Ex post compensation for WTE impacts at the Smøla Wind Farm: A application of Equivalency Analysis (EA)

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CERE

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So let's assume …

… we have done everything we could to avoid / mitigate raptor collisions

Removed turbines
Moved turbines

← Avoid

Mitigate →

Painted turbines infrared
Shut down turbines (birds)
Closed roads (wolves)
We've even opened vulture restaurants ..

… but *residual damage* remains. This is where compensation comes into the picture

- Enhance or protect habitat
- Improve breeding opportunities
- Improve breeding success
- Remove threats to a species

(I dislike the term compensatory mitigation …)

The question is …

… How do we get from here to there?

What is the purpose?

Compensate the public for <u>their</u> loss

Anthropocentric idea (like “sustainability”)

Implication → more flexible

Photo: Espen Lie Dahl

Background

Conflict ?

- CBD goal → reduce biodiversity loss
- Climate Change → reduce CO_2 emissions (wind)
- Solutions to conflict?
  1. Natura2000 network of land protection (sufficient?)
  2. Resource-based compensation
- But "how much is enough" compensation?
  - Need an interdisciplinary scaling method

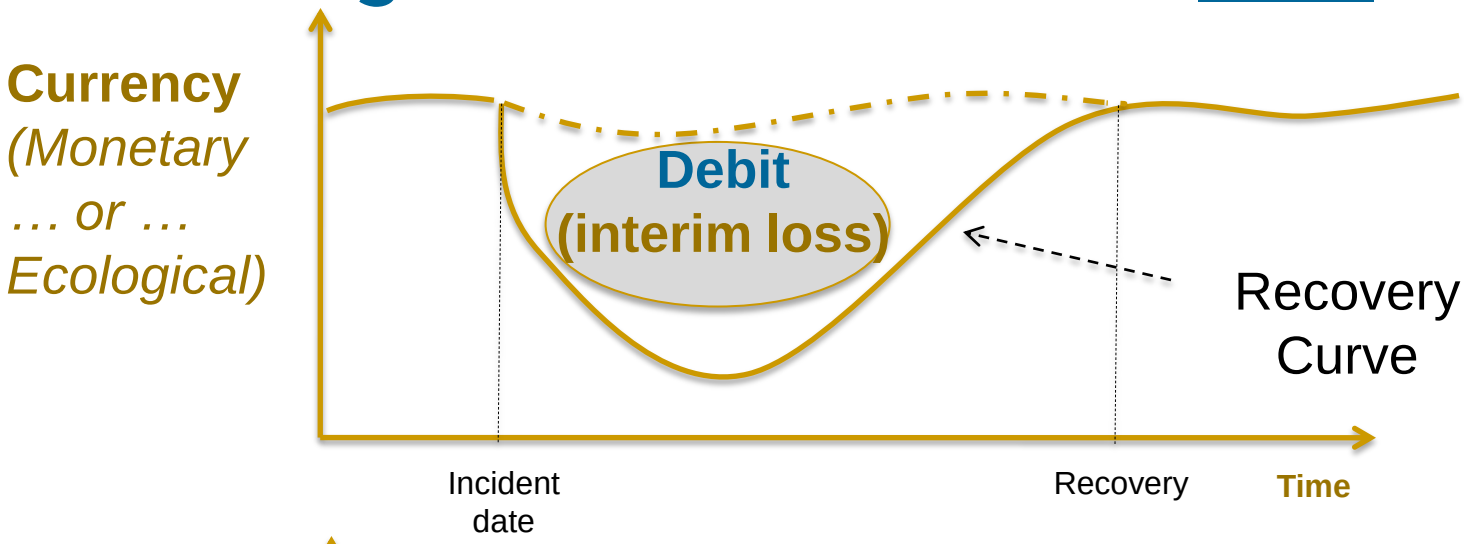
    → Equivalency Analysis (EA)

