Environmental Compensation using the REMEDE Toolkit: *How much is enough ?*

REMEDE

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Företagets utökade miljöansvar
(Operators' Increased Environmental Liability)

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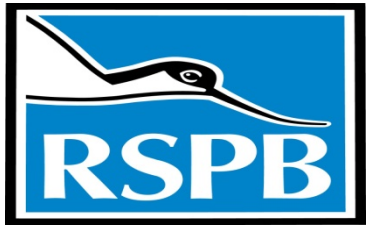
REMEDE partners



Pels Rijcken
& Droogleever
Fortuijn *advocaten*
en notarissen

DISCLAIMER

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Roadmap to Presentation

1. The REMEDE Project – what is it ? how can I get more info?
2. Background & Overview of "Equivalency Analysis"
3. Real-life examples of equivalency analyses
4. The REMEDE Toolkit's 5 Steps of Equivalency Analysis
   - Step 1: Initial evaluation
   - Step 2: Quantify debits
   - Step 3: Quantify credits
   - Step 4: Scale remediation & remediation costs
   - Step 5: Monitoring & reporting

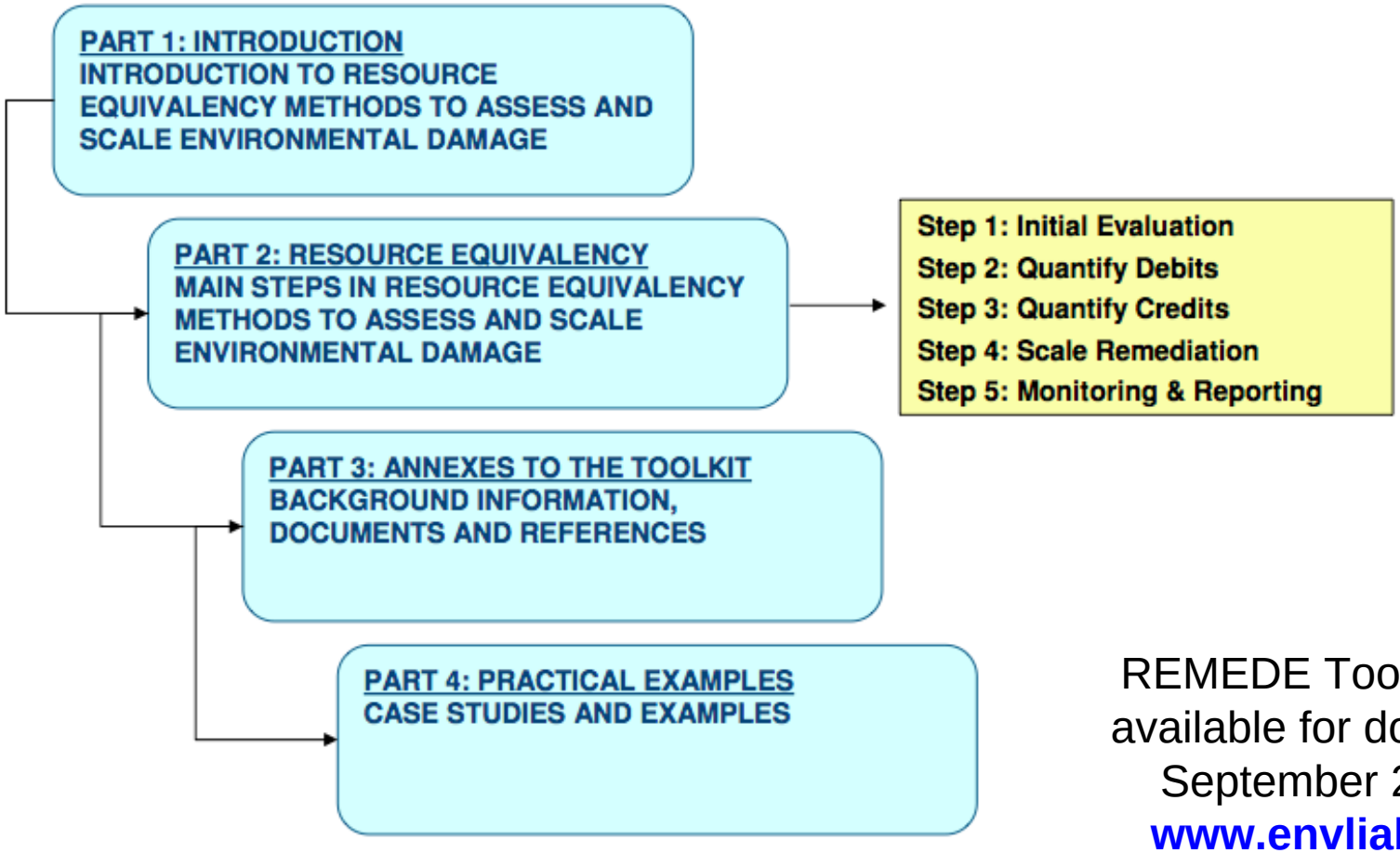
First things first: REMEDE Project

- **What ?** An EU-sponsored project (2006 – 2008)
  - **R**esource **E**quivalency **M**ethods for Assessing **E**nvironmental **D**amage in the **E**U (**REMEDE**)
  - Develop methods to determe *how much is enough* remediation?
- **Why the REMEDE Project?**
  - EU's Environmental Liability Directive (Annex II)
  - EU's Habitats Directive
  - EU's Wild Birds Directive
  - EU's Environmental Impact Assessment Directive

Results of project are also relevant for:

- (International treaties – Erika Oil Spill, France 1999)
- (Environmental permitting – future wind power plants in Europe ?)
- (Cost benefit analysis, CBA, to measure and value impacts)

Project Output: REMEDE Toolkit



REMEDE Toolkit will be available for download in September 2008 at:
www.envliability.eu

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REMEDE Toolkit Case Study
Examples of Equivalency Analysis

- Chemical tank collapse (Sweden)
- Mining spill (Spain)
- Forest fires (Spain)
- Chronic mining pollution (Czech Rep.)
- Vistual gas pipe crossing & Baltica motorway (Poland)
- River Itchen, UK
- Coastal defence, UK
- Airbus facility, Germany
- Habitat banking, Germany
- Migratory birds, UK & Germany

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What is **NOT** in the REMEDE Toolkit

1. No determination of "significant damage" (*allvarlig miljöskada*)
   - Each member state must decide how to *define* "significant" but the Toolkit can help …
2. No decision on how much primary remediation is needed (this is a biological question)
3. No guidance on what the baseline should be
   - But it does contain guidance on different approaches
4. No prescriptive guidance
   - To use the Toolkit effectively requires creativity (!)

