

# Multi- Criteria Analysis (MCA)

MCA principles:

1. Society is formed of competing interests, there is no 'best' policy option that suits everyone
2. Monetisation doesn't capture the value of nature (technical and ethical)
3. Need another way of capturing that value

# Multi- Criteria Analysis (MCA)

- Goes beyond CBA and SROI
- Stakeholder driven.
- Focusses on distribution of costs and benefits
- Does not require monetization of non-marketed goods
- Escapes some of the inherent biases of SROI and CBA.
- Particularly useful investigating trade-offs
- Useful for analysing competing interests and objectives, specifically for what refers to access to scarce resources.

# What are the multiple objectives of fisheries management

- Conservation of stocks
  - Food production
  - Income / revenue
  - Jobs
  - Community sustained
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- Multiple objectives of the CFP (Box 1)

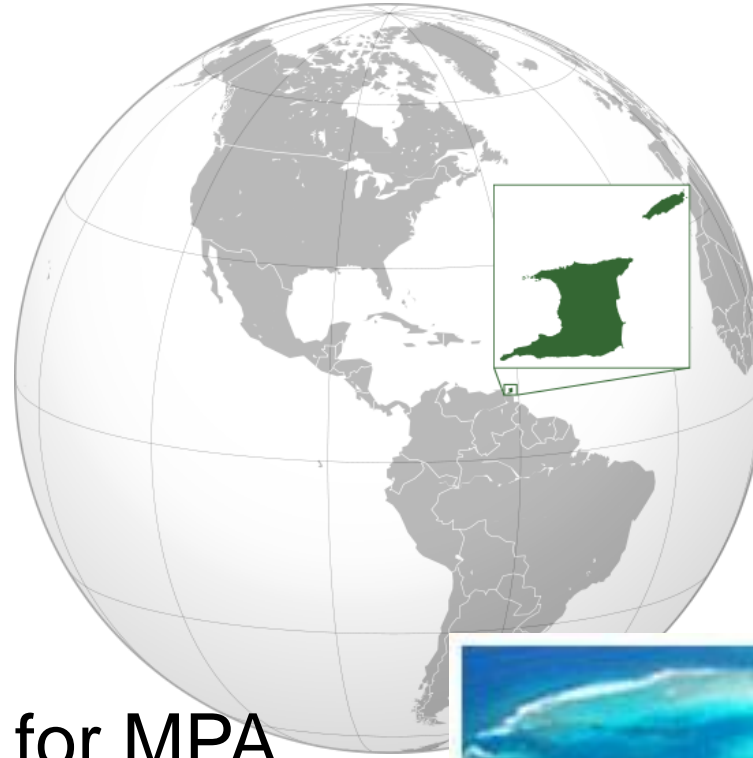
# How does MCA differ from CBA or SROI?

- Considers a range of options
- Considers all stakeholders and distinguishes them
- Consults stakeholders on the criteria to be used
- Stakeholders rank the criteria
- Indicators do not need to be monetised
- Based on the score and ranking, the most preferred / least preferred options are identified for each stakeholder group
- No single ratio or value

A case study from Tobago...

## The Buccoo Reef MPA

Trade off analysis for MPA management = Multi-criteria analysis (MCA)



## The Buccoo Reef MPA: Why MCA?

- Including multiple objectives within decision making
- MPAs in the region deteriorating
- Marginalisation of key stakeholders a cause
- MCA to make sure this doesn't happen
- Opportunity to build consensus and aid management
- Appropriate technique for complex systems and potential conflicts
- Builds consensus
- Helps stakeholder buy-in and management

# Why did they choose MCA?

- MCA combines stakeholder analysis and socio-economic tools, as well as ecological considerations
- Includes all stakeholders = Participatory
- Tool for decision-making
- Analyse trade-offs
- Holistic

# The MCA Process – summary

- Background research / available data
  - Define and identify stakeholders
  - Identify key drivers and outcomes (regulators and government agencies)
  - Defining scenarios and criteria
  - Scenarios A, B , C and D (not inevitable)
  - Believable and feasible futures
  
  - Low  $\Leftrightarrow$  high tourism expansion, with / without environmental management
  
  - Different development trajectories
-



## The *MCA* *process (I)*

### **Establish decision context** (Institutional Analysis)

Who are the key players  
(stakeholders)?

What are the aims of the process?

