Economic Assessment of Watershed Practices, Projects and Programs

- Introduction
- Although watershed management deals predominately with physical and biological processes, it is important to have some understanding of the economic and financial implications of what is being done or proposed.
• Often the bottom line for approving a proposed watershed activity hinges on monetary values for benefits and costs.

• Given options for different activities, watershed planning should aim to maximize net returns or benefits minus costs.
Role of Economics

- Economics is concerned with how consumers, producers, and society deal with the allocation of scarce resources toward alternative uses.
  - Prices reflect the relative scarcity of resources.
  - There are other opportunities or uses for these resources.
Evaluating alternatives

• Decision-makers need information on how to evaluate alternative or different projects, proposals or programs.

• One approach is Benefit-Cost Analysis (BCA). This method measures monetary benefits and costs from each project or proposal over time.
Time preferences

• When we compare monetary values such as incomes or prices over time, you may find yourself asking: Is a dollar today worth a dollar two years from now?
• Would you prefer to have a sum of money today or sometime in the future? Some may want the money now to gain satisfaction from buying desired commodities or from investing the money in an interest-earning opportunity.
• A person who prefers the sum of money now than later is said to have a **positive time preference**.

• A person who prefers the sum of money later than now is said to have a **negative time preference**.

• A person who is indifferent between money now or later is said to have **zero or neutral time preference**.
Exchange between current and future dollars

- Accounting for time is similar to a currency exchange changing dollars for yen or francs. The two mechanisms that act as an exchange between current and future dollars are called compounding and discounting.

- Compounding is a procedure to find future value. If you have a savings account, you’ve witnessed compounding in action.
Compounding

- \( F(t) = P(1 + \frac{r}{k})^{kt} \)

- where \( F(t) \) = future value at time \( t \),
- \( P \) = present value or value of the initial investment,
- \( r \) = interest rate,
- \( k \) = number of compounding or discounting periods (e.g., annually, quarterly, monthly etc.), and
- \( t \) = time (in years).
Compounding example

• Example: If you invested $300 into a savings account at First Hawaiian Bank with annual interest rate = 3% compounded quarterly, what is the future value of this investment five years from now?

• \[ F(t) = P(1 + \frac{r}{k})^{kt} \]
• What do we know about these?
• \( P = 300 \)
• \( k = 4 \)
• \( r = .03 \)
• \( t = 5 \)
Continue example

- $F(5) = 300(1 + .03/4)^{4(5)}$
- $= 300(1.0075)^{20}$
- $= \$348.36$
Discounting

- Discounting is a method to find present value of an investment.

- Use the compounding formula and solve for $P$:
  - $F(t) = P \,(1 + \frac{r}{k})^{kt}$
  - $P = F(t)(1 + \frac{r}{k})^{-kt}$
  - where $(1 + \frac{r}{k})^{-kt}$ is called the discount factor.
Example: Suppose an investment will be worth $348.36 in five years. The investment is a savings account which has an annual interest rate of 3% compounded quarterly. What is the value of the principal or initial value of the investment?

\[ P = F(t)(1 + \frac{r}{k})^{-kt} \]

\[ P = 348.36\left(1 + \frac{.03}{4}\right)^{-4(5)} \]

\[ P = 348.36(1.0075)^{-20} = 348.36(0.86119) \]

\[ P = $300 \]
Net Present Value

• Earlier it was mentioned that the watershed manager should maximize net returns or benefits minus costs.

• Since a proposed project or program is likely to have benefits and costs for a number of years, it is useful to apply the present value or discounting technique since the values of benefits and costs can be evaluated in present dollars rather than future dollars.

• Net returns = benefits – costs

• This “net” concept is similar to profits or net revenue:
  • Profits = Net revenues = revenues – costs
**NPV**

- However, since benefits and costs accrue over time, they are discounted back to the present. This allows evaluation to be done in current dollars.

\[
NPV_j = \sum_{t=0}^{n} \frac{B_t - C_t}{(1 + i)^t}
\]
Discounting benefits and costs over time:

\[ NPV = \frac{B_0 - C_0}{(1+i)^0} + \frac{B_1 - C_1}{(1+i)^1} + \frac{B_2 - C_2}{(1+i)^2} + \ldots + \frac{B_n - C_n}{(1+i)^n} \]