Background on Equivalency Analysis

- 1989 Exxon Valdez
  - $1 **b**illion in env. compensation using *monetary valuation* of resource loss
- Early 90s: A better way ?
  - *equivalency analysis* developed by resource economists. Also called:
    - Resource equivalency analysis
    - Habitat equivalency analysis
    - Value equivalency analysis
    - Resource equivalency method (REMs)

The EU-funded REMEDE project focused on development of resource equivalency methods for the European context

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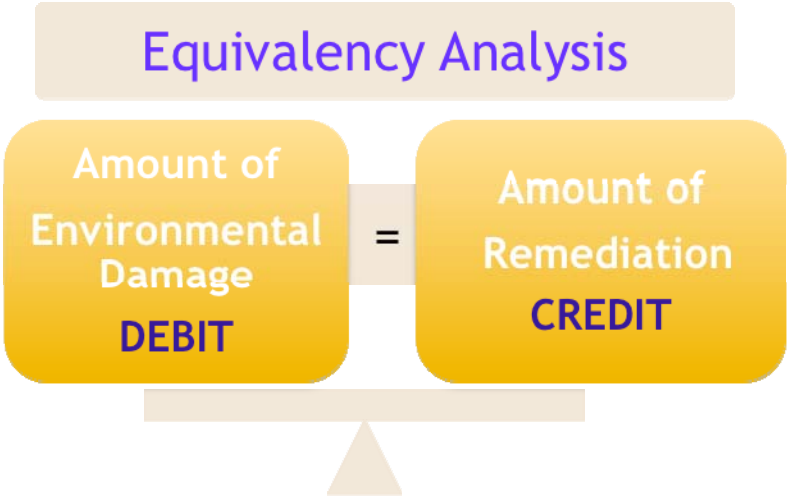
How much is enough ?

- How much of what ?
  1. (equivalent) natural resources
     - lake, river, wetland, fish, birds, vegetation, etc
  2. (equivalent) services the resource provides
     - groundwater, species habitat, recreation (fishing, boating)
- Enough to do what ?
  - Enough to compensate the public for the loss of resources/services
  - Not a punitive punishment against a firm
  - Not political revenge
  - Not a payment or a fine to the government

Public Compensation

- Environmental compensation is provided through:
  - Resource/service restoration
  - Resource/service replacement
  - Resource/service enhancement
- Equivalency Analysis provides a method to balance loss & gain



- A popular example called by another name: Carbon Offsets (!)

Resource Equivalency Analysis (REA) Lake Apopka, Florida 1999

- Pesticides in a lake killed 100s of birds and caused reproductive injuries
- **Debit**: ~5,000 *discounted "bird years"*
- **Credit**: purchased land and restored marsh habitat to restore a present value equivalent of "bird years"
- **Restoration cost**:$10 million paid in environmental liability by the liable Water District

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Value Equivalency Analysis (VEA) Lake Hartwell, GA/SC 1999

- PCB contamination in a lake led to a fish consumption advisory
- Some fishermen did not go fishing, others had a diminished fishing experience
- **Debit**: $7 - $18 million in lost recreational value to fisherman
- **Credit**: construct new fishing lakes, improve public access for fishing, and stock fish in lakes
- **Restoration Cost**: $7 - $18 million (value-to-cost)

In this case, VEA helps remediate a resource service (recreation) that is different than the damaged resource (fish population)

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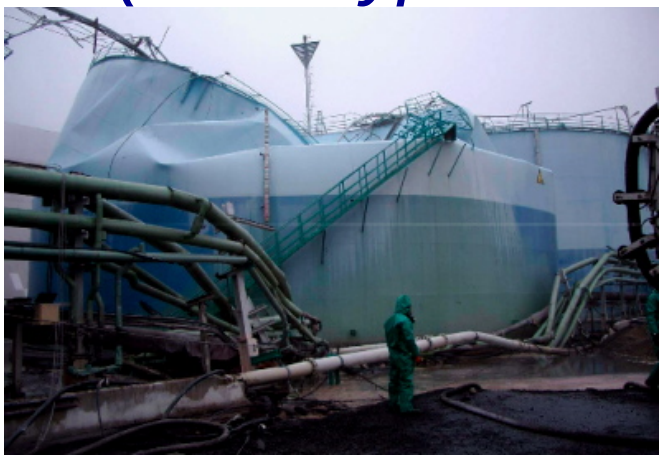
Habitat Equivalency Analysis (HEA) Helsingborg, Sweden *(2005 hypothetical)*

- Acid spill in a harbor
- Harbor-bottom sediment no longer provides *habitat services* to flora and fauna
- **Debit**: 33 *discounted hectare-years* of habitat services were lost
- **Credit**: 1 *discounted hectare year* of habitat services provided by a sea grass restoration project
- **Cost**: ~€100,000 (1 miljon kr)