Drivers, pressures and stakeholders

# Context

- BRT Tobago (see following map)
- Reefs, lagoon and mangrove swamp
- 150Ha marine 300 Ha terrestrial

## DRIVERS

- Growth of tourism
- Growth of local population

[http://www.cserge.ac.uk/sites/default/files/gec\\_2000\\_02.pdf](http://www.cserge.ac.uk/sites/default/files/gec_2000_02.pdf)

# BUCCOO REEF MARINE PARK

— Proposed boundary

— Existing boundary



### Considerations

- Reef systems are complex
- Many interactions (run-off, fisheries & recreation, ..)
- Most development strategies in tropical reef systems include tourism
- Land use changes have impacts on lagoons, mangroves and reefs and impact on coastal livelihoods
- Dependence on fisheries
- Economic and ecological systems are linked and have feedback loops

### Considerations

...

continued

- Non-consumptive and consumptive uses: all uses are 'subtractable' e.g. fisheries and recreation (pollution, consumption, congestion..)
- Quality of reefs is a concern for tourism
- Complex systems of property rights (state, private and common) - potential for conflict
- Involvement in process as a key consideration for stakeholders
- Need transparent solutions

# Pressures

- Land-Based Pollution
- Fishing Activities
- Physical Damage
- Effects of Climate Change

# Stakeholders

- Local residents
- Local council
- Tobago House of Assembly
- Regulators
- Fishermen
- Recreational users
- Reef tourism operators
- Water sport and dive shop operators

## The MCA process (II)

### □ **Identify options: Scenarios**

What are the alternative courses of action (options, scenarios) that can satisfy the aims?



# Scenarios

**Tab 1: Scenarios for Buccoo Reef Marine Park and the driving forces of change**

Scenario	New tourist beds in BRMP area*	Population in BRMP area*	Percentage waste treated
A: Limited tourism development without complementary environmental management	240	6900	9
B: Limited tourism development with complementary environmental management	240	6900	49
C: Expansive tourism Development without complementary environmental management	1580	7400	18
D: Expansive tourism development with complementary environmental management	1580	7400	69

## The MCA process (III)

### □ **Determine Criteria (and sub-criteria)**

Which criteria will measure the success of each scenario?

Break them down into sub-criteria (more specific)

# Assessing criteria under different scenarios

## **Economic criteria**

- Macro economic benefits & recreational user benefits
- Also non market tourism experience data
- Sustainability of tourism based on quality of marine environment
- Number of tourists; revenue (using multipliers) overall benefits
- NPV ~9-18mio US\$
- Recreation: visitor perceptions, WTP studies, CV surveys of 1,000 visitors and residents.
- TEV: use and non-use values

# Economic criteria

WTP to prevent further deterioration under scenarios A-D.

Scenarios	Total WTP of users and non-users of BRMP to 2007 (DC) (USD m)	Total WTP of users and non-users of BRMP to 2007 (OE) (USD m)	Net present value of WTP to 2007 (DC) (USD m)	Net present value of WTP to 2007 (OE) (US\$ M)
Expansive Tourism Development	17.83	7.09	9.22	3.67
Limited Tourism Development	11.27	4.48	6.24	2.48

*Note:*

Net present values estimated at discount rate of 0.10.

DC = dichotomous choice OE = open-ended contingent valuation questions.

# Economic criteria

- Higher revenues through expansive tourism development
- Long term impacts of tourism may have different impacts (social and environmental)

## Social criteria

- Distribution of impacts
- Local employment; informal employment; local access to BRMP
- Sub-criteria related to employment distribution (Trinidad)
- Semi-structured surveys with local business vendors to establish if business activity linked to the MPA
- Also asked about hopes and fears regarding tourism
- Issues: size and type of hotels; types of tourists; park and beach management levels

Drivers  
affecting  
social  
criteria...  
how will  
these affect  
local  
businesses?

- More tourist beds
- Population growth
- % waste treatment at tertiary level (from available data)
- Supported by sub-criteria and indicators

# Impacts of factors under scenarios listed as + 0 -

**Table 5: Possible impacts of scenario drivers on income of informal business vendors**

Scenario drivers	With enhanced environmental management	Impact on IBV income (+/-/?)	Without enhanced environmental management	Impact on IBV income (+/-/?)
Expansive tourism development	Larger hotels (own craft shops).	-	Larger hotels (own craft shops).	-
	Increased management may lead to removal of vendors	-	No change in environmental or park management	0
Limited tourism development	Smaller hotels (more adventurous tourists).	+	Smaller hotels (more adventurous tourists).	+
	Increased management may lead to removal of vendors	-	No change in environmental or park management	0

Source: Generated from qualitative responses to survey of informal businesses (see text).

Notes: + represents positive impact; - represents negative impact; 0 represents no significant impact (see text).



# Ecological criteria

1. Reef quality
2. Seagrass extent
3. Mangrove extent

# Ecological criteria (continued)

- Water quality as major indicator of ecosystem health
- Run-off as major issue
- Impacts on coral reef system > smothering and nutrient loading
- Mangroves assimilate nitrogen and reduce effects of eutrophication
- Indicator: nitrogen concentration (impacts human health and algal build-up)
- Impact of development on nitrate is estimated per person, dependent on tertiary sewage treatment
- Again, the scenarios have an impact, in particular the number of tourists and level of environmental management

## Assumptions for the ecological criteria

- More people > more nitrate.
- Ambient N concentrations are equal throughout BRMP.

