

Final Assignment: Cost-Benefit Analysis and Net Present Value

1. With and without project scenarios

Without the project scenario	With Project scenario
<p><u>Land use condition</u></p> <ul style="list-style-type: none"> - Land degradation - Illegal mining - Water pollution - Ecosystem services declines 	<p><u>Sustainable land management</u></p> <ul style="list-style-type: none"> - Afforestation - Legal and improved mining/stricter - River restoration - Improved agricultural methods <p><u>Land use condition</u></p> <ul style="list-style-type: none"> - Soil fertility improved - Pollution from mining decrease/water quality improved - Ecosystem services improved
<p><u>Stakeholders condition</u></p> <ul style="list-style-type: none"> - Farmers agricultural production decrease - Scarcity of water - Effect on health of local communities - Illegal miners benefited - Displacement of local communities - Loss of livelihoods - Conflict 	<p><u>Improved condition</u></p> <ul style="list-style-type: none"> - Agricultural production increase - Access to water improved - Health improved - Jobs from mining sectors - Livelihood alternatives - Settled and stability

2. Benefits and costs of the two scenarios

Criteria	Without project USD/ha/YEAR		With project USD/ha/YEAR	
	Benefits	Cost	benefits	Cost
Crop and livestock production	400		4000	
Mining	300		700	
Fresh water use	30		600	
Total benefits	730		5300	
Costs of land degradation		5300		
Costs of water pollution		1100		
Health costs		500		
Costs of displacing local community		2000		
Labour cost for conservation				3000
Water policy cost (% of GDP)				400
Other operational costs				500
Total costs		8900		3900

3. NPV and Sensitivity Analysis

	Without project	With project
Benefits	730	5300
Costs	8900	3900
Net benefits	-8170	1400

In order to analyse how the NPV may change with the use of different discount rates and time horizons a sensitivity analysis was conducted. The NPV will be calculated for 10, 20, 30, and 40 years applying three different discount rates (0%, 5% and 10%).

	Year 1 (present)	Year 10 (2024)	Year 20 (2034)	Year 30 (2044)	Year 40 (2054)
Benefit	730	1500	3200	5000	5300
Discount rate	0%	0%	0%	0%	0%
Discount factor	$\frac{1}{(1+0\%)^{1-1}}$ =1	$\frac{1}{(1+0\%)^{10-1}}$ =0.11111	$\frac{1}{(1+0\%)^{20-1}}$ =0.05263	$\frac{1}{(1+0\%)^{30-1}}$ =0.03448	$\frac{1}{(1+0\%)^{40-1}}$ =0.02564
Present value = Discount factor * Benefit	730	166	168	172	136

	Year 1 (present)	Year 10 (2024)	Year 20 (2034)	Year 30 (2044)	Year 40 (2054)
Benefit	730	1500	3200	5000	5300
Discount rate	5%	5%	5%	5%	5%
Discount factor	$\frac{1}{(1+5\%)^{1-1}}$ =1	$\frac{1}{(1+5\%)^{10-1}}$ =0.10582	$\frac{1}{(1+5\%)^{20-1}}$ =0.05013	$\frac{1}{(1+5\%)^{30-1}}$ =0.03284	$\frac{1}{(1+5\%)^{40-1}}$ =0.02442
Present value = Discount factor * Benefit	730	159	160	164	129

	Year 1 (present)	Year 10 (2024)	Year 20 (2034)	Year 30 (2044)	Year 40 (2054)
Benefit	730	1500	3200	5000	5300
Discount rate	10%	10%	10%	10%	10%
Discount factor	$\frac{1}{(1+10\%)^{1-1}}$ =1	$\frac{1}{(1+10\%)^{10-1}}$ =0.10101	$\frac{1}{(1+10\%)^{20-1}}$ =0.04785	$\frac{1}{(1+10\%)^{30-1}}$ =0.03135	$\frac{1}{(1+10\%)^{40-1}}$ =0.02331
Present value = Discount factor * Benefit	730	152	153	158	124

	Year 1 (present)	Year 10 (2024)	Year 20 (2034)	Year 30 (2044)	Year 40 (2054)
WITH PROJECT					
Benefit	730	1500	3200	5000	5300
Costs	3900	800	400	200	100
Net benefit	-3170	700	2800	4800	5200

WITHOUT PROJECT					
Benefit	730	450	340	300	300
Costs	1200	3200	4200	6600	8900
Net benefit	-470	-2750	-3860	-6300	-8600