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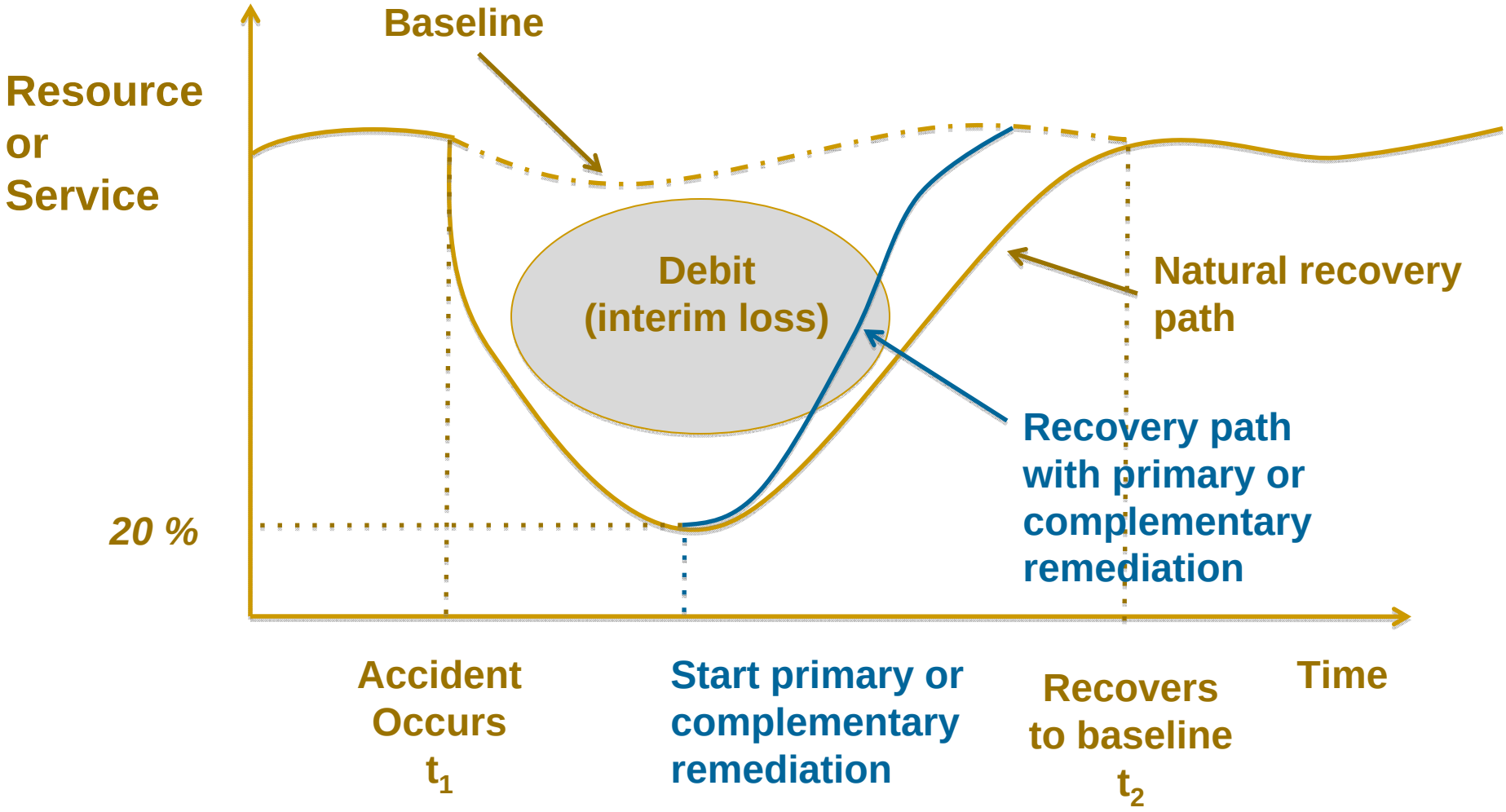
Different types of remediation in ELD

- **Primary remediation** (on-site, to baseline)
- **Complementary remediation** (to fully remediate to baseline if primary remediation not sufficient, on-site)
- **Compensatory remediation** (to address interim losses, can be off-site or on-site)

Primary Remediation example	**Complementary/Compensatory Remediation example**
• Clean up damage • Remove contaminants 1st response decides how much	• Restore, replace, enhance (compensate for the "interim loss") REMEDE TOOLKIT decides how much

What is the "debit" (interim loss)



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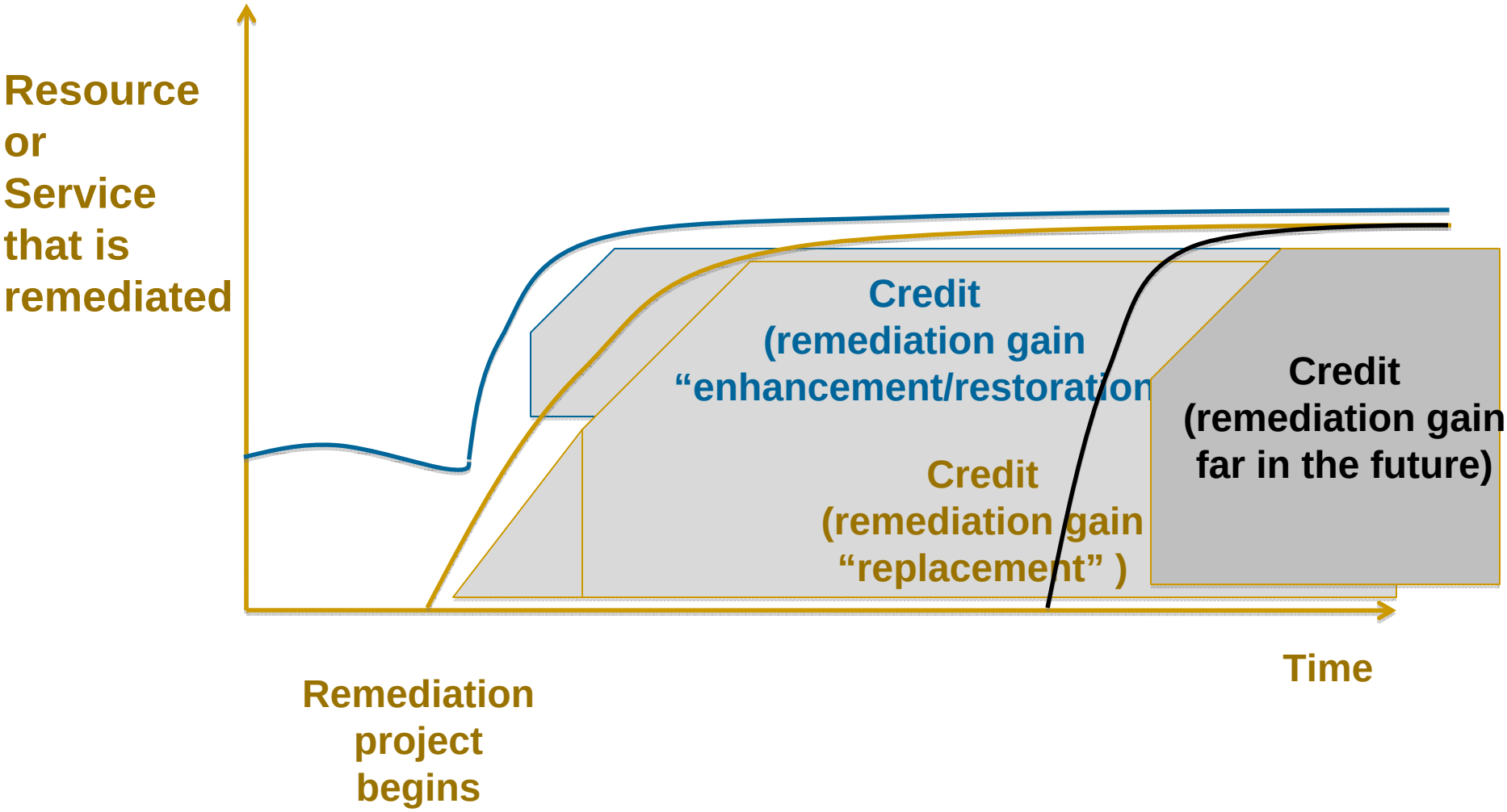
What is the “credit” ?



