



Examples



A forestry firm wants to compute the future value of a series of revenues resulting from three cork extractions starting 9 years from now (108 € / ha (i = 0.05))




$$K_{27} = 108 [(1+0.05)^{(3 \times 9)} - 1] / (1.05^9 - 1) = 535$$


And now, calculate the present value :

$$K_0 = K_{27} / (1+0.05)^{27} = 143$$

1




Keypoints

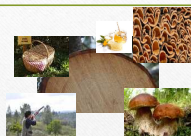


- Improper accounting for inflation has often caused major errors in forestry investment analysis.
- Inflation is measured by annual percent changes in the consumer price index or other prices indexes.
- Nominal values can be deflated to arrive at real values that exclude inflation.
- Nominal interest rates tend to rise and fall with the inflation rate, while real interests are more stable.

2




Keypoints




- To correctly compute present values, express cash flows in real values and use real interest rate
- Alternatively, let cash flows include projected inflation and include the same rate of inflation in the discount rate
- When calculating NPV, if your values are nominal values, use nominal rate to obtain present value (if i available), or deflate nominal value to real values and discount them using real rate

3





Taxation



- Taxes must also be considered to accurately represent revenues and costs of a project, and thus to assess project indicators.
- All revenues should be converted to an after tax basis, all deductions, credits and other cost related tax savings should be considered and an after discount rate should be used.
- A **after tax revenue** are calculated by subtracting taxes due from revenues received.
 - After-tax revenue = Before-tax revenue - tax rate * Before-tax revenue
 - After-tax revenue = Before-tax revenue * (1- tax rate)



4

Taxation

- **After tax costs**
- Legitimate business expenses can be deducted from taxable income in calculating tax liability and deductible costs therefore have tax advantage
- There are two broad types of deductible expenditures:
 - Expensed
 - Capitalized
- To *expense a cost* is to deduct the expenditure (salaries, wages property taxes...) in its entirety in the tax year in which expenditure occurs.
- After-tax cost is found by determining their tax savings and subtracting the tax saving from the before tax cost.

5

Taxation

- **Examples**
- A landowner receives 10000€ from a timber sale. If her marginal tax rate is 23%, what are her after tax revenues?

After tax revenues = $10000 (1 - 0.23) = 7700\text{€}$
- If the landowner's 1700€ cost could be expensed for tax purposes, what's the effective cost of initial expenses? The tax rate is 23%

After tax costs = $1700 (1 - 0.23) = 1309\text{€}$

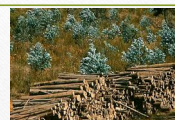
Tax = 391 €

6

SM1



Taxation



- **Capitalized costs**

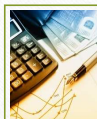
- Costs that are not deducted entirely in the year they occur are capitalized. For record keeping purposes they are assigned to a capital account basis and they are deducted in one of three ways:
 - Certain resource based assets like oil, gas and timber (costs are deducted as the asset is used and depleted).
 - “Non-wasting” asset like land (costs are deducted when the asset is sold).
 - “Wasting” assets like buildings and equipment – costs are deducted as the asset depreciates. The schedule of depreciation deductions is defined based on the type of asset and the expected length of service.
- Timberland included both timber and land. And for this specific case costs must be allocated between a land account and a depletion account.

Land account – deducts costs from the income obtained when land is sold

Depletion account – deduct as the timber is sold

7

SM1



Taxation



Depletion account – deduct as the timber is sold

- The *depletion rate* is the amount you can deduct per unit of volume cut
 - = (basis for depletion/total volume) * volume cut
- The *depletion allowance* is the amount you can deduct after a timber sale
 - = depletion rate * volume cut
- A landowner has 20000€ in the basis of depletion on a specific tract and 15500€ in the land account. This year he sells half of the timber value for 32000€ and would like to know how much money he can deduct from the timber sale income.
 - Since 50% of volume is harvested, 50% of basis for depletion can be deducted, so deduction is 10000€.
 - Assume a tract had 160 m3 of timber prior to sale.
 - Depletion rate = $(20000/160)*80 = 10000€$
 - The adjusted basis = $20000 - 10000 = 10000 €$


In the end:
15500 land + 1000
depletion account

Slide 7


SM1 Susete Marques; 03/10/2016

Slide 8

SM1 Susete Marques; 03/10/2016




Taxation




- The third type was wasting assets whose costs are deducted as they depreciate.

$$\text{After tax cost} = \text{Before tax cost} - \sum_{n=0}^N \left[\frac{(\text{Tax rate})(\text{Deduction}_n)}{(1+i)^n} \right]$$