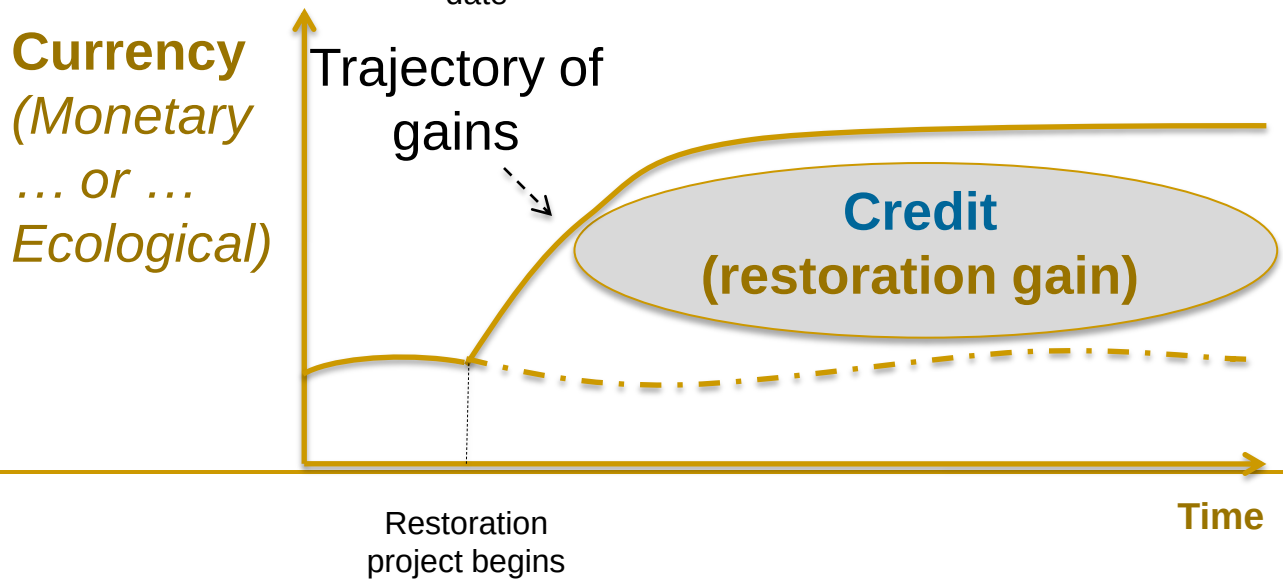
REMEDE Project

- What is it? (www.envliability.eu)
  - EU-funded research project (2006-2008)
  - **R**esource **E**quivalency **M**ethods for Assessing **E**nvironmental **D**amage in the **E**U (**REMEDE**)
- What did it produce ?
  - **A** guidance document for EU Member States on Equivalency Analysis (EA) (REMEDE Toolkit)
- Who?
  - Ecologists, economists, lawyers
- Why?
  - Several EU Directives require environmental compensation

Illustrating EA

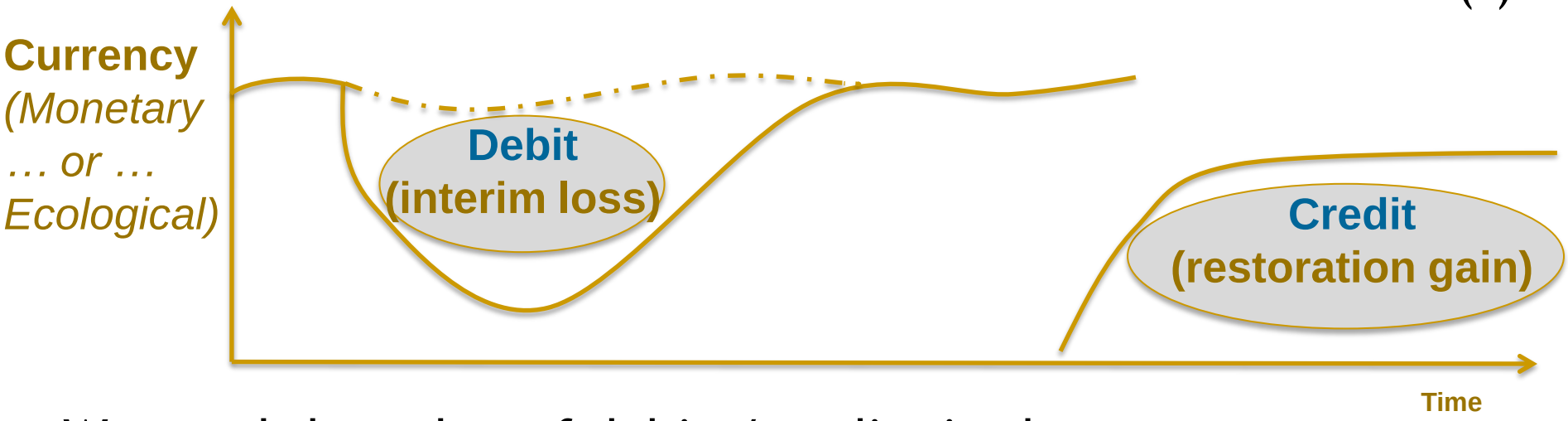
Measuring Debit/Credit across time and space