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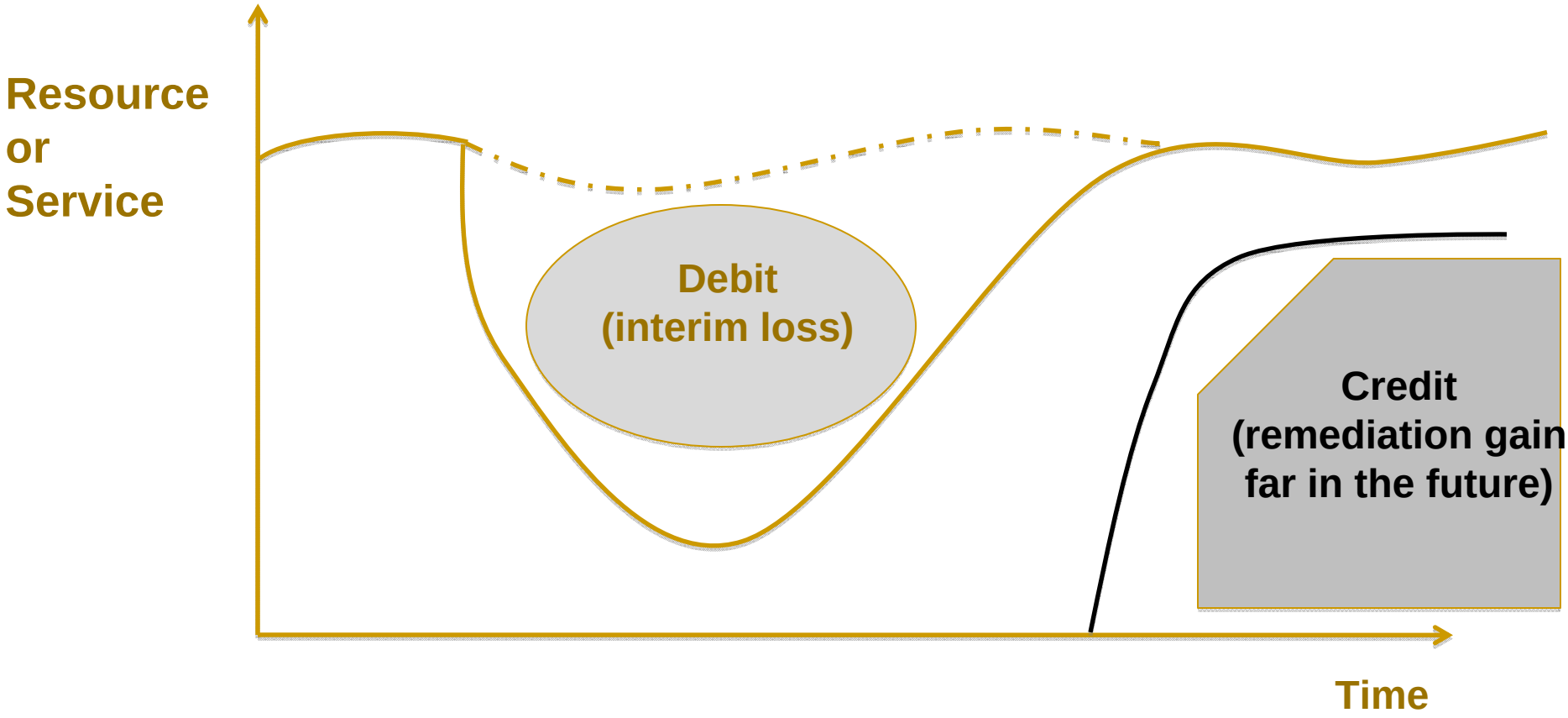

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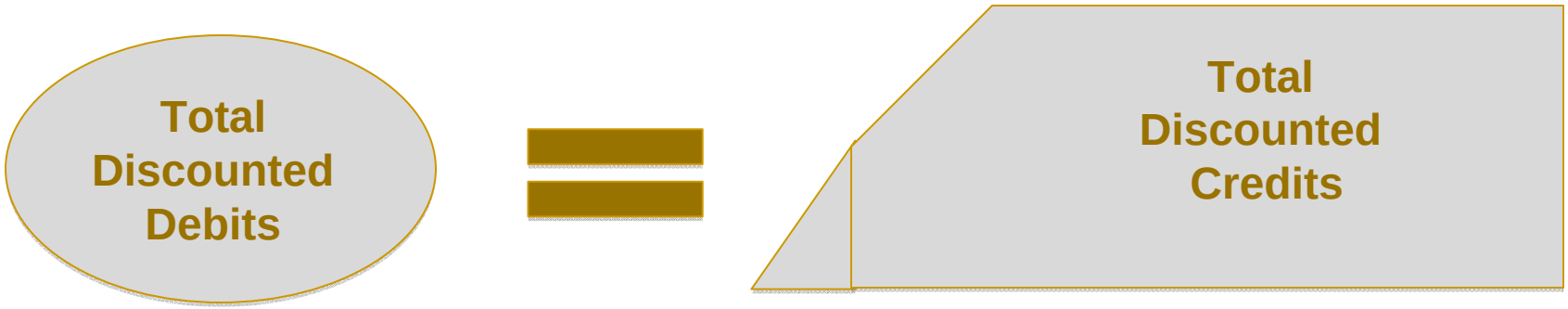
Equivalency over time
Debit = Credit



- Calculate total discounted debits over time
- Calculate total discounted credits over time
- Scale the remediation (make sure they are equal)
  - In practice: total debits ÷ *per unit* credits

REMEDE Toolkit: 5 STEPS

- Step 1: Initial evaluation
- Step 2: Quantify debits (environmental damage)
- Step 3: Quantify credits (remediation gains)
- Step 4: Scaling remediation & remediation costs
- Step 5: Monitoring & reporting

Step 1: Initial Evaluation

- To determine whether an *equivalency analysis* should be performed
  - What Directives/legal frameworks are relevant?
  - What type of damage (ecological vs. human use?)
  - What data is available to measure damage?
  - What type of remediation project is relevant?
  - etc. etc.
  - But the most important question is …

Step 1: Initial Evaluation (cont.)

Will *primary* remediation return resources to the baseline rapidly ?

OR (if not)

Is *complementary* and *compensatory* remediation necessary?