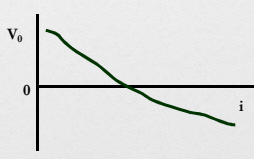
9



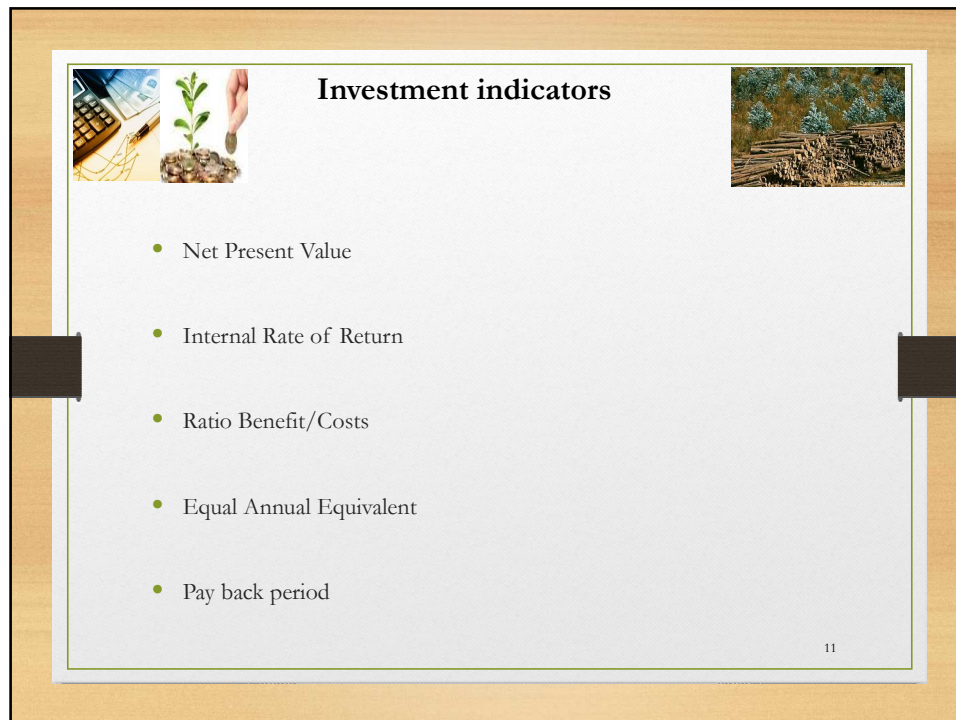
Risk



- The economic viability of our forest if affected by several factors:
 - price of timber,
 - life of plantations,
 - costs,
 - risk...
- How can we assess uncertainty caused risk?
 - Sensitivity analysis
 - Allows the verification oh how the results associated with economic indicators defined in investment (eg. IRR) vary when some of the parameters are modified.



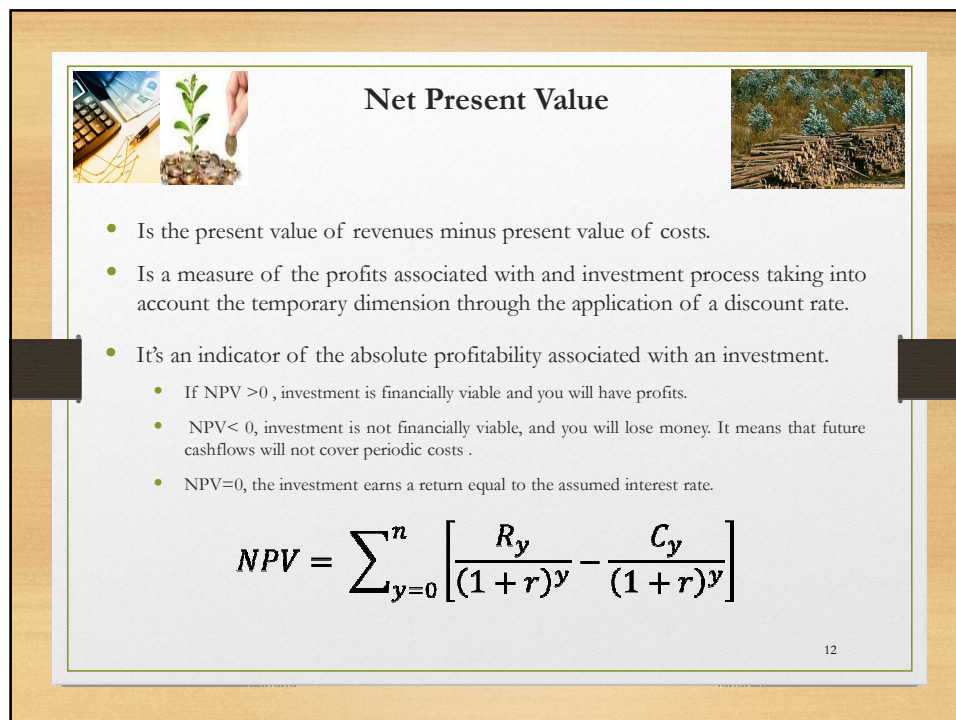
10



Investment indicators

- Net Present Value
- Internal Rate of Return
- Ratio Benefit/Costs
- Equal Annual Equivalent
- Pay back period