Discounting

- Debits and credits occur at different times – affects value (!)



- We need the value of debits/credits in the same *currency* so we can add or compare them
- Discounting converts impacts to "present value"
- Discounting assumes future is *worth less*

Why is the future worth less? (discounting)

- Equivalency Analysis assumes humans are **impatient** when experiencing/consuming environmental resources
  - Eat drink and be merry, for tmw we may die

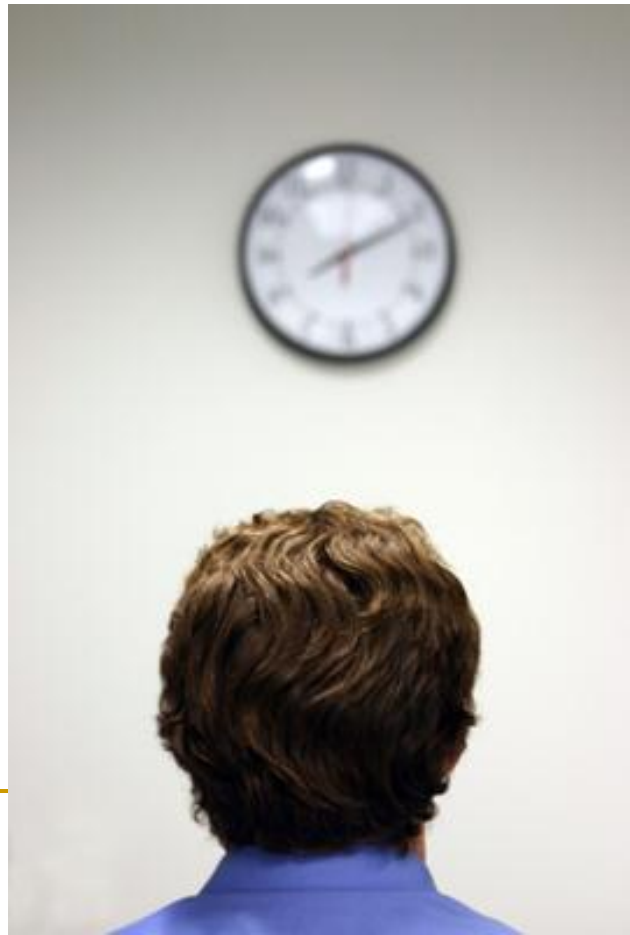
What is a greater gain in value to you?

(1) A restored WTE today or
(2) A restored WTE in 100 years from now

Most would say (1).

