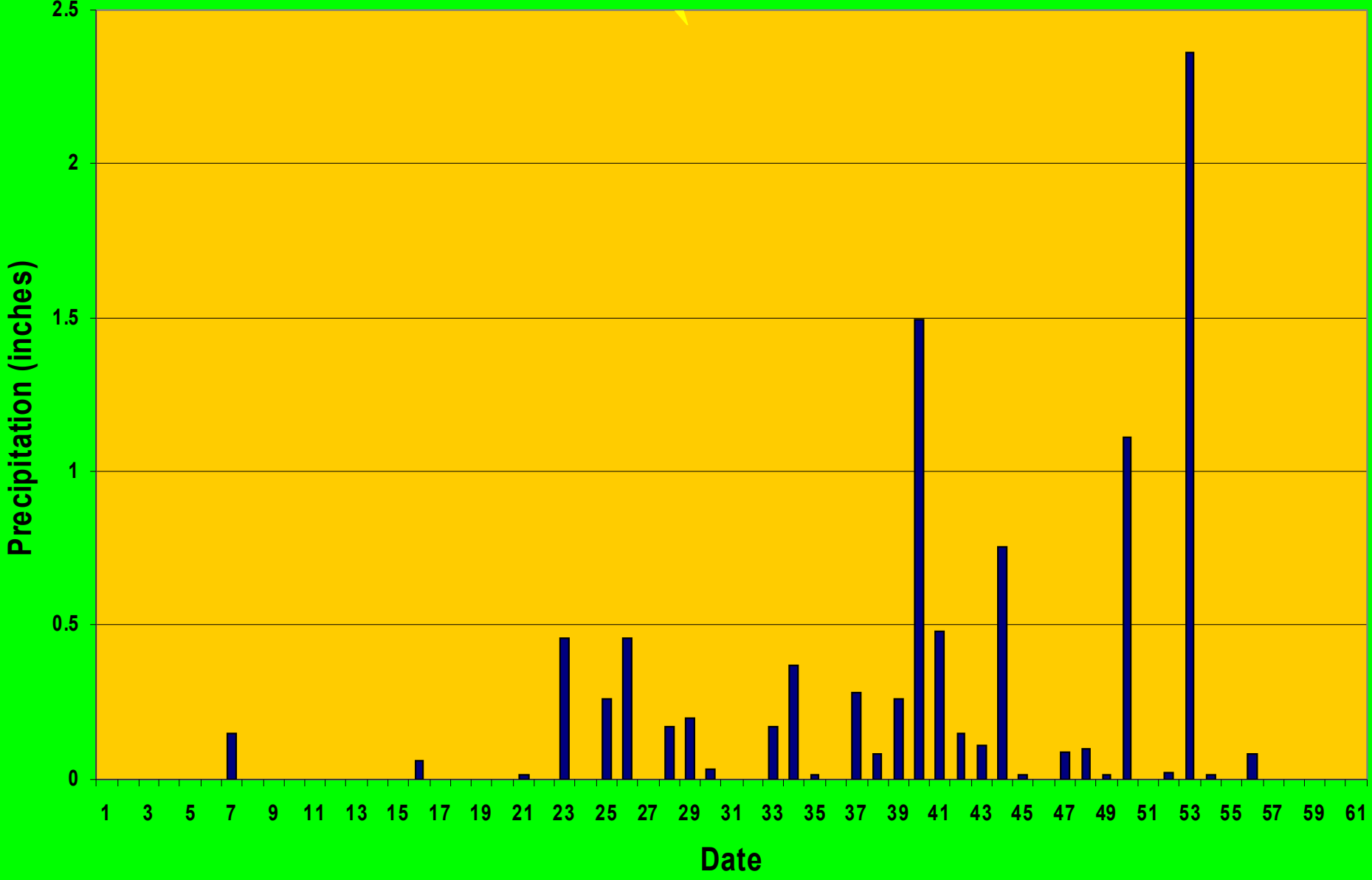
CASCABEL PROJECT AREA



Cascabel Ranch Watershed Boundaries and Treatment Types



Daily Precipitation HCascabel July-August 2005



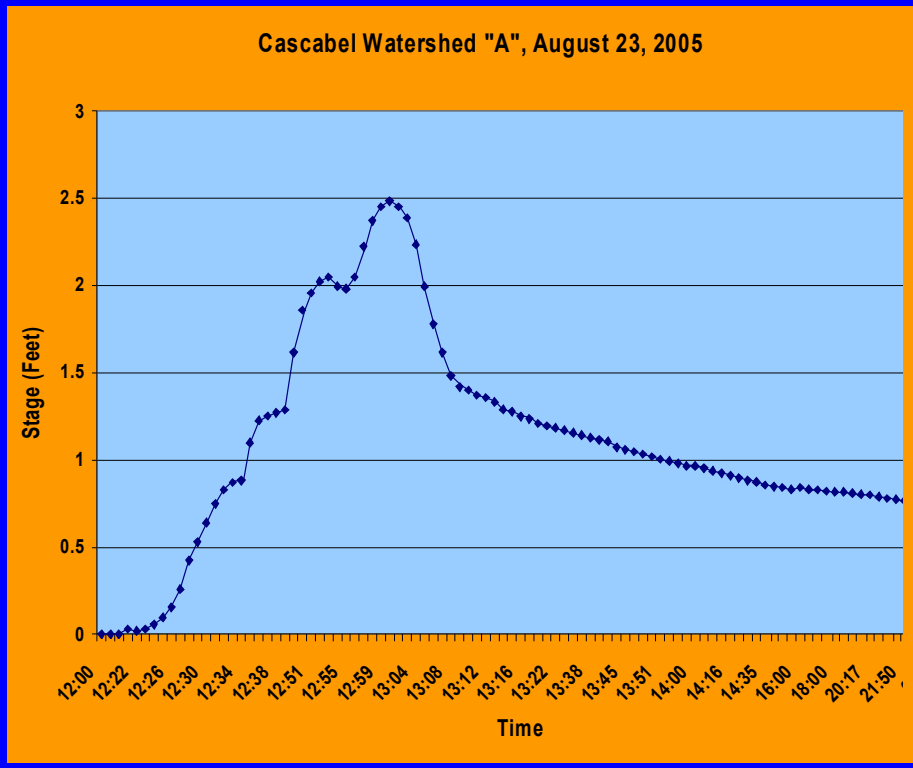
Precipitation on August 23, 2005

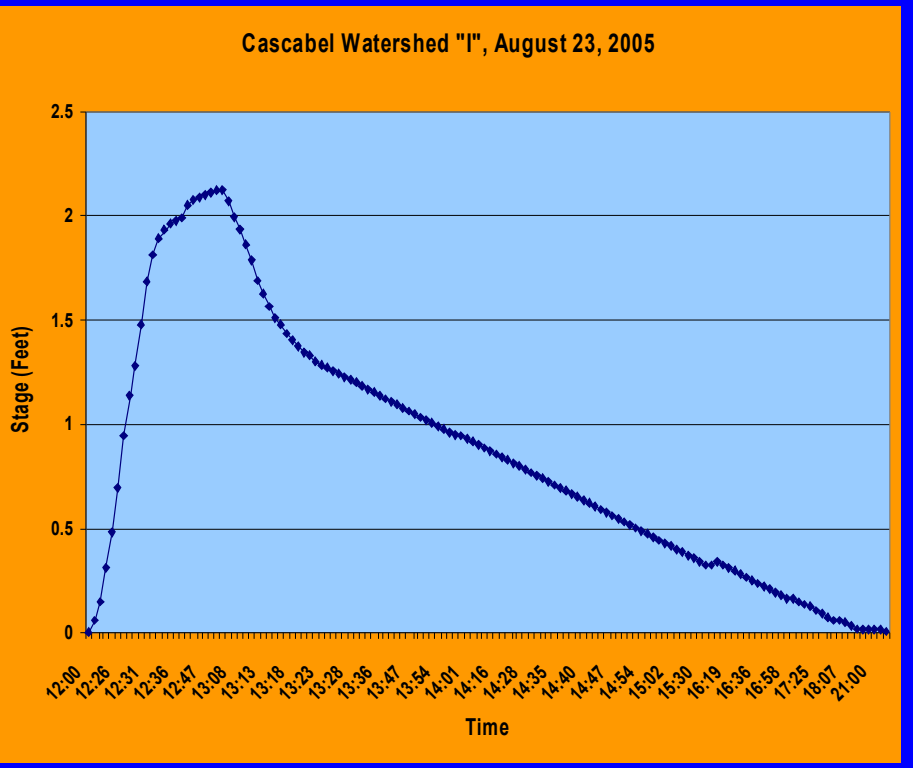
Station	Total ppt. (inches)	Start Time	End Time	Highest (in/hr)
HCascab	2.36	12:00	16:00	1.90
J2Cascab	2.33	12:00	16:00	1.93
A-B	2.64	12:01	15:44	2.94
E	2.03	12:12	15:52	2.24
F-G	1.36	12:09	15:49	1.52
I	2.99	12:06	15: 47	3.31
K	2.81	12:13	16:02	3.19
M-N	1.43	12:21	15:52	1.98