If primary remediation does not get us back to baseline rapidly, then we will need an equivalency analysis (go to Toolkit!)

Step 1: Initial Evaluation (cont.)

- We will most likely need an equivalency analysis (i.e., c*omplementary* and *compensatory remediation)* if:
  - Damage is "Significant" (not for Toolkit to decide!)
  - Primary remediation is not possible (too dangerous, no clean up technique available, etc)
  - Primary remediation possible, but not sufficient to reach baseline
  - Primary remediation causes additional damage (!)
  - Damage will persist for a prolonged period
  - Etc.

Step 2: Quantify debit (environmental damage)

Three major sub-steps:

a) Identify damaged resources/habitat/service
b) Determine cause of damage (debit)
c) Quantify debit

Step 2a: Identify damage

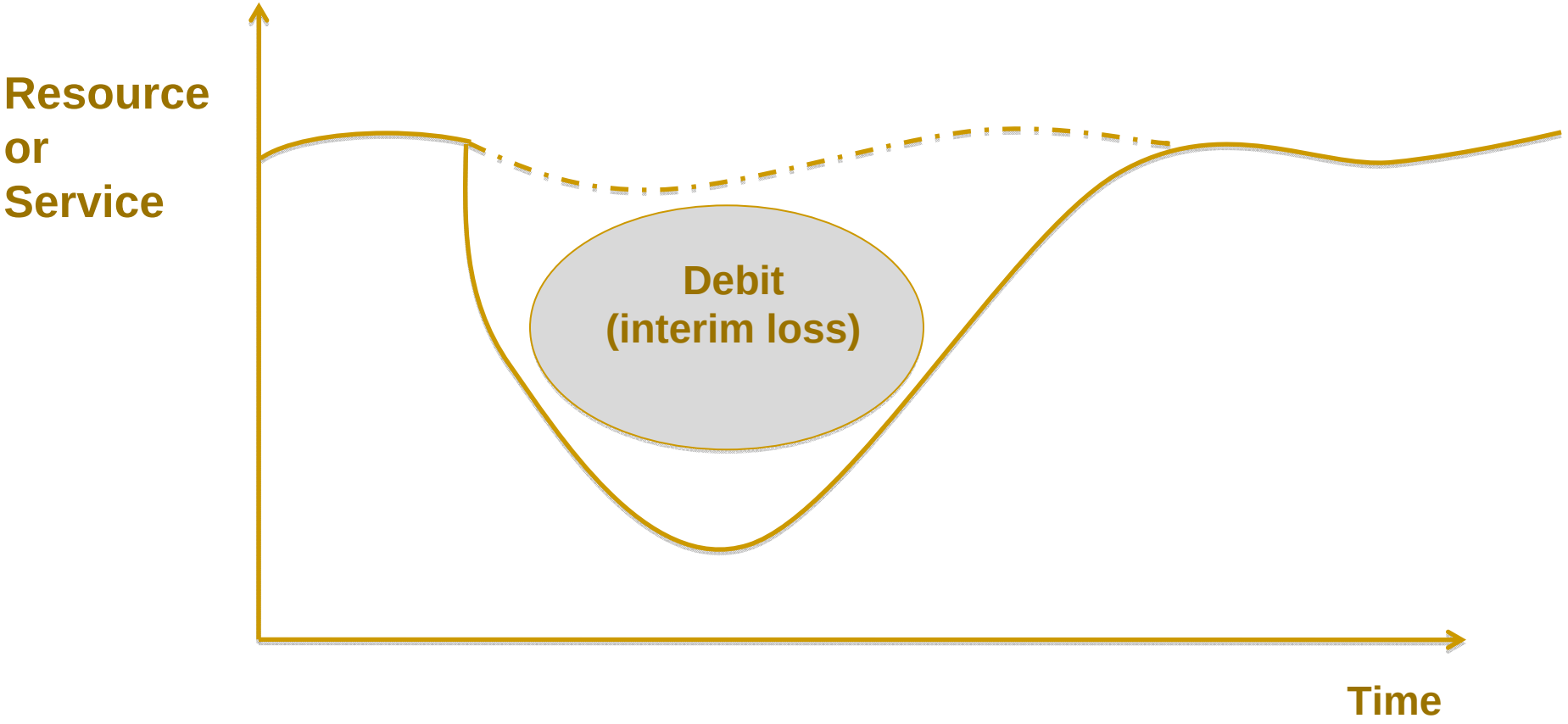
- Evidence of damage (Toolkit can *help* with 'significance')
  - Individuals (death, disease, behavioral, etc)
  - Population change (abundance, age/size structure)
  - Habitat change (diversity, composition, function)
  - Landscape (tree/plant cover)
  - Recreational (boating/swimming/fishing closure)
- Ecological evidence is usually based on:

Existing data and literature	Field studies
Laboratory toxicity studies	Ecological models

Step 2b: Determine cause

- Sometimes straight-forward
  - Easy to identify the polluter
  - Easy to identify the pollutant/cause of problems
- Other times, not so straight-forward
  - Why are organisms dying/injuried ?
  - Where is the pathway causing the death/injury

Step 2c: Quantify Debit



- Goal → Quantify the size of this debit/interim loss

Step 2c: Quantify debit

- "major" inputs we need to calculate debit:

Metric	How do we measure the amount of damage?
Baseline	What were the conditions without the damage?
Degree of Loss	How bad of an impact was the incident?
Timing	When was it damaged ? For how long? How to account for time ?

Let's discuss each of these inputs …

Step 2c: Metrics

- Measure "an amount" of damage/remediation
  - ecological damage/remediation
  - human use damage/remediation
- Examples of metrics used in equivalency analysis
  - Area of de-vegetated habitat (hectares)
  - Area of habitat which exceeds contaminant concentration thresholds (hectares, km of stream)
  - Fish density (number of fish per m^2)
  - Fish biomass (kg)
  - Bird production (bird years foregone)

Metric must be same on the DEBIT and CREDIT side of equivalency !

Step 2c: Baseline

- Conditions that would have been expected to exist *had the incident not occurred*
  - Does not mean “pristine” nor “static”
- How to define baseline in terms of our metric ?
  - Collect data before-and-after incident
  - Collect data from a “control/reference” location to explain the “before” condition of damage location
  - Ecological models that explain the typical “before” condition of that type of resource
  - Historical photographs/information

Step 2c: Degree of Loss

- A "service loss" tells us how much of the environment was damaged and is usually measured in %
- % service loss is usually measured as a quantifiable change in the metric.

