Key Elements of Metric Design

ECOSYSTEM SERVICES PROJECT

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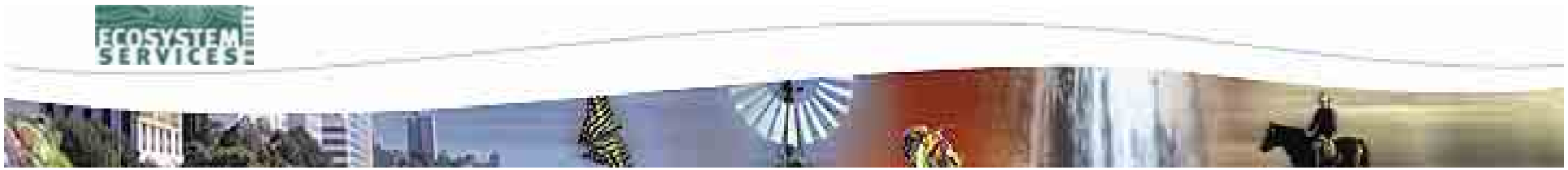
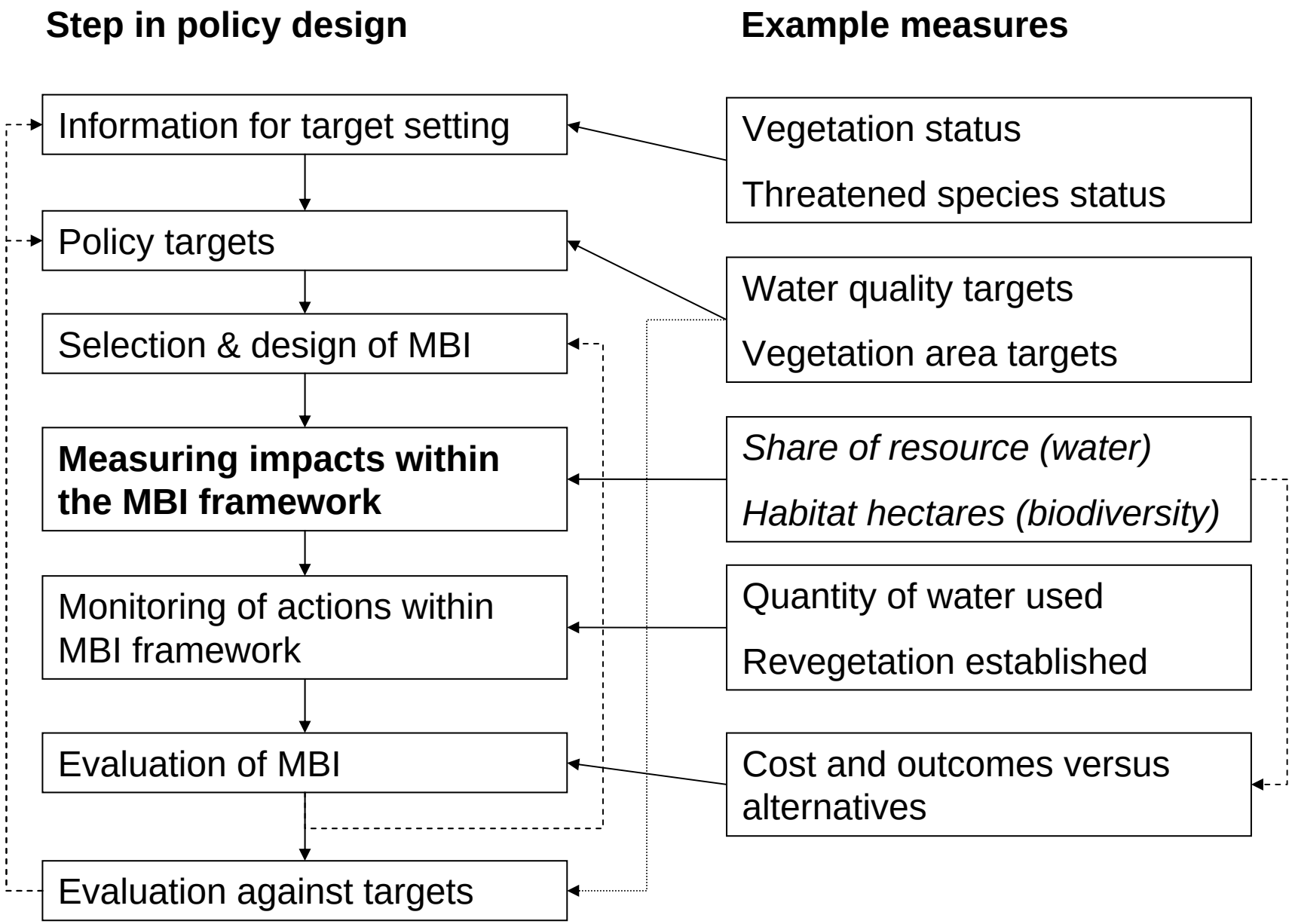
Elements of metric design

- Metrics?
- The role of the metric in an MBI.
- Principles in metric design.
- Economic context of the metric.
- Metric examples.