Preliminary Peak Storm Flows for August 23, 2005

South Watershed	Peak Flow (cfs)	North Watershed	Peak Flow (cfs)
A	67.2	H	76.8[C]
B	69.0 [C]	I	52.6
C	51.2	J2	61.9 [C]
E	59.8	K	67.9*
F	24.6	M	65.0
G	34.0	N	31.3

Hydrographs for Watersheds “A” and “I” on August 23, 2005



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SIDE-SLOPE EROSION

Water-shed	Spring 2005		Fall 2005	
	Tons/Ac	Ft^3 /Ac	Tons/Ac	Ft^3 /Ac
A	9.9 ± 1.2	281.8 ± 35.5	10.8 ± 1.2	306.2 ± 35.5
I	17.7 ± 2.3	502.2 ± 66.1	4.6 ± 1.0	131.0 ± 27.0

SEDIMENT BASIN MEASUREMENTS

Lower Basin Section of Watershed A

Aug. 2003 to Mar. 2005 52.2 ft^3

Mar. 2005 to Jan. 2006 190.0 ft^3

Entire Basin (2003-2006)

Watershed A 347.4 ft^3 4.4 ft^3/Ac/Yr

Watershed I 190.3 ft^3 1.7 ft^3/Ac/Yr

PERCENT DISTRIBUTION OF PEBBLE COUNTS

Class Name	Size (in)	WS "A"	WS "I"
Sand	<0.8	46.3	23.3
Gravels	0.08-2.5	33.3	61.8
Sm. Cobbles	2.5-5.0	6.5	7.5
Lg. Cobbles	5-10	9.9	1.5
Sm.Boulders	10-20	4.0	1.5
Med.Boulders	20-40	0	0
Lg.Boulders	40-80	0	0
V. Lg.Boulder	80-160	0	4.4