Incremental net benefit	-2700	1450	6660	11100	13800
Present value of incremental net benefit (10% discount rate)	-2700	6150	1089	69974	33540
Economic Net present value (10% discount rate)	$= -2700+6150+1089+69974+33540$ $= 108053$				

Therefore, due to the positive NPV obtained, the project is considered worth undertaking. It is clear that the provisioning services have decreased. A "with project scenario" would lead to sustainable land management including afforestation, strict mining regulations, river protection and improved agricultural methods. These would translate into increase in agricultural productivity, improved access to good quality water, job creation and improved revenue from controlled mining, enhancement of alternative livelihood, reduced stakeholder conflicts, improved health for the local communities, better organised settlements and reduced land degradation due to improved land use methods.

Possible projects and/ or policies to intervene would be: Policy on strictly controlled mining, Policy imposing charges on pollution (polluter pays principle), Project/policy on afforestation, Land use policy, and River bank and water catchment protection. The social consequences would be change of common sources of livelihoods, relocation of some community members to affect appropriate land use, improved health and access to cleaner water, job opportunities in the organised mining sector, fewer conflicts over allocation of resources, adoption of new technologies and farming methods as well as the limitation on forest use.

Assignment 6: Likely Results if real stakeholders were involved:

For several decades the people of the Amansie Central District of the Ashanti Region of Ghana have enjoyed various ecosystem services. Unfortunately most of this has been carried out at the expense of the land and environment. The following are the findings obtained based on the Contingent Valuation (administration of questionnaires) carried out in the district: The sample interviewed consisted of 55% male and 45% female residents. The men interviewed are predominantly between 41-50 years of age (63%), are married (94%) and engaged in farming (75%) and mining (30%). 80% have lived in the district for over 40 years while 74% had both parents and grandparents who lived in the district. About 42% attained basic level education while the average monthly income is between GH¢300 - GH¢600 (74%). They all enjoy at least 3 provisioning services with food, biodiversity and gold as the most common. 60% use at least 4 Ha of land while 88% have observed a decrease in provisioning services. The survey shows that 44% are willing to pay between GH¢ 250 and GH¢ 500 per annum for the provisioning services. 72% think that man's activities have an impact on the land and its provisioning services. While 76% believed that mining was the main cause of land degradation in the area, only 24% would support a total ban on mining. Only 22% were optimistic that the degraded land could be restored to its glorious past. Suggestions for improving the land include afforestation and stricter mining regulations.

About 59% of the female residents interviewed are between 31-40 years old and 86% are married. Up to 36% have acquired basic level education and only 26% of them earn between GH¢ 200 and GH¢ 500 monthly. 65% have lived in the district for 31-40 years and 72% had both parents and grandparents who lived in the district. The provisioning services they most enjoy are food, forest products, fish and bush meat. They require about 3Ha of land to meet their needs. Even though 84% have observed a decrease in provisioning services only 34% are willing to pay less than GH¢ 250 per annum for continued use of the

provisioning services. An estimated 45% are not sure if man's activities have an impact on the land and its provisioning services. However, 37% think that it causes a decrease in the provisioning services. About 82% believed mining is the main cause of land degradation while 53% would support a total ban on mining activities. 44% of sampled female respondents are optimistic that the degraded ecosystem could be restored to its glorious past.

Suggestions to maintain/improve the land and provisioning services include use of improved farming methods, introduction of resting periods for rivers and a better education system. This survey therefore indicates that majority of the people interviewed have lived most of their lives in the district and enjoy a wide variety of its provisioning services. They observed a decrease in provisioning services in recent years but are not all keen on paying for the continued use of the provisioning services. However, with proper awareness campaign and through education and other interventions, they could be encouraged to pay between GH¢ 500-800 annually so as to ensure a more sustainable development.

NB: US\$1 = GH¢ 2.80 (New Ghana Cedis- Local currency).

Assignment 5: Research Method: Contingent Valuation Approach

Sampling Plan: 1,000 randomly selected residents of the Amansie Central District of the Ashanti Region of Ghana. The sample will include people of different gender, income, age, occupation, geographical location and educational level. The district will be divided into 4 quadrants from which a quarter of the respondents will be selected to ensure variation in the sample.

Means of data collection is through face to face interviews.