If we choose (2), you are NOT impatient.
… And, there is no incentive to compensate today

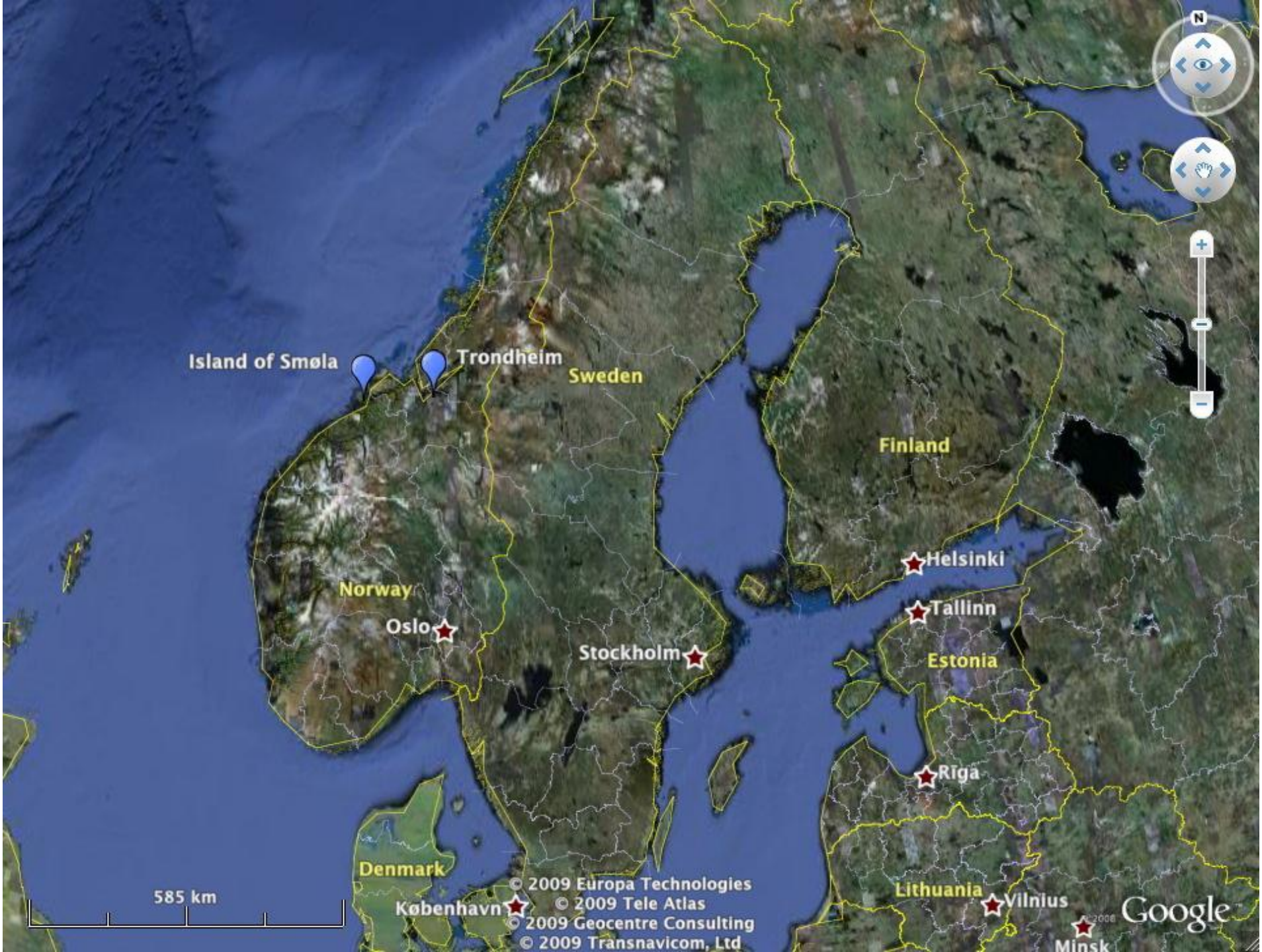
Thus, we use a 3% discount rate in this study



Illustrative Case Study: Smøla

- Interdisciplinary case study:
  - Swedish Agricult. University (economics)
  - Norway Inst. for Nature Research (ecology)
- Objective:
  - Estimate the debit from WTE mortality and scale the compensatory credit
- Why?
  - Illustrate “new” EA method in EU
  - Provide Statkraft with a credible approach should they choose to compensate for WTE mortality

Photo: Bjørn Iuell


Island of Smøla
Trondheim
Sweden
Finland
Helsinki
Norway
Oslo
Tallinn
Stockholm
Estonia
Riga
Denmark
København
Lithuania
Vilnius
Minsk
585 km
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Google