11

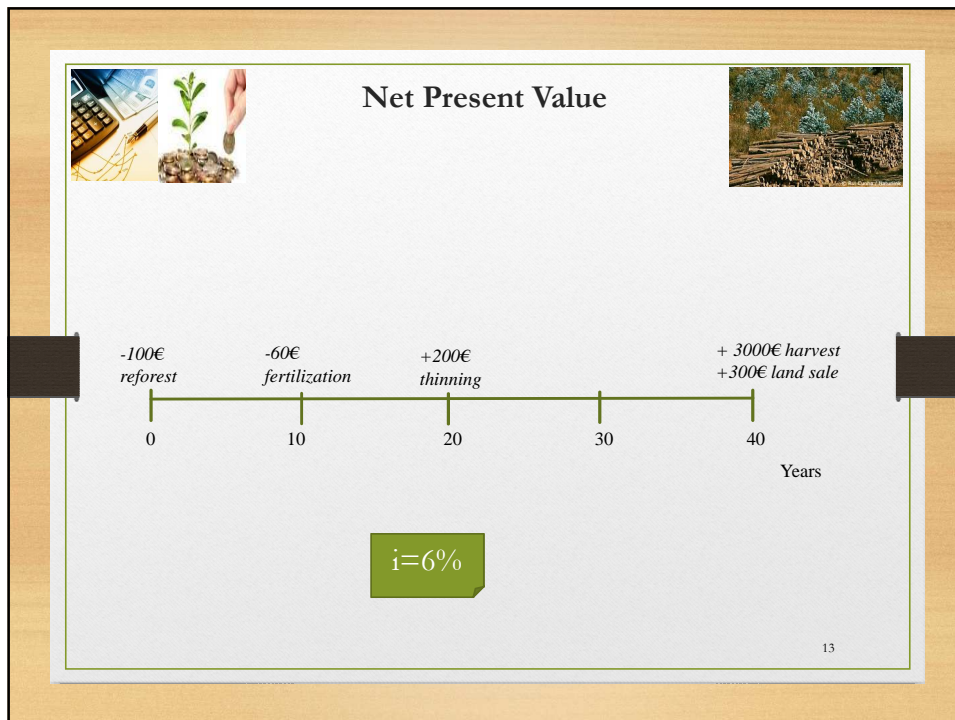


Net Present Value

- Is the present value of revenues minus present value of costs.
- Is a measure of the profits associated with an investment process taking into account the temporary dimension through the application of a discount rate.
- It's an indicator of the absolute profitability associated with an investment.
 - If $NPV > 0$, investment is financially viable and you will have profits.
 - $NPV < 0$, investment is not financially viable, and you will lose money. It means that future cashflows will not cover periodic costs.
 - $NPV = 0$, the investment earns a return equal to the assumed interest rate.

$$NPV = \sum_{y=0}^n \left[\frac{R_y}{(1+r)^y} - \frac{C_y}{(1+r)^y} \right]$$

12



Net Present Value

$$NPV = \frac{200}{(1 + 0.06)^{20}} + \frac{3000 + 300}{(1 + 0.06)^{40}} - \frac{60}{(1 + 0.06)^{10}} - 100$$

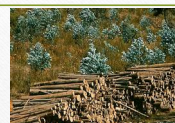
$$NPV = \frac{200}{3.207} + \frac{3300}{10.286} - \frac{60}{1.791} - 100$$

$$NPV = 249.69 \text{ €/ha}$$

14



Internal Rate of Return (IRR)



- The IRR is defined as the discount rate that is required to arrive at a NPV of zero.
- It can be view as the expected interest from an investment.
- Is a reflection of the efficiency of an investment. Higher IRR, more attractive the investment .
- Is a rate of growth of an investment, that we can compare against the rate of return for alternative investments, such as money markets, savings accounts or certificates of deposits.

