How will the stakeholders respond to your Health Risk Assessment?

Prime Minister?

Minister of Tourism?

Minister of Agriculture and Aquaculture?

Minister of Natural Resources?

Minister of Industry?

NGOs against bison translocation ?

NGOs in favour of bison translocation?

Decision challenges

- Not pleased:
  - The Prime Minister
  - The Minister of Tourism
  - The Minister of Natural Resources
  - All stakeholders in support of bison on the Mallotus Islands

- Pleased:
  - The Minister of Agriculture and Aquaculture
  - The Minister of Industry
  - All other stakeholders against bison translocation to the Mallotus Islands

An approach to decision-making

- Health risks are just one of the concerns that influence the final decision about wildlife translocations and other complex issues

- How can different views, opinions and values be incorporated into decision-making?
  - One approach is MCDA
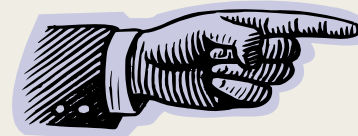
What is MCDA?

MULTI-CRITERIA DECISION ANALYSIS

'...a structured approach to decision-making that weighs animal health concerns with other factors.'

– Political, environmental, financial, social

– Also considers different perspectives and values and evaluates multiple criteria

Uses of MCDA

- Identify a single preferred alternative

- Generate a short list of possible alternatives that can then be further considered

- Rank all the possible alternatives from best to worst

- Distinguish acceptable from unacceptable alternatives

MCDA process

- Is transparent and repeatable
- Provides a mechanism for inputting and organizing opinions from different stakeholder groups
- Is basically a series of pair-wise comparisons
  - Evaluates how different decision criteria score for different alternatives.

8 Steps in MCDA

1. Define the problem
2. Identify the stakeholders
3. Identify the alternatives
4. Identify and define the decision criteria

5. Weight the decision criteria
6. Establish how to measure each criterion
7. Score each criterion-alternative pair
8. Analyse the data

Decisions, decisions, decisions

- What to wear?
- What to eat?
  - Cost
  - Calories
  - Balance of nutrients
  - Taste

1. Define the problem

- Your office is planning to purchase 2 new field vehicles.

Problem:

Which vehicles should be purchased?

2. Identify the stakeholders

- Who will be affected most by this decision? Who is able to influence the decision?
  - Field staff
    - Those who will use the vehicles
  - Senior government officials
    - Those who determine budgets
  - Office managers
    - Those responsible for the safety of their staff

3. Identify the alternatives

- There are many different vehicles to choose from:

4. Identify and define the decision criteria

- What are some factors that will influence the final decision and differentiate between the alternatives?
    - Cost
    - Fuel efficiency
    - Four-wheel drive
    - Cargo space
    - Passenger capacity
    - Safety

5. Weight the decision criteria

- Depends on the perspective of the stakeholder group
  - Field staff:
    - Four wheel drive and cargo space
  - Senior government officials:
    - Cost
  - Office managers:
    - Safety

6. Establish how to measure each criterion

- Cost   - a currency value (e.g. $)

- Fuel efficiency   - km/l

- Four-wheel drive   -Y or N

- Cargo space   - cubic meters

- Passenger capacity -number of seats

- Safety   -5 or 10 point scale

7. Score each criterion-alternative pair

Alternatives	Criteria					
	Cost (Euro (€))	Fuel (L/100km)	Four-wheel drive (Y or N)	Cargo (m^3)	Passenger (Number)	Safety (5 pt scale)
	Minimize	*Minimize*	Y	*Maximize*	*Maximize*	*Maximize*
Economy	10,000	5	N	0.5	5	4
Sports	30,000	9	N	0.2	4	5
Rugged truck	19,000	14	Y	1.32+	5	4
Van	24,000	11	N	0.3+	8	5

8. Analyze the data

- Economy car – preferred for cost and fuel efficiency

- Sports car – preferred for safety

- Rugged truck – preferred for four-wheel drive and cargo space

- Van – preferred for passenger capacity and safety

How to we make a decision?

- MCDA considers:

- How well each of the alternatives scores for each of the criteria

- How important each criterion to the different stakeholder groups

There is no one correct choice of vehicle

The best choice balances the alternatives, the criteria and the perspectives of the stakeholders in making the decision.

MCDA and Health Risk Assessment

HOW TO DECIDE IF BISON SHOULD BE INTRODUCED TO THE MALLOTUS ISLANDS?