Questionnaire

A. Social, demographic and economic characteristics of the respondent

1. Age (years): below 20 () 21-30 () 31-40 () 41-50 () Above 50 ()
2. Gender: Male () Female ()
3. Marital status: Married () Divorced/separated () Widow/widower () Never married ()
4. Main occupation: Farmer () Hunter () Farm/firm worker () Miner () Others (specify) ()
5. Level of Formal Education attained: No formal education () Basic level () Secondary level () Tertiary level () Technical education ()
6. Monthly Income (local currency): Below GH¢300 () GH¢300.00-GH¢600.00 () GH¢600.00-GH¢1,000.00 () Above GH1,000.00 ()
7. How long have you lived in Amansie Central District (years)? Less than 10 years () 11-20 years () 21-30 years () 31-40 years () Above 40 years ()
8. Did your parents or grandparents live here? Parents only () Grandparents only () Both parents and grandparents () Neither parents nor grandparents ()

B. Ecosystem Services

1. What provisioning services do you enjoy/ benefit from the land [Indicate all that apply]? Food () Cash crop () Forest products () Fish () Bush meat () Biodiversity () Gold () Others (specify) () (please see table below for more:)
2. How much land in the Amansie Central District do you utilize to meet the above provisioning servicesHa
3. Do you observe an increase or decrease in provisioning services? Increase () Decrease () No change ()
4. Are you willing to pay for the continued use of provisioning services you enjoy from the land? Yes () No ()
5. If yes, how much are you willing to pay per annum (local currency)? Less than GH¢250.00 () GH¢250.00-GH¢500.00 () GH¢500.00-10,000 () Above 10,000 ()
6. Do you think that man's activities have an impact on the land and its provisioning services? Yes () No () Not sure () Maybe ()
7. What activity of man is the main cause of land degradation in your area? farming () mining () logging (), cultural practices () Others (specify) ()
8. Would you support a total ban of mining in your area? Yes () No () Don't Know ()
9. What is the nature of this impact on the provisioning services? Increase () Decrease () No change ()
10. Are you optimistic that the degraded ecosystem can be restored to its past "glory"? Yes () No () Not sure ()
11. What suggestions do you have towards maintaining/ improving the land and its provisioning services?

Sources of Biases:

- o Method is prone to design biases as a result of the hypothetical nature of the market, social desirability effect etc.
- o It is prone to several information biases
- o The CV is prone to the part-whole bias
- o The market set up is hypothetical and respondents may provide estimates of their willingness to pay that are also hypothetical

Assignment 4: Scenarios

Baseline:

This is the status of the ecosystem services in the current condition (2014). This is only meant for comparison with other scenarios.

S1: Business as usual (BAU)

This scenario describes the status quo. It explores the situation of the ecosystem services provided by the land assuming the existing land uses and economic activities would continue for the next four decades without any major interventions (regulations or development plans)

S2: Development scenario

This scenario aims to maximize the benefits of the land for only a single service such as mining or other farming practices. This scenario emphasizes on economic growth without a concern for the environment (conservation)

S3: Conservation scenario

This scenario is intended to preserve and/or conserve the ecosystem services. It emphasize land restoration and preservation with no significant use of the resources for maximizing economic benefits

S4: Multifunctional use scenario

In this scenario, the aim is to optimize the multiple use of the land in a sustainable manner (address economic, environmental and social goals).

Note

- Except S1, the other assumes intervention policies and measures
- within each scenarios different management strategies may be considered
- all benefits and costs (direct and opportunity costs) will be considered
- tradeoffs between landuse options will be analysed
- stakeholders : Who loss or win? Will be answered

Assignment 3: Valuation method

The contingent valuation method (CVM)

We preferred the Contingent Valuation Method (CVM) because it can be used to estimate economic values for all kinds of ecosystem and environmental services. It can be used to estimate both use and non-use values; typical in our ecosystem - The Gold Craze in the Amansie Central District of Ghana. CVM involves directly asking people, in a survey, how much they would be willing to pay for specific environmental services.

Advantages of the Contingent Valuation Method:

- CVM is flexible - it can be used to estimate the economic value of virtually anything.
- CVM is the most widely accepted method for estimating total economic value (TEV), including all types of non-use values. CV can estimate use values , as well as existence values , option values and bequest values.
- The nature of CV studies and the results of CV studies are not difficult to analyze and describe.
- CVM is based on what people say they would do (as opposed to what people are observed to do).

· CVM is one of the only ways to assign money values to non-use values of the environment—values that do not involve market purchases and may not involve direct participation.