15



Internal Rate of Return (IRR)

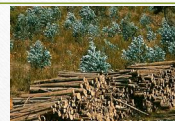


- How do we arrive at the IRR?
- Solving: $NPV = 0 = \sum_{t=1}^T \left(\frac{Cashflows_t}{(1+IRR)^t} \right) - C_0$
- Is commonly compared to cost of capital or hurdle rate or interest rate.
- If $IRR > \text{hurdle rate}$ -> favorable investment with positive NPV
- If $IRR < \text{hurdle rate}$ -> would result a negative NPV

16



Internal Rate of Return (IRR)



- Although, some investors may evaluate decision based only on NPV.
- Disadvantages of using IRR?
 - When cashflows fluctuate from + to -, may result multiple IRR.
 - Intermediate positive revenues are not assumed to be reinvested at the IRR.
 - Valuing forest related commodities, costs and revenues are monetized.

17



Benefit/Cost Ratio



- Can also be called Ratio Profit/Investment.
- The benefit/cost (BCR) is the present value of revenues associated with an investment divided by the present value of costs.

$$BCR = \frac{\text{Present value of benefits}}{\text{Present value of costs}}$$

- If BCR if an investment equaled 1 -> NPV=0 and IRR= discount rate assumed.
- BCR >1 -> NPV > 0 -> IRR > hurdle rate

18



Benefit/Cost Ratio



- **Advantages:** Can be applied to values that are not necessarily expressed monetarily. Applicable to natural resources management analysis involving noncommodity resources.
- **Assumption:** Values in both the numerator (benefits) and denominator (costs) have the same units, so the ratio will be unitless.

19



Equal Annual Equivalent

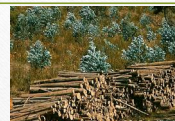


- EAE is the net revenue (or cost) that you can obtain (or will incur) annually, over the life of an investment, given the discount rate that was applied.
- Conceptually, EAE is similar to the payments associated with a loan, and also is referred to as equal annual income and equivalent annual cash flow.
- The initial computation for EAE analysis is the NPV of one rotation of a forest investment. The remainder of the EAE calculation determines the extent of the annual payments that would be required to equal the NPV using the discount rate that is assumed.

20



Equal Annual Equivalent



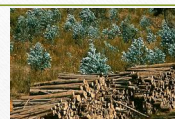
- The advantage of using EAE is that we can evaluate investments that have different time horizons. As a decision tool, we would possibly accept or invest in projects that yield a positive EAE. If several investments are being considered, then the ones with the higher EAE values would be more economically attractive than the others with lower (yet positive) EAE values.
- The EAE is simply the NPV converted to an annual value paid at the end of each year (or time period) for the life of the investment.

$$EAE = NPV \left(\frac{i(1+i)^n}{(1+i)^n - 1} \right)$$

21




Equal Annual Equivalent




- **Example:** Assume we have 200 acres of bare ground near Greenwood, Mississippi, and feel that there are two options to using this property productively. The first would be to afforest the site with oak trees that can be harvested in 50 years. It will cost \$250 per acre to prepare the site, purchase the seedlings, and plant the oak seedlings. When the harvest occurs in year 50, we can expect to earn \$7,116 per acre. The second option would be to grow soybeans, which can be planted and harvested once every year. Our expected annual total cost is \$228 per acre and your expected annual revenue is \$234 per acre. The net return for option two is \$6 per acre per year. Option one does not have a yearly cost or revenue stream and each investment occurs at different time periods. To reconcile the cost and revenue for option one, we need to discount the harvest revenue back in time to period zero. To do this we must assume an interest rate. In this case, assume an interest rate of 5.5 percent.

22




Equal Annual Equivalent




- $Present\ value = \left[\frac{7116}{(1+0.055)^{50}} \right] - 250 = 239.34\ per\ acre$
- Now, to effectively compare option one and option two we need to convert the NPV for option one into an EAE. First, substitute the relevant values into the EAE formula just mentioned.
- $EAE = 239.34 \left(\frac{0.055(1+0.055)^{50}}{(1+0.055)^{50}-1} \right) = \$ 14.14\ per\ acre$
- Second, now that we have calculated the EAE for option one, we can compare it to our annual net return for option two. As we can see, option one yields a yearly return per acre that is \$8.14 greater than option two. Therefore, we would decide to afforest the 200 acres with oak seedlings.

23

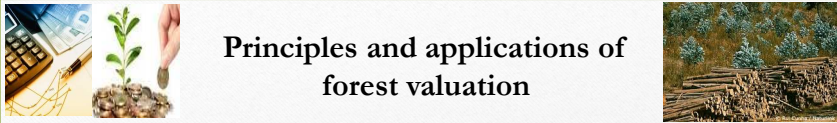


Payback period



- Payback period is the period of time it take for an investment to “pay back” the initial costs.
- The criterion does not account for the time value of money, of course, since compound interest is not involved.
- The project with shortest payback period is generally since a shorter time period generally implies lower risk.