Measures and metrics …

- There are many measures of ecosystem services in NRM …
- Only rarely will the same measure be used for multiple roles.
- Roles of measures include setting targets, allocating funds, evaluating outcomes.
- Focus here is allocating funds using MBIs.

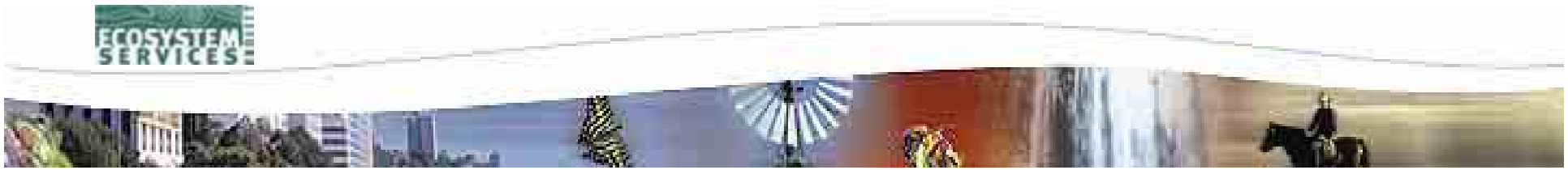



Step in policy design
Example measures
Information for target setting
Policy targets
Selection & design of MBI
Measuring impacts within the MBI framework
Monitoring of actions within MBI framework
Evaluation of MBI
Evaluation against targets
Vegetation status
Threatened species status
Water quality targets
Vegetation area targets
Share of resource (water)
Habitat hectares (biodiversity)
Quantity of water used
Revegetation established
Cost and outcomes versus alternatives

What is the metric in a MBI?

What is a metric:

- **The metric is the measure of what is being bought and sold in the market.**
- **It is THE critical element in evaluating alternative actions / purchases.**
- **Therefore it reflects a complex bundle of tradeoffs.**



Some metrics …

- **Tonnes of wheat (decision on $/tonne)**
  - Additional quality measures: protein, moisture …
- **Kilograms of wool (decision on $/kg)**
  - Additional quality measures: microns, foreign matter …
- **Vegetation cover index ($/unit)**
  - Additional quality measures: diversity, disturbance …

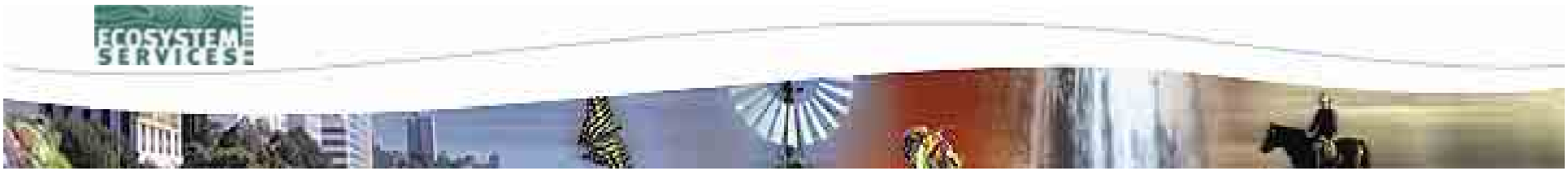
Roles of a metric in MBIs

- Measuring relative or absolute outcomes
- Defining (some of) the rights that will be contracted upon
- Allocating scarce funds between alternative uses
- Setting goals for evaluation of outcomes
- Not pure biophysical change but also other drivers of value …

It was too late to retract her bid.
Catherine had purchased the
small man on the motorbike.