WTEs at Smøla

(Haliaeetus albicilla)

The **debit** so far:
2005: **4 dead WTEs found**
2006: **6**
2007: **2**
2008: **9**
2009: **7**
2010: **11**
Total → 39 (plus 1 golden eagle)

The **debit** going forward:
2011: **?? dead WTEs found**
2012: **??**
…

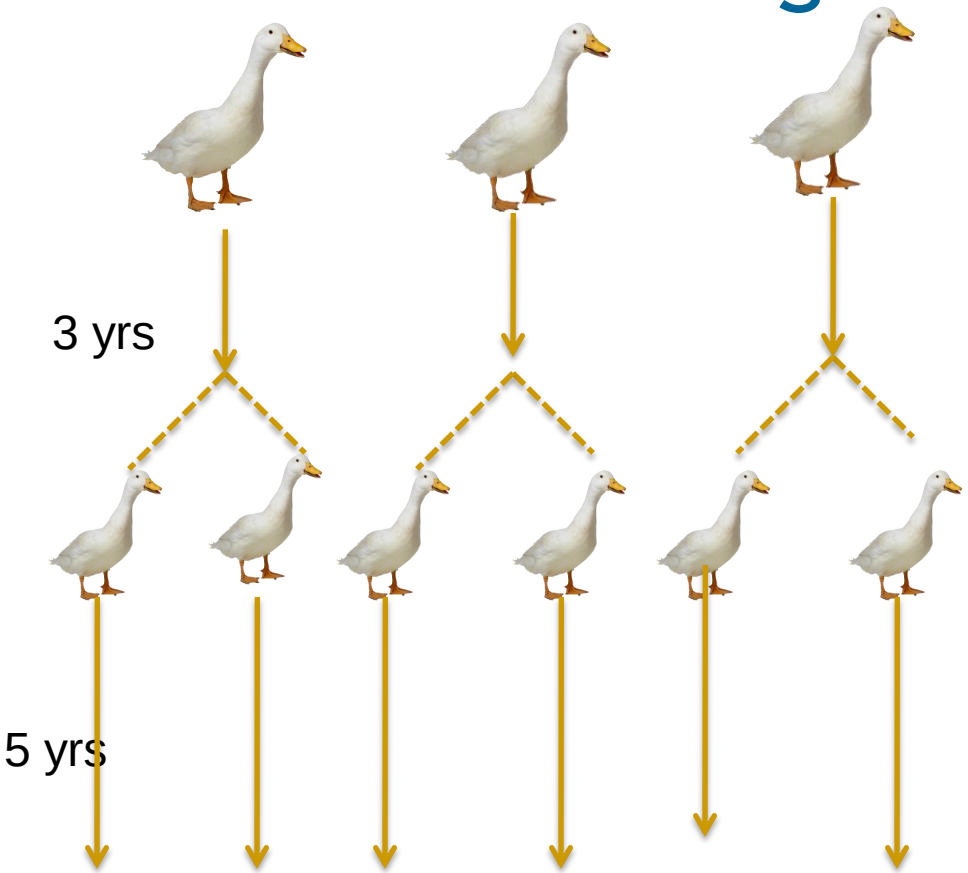
In our study we project a loss of
5 WTEs per year until 2027

Photo: Espen Lie Dahl

Our compensation currency

- What 'metric/*currency*' do we want to use to trade-off a debit with a compensatory credit?
  - Option #1: Monetary currency
    - Ask Norwegians to value this impact in NOK … too controversial
  - Option #2: Count Birds
    - Count individual birds affected (counts them for 1 year)
  - Option #3: Count Bird-Years (BY)
    - Count the years a bird would have lived … plus … all the years its offspring would have lived

Environmental Metric: Illustrating Bird-years (BYs)



Count Birds (B)

✓ 3 dead birds found

- **Debit** → 3 birds lost
- **Credit** → 3 birds to be gained

Count Bird-Years (BYs)