Metric Example	Quantified Metric Baseline	Quantified Metric Post-spill	Service Loss
No. of salmon	100	25	75%
Acres of habitat developed	5	1	20%
Acres of habitat that exceeded contamination thresholds	10	10	100%

Step 2c: Timing (the discount rate)

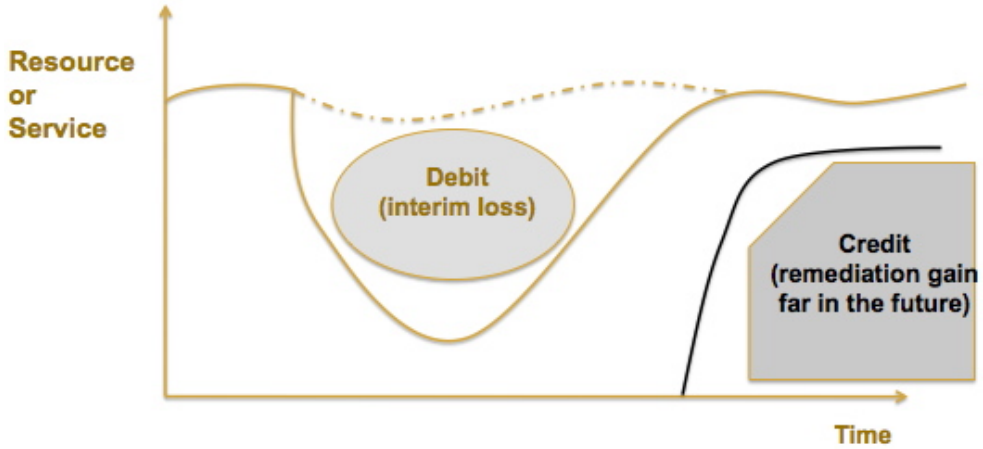
- We assume that resources/services/money have "value"
- An important component of value is **TIME:** *when* a resource/service/money is available to the public
  - in the past ? … in the present (today)? … in the future ?
- An example using money (which has value)
  - 1 SEK is worth more to you TODAY than 1 SEK in the FUTURE (e.g., 10 yrs)
  - 1 SEK would have been worth more to you 10 yrs ago than 1 SEK today
- Why ? A few reasons, but … one is that humans are inherently impatient (!). We prefer good things to happen today, rather than wait
  - Eat drink and be merry, for tmw we may die!

Timing (the discounting rate)

- Equivalency analysis assumes the same "impatience" applies to resources/services (which have value)
- Which option is a greater loss of value to you?
  - (1) A damaged wetland today or
  - (2) A damaged wetland in 100 years from now?
  - Most would say (1) is a greater loss, which implies a positive discount rate
- Which option is a greater gain in value to you?
  - (1) A restored/remediated wetland today or
  - (2) A restored/remediated wetland in 100 years from now.
  - Again, most would say (1). If (2), there is no incentive to remediate today !
  - If we wait 100 years, then the public is not compensated

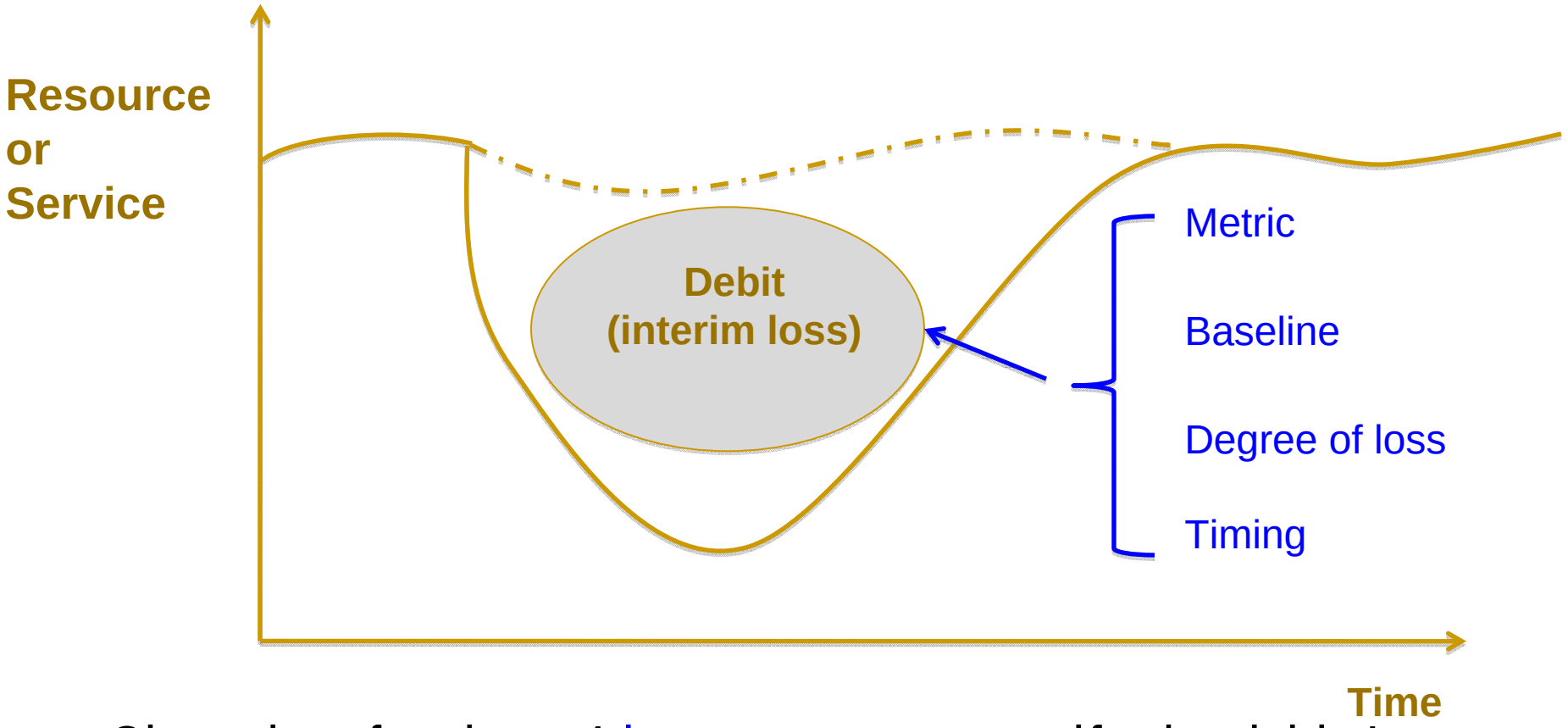
Discount rate: adjusts "time" value

- Debits and credits occur at different times



- The discount rate adjusts the value of those debits/credits into "today's value" so we can add or compare them.
  - Impacts that occur in the future are "adjusted" downward
  - Impacts that occur in the past are "adjusted" upward
- Analogy: exchange rates adjust "currency" value

Step 2c: Quantify Debit



- Given data for these 4 inputs we can quantify the debit !
- Quantitative example comes later with the Helsingborg case

Step 3: Quantify credits (remediation gains)

Two major sub-steps:

a) Identify possible remediation projects
   - What can we fix ? On-site or off-site ?