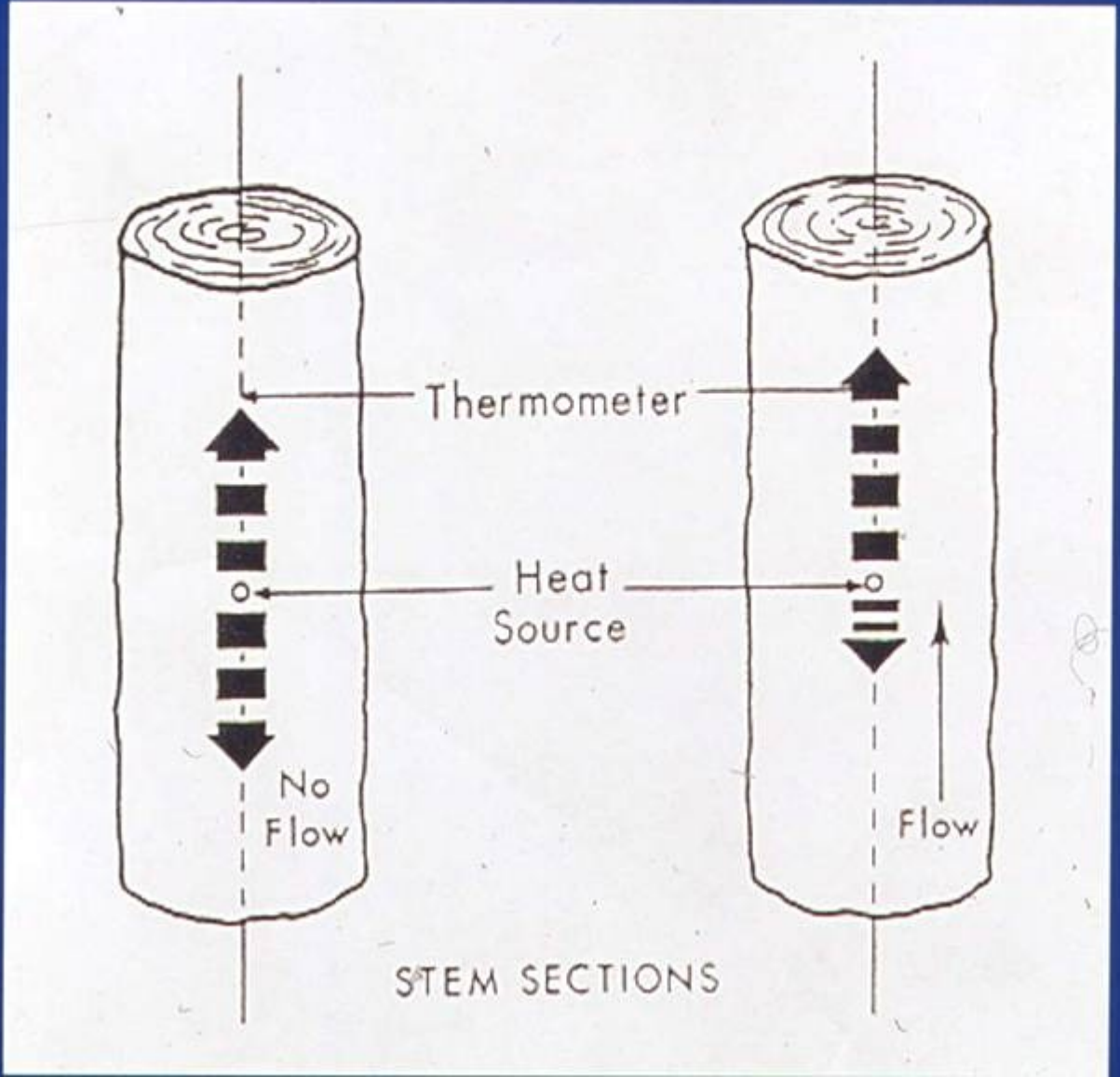
CHANNEL CHARACTERISTICS (%)

Characteristic	Watershed A	Watershed I
Rock	6.4	15.9
Fine Alluvium	24.7	3.0
Coarse Alluvium	62.4	74.0
Vegetation	4.6	6.4
Woody Debris	0.7	0.7
Other	1.2	0.0


THANK YOU


COOPERATORS
Rocky Mountain Research Station
Natural Resources Conservation Service
Coronado National Forest
The University of Arizona
Animas Foundation
Malpai Borderlands Group
Cascabel Ranch
Arid Lands Project

SAPFLOW VELOCITY METHOD



Sediment Collected at the Lower "A" Basin For Two Periods (ft^2)

Transect	Aug. 2003 Mar. 2005	Mar. 2005 Jan. 2006
0 + 00	- 0.6	+13.0
0 + 01	+ 4.9	+15.6
0 + 02	+ 4.4	+ 7.5
0 + 03	+ 1.0	+12.2
0 + 04	+ 4.3	+ 4.2
0 + 05	+1.3	+ 8.0
0 + 06	+0.6	+ 7.8

Some Birds Observed at Cascabel In 2003

Spring & Fall	Only Spring	Only Fall
Bushtit	Dusky-capped flycatcher	Montezuma quail
Mexican jay	Northern mockingbird	
Juniper titmice	Turkey vulture	
Mourning dove	Red-tailed hawk	
Scaled quail	Gould's turkey	

WS "B" Cover Changes

	2000	2001	2002	2003	02-03 (t-test)
Bare Soil	18.4	14.0	16.0	21.7	0.014
Rock	21.7	16.9	21.8	25.8	0.283
Litter	9.0	11.7	18.6	18.3	0.939
Peren. Grass	40.9	43.7	30.3	16.3	0.000
Tree & Shrub	25.4	31.3	25.9	23.6	0.628

VEGETATION SAMPLING DESIGN CASCABEL WATERSHEDS