✓ 3 dead birds found, 3 yrs to live

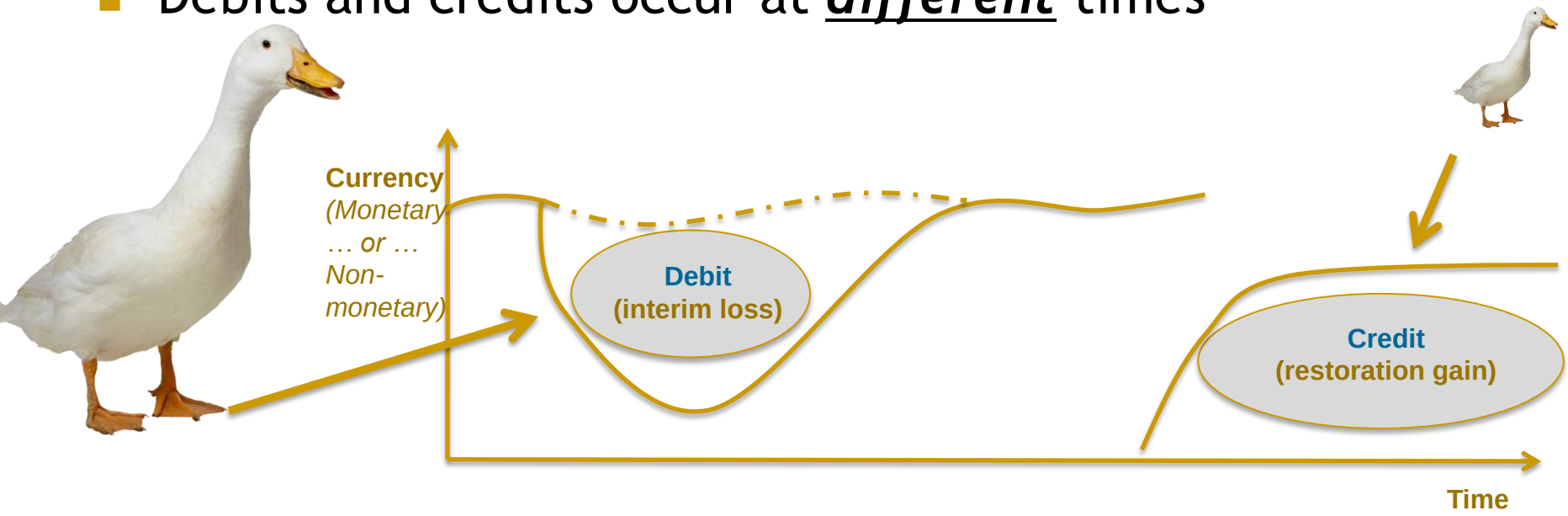
Debit → DIRECT LOSS = 9 BYs

→ INDIRECT LOSS = 30 BYs

Credit → Must create 39 BYs

Discounting value of a Bird

- Debits and credits occur at ***different*** times



- Remember: future is worth less
- Thus, we use Discounted Bird Years (DBYs) not BYs.

Quantify debit from turbine collisions

- Assume WTE collision rate continues to 2027 (109 total collisions) and a 3% discount rate. Total **Debit** is:

  Direct DBYs (lost life expectancy due to collisions)

  +

  Indirect DBYs (lost life expectancy from offspring)

  =

  3,475 DBYs (measured in present (2009) terms)

3 questions to answer:

1. What compensatory projects create "DBYs"?
2. How many "DBYs" can we create (per unit)?
3. How many units do we need to ensure "equivalence"?

Q#1: What compensatory projects create “DBYs” ?

- Improve WTE breeding success
  - Build/enhance sea eagle nests
- Improve WTE breeding opportunities
  - Purchase, restore, improve sea eagle habitat that is currently threatened *in Norway or perhaps in Eastern Europe*
- Reduce WTE mortality
  - Measures to prevent train collisions
  - Measures to prevent lead poisoning
  - Measures to prevent electrocution at utility pylons

I choose electrocution prevention for purpose of illustration … (but I also think it’s a good idea)

Power line electrocution (sea eagle)

Source: **Norwegian Television Program "Ute i Naturen" (8 Sept. 2009)**

Q#2: How many “DBYs” can we create ?