Limitations of the Contingent Valuation Method:

- CVM assumes that people understand the good in question and will reveal their preferences in the contingent market just as they would in a real market. However, most people are unfamiliar with placing money values on environmental goods and services.
- The stated willingness to pay in a contingent valuation format may be biased because the respondent is actually answering a different question than the examiner had intended – this is based on the argument that respondents may be expressing their feelings about the scenario or the valuation exercise rather than the actually expressing value for the good.
- Some scholars argue that there is a fundamental difference in the way that people make hypothetical decisions relative to the way they make actual decisions.
- The “embedding effect” - a problem that is observed when people are first asked for their willingness to pay for one part of an environmental asset and then asked to value the whole asset - the amounts stated may be similar.
- It is also argued that estimates of nonuse values are difficult to validate externally.

Assignment 2 - Economics of Land Degradation in Sub-Saharan Africa Group

Ecosystem: The Gold Craze in the Amansie Central District of Ghana

The Ecosystem is found in the Amansie Central District of the Ashanti Region of Ghana. The district has a total area of about 710sqkm and a population of about 100,000. It has rich and fertile agricultural land producing food and cash crops like cassava, plantain, maize, cocoa, palm, among others. The Ecosystem is also blessed with many rivers and water bodies and large deposits of gold which has rather turned into a “Curse” as a result of a surge in illegal mining activities. Water bodies are now seriously polluted and farmers displaced due to the illegal mining practices. Several square kilometers of the ecosystem have been degraded. Different stakeholders with different interests and influences are now debating on how to restore the ecosystem.

Part I

WHICH ECOSYSTEM SERVICE(S) DOES YOUR ECOSYSTEM PROVIDE?

1. Provisioning:

a. Services: Food (fruits and vegetables) and cash crops (Cocoa and palm); Forests products (mushroom, snails, lumber for building, medicinal plants, firewood, forage for livestock, materials for handicraft, et c.); fish, bush meat, Biodiversity (fresh waters, snakes, squirrels, rats, lizards, birds, insects), gold. -

b. Stakeholders: About 100,000 district Inhabitants, Local and Central Governments, Miners, Farmers, Traditional Authorities, Foreign Investors, upstream and downstream users of the streams/ivers.

2. Regulating:

a. Services: The rich vegetation of the ecosystem promotes climate regulation, purification of water and air, Carbon sequestration, waste decomposition and detoxification, pest and disease control, enhance Pollination, etc.

b. Stakeholders: All the about 100,000 inhabitants and nearby communities whose activities upstream can affect the ecosystem in the area.

3. Supporting:

a. Services: Soil Formation (provisioning services depend on soil fertility), Photosynthesis (produces oxygen necessary for most living organisms), Primary Production (assimilation or accumulation of energy and nutrients by organisms), Nutrient cycling (nitrogen and phosphorus cycle through ecosystems), Water cycling (essential for living organisms).

b. Stakeholders: All the inhabitants from the district and nearby communities benefit from the supporting services provided by the ecosystem.

4. Cultural:

a. Services: Majority of the people have strong beliefs in certain taboos, for instance, in the Ampomanka stream, mud fish is not eaten. Farming activities are forbidden on certain days and there are several sites of historical, spiritual, scientific and aesthetic importance in the district which are potential tourism spots including; The Subin Shelter Belt Forest Reserve, the Oda River Forest Reserve, the Aboabo Ayanta shrine where people go for divination and Penipa Shrine.

b. Stakeholders: Farming Taboo-days are observed by all inhabitants while a significant number of the inhabitants also observe the traditional and spiritual beliefs and customs; Tourists, Academia and Handicraft Weavers.

Part II

Who benefits from the ecosystem service?

a. Provisioning: - the about 100,000 inhabitants, hundreds of residents in nearby cities who buy foodstuffs from the area, local and central government who earn revenue from cocoa and gold; farmers, miners, traders, handicraft weavers, traditional authorities.

b. Regulating: All inhabitants and nearby communities benefits directly and indirectly.

c. Supporting: All living creatures; human, plants and animals

d. Cultural: The Chiefs and people of the area, tourists, academia

Who pays for the ecosystem service?

a. Provisioning: The inhabitants pay for the ecosystem services since their actions or inactions impacts negatively or positively on the ecosystem

b. Regulating: The people of Amansie Central District since their stewardship of their ecosystem determines the impacts

c. Supporting: The people of Amansie Central District since their stewardship of their ecosystem determines the impacts

d. Cultural: The people of Amansie Central District, tourists and academia.
