# Valuation of the mangroves ecosystem in the Limpopo estuary

An Inception Report Presentation

For

RESILIM & CDS

By

Sennye Masike

# Background to the assignment

- commissioned by RESILIM as part of the larger project titled **Resilience in the Limpopo Basin Programme**
- Funded by USAID/Southern Africa
- The overall objective is improving trans-boundary management of the Limpopo River Basin to enhance community and ecosystem resilience to climate change impacts

# Objective of the assignment

- to appreciate the economic values of the Mangroves ecosystem in the estuary of the Limpopo River
- ensure their integration in economic decision-making process for optimal and sustainable utilisation of mangroves ecosystem
- As mangrove support communities directly and indirectly, their optimal and sustainable utilisation could reduce vulnerability of the Zongoene community to climate change

# Assignment scope

- The assignment will involve deriving mangrove TEV in the Limpopo Estuary

# Assignment specific tasks

- The specific tasks for the assignment can be grouped into 4 thematic areas
- **Mangroves ecological structure** ( ecosystem service providers, community structure, key environmental factors, determination of spatial and temporal influence of mangroves functions)
- **Mangroves ecosystem valuation** ( based on use and non-use values)
- **Development of guidelines for mangrove valuation**
- **Assessment of the sustainability of mangroves aforestation project** (ecological, socio-economic conditions)

# Methods and approaches

- Methods to be employed in achieving the specific tasks
- Data requirements
- Deliverables under each theme
- Outputs

# Mangroves ecological structure

- Will involve detailed ecological analysis of the mangroves in terms of species composition, relationship between the species, species roles and functions in mangroves as a system (dissipating wave energy, settling of sediments, breaking down of nutrients, habitat for fish etc)
- Determination of the spatial and temporal influence of mangroves in providing services

# Methods to achieve ecological structure

- Literature review: well researched and documented ecosystems on planet in terms of ecological structure, species composition, roles and functions of the species. Extensive literature will be undertaken to partially achieve the task
- Direct field assessment: to ground truth and supplement the output of the desktop study where information gaps have been identified. The Field assessment would also allow an opportunity for consultation with the local communities and first hand assessment of the study site.

- Stratified sampling: to ensure; representation of all habitat classes, sufficient coverage of localities with less information, representative sample of local communities, coverage of all major land use types and biodiversity based resources utilisation groupings.

# Planned activities

| Item no | Activity | Status | Due-date |
|---|---|---|---|
| 1 | Collation of relevant documentation and literature | Pending | 28 Sept. |
| 1 | Review of all collated documentation | Pending | 28 Sept. |
| 2. | Mapping of the mangroves ecological structure | Pending | 4 Oct. |
| 3 | Identification of the roles and functions of identified flora and fauna species | Pending | 4 Oct |
| 4. | Field visit for ground truthing purposes and stratified sampling | Pending | 12 Oct |
| 5 | Consultation with key informants to determine the spatial and temporal context of mangroves services | Pending | 12 Oct |
| 6 | A section of the report write up; ecological description and inventories, types of ecosystems goods & services, and spatial context of biodiversity and hence ecosystem services | Pending | 19 Oct |

# Outputs

- Section of the report detailing
- Mangroves species composition
- Roles and function of species
- Relationship between species
- Spatial and temporal influence of mangroves (GIS map where possible)

# Mangroves valuation

- Involve putting a monetary value on mangroves ecosystem, how much are mangroves worth in monetary terms
- Mangroves multi functional
- they provide products, functions and service
- They are used directly, indirectly
- Total economic value as a valuation framework is mandatory
- TEV = user +non-user values

# Steps and methods

- Identification of all products, functions and services offered by the mangroves through consultation and literature review
- Quantification of products, functions and services used by communities through consultation and literature review
- Valuation exercise methods

- Market prices and surrogate markets: Some products derived from mangroves are sold in a market either formal or informal. Market prices will be used to infer to value of the products
- Surrogate market prices: for those products that do not have a market but have close substitutes a surrogate market price will be used. The approach uses a market price of a close substitute as a proxy measure of value for the non-marketed goods or services. In this case, both are converted to the same common denominator such as heating value, energy value