Reflect on what we know from cartoon if Catherine is the government purchase officer –

- **Information from our metric: One small man on a motorbike!**
- **Is this a suitable measurement for her policy goal?**
- **Are we interested in small men on motorbikes? Do we need to know how small? What if the small man is in Japan?**
- **What do we really need to know to make decisions and what is superfluous (or even misleading to our goal)?**
- **What principles can be employed to help design the appropriate metric?**



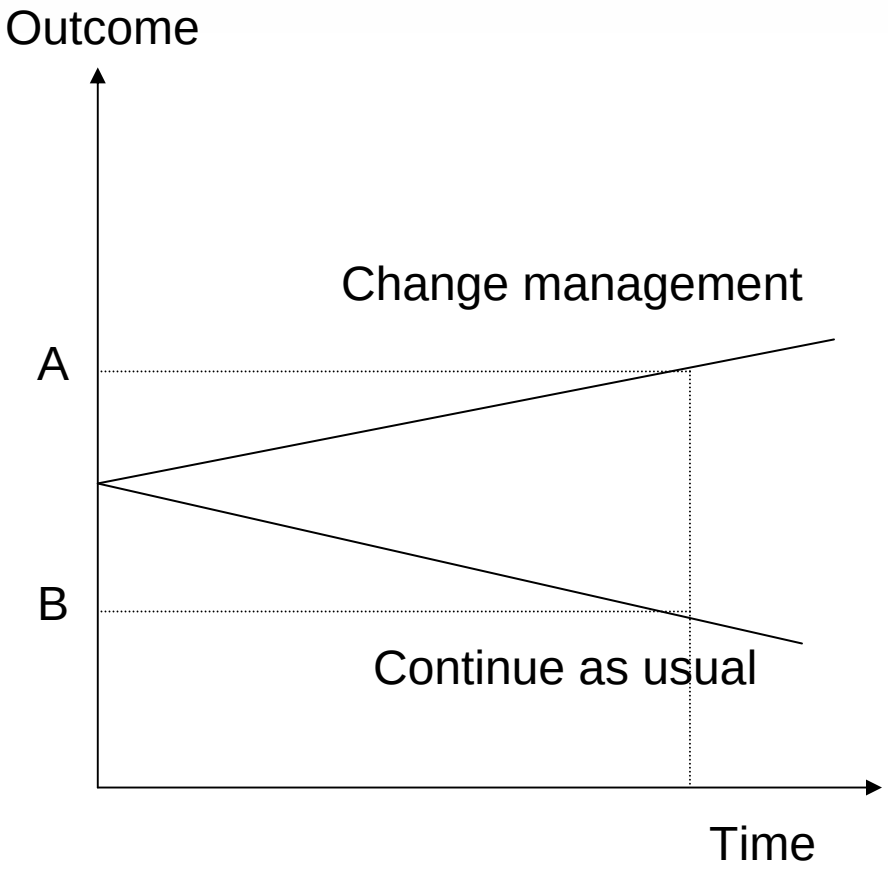
Nine key elements of metric design

1. Quantity / quality	➢ Hectares versus species
2. Spatial relations	➢ Does spatial coordination matter?
3. Relative change	➢ Marginal improvements matter
4. Location	➢ Up/down-stream / distance to benefit
5. Timing	➢ Years to achieve outcome
6. Implementation risk	➢ Failure to change management
7. Outcome uncertainty	➢ Desired outcome does not result
8. Irreversibility/thresholds	➢ What happens if nothing is done?
9. Spillover impacts	➢ Will the solution create problems?

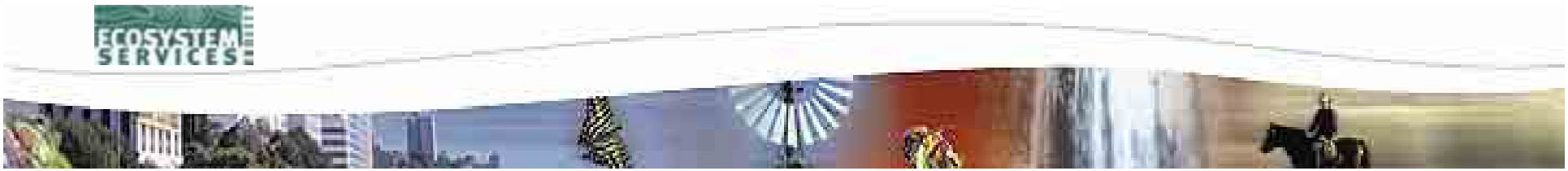
Elements of metric design …

Quantity / quality	Absolute and quantitative measure of ecosystem service quality and quantity
Spatial	Do some spatial combinations of management changes yield greater outcomes?
Relative change	Measured change from business as usual value? Is there a duty of care requirement / baseline?
Location	Are there distance functions, path impacts, thresholds, synergies to different sites?
Timing	Change now preferred over future change Permanent change may be valued more highly
Implementation risk	Likelihood of successful implementation.
Outcome uncertainty	Probability of success of actions
Irreversibility	Thresholds, extinctions, other?
Spillover impacts	Adverse impacts of management change?