Step 1. Define the problem

- Issues:
  - Some stakeholders support the translocation
  - Others are opposed to the translocation
  - The health risk assessment identified important health risks
- MCDA objectives:
  - Analyse the pros and cons of the translocation
  - Identify alternative options to reduce risk
  - Present results to decision-makers

2. Who are the stakeholders

- Government Agencies (at source and at destination)

- Source Environment:

- Destination Environment

- Non-Government groups (national, international)

- International Organizations

Bison Translocation Stakeholders:
Golden Fleece Sheep Breeders Association
Ministry of Environment/Wildlife
Ministry of Agriculture/CVO
Ministry of Tourism
Goose hunters
Anguille Original Peoples Council
Fastbuck Business Association
Atlantis Natural History Club
Bison Conservation International
Political party in power
Aggregate Exports Inc
Calliope International

Group discussion about stakeholders

- Are there any other stakeholders to add to this list?

- Which stakeholders are likely to benefit the most and which are likely to experience the most significant negative effects?

- Are there some groups that could be categorised together because they have similar concerns and perspectives?

	Bison health and conservation	Mineral extraction (short term financial gain)	Tourism (long-term economic stability)	Culture (aboriginal, farming tradition, etc)	Natural history and ecology of the Mallotus Islands	Sheep health and production
Golden Fleece Sheep Breeders Association				X		X
Ministry of Environment/Wildlife						
Ministry of Agriculture/CVO						
Ministry of Tourism						
Goose hunters						
Anguille Original Peoples Council						
Fastbuck Business Association						
Atlantis Natural History Club						
Bison Conservation International						
Political party in power						
Aggregate Exports Inc						
Calliope International						

Final stakeholder list

- **Sheep farming**
  - Golden Fleece Sheep Breeders Association
  - Ministry of Agriculture/CVO
- **Culture and environmental protection**
  - Anguille Original Peoples Council
  - Atlantis Natural History Club
  - Ministry of Environment/Wildlife

- **Tourism**
  - Ministry of Tourism
  - Goose hunters
  - Political party in power
- **Business**
  - Aggregate Exports Inc
  - Fastbuck Business Association
- **Bison conservation & welfare**
  - Bison Conservation International
  - Calliope International

3. Identify the alternatives

- How can the issues and concerns about the translocation be addressed? Can the risks associated with translocation be reduced?
  - Health risks
  - Non-health concerns

Stakeholder group concerns:

- Sheep farming:
  - Loss of sheep farming and industry
- Culture and environmental protection
  - Loss of Anguille culture and ecology of the islands
- Tourism
  - Reduced long term revenue
- Business
  - Cancellation of the plans to mine the islands
- Bison conservation and welfare
  - The bison will die if translocated to Atlantis

Final list of alternatives

- Do not translocate bison to Atlantis
- Translocate the bison as described in the translocation plan
- Translocated the bison but fence off the main breeding areas (grasslands) used by Dirk's Storm Petrels
- Translocate the bison and remove the sheep
- Translocate fewer bison and only place them on the largest of the Mallotus Islands
- Translocate the bison to mainland Atlantis, not the Mallotus Islands

4. Identify and define the decision criteria

- How to choose between the alternatives?
- The criteria should be:
  - Clearly stated
  - Concise
  - Measurable
  - Able to discriminate between the alternatives

Small group work

- Identify and define the decision criteria for translocation of bison to Atlantis

  – Each table represents a stakeholder group

  – Develop a short list of useful criteria that will help distinguish among the alternatives from your stakeholder group perspective.

  – Fill in the table on page 97

Group discussion

- Develop a final list of criteria

- Group the criteria into themes (categories)

Final list of decision criteria

- Health
  - Infectious disease risk to sheep
  - Infectious disease risk to bison
  - Welfare of bison – concern that the habitat cannot sustain bison
- Economics
  - Cost of translocation
  - Annual income of the Mallotus Islands
  - Mineral extraction – will it go ahead?
- Socio-ecological
  - Loss of wild bird habitat
  - Loss of sheep range
  - Impact on Anguille culture
  - Loss of sheep breeding culture and heritage

5. Weight the decision criteria

- Determine the relative importance of each decision criterion

- Will depend on the perspective of each stakeholder group

6. Establish how to measure each criterion

- Each criterion needs to be measurable – either quantitatively or qualitatively

- Some criteria may include multiple measures
  - One measure for each component of the criterion
  - All component measures need to be brought together for an overall measure of the criterion