Smøla pylon search October 2009

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Smøla pylon search October 2009

Pylon Type	Pylons searched	Electrocuted birds	Electrocuted WTEs
Transfer station	87	49	1
Switcher	34	21	1
Top-mounted insulator	571	47	4
Junction	36	19	2
Switcher & Junction	12	2	0
Total	740	138	8

Q#2: How many “DBYs” can we create ?

Q#2: How many DBYs can we ?
Final estimation

Hypothetical compensation project assumes:

- Retrofit switchers to prevent electrocution
- Begin in 2012, benefits lasts until 2037 (25 yrs)
- leads to .01 fewer WTE deaths/pylon/yr (100% effective)
- **Credit "Per switcher retrofitted"** is:

Direct BYs gained (avoided electrocution)

+

Indirect BYs gained (avoided productivity loss)

=

6.2 DBYs (in 2009 terms) per pylon over 25 year period

Q#3: How many units do we need?

We lose **3,475** DBYs from 2005-2027

We gain **6.2** DBYs from 2012-2037 for *each* switcher retrofitted

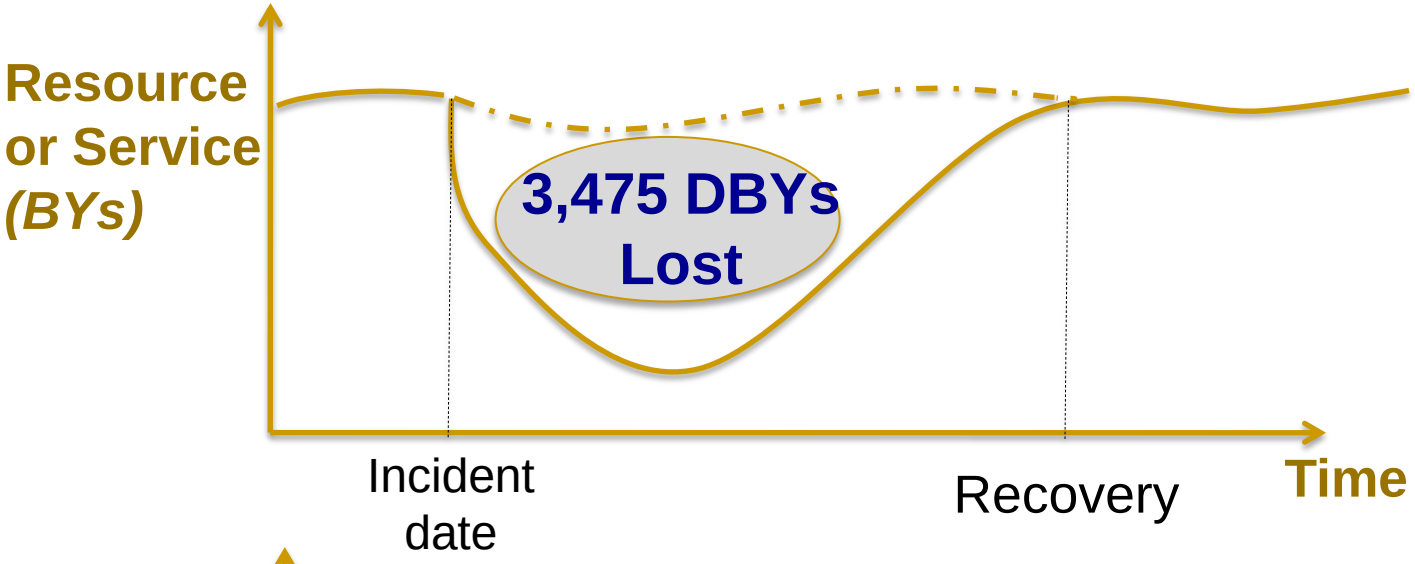
(remember: DBYs is a common "2009" currency)

Scaling → How many switchers do we retrofit to reach "equivalence" between debits & credits?

