Integrated Recreation Use and Net Economic Value Utility

GCMRC Socioeconomics Workshop
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Support for this Effort

- Bureau of Reclamation
- National Park Service
- University of Denver

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RECLAMATION
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Purpose

The goal of this effort was to develop an integrated tool for the calculation of recreation use and net economic value at Lake Powell, Glen/Grand Canyons and Lake Meade.

Focus

- The utility framework described here focuses on recreation use value exclusively.

Control Variables

- There are two variables under management control:
  - Release (Q) and elevation
  - Fluctuations in release.

Net Economic Use Value

- The net economic value (NEV) of recreation depends on both the level of recreation use and the (nonmarket) value of that use.
- Our focus is on those activities which are directly affected by reservoir and river operations.

NEV Lakes Powell and Meade

- Powell
  - Douglas and Harpman (2004)
  - Douglas and Johnson (2004)
  - Duffield, Neher and Patterson (2007)

- Meade
  - Martin (1980)
  - Duffield, Neher and Patterson (2007)

NEV of Recreation in Glen Canyon

- Angling in Glen Canyon.
  - Richards and Wood (1985).
  - Bishop et al (1987).
- Day-use rafting in Glen Canyon.
  - Bishop et al (1987).

NEV of Recreation in Grand Canyon

- Commercial white water boating
  - Bishop et al (1987)
  - Hammer (2001)
- Private white water boating.
  - Bishop et al (1987)
- Boating below Diamond Creek.
  - Estimates based on Bishop et al (1987) for EIS's

Technical Basis

- The Lake Powell and Lake Meade models utilize monthly visitation relationships developed by Duffield, Neher and Patterson (2007) and NEV data from the literature.
- The river model utilizes the relationships estimated by Bishop et al (1987).

Detailed Methods Matrix

Location/Reach	Activity	Recreation Use (trips)[1]	Economic Value ($/trip)
Glen Canyon	Day Use Rafting	Use is either unaffected by changes in flow or is held constant.	Economic value varies with flow and fluctuations. It is estimated using Bishop et al (1987)
	Angling		
Grand Canyon	Private WW boating		
	Commercial WW boating		
Below Diamond Creek	Private WW boating		Economic value varies with flow and fluctuations. It is assumed to be a proportion of Bishop et al (1987).
	HRR 1-day WW boating		
	HRR overnight WW boating		
	HRR day use rafting		
Lake Powell	General recreation	Recreation use varies with lake elevation. It is estimated using Duffield, Neher and Patterson (2007)	Literature value.
Lake Mead	General recreation		

[1] A trip is one individual recreating at the site. The duration of a trip is variable.

What's the Point?

- The utility described here does not contribute anything new to our state of knowledge.
- This utility builds upon work by Mike Welsh (circa 1987) and automates a tedious and complex series of calculations.
- For example, the NEV of WW boating is described by the equation which follows.

Commercial Boating NEV

For constant flows (fluctuations ≤10,000 cfs)

$$WTP = \int_0^D [1 + \exp(1.908169 - 0.311528Q + 0.004682Q^2 + 0.003676X]^{-1} dX$$

Where: WTP=NEV in 1985$ per trip
Q=flow in cfs
X=bid or price in $

?

And where D is defined as:

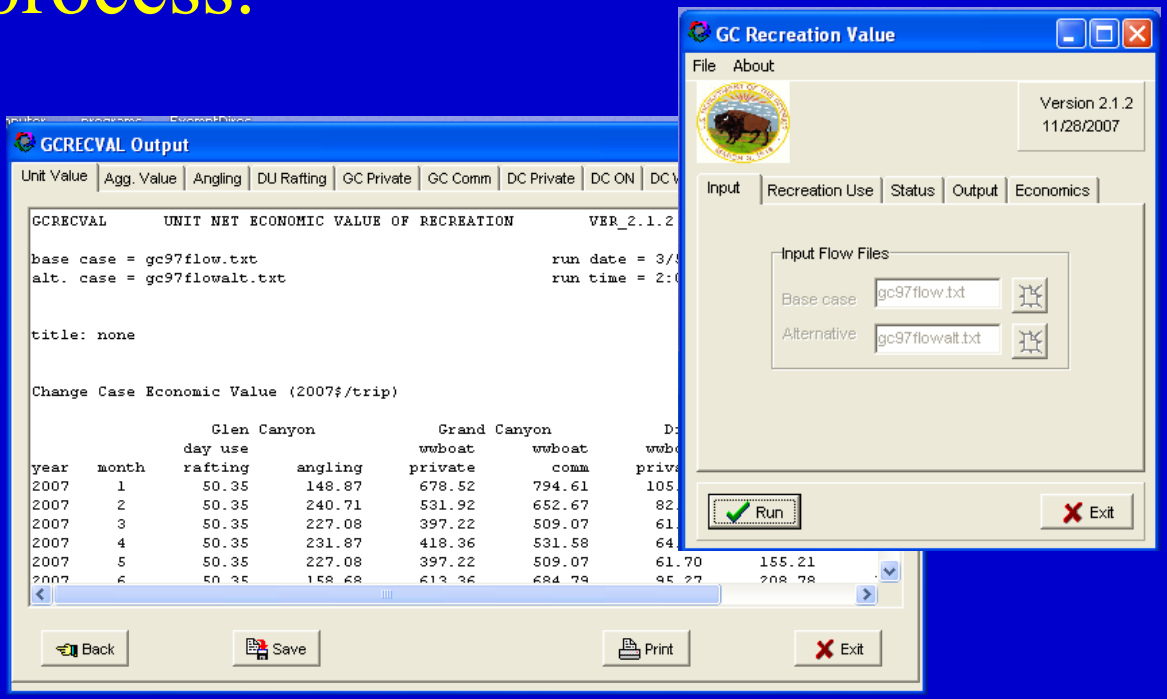
$$D = \frac{[\ln(99) - (1.908169 - .0311528Q + 0.004682Q^2)]}{0.003676}$$

Observation

- Manipulation of this and other estimated NEV relationships requires numerical techniques (and fortitude).
- This is repetitive, time-consuming, complicated and tedious.
- The sheer effort required has frequently precluded policy analysis use.

The Software Framework

- A lake NEV model and a river NEV model were developed for use during the LTEP-EIS process.



What the Utility Does…

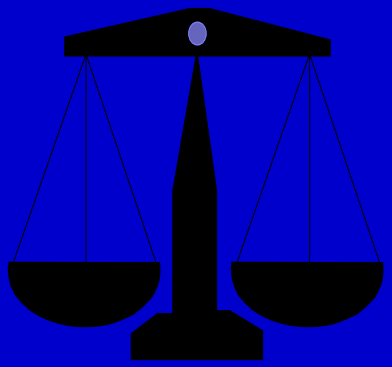
- The software applications compute the NEV for each activity and site by month in the RiverWare hydrology data set (12 months ×101 years × 101 traces).
- NEV's are escalated and discounted.
- The moments (mean, median, 90%, 10% etc) of the resulting NEV distribution are then extracted and reported.

Example Summary Output

```
GCRECFULL      SUMMARY-- NET ECONOMIC VALUE OF ANGLING        VER_1.0.1  11/28/07

base case = gc_na_outflowtest.txt                          run date = 3/11/2008
alt. case = gc_alt_outflowtest.txt                         run time = 9:35:26 AM
recreation use = gc2007rec.txt

erate (%) =  2.2000                                        drate (%) =  4.8750


Mean Annual Value
---------------------------------
Change case ($) =    2834630.0
Base case   ($) =    2839081.4
---------------------------------
Difference  ($) =      -4451.4  (-0.16%)


90% Exceedence Annual Value
---------------------------------
Change case ($) =    2475426.1
Base case   ($) =    2494990.3
---------------------------------
Difference  ($) =     -19564.2  (-0.78%)


10% Exceedence Annual Value
---------------------------------
Change case ($) =    3222790.6
Base case   ($) =    3228192.6
---------------------------------
Difference  ($) =      -5402.0  (-0.17%)
```

The Punch Line

- The integrated framework allows us to rapidly calculate the NEV of recreation for any given management alternative.
- We can compare the results with those of other resources to assess relative impacts.



Anticipated Update

- When the NPS recreation economic studies described previously are completed, this new information will be incorporated into the software utilities described earlier.
- To reiterate, this will facilitate convenient and rapid impact assessment.