Annual income to the islands
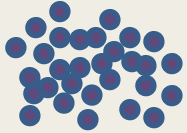
- Multiple sectors contribute to the annual income of the Mallotus Islands:
  - Tourism
  - Sheep industry (fleece and cheese production)
  - Goose hunting
- Total annual income will be a summation of each of these components

Small Group Work

- On each table there are 100 small objects

- Divide these up among the 3 major categories (health, economics and socio-ecological)

- Subdivide the 3 piles into the specific criteria included in each theme

Health			Economics			Socio-Ecological			
Insert weight 30									
Infectious disease risk to sheep	Infectious disease risk to bison	Welfare of bison	Cost of translocation	Annual Income to the islands	Mineral extraction	Loss of wildlife habitat	Loss of sheep range	Impact on Anguille culture	Loss of sheep farming culture
Insert weight 10	10	10							

Small Group Work continued….

- Once you have weighted the decision criteria, discuss how to measure each criterion
  - Enter your group recommendations into the last row of the table on page 102

Final weights used in data analysis

Stakeholder groups	Criteria									
	Health			Economics			Socio-ecological			
	Sheep	Bison	Welfare	Cost	Mineral	Income	Habitat	Range	Anguille	Farmer
Bison conservation and welfare	5	25	20	5	7.5	7.5	7.5	7.5	7.5	7.5
Sheep farming	10	10	5	5	10	10	10	15	5	20
Tourism	7.5	7.5	5	10	10	30	10	10	5	5
Business	5	5	5	5	40	5	5	20	5	5
Culture and environmental protection	5	5	5	5	10	5	25	5	30	5

7. Score each alternative-criterion pair

- Provide a score for each alternative-criterion pair

- This can be time consuming and relies on multiple sources of data:
    - Scientific literature
    - Government reports
    - Historical records
    - Expert and stakeholder opinion

Data considerations

- ## What if there are no data?
  - ### Expert opinion/stakeholder informants
    - There are precise methods developed to reliably gather information from key informants
      - Transparent and repeatable

- ## Scores don't change unless new data become available
  - ### They are not affected by the stakeholder concerns or opinions

	Health Criteria		
Criteria:	Disease threats to endemic species (sheep)	Disease threats to imported species (bison)	Animal welfare (bison)
Measure:	4-point scale (0=negligible; 1=low; 2=medium; 3=high) Average	scale (0=negligible; 1=low; 2=medium; 3=high) Average	scale (0=negligible; 1=low; 2=medium; 3=high)
Components:	Probability of introduction	Probability of exposure	Probability that the habitat cannot sustain bison
	Probability of exposure	Magnitude of consequence	
	Magnitude of consequence		
Desired effect:	Minimise	Minimise	Minimise
Alternatives			
A: Do not translocate bison	Score each component Sum component scores: 0+0+0=0 Calculate an average: 0/3=0 0=Negligible	Score each component Sum component scores: 0+0=0 Calculate an average: 0/2=0 0=Negligible	0 0=Negligible
B: Translocate bison as proposed	Negligible	High	Medium
C: Fence off the sea bird colonies and/or restrict bison movement	Negligible	High	Low
D: Translocate bison as proposed and remove sheep	Negligible	Medium	Medium
E: Translocate fewer bison and only place them on the largest of the Mallotus Islands	Negligible	Medium	Medium
F: Translocate bison to parks and protected areas on the main island of Atlantis	Negligible	Negligible	Negligible

8. Analyse the data

- MCDA is really a series of pair-wise comparisons but this can quickly become complex when there are several alternatives, many criteria and multiple stakeholders involved

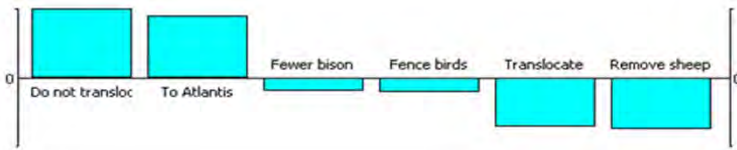- Several computer programs have been developed to help with this
 - Promethee