# Products that will be valued

- Fuel wood
- Timber
- Poles
- Fish, crabs and shrimps
- Pharmaceutical products
- Carbon store and sequestration

# Production function

- Value ecosystem services through their association and contribution to production of marketed goods and services.
- E.g. mangroves have various functions and services that contribute or support a wide range of economic production processes such as production of fish, agricultural output etc

# Steps in PF

- The physical effect of change in an ecosystem resource or service on an economic activity are established
- The impact of the ecosystem change is valued in terms of the corresponding change in marketed output of the relevant activity. The ecological service or product is treated as an input to the economic activity and its value equated with its impact on the productivity of the marketed output.
- Development of mathematical models/functions. Based on the information gathered, a mathematical model will be developed with the ecosystem services as an input in production of a marketed goods and the coefficient of mangrove will be used to infer its economic value.

# Products to be valued

- On-site fisheries products mainly crabs, fish
- Supporting off-site fisheries mainly fish and shrimp
- Protective function of mangroves

# Hedonic pricing method

- though some ecosystem goods and services are not marketed or traded, they have properties that affect the value of goods and services.
- E.g individual willing to pay (WTP) for a house or agricultural field that is in close proximity to pristine mangroves relative to the one with degraded mangroves.
- Therefore, the difference in price could be attributed to the protection functions of mangroves

# Steps in HPM

- Collect cross sectional data on price of properties or agricultural yields from field along mangroves and those far from mangroves or degraded mangroves
- Develop statistical models to determine the contribution of protective function of mangroves to the value of houses.

# Functions and service to be valued

- Protective function of mangroves
- Aesthetics of mangroves

# Avoided costs/replacement costs

- This is based on the costs that could have been incurred had the ecosystem been breached or degraded or the cost of moving an activity or asset to another location which provides an equal level of protection.
- A damage cost function based on extreme events will be used to estimate the value of mangroves in offering protection
- If data is not available benefit transfer methods will be used from other countries

# Travel costs method

- This method will be used to estimate the value mangroves as a tourism area
- Zonation of the area of interest: zoning will be categorised into local, national, regional and international
- Estimation of visits from each zone: data will be collected from the tourism operators on visits from each zone
- Visitation rates: visitation rate is estimated as the ratio between visit from each zone over total population of each
- Estimation of the cost of travel from each zone
- Derivation of the demand curve based on visitation rates and cost of travel
- The area under the demand curve will be consumer surplus which will be the value of mangroves based on visit

# CVM

- CVM is a direct and hypothetical method that infers to the value of ecosystem resources by directly asking individuals their WTP or WTA upon creation of a market
- It is based on a questionnaire to infer to the WTP and WTA for the protection of mangroves.
- WTP is a function of aspects such as income, benefits derived attitudes to the ecosystem being valued

# Products, functions and service to be values

- Ecotourism
- Option value
- Existence value
- Protective function of mangroves

# Planned activities

| Item no | Activity | Status | Due-date |
|---|---|---|---|
| 1 | Consultation with members of the communities and stakeholders | Pend | 18 Oct |
| 2. | Identification of mangroves ecosystem services, functions and products | Pend | 18 Oct |
| 3 | Survey to quantify products harvested and number of community benefiting from the ecosystem services | Pend | 18 Oct |
| 4. | Survey to determine the WTP for option and existence values for mangroves ecosystems | Pend | 18 Oct |
| 5 | Identification and establishment of the relationship between production function and environmental factors | Pend | 18 Oct |
| 6 | Data analysis and derivation of the economic value of mangroves | Pend | 26 Oct |
| 7 | Report write up on mangroves ecosystem valuation | Pend | 26 Oct |

# Data requirement

| Method | Data | Probable source |
|---|---|---|
| CVM | Survey that presents scenario and elicit WTP for specified services | Past studies and conduct own study on WTP |
| Household Production Function | Change in mangroves status (deforestation, degradation)<br>Agricultural output over time<br>Net value of produced goods | Agricultural statistics<br>Environment statistics<br>Producers<br>Agricultural departments |
| Hedonic Pricing Method | Prices of marketed goods such as property,<br>Characteristics of mangroves status (attributes) | National accounts statistics<br>Environment statistics |
| Replacement /mitigation/relocation cost | Extent of loss of goods and services<br>Cost of replacing the lost goods and services | Agricultural statistics<br>National accounts statistics<br>Health statistics |
| Surrogate | Prices of alternatives such as | National statistics, energy |