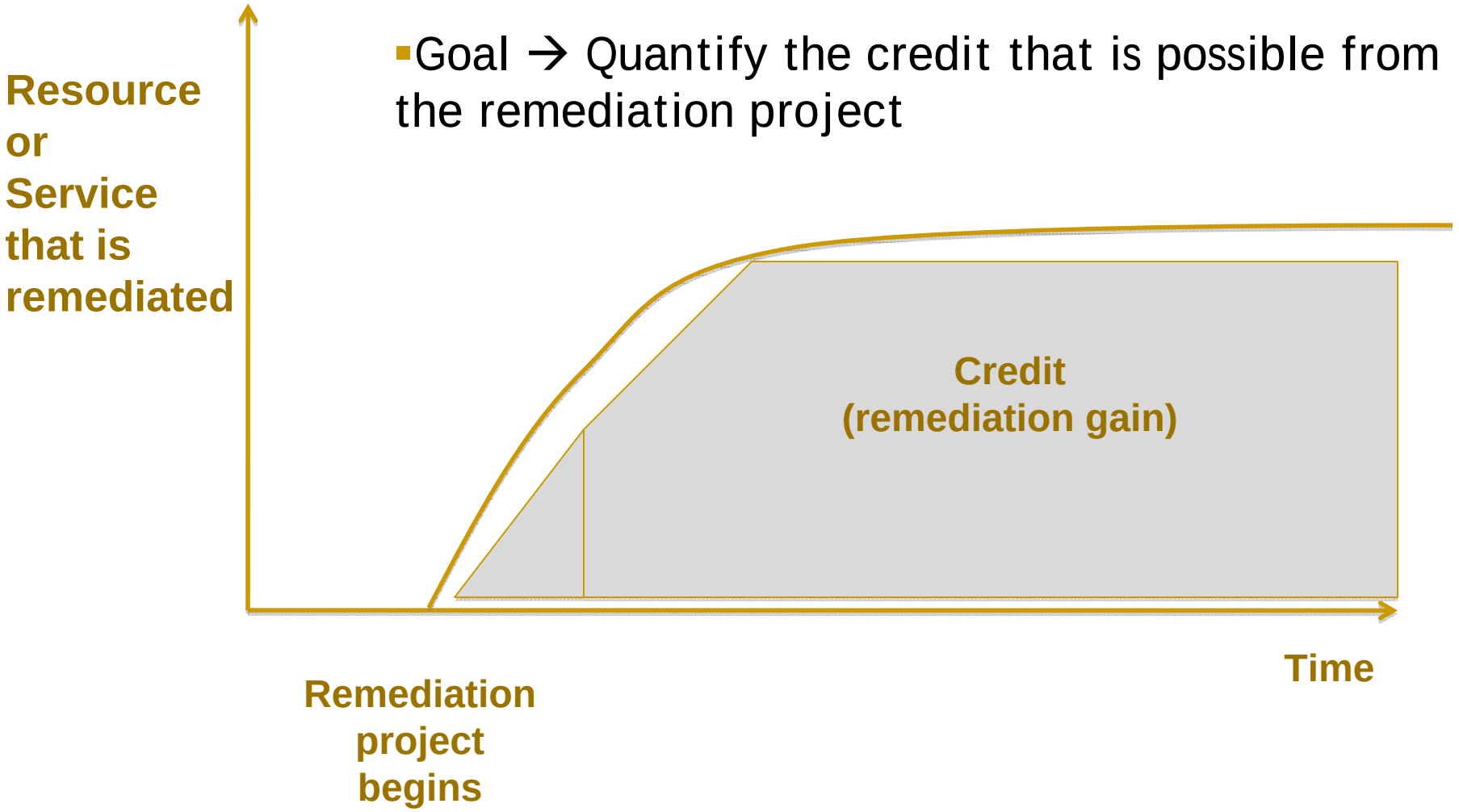
b) Quantify credits (remediation gains)
   - What are the possible environmental gains from the project(s) ?

Step 3a: Identify possible remediation projects

- Habitat improvement or creation
  - Forests, wetlands, stream, ponds, etc
- Resource improvements
  - Spawning, stocking, replanting, water treatment
- Contaminant clean up that enhances resource
- Protection or preservation
  - Warning (!): must provide “net” improvements
  - Would that land have been protected anyway ?