24



Principles and applications of forest valuation

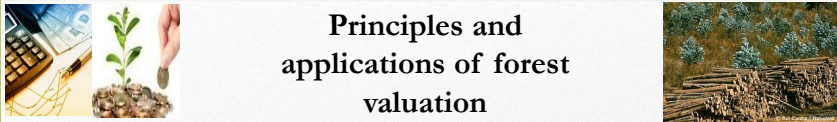
To make decisions appropriate to stated goals, we need measure of the worth of things.

Valuation - Principles, concepts and methods for estimating the value of goods and services.

Forest valuation, is complicated by market imperfections, high interest costs for using resources over time, the many unpriced outcomes and conditions and the nature of public goods.

Value is a human perception, is the worth of something to a particular individual, at a given place and moment in time. The measure of worth is set by the time, goods or money an individual is willing to give up in exchange for the desired good or service.

25



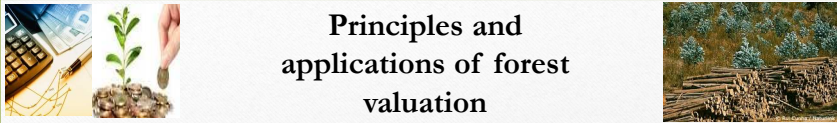
Principles and applications of forest valuation

Three interconnected perspectives:

- market value,
- value-in-use
- social value.

- Market value – is the result of buyers and sellers interacting about a certain good or service in a point in time
- Value-in-use is the value that a particular buyer or seller assigns to a good or service as a function of expected use.
 - A tree farmer would estimate the value of all future income from timber sales.
 - A recreationist would focus on the value of satisfaction received from owning and using the property for hiking, camping and other recreation activities.
- Social value – are those values that help society attain its goals, usually for goods and services “unpriced”.

26



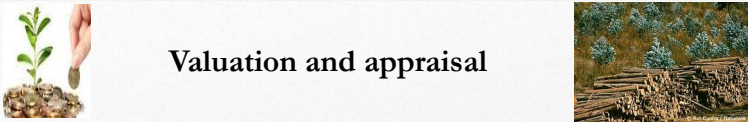
Principles and applications of forest valuation

Appraisal is the application of valuation methods to establish/estimating the value of an asset for a specific individual (or group) at any given time.

In forestry, virtually all professional appraisals are concerned with buying or selling assets, establishing a basis for taxation, evaluating investment performance or with finding a value for setting a variety of legal actions.

Market values is the most common and legally preferred conceptual framework used to guide appraisers.

27




Valuation and appraisal

Appraisal purposes

Most common forestry situations requiring appraisals:


- Loans, mortgage, and investments
- Transactions in property rights
- Taxation
- Planning
- Damage and legal activities.

28




Valuation and appraisal

Appraisal methods




- Market evidence (actual sales records, transactions evidence)
 - Appraisers job is to collect info, evaluate comparability, and make informed estimates of value.
- Capitalized income value (forecast a schedule of costs and revenues and do a pro forma analysis, and calculate NPV based on assumptions)
- Derived residual value (It calculated by deducting all production costs from the selling price of the final product)
 - Maximum that can be paid for the asset
- Market quantification (involves estimating supply and/or demand equations for a specific market)
- Replacement cost
- Expert judgment

29



Valuation and appraisal



Representative conditions

↓

Inputs
Goods and services
Prices

↓

Interest rate selection

↓

Schedule of income and costs

↓

NPV

- Land expectation value (LEV)

- Forest value

→

- Damage

- Compensation

30

Importance of the LEV

- The LEV provides a method of estimating the value of forest land (excluding the value of the standing timber) for land that is used primarily for growing timber on an even-aged basis.
- The LEV (or various generalizations of it) is the main tool used to identify optimal even-aged management regimes, including rotation decisions, thinning regimes, stand establishment effort and intermediate treatments, when the primary objective of the landowner is to maximize their financial return.
- The **Land Expectation Value (LEV)** is the present value, per unit area, of the projected costs and revenues from an infinite series of identical forest rotations, starting initially from bare land.

What is the LEV?

- Assumptions:
 - i. the forest land is used primarily for growing timber on an even-aged basis,
 - ii. each rotation is of equal length,
 - iii. the sequence of events within each rotation is the same, and
 - iv. the net revenue associated with a particular event within a rotation is the same for all rotations.