# Output

- Economic value of the mangroves

## DEVELOPMENT OF GUIDELINES FOR MANGROVES ECOSYSTEM VALUATION

- This phase will involve development of the guideline to be used by non-environmental economists to value mangroves
- It will detailed the steps, processes and activities require in valuation
- Will also entail examples and case studies

# Methods

- Literature review on valuation techniques

# Planned activities

| Item no | Activity | Status | Due-date |
|---|---|---|---|
| 1 | Literature and documentation review on valuation methods, procedure and processes | Pending | 27 Sept. |
| 2. | Development of the guidelines for valuing the mangroves ecosystem | Pending | 4 Oct |
| 3 | Write up on the development of guidelines for mangroves valuation | Pending | 4 Oct |

## ASSESSMENT OF MANGROVES REFORESTATION SUSTAINABILITY

- This phase aims at assessing the sustainability of reforestation.
- Sustainability will be assessed from the economic, social and ecological point of view
- Economic sustainability will look at the viability of the project
- Social sustainability will assess capability of the institution to commission the project
- Ecological sustainability will assess the ecological conditions to determine whether seedling can establish (pollution, climate, etc)

# Methods

- Cost Benefit analysis: it is an appraisal technique that looks at the costs and benefits of implementing the project.
- The seven steps of CBA will be followed to determine NPV of the project
- Financing mechanism: an assessment will be undertaken to determine financing strategy to determine the financial dependency of the project

- Institutional and social matrix: an institutional assessment will be undertaken to determine skill availability and skills required to implement the project based on developed matrix
- Aspects that would be investigated under social sustainability include availability of skill to implement the project, reliance on external skills and human resources, issues of enforcement and legal framework to protect and regulate use of reforested mangroves.
- Consultation with stakeholders will be undertaken to score the matrix

- Ecological sustainability assessment: ecological sustainability deals with evaluation of the long term ecological integrity and determines whether it would allow mangrove reforestation.
- Assessment will consider climate, environmental, anthropogenic and ecological variables.
- Field visits will be undertaken to undertake assessment

# Planned activities

| Item no | Activity | Status | Due-date |
|---|---|---|---|
| 1 | Identification of the costs and benefits of mangroves reforestation | Pending | 25 Oct |
| 2. | Quantification of the costs and benefits of mangroves reforestation | Pending | 25 Oct |
| 3 | Deriving NPV for mangrove reforestation | Pending | 25 Oct |
| 4. | Consultation with relevant stakeholders to identify the costs and benefits of mangroves reforestation | Pending | 25 Oct |
| 5 | Development of institutional capacity assessment matrix | Pending | 25 Oct |
| 6 | Consultation with relevant stakeholders to score the institutional capacity matrix | Pending | 25 Oct |
| 7 | Site visit to assess the climatic and ecological conditions and their suitability for reforestation | Pending | 25 Oct |
| 8 | Write up on mangroves reforestation sustainability | Pending | 25 Oct |

# Data requirement

| Method | Data | Probable source |
|---|---|---|
| NPV | Costs for mangroves reforestation<br>Revenue or benefits or mangroves reforestation | Economic valuation of mangroves<br>Mangroves reforestation project proposal |
| Institutional capacity assessment | Skill required for mangroves reforestation<br>Availability of skill in the country and relevant institutions<br>Enforcement and monitoring capacity | Survey and consultations with the relevant stakeholders |
| Ecological assessment | Ecological and climatic conditions | Environmental Statistics<br>Climate and Weather data<br>Population Census (numbers & spatial distribution<br>Water monitoring Statistics (flow, floods, possibly chemistry) |

# Project deliverables

| Assignment Deliverable | Due date |
|---|---|
| Inception report | 19 Sep. 2014 |
| Inception workshop | 07 Oct 2014 |
| Draft report on valuation | 31 Oct. 2014 |
| Draft report on valuation guidelines | 31 Oct. 2014 |
| Workshop on Drafts | 05 Nov. 2014 |
| Final Report on valuation | 28 Nov. 2014 |
| Final report on Valuation guideline s | 28 Nov. 2014 |