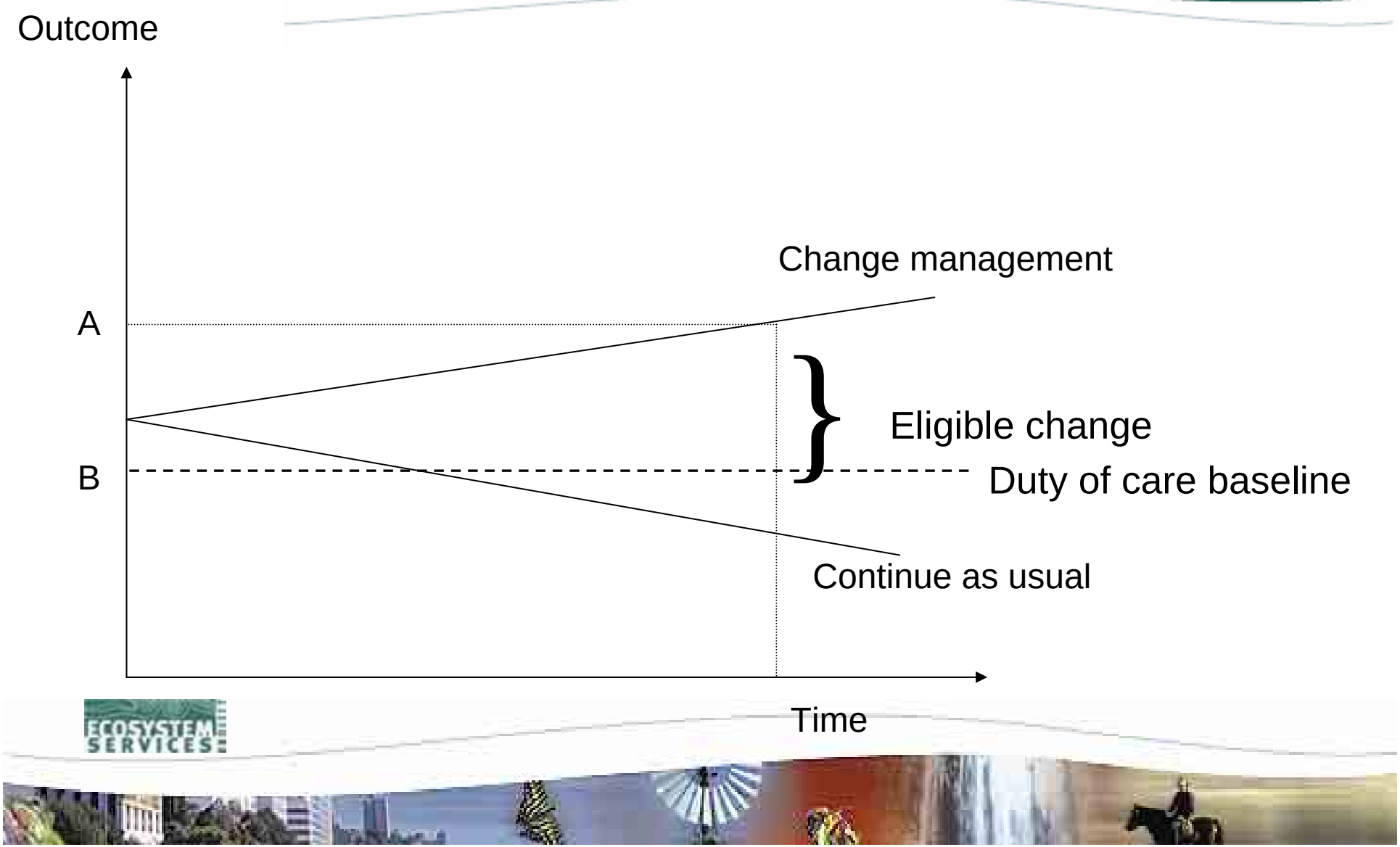
Economic concepts in metric design - relative change



- **Aim is usually to pay only for the improvement in outcomes.**
- **Improvement from what? Now? From if we do nothing?**
- **Hence, good baseline definitions and estimates are needed for comparison.**
- **Often the baseline is a duty of care that needs to be defined …**