Questions and Discussion?

Have a Great Day!

David Harpman: dharpman@usbr.gov
(303) 445-2733

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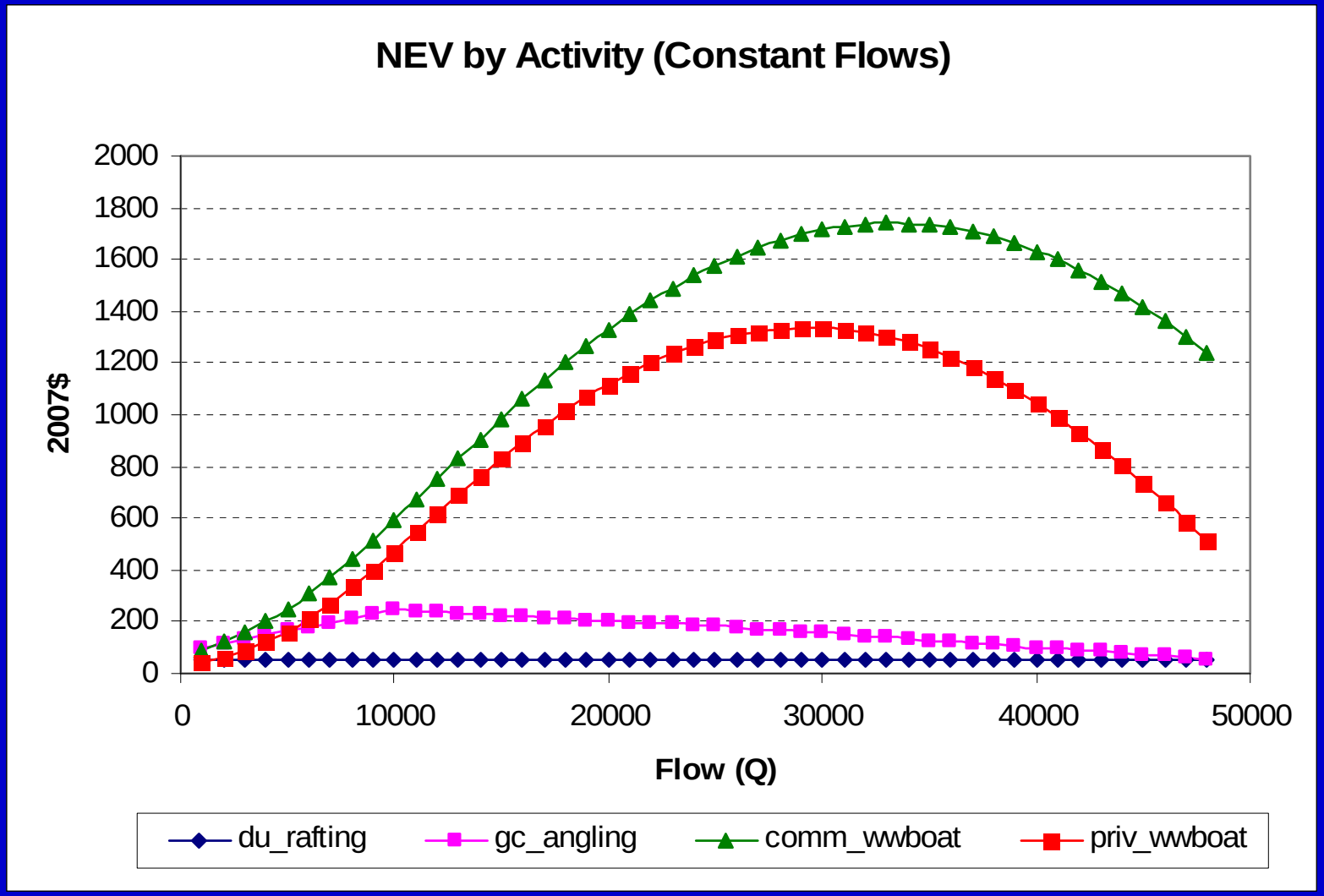
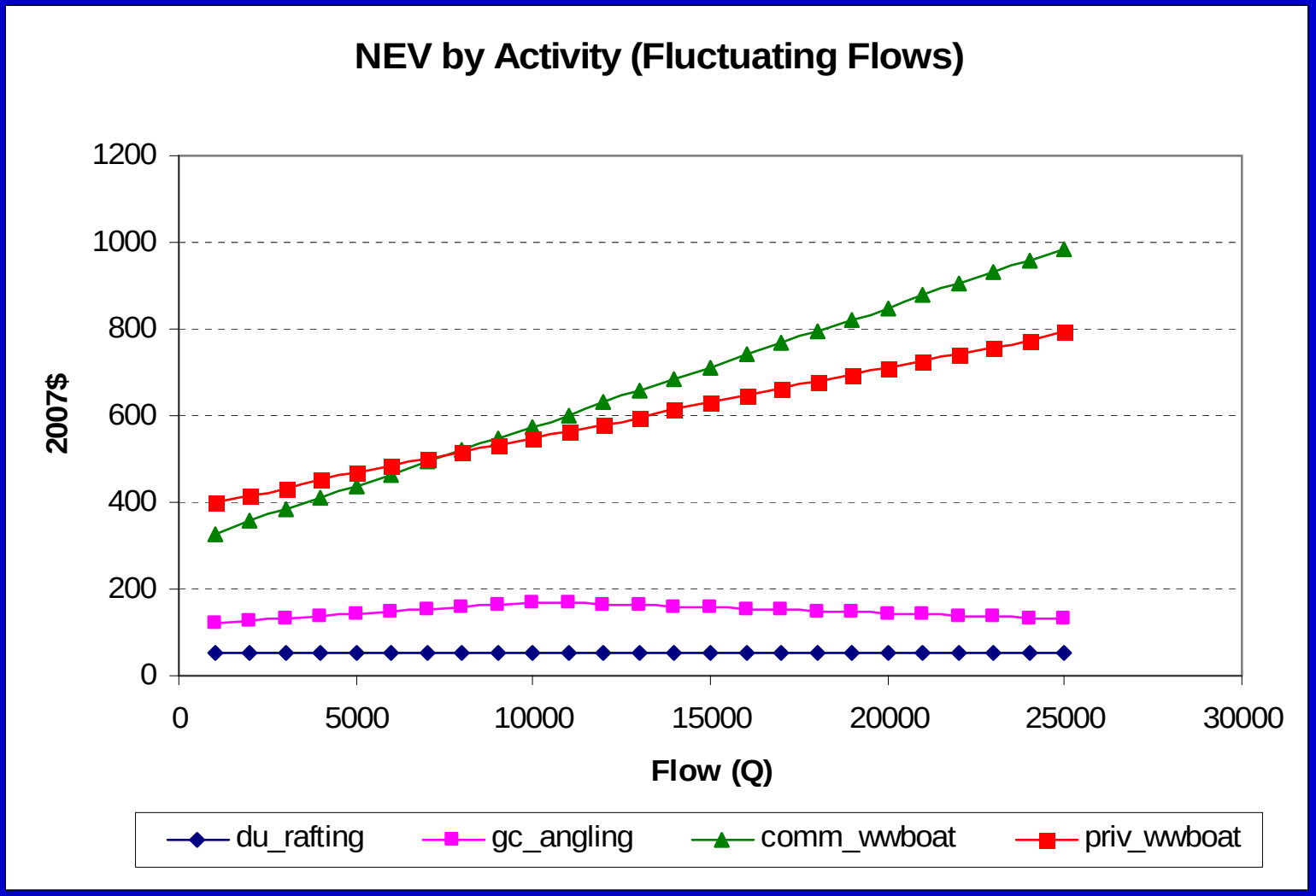
NEV by Flow (1)


NEV by Activity (Constant Flows)
2007$
2000
1800
1600
1400
1200
1000
800
600
400
200
0
0
10000
20000
30000
40000
50000
Flow (Q)
du_rafting
gc_angling
comm_wwboat
priv_wwboat

NEV by Flow (2)


NEV by Activity (Fluctuating Flows)
2007$
1200
1000
800
600
400
200
0
0
5000
10000
15000
20000
25000
30000
Flow (Q)
du_rafting
gc_angling
comm_wwboat
priv_wwboat