Bison conservation ..	Sheep disease	Bison disease	Bison welfare	Translocation	Mineral	Income	Habitat	Range	Anguille	Sheep farmers
Unit	4-point	4-point	4-point	$1 000 000	4-point	$1 000 000	4-point	4-point	4-point	4-point
Cluster/Group	♦	♦	♦	🟩	🟩	🟩	🔵	🔵	🔵	🔵
Preferences										
Min/Max	min	min	min	min	min	max	min	min	min	min
Weight	5.00	25.00	20.00	5.00	7.50	7.50	7.50	7.50	7.50	7.50
Preference Fn.	Usual	Usual	Usual	V-shape	Usual	Linear	Usual	Usual	Usual	Usual
Thresholds	absolute	absolute	absolute	absolute	absolute	absolute	absolute	absolute	absolute	absolute
- Q: Indifference	n/a	n/a	n/a	n/a	n/a	$ 1.00	n/a	n/a	n/a	n/a
- P: Preference	n/a	n/a	n/a	$ 2.00	n/a	$ 2.00	n/a	n/a	n/a	n/a
- S: Gaussian	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Statistics										
Minimum	1.00	1.00	1.00	$ 0.00	2.00	$ 18.30	1.00	1.00	1.00	1.00
Maximum	1.00	4.00	3.00	$ 12.00	4.00	$ 32.45	4.00	4.00	4.00	4.00
Average	1.00	2.67	2.17	$ 5.33	2.83	$ 27.62	2.50	2.33	2.50	2.67
Standard Dev.	0.00	1.25	0.90	$ 3.82	0.90	$ 4.82	1.26	1.11	1.26	1.37
Evaluations										
Do not translocate	Negligible	Negligible	Negligible	$ 0.00	High	$ 27.60	Negligible	Negligible	Negligible	Negligible
Translocate	Negligible	High	Medium	$ 5.00	Low	$ 32.30	High	Medium	High	High
Fence birds	Negligible	High	Low	$ 8.00	Low	$ 32.45	Low	Medium	Low	High
Remove sheep	Negligible	Medium	Medium	$ 12.00	Low	$ 18.30	High	High	High	High
Fewer bison	Negligible	Medium	Medium	$ 4.00	Medium	$ 29.45	Medium	Low	Medium	Low
To Atlantis	Negligible	Negligible	Negligible	$ 3.00	High	$ 25.60	Negligible	Negligible	Negligible	Negligible

| Bison conservation ..	Sheep disease	Bison disease	Bison welfare	Translocation	Mineral	Income	Habitat	Range	Anguille	Sheep farmers
Unit	4-point	4-point	4-point	$1 000 000	4-point	$1 000 000	4-point	4-point	4-point	4-point
Cluster/Group	◆	◆	◆	▮	▮	▮	●	●	●	●
Preferences										
Min/Max	min	min	min	min	min	max	min	min	min	min
Weight	5.00	25.00	20.00	5.00	7.50	7.50	7.50	7.50	7.50	7.50
Preference Fn.	Usual	Usual	Usual	V-shape	Usual	Linear	Usual	Usual	Usual	Usual
Thresholds	absolute	absolute	absolute	absolute	absolute	absolute	absolute	absolute	absolute	absolute
- Q: Indifference	n/a	n/a	n/a	n/a	n/a	$ 1.00	n/a	n/a	n/a	n/a
- P: Preference	n/a	n/a	n/a	$ 2.00	n/a	$ 2.00	n/a	n/a	n/a	n/a
- S: Gaussian	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Statistics										
Minimum	1.00	1.00	1.00	$ 0.00	2.00	$ 18.30	1.00	1.00	1.00	1.00
Maximum	1.00	4.00	3.00	$ 12.00	4.00	$ 32.45	4.00	4.00	4.00	4.00
Average	1.00	2.67	2.17	$ 5.33	2.83	$ 27.62	2.50	2.33	2.50	2.67
Standard Dev.	0.00	1.25	0.90	$ 3.82	0.90	$ 4.82	1.26	1.11	1.26	1.37
Evaluations										
Do not translocate	Negligible	Negligible	Negligible	$ 0.00	High	$ 27.60	Negligible	Negligible	Negligible	Negligible
Translocate	Negligible	High	Medium	$ 5.00	Low	$ 32.30	High	Medium	High	High
Fence birds	Negligible	High	Low	$ 8.00	Low	$ 32.45	Low	Medium	Low	High
Remove sheep	Negligible	Medium	Medium	$ 12.00	Low	$ 18.30	High	High	High	High
Fewer bison	Negligible	Medium	Medium	$ 4.00	Medium	$ 29.45	Medium	Low	Medium	Low
To Atlantis	Negligible	Negligible	Negligible	$ 3.00	High	$ 25.60	Negligible	Negligible	Negligible	Negligible