Relative change with duty of care



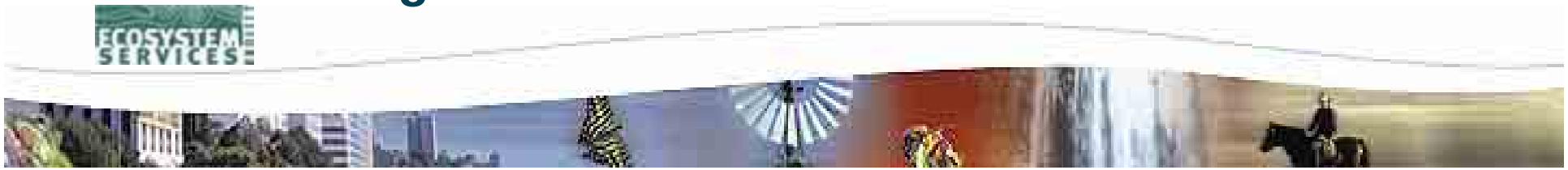

AUCTION
AUCTION

What really matters in metric design – a salinity example

1. Quantity / quality	➢ How much salt
2. Spatial relations	➢ Are changes additive or other?
3. Relative change	➢ Compared to current management
4. Location	➢ Higher in catchment is better
5. Timing	➢ Faster response better
6. Implementation risk	➢ Limit permissible actions
7. Outcome uncertainty	➢ Identify high probability areas
8. Irreversibility/thresholds	➢ if problems identified reject bid
9. Spillover impacts	➢ Impacts on stream flow / other?

How do we construct the metric?

- **The most important aspect of metric design is quantity / quality (including impact of spatial attributes).**
- **This is often adjusted to reflect net change from what would happen anyway (the do nothing baseline) or another defined baseline.**
- **Location, timing and risk/uncertainty weight the quality / quantity attribute.**
- **Irreversibility and spillovers are often included as filters but can be included as weights.**
- **If multiple outputs metrics are considered individual metric weights will need to be considered.**



Principles of metric design – salt reduction

Quantity / quality:

- **Modelled tonnes salt under different landuses**

Spatial relationship:

- **Site A benefit = *f*(site$_A$ relationship to others)**

Relative change:

- **Site A physical benefit = (tonnes salt$_{Change}$ - tonnes salt$_{Nochange}$)**

Location / risk / uncertainty weights:

- **Site A benefit = weight * (physical measure)**

Timing:

- **Site A benefit = discounted (weighted physical measure)**

Metric design issues – in-stream salinity in the upper Wimmera Catchment

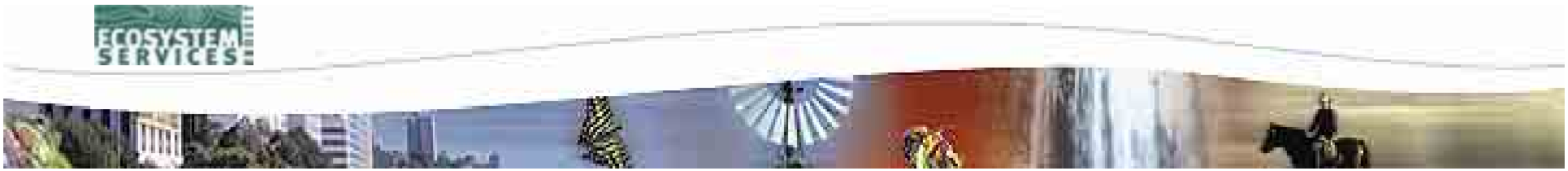
Quantity / quality	Salt discharge estimated from landuse change
Spatial relationships	None identified
Relative change	Change from standardised baseline estimate defined broadly by grazing / erosion DOC
Location	Specified downstream point (Horsham) No path impacts, thresholds, synergies
Timing	Steady state model (only short / medium term)
Implementation risk	Actions restricted to local species plantings
Outcome uncertainty	Actions restricted and only high priority systems eligible
Irreversibility	None identified
Spillover impacts	None considered significant but impact on water flows will be further considered.

Metric design issues – recharge in Coleambally Irrigation Area

Quantity / quality	Model net recharge to aquifer from irrigation
Spatial relationships	Impacts of phase cropping or inter-planting on recharge from site included in model
Relative change	Recharge compared to no irrigation
Location	3 separate response zones (separate markets)
Timing	Annual cropping cycle but longer period for monitoring success
Implementation risk	Limited crop options and easily monitored
Outcome uncertainty	Ongoing monitoring and model calibration.
Irreversibility	Unlikely at individual level. Targeted for future research.
Spillover impacts	None significant

For discussion

1. **What 'product' or ecosystem service attributes are important and will need to be considered within the metric?**
2. **How could you effectively measure/incorporate these attributes?**
   - Directly (outputs)?
   - Indirectly – e.g. by a proxy that is easier to measure?
   - Identifying changes to management (inputs)?
3. **Is there an existing metric that can be applied?**
   - Advantages / disadvantages?
4. **What might some of the costs, time and data constraints or other issues in designing a metric be?**



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