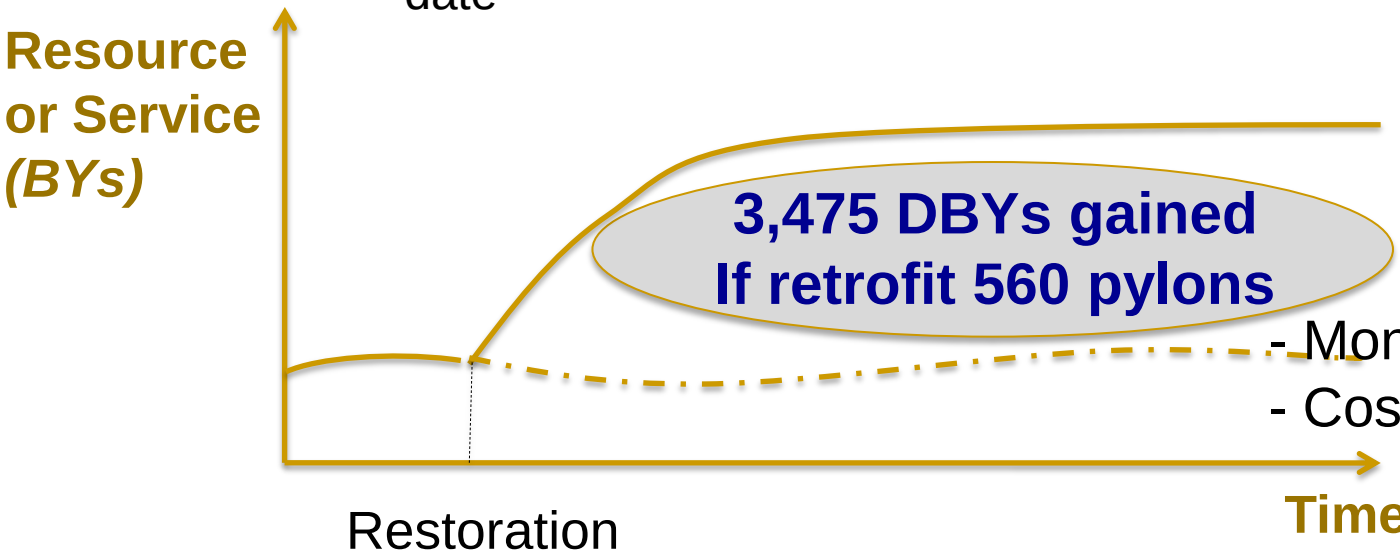
~560 switcher pylons (=3,475/6.2)

If we retrofit 560 pylons today (and maintain them for 25 years) we create the same number of DBYs that were lost from turbine collisions between 2005-2027

Conclusion: Debit = Credit over time



The public is compensated for their loss



- Monitoring (!)
- Costs of restoration (?)

Conclusion & Summary

- Resource-based compensation …
  - … aims for “no net loss of human well-being”
  - … is increasing in EU due to several Directives
  - … is a tool to help reverse decline of biodiversity (CBD)
- The REMEDE project’s EA methodology …
  - … is widely applicable (oil spills, roads, mining, wind etc)
  - … requires a “currency” to measure environmental loss/gain (doesn’t have to be money!)
  - … requires significant data to quantify debit and credit
- When is compensation needed?
  - Must a population level effect be proven?
  - ... or ...
  - Is compensation “good practice” in reaching CBD goals?

T H A N K S

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Details in the paper :
http://pub-epsilon.slu.se:8080/1671/
(note: numbers don't match the presentation due to new data collection, but the methods have not changed)

Paper on economics & compensation in ecological journal:
http://pub-epsilon.slu.se:8080/2520/

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The Swedish Environmental Protection (SEPA)

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Norwegian Institute for Nature Research (NINA)

Further Discussion

- Is electrocution mitigation by wind power companies considered ‘compensation’ if power line companies *should be doing it anyway*?
  - Counter argument → “Not much done so far … much to do”
  - Existing vs. new pylons