## The MCA *process (IV)*

### □ **Derive Performance Matrix**

How does each scenario  
score on each criterion?  
'Harmonise' impact scales  
assessed on different units

# Impacts on criteria under scenarios

**Table 1: The estimated impact of four development scenarios for the BRMP on economic, social, and ecological criteria**

Criteria	Scenario			
	A	B	C	D
<b>Economic</b>				
1: Economic revenues to Tobago (US\$m)	9	11	17	19
2: Visitor enjoyment of BRMP (US\$m)	1.2	2.5	0.9	1.7
<b>Social</b>				
3: Local employment (no. jobs)	2,500	2,600	6,400	6,500
4: Informal sector benefits (score)	5	4	3	2
5: Local access (score)	6	5	6	7
<b>Ecological</b>				
6: Water quality ( $\mu\text{g N/l}$ )	1.5	1.4	2.2	1.9
7: Sea grass health (g dry weight/m <sup>2</sup> )	18	19	12	15
8: Coral reef viability (% live stony coral)	19	20	17	18
9: Mangrove health (ha)	65	73	41	65

## The *MCA* *process* (v)

### □ **Assign Weights**

How important is each criterion for the final decision? (different stakeholders may attach different importance on each criterion)

# Weighting by stakeholders

- All these criteria are presented to stakeholders to get their weighting (priorities)
- FG discussions with fishers; local communities, local businesses and entrepreneurs, reef tour and water sports operators, technical staff from Tobago House of Assembly (one to one structured interviews). Questionnaires for tourists rather than FGs.
- Process revealed that they prioritised ecosystem health
- This underpins livelihoods and economic prosperity
- Generates ordered ranking of development scenarios: highest score = most desirable

# Weighting

Table 3: Derived weights and rank orderings for development scenarios for six stakeholder groups.

	Equal weighting	Approximate consensus of local stakeholders	Regulatory agency	Recreational users
<b>Weight</b>	33:33:33	20:30:50	19:29:52	9:32:59
<b>Scenario ranking (lightest ranking)</b>	D: Expansive tourism development with complementary environmental management	B: Limited tourism development with complementary environmental management	B: Limited tourism development with complementary environmental management	B: Limited tourism development with complementary environmental management
	↓	↓	↓	↓
	B: Limited tourism development with complementary environmental management	D: Expansive tourism development with complementary environmental management	A: Limited tourism development without complementary environmental management	A: Limited tourism development without complementary environmental management
	↓	↓	↓	↓
	A: Limited tourism development without complementary environmental management	A: Limited tourism development without complementary environmental management	D: Expansive tourism development with complementary environmental management	D: Expansive tourism development with complementary environmental management
	↓	↓	↓	↓
<b>(lowest ranking)</b>	C: Expansive tourism development without complementary environmental management	C: Expansive tourism development without complementary environmental management	C: Expansive tourism development without complementary environmental management	C: Expansive tourism development without complementary environmental management



## The *MCA* *process (VI)*

### □ **Overall Value: Results**

Adjust Performance Matrix by  
Weights

Rank scenarios by their desirability

# Ranking by stakeholders

**Table 2: Results of stakeholder preference ranking**

<i>Priority Areas</i>	<i>Bon-Accort Village Council</i>	<i>Buccoo Village Council</i>	<i>Depts of the THA*</i>	<i>Fishers</i>	<i>Recreational users**</i>	<i>Reef Tour Operators</i>	<i>Water Sports/ Dive ops.</i>
Economic Growth (%)	22	25	19	18	9	27	23
Social issues (%)	32	35	29	40	32	32	15
Eco-system (%)	47	40	52	43	59	42	63

# Results

- Arbitrary equal weighting of economic, social and ecological criteria

## Results:

- Scenario B highest ranking
- Differences thereafter
- Regulators and recreational users: environment prioritised over economics

## The *MCA* *process* *(VII)*

### □ **Sensitivity Analysis**

How sensitive is ranking to changes in scores and weights?

Identify trade-offs between stakeholder preferences

# The *MCA* *process* *(VIII)*

## □ **Negotiation**

Present MCA results & sensitivity  
Analysis to stakeholders  
Negotiate a consensus with them

## Final steps

- Series of meetings to build consensus, trust and understanding of management strategies
- Agree priorities - stakeholders present their findings to each other
- First steps towards co-management

### Conclusions:

1. We need to look at trade-offs
2. Tourism levels vs. reef health
3. Quantitative and qualitative data included
4. Don't have to monetise trade-offs
5. Stakeholder involvement moves beyond short term conflict > role in management
6. Builds consensus
7. Empowerment
8. Co-management
9. *Outcome: better reef, lagoon and mangrove condition and corresponding tourism experience and jobs*

# Any questions?