Step 3b: Quantify credits

- Goal → Quantify the credit that is possible from the remediation project



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Step 3b: Quantify credits

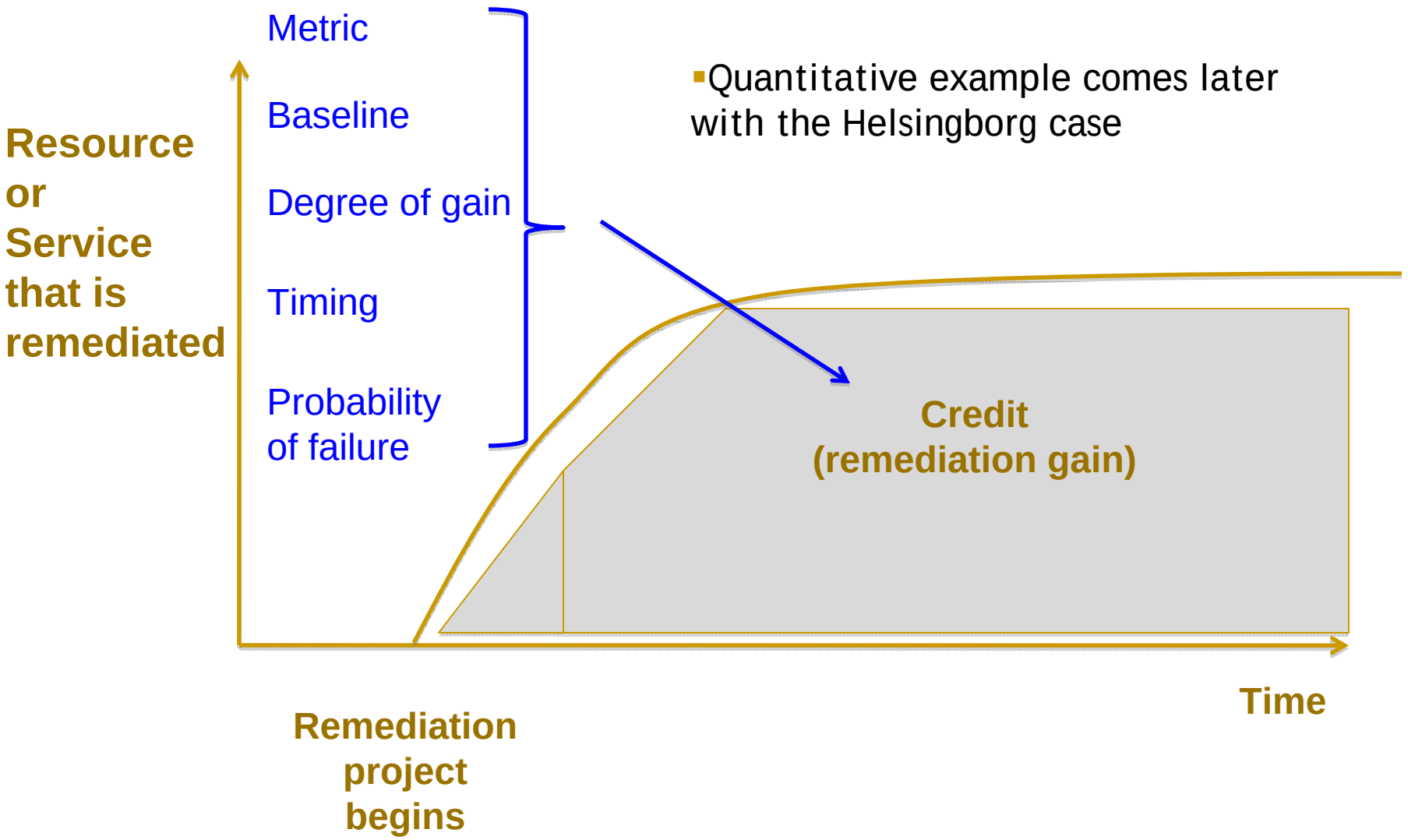
- "major" inputs we need to calculate credits:

Metric	Must be the same as the debit side
Baseline	What are the conditions of this resource before we start to restore/remediate it?
Degree of gain	How much improvement can we obtain in the metric ?
Timing	When will the improvement take place? For how long? How to account for time ?
Probability of failure	What if the expected remediation gain is unknown/uncertain, how do we adjust for that ?

Degree of gain & probability of failure

- Difficult to estimate improvements to remediated environments
- Limited ecological publications related to this topic
- Remediated environments unlikely to provide full services that the damaged environment provided before the incident
- Because of all this uncertainty, a common practice is to include a probability of failure
  - In practice, this encourages “extra” remediation to ensure the goal is reached (a precautionary principle)

Step 3b: Quantify credits

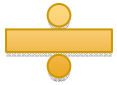


- Quantitative example comes later with the Helsingborg case

Step 4: Scale Remediation

Q: How much is enough ?

A: Just enough credit to off-set the debit

Total debits		Credit we get for each unit remediated (per unit credits)

Simple example:

- Loss of 5,000 discounted “bird years” (total debit)
- Obtain a per unit credit of 2,500 discounted bird years for each hectare of land we purchase/remediate
- Then we must remediate 2 hectares (5,000/2,500)

Step 4: Remediation Costs

- Equivalency Analysis is a replacement cost approach **Exception: A VEA using a "value2value" approach … more on that later**
  - Liability is based on what it costs to replace it, not necessarily what it is worth (a stolen bike?)
- Costs are site specific (land, labor, etc)
- Contingency costs should be added (~20%)

Step 5: Monitoring and Reporting

- Objective: develop a plan to ensure the remediation project achieves its goal.
- See REMEDE Toolkit for detailed recommendations
- Benefits of regular monitoring:
  1. Ensure success of remediation project
  2. Also provides valuable information about "service gain" for future remediation projects.
     - Swedish Authorities may want to consider a database to collect information on how different remediation strategies have worked (or haven't worked !)

Conclusions & FAQs

Q #1. Why do we care about Equivalency analysis?

A: ELD of course … but the methods are widely applicable elsewhere, too. For example:

- Other EU Directives (Habitats & Wild Birds, EIA)
- Improved environmental permitting
  - US Clean Water Act permits & env. compensation
- World Bank interested in its use
- Wind power development in Europe ?

Conclusions & FAQs

Q #2. How long does it take to conduct an "equivalency analysis"

A: It depends ... (thanks to Josh Lipton for his answer)

- Simple template → weeks to months
  - Very limited site data, simplifying assumptions, standardized remediation project available
- Intermediate → months to years
  - Some site data available to calculate credits/debits, remediation project requires some identification and design
- Comprehensive → years
  - Site-specific data used to support all assumptions used in debit/credit calculations, significant effort to design remediation project

Conclusions & FAQs

Q #3. Equivalency analysis assumes we can replace a damaged resource, what if we can't?

A #1: Not a good approach for endangered species

A #2. VEA is another option (thanks to David Chapman for this answer)

- Value of a resource is the rate at which people are willing to trade one resource for another
  - Commonly … how much money will you trade for a protected resource?
  - But also … how many hectares of wetland will you trade for kilometers of hiking trails?

Conclusions & FAQs

Q #4. There is so much uncertainty with the "significant damage" threshold. What is it going to cost?

A: Hard to tell, but US experience is interesting

- Law firm did a review of US NRDA cases in 2003 and came up with several conclusions
  - Source: American Bar Association www.abanet.org
    - "Superfund and Natural Resource Damages Litigation Committee – Newsletter" May 2003

Environmental Liability in the US
(NRDA cases 1989 – 2001)

- Large variation ($1,000 up to $1,000,000)
  - $75 million or more (12-15 cases?) [Valdez = $1billion]
  - $10 - $75 million (20 cases ?)
  - $1 - $10 million (hundreds ?)
  - $500,000 or less (thousands !)
- Approximately $100,000,000 per year
  - Comparison: Clean up costs are $1 to 2 billion per year (much higher than env. liability)

** Half are oil spills; many are retrospective (relevant in Europe?)

T H A N K S !

QUESTIONS ?

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