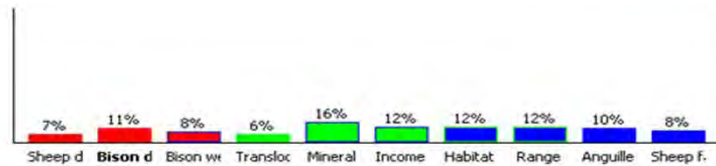**Bison conservation and welfare:**
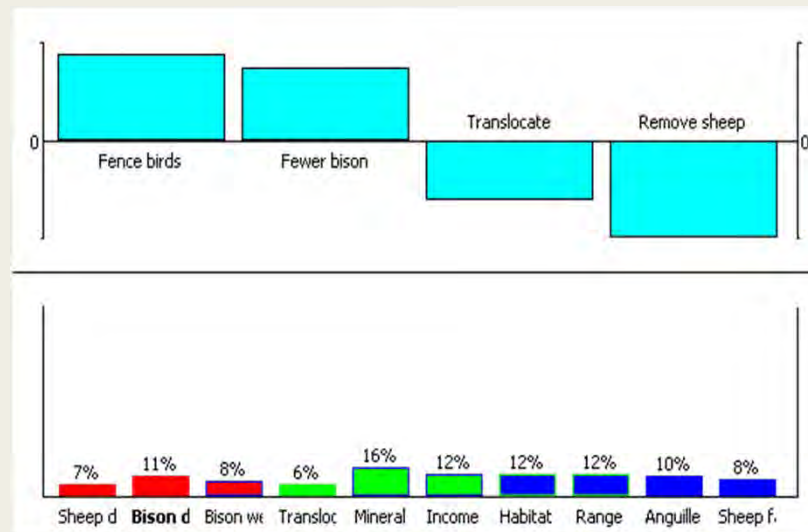
Business:
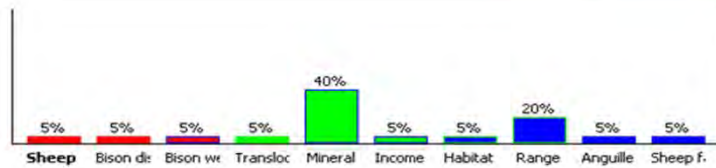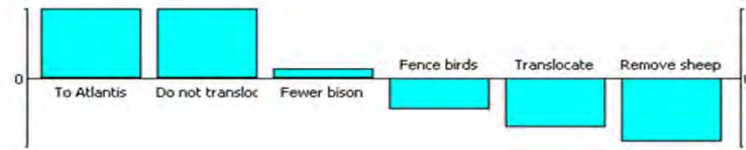
Sheep farming:
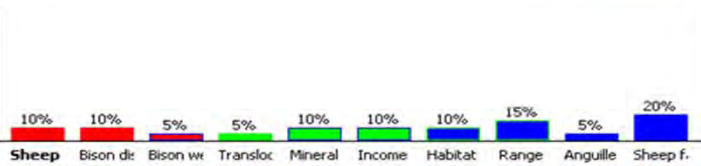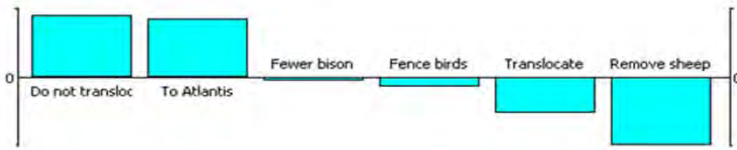
Culture and environment:
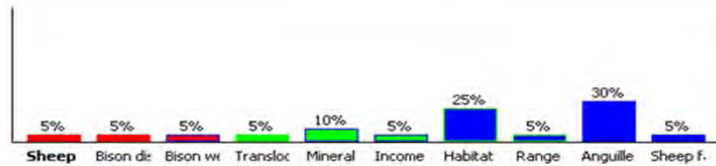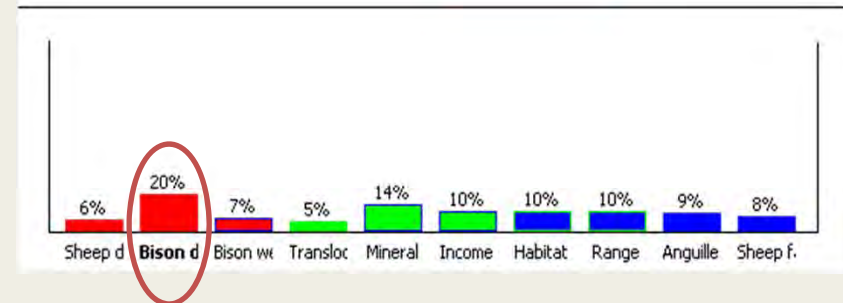
Tourism:
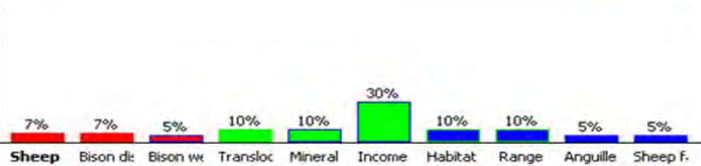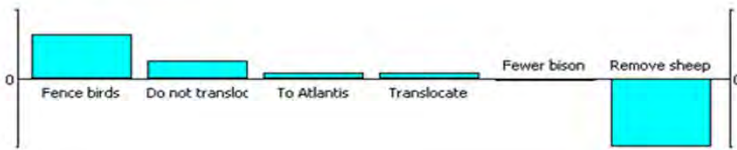
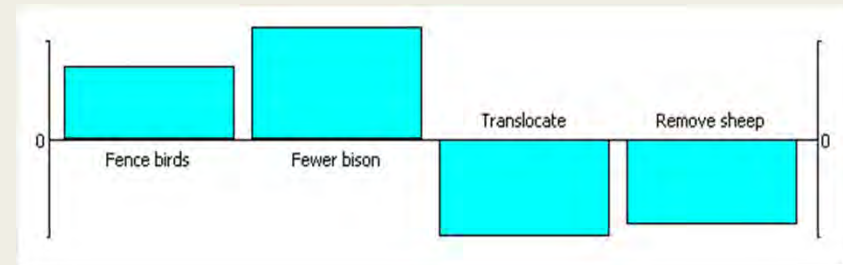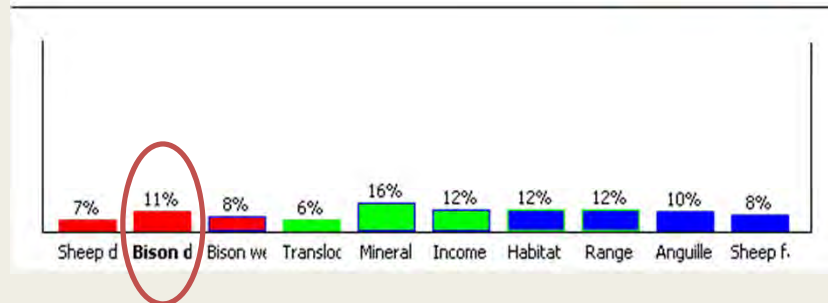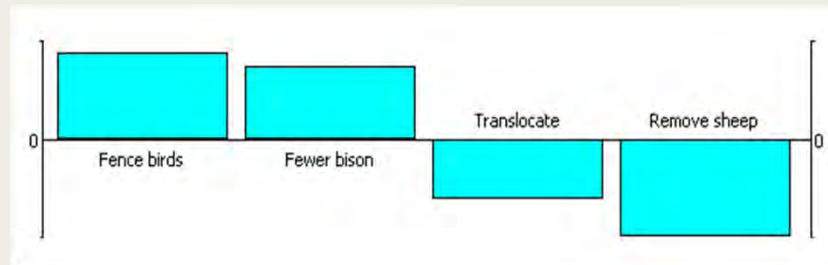**Overall:**

Remove alternatives

- If the government is determined that bison will be translocated to the Mallotus Islands, then 2 alternatives are no longer options

Making a final decision

- Reassess the weights given to each criterion:

Uncertainty in MCDA

- There will be uncertainty in most aspects of MCDA when dealing with wildlife:
  - Scores
  - Weights
  - Measures
- This is the biggest challenge

"Garbage in-garbage out"

How to deal with uncertainty

- Informal sensitivity analysis:
  - Change the scores
  - Change the weights
- Formal sensitivity analysis
- Include uncertainty as a criterion

Conclusion

- MCDA is not magic

  – it provides a way to organise, assess and rank multiple criteria

- MCDA does not determine "right" or "best" decisions

  – it clarifies the components of complex problems

MCDA and ranking pathogens for surveillance

- In this situation, the pathogens are the alternatives

- Selected criteria might include burden of illness, pathogen prevalence, economic implications, cost of surveillance, etc…

- Provides transparency as to why (or why not) certain pathogens are included in surveillance