



CHALLENGES SURROUNDING THE USE OF REFERENCE SITUATIONS IN LAND USE IMPACT ASSESSMENT

Maria Nordborg
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CONTENT OF THIS PRESENTATION

- What are reference situations?
- Nordborg et al. – selected results
- Is a reference situation at all necessary?
- What should the reference situation be?
- Criticism against the PNV concept
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WHAT ARE REFERENCE SITUATIONS?

- “The hypothetical situation without the studied product system” (Soimakallio et al. 2015)
- A baseline to which the quality level (of e.g. ecosystem services or biodiversity) in the assessed land use situation is compared (UNEP-SETAC guideline on land use impact assessment, 2013).

AIM (NORDBORG ET AL.)

- Test and evaluate the land use impact assessment models recently proposed by UNEP-SETAC.
- Especially considering the use of reference situations.

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Challenges in developing regionalized characterization
factors in land use impact assessment: case studies of animal
protein production in Sweden

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Maria Nordborg,[†] Yaw Sasu-Boakye,[†] Christel Cederberg,[†] and Göran Berndes[†]

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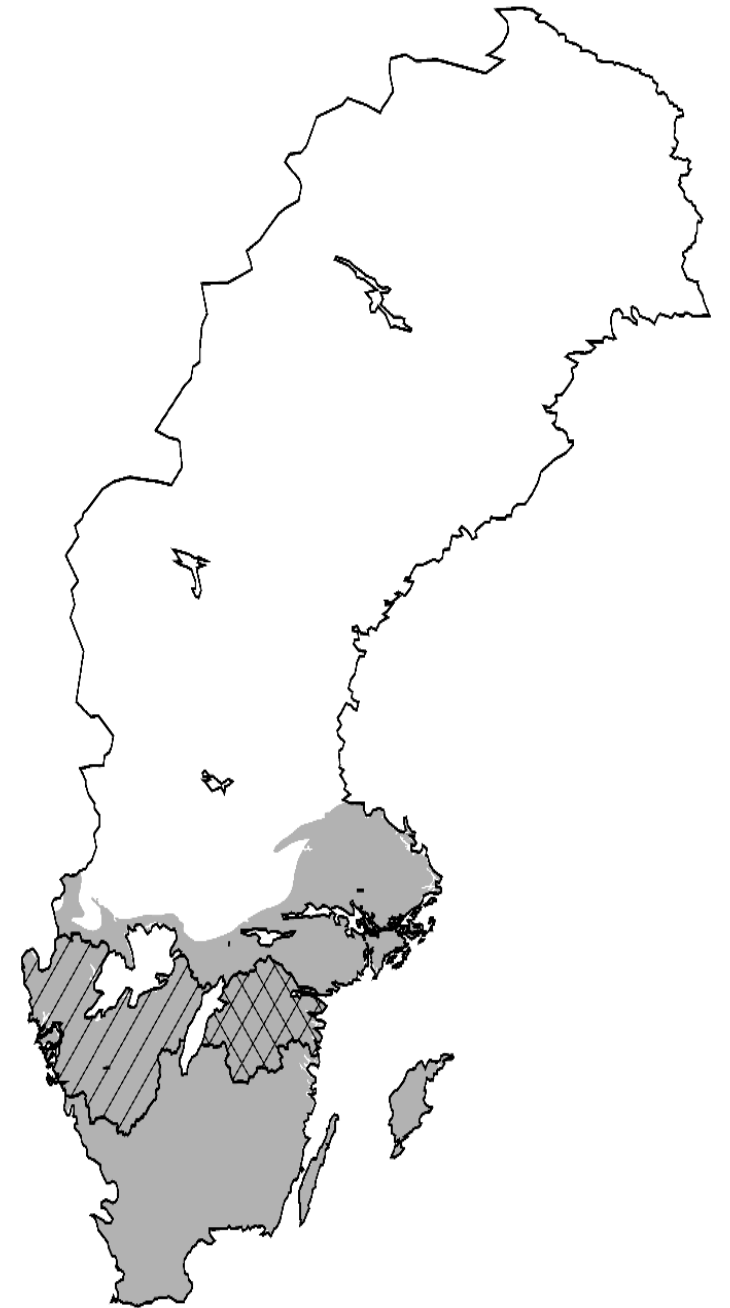
Department of Energy and Environment, Division of Physical Resource Theory, Chalmers University of
Technology, SE-412 96 Gothenburg, Sweden

Abstract

Purpose The UNEP-SETAC Life Cycle Initiative has recently developed a guideline framework for land use impact assessment. This article evaluates the feasibility and highlights the challenges of applying a set of methods that adhere to this framework, and identifies the strengths and weaknesses of the indicators used in these methods, for the purpose of supporting further methodological development. *Methods* The methods were tested in two case studies of animal protein production in Sweden: dairy milk and pork. The reference situations were defined as the potential natural vegetation. County-level characterization factors (CFs) were calculated and occupation impacts were assessed for five ecosystem services, using six ecosystem service indicators: carbon flow change, groundwater filtration capacity, physicochemical filtration capacity, soil loss, and soil organic

METHOD (NORDBORG ET AL.)

- **Land use impact assessment models** proposed in the UNEP-SETAC guideline on global land use impact assessment (Koellner et al. 2013).
- Assessed land use impacts in **two case studies**: pork and milk production in two Swedish regions.
- Considered **six ecosystem services** (not biodiversity)
- **Calculated regionalized characterization factors** for two Swedish regions.
- Reference situation: **potential natural vegetation (PNV)**
 - PNV: the expected state of mature vegetation in the absence of human intervention



SELECTED RESULTS (NORDBORG ET AL.)

- Need data, but the natural vegetation at the studied location does not exist.
- Our “solution”: extract data from neighboring land areas that resemble the PNV.
- But these land areas may not be good representations of the PNV at the studied locations.
- Properties / qualities of land can vary a lot over short distances.



SELECTED RESULTS (NORDBORG ET AL.)

- 20% used as arable land: Land qualities/properties determine the use.
- Data from land areas which resemble the PNV today may not correspond to “natural” conditions in the assessed land use areas.
- <2% of forest in South of Sweden classified as native: data may not be available or very limited.



SELECTED RESULTS (NORDBORG ET AL.)

- Example with the ecosystem service **water purification**.
- **Characterization factors**, which are used to assess impacts, are calculated as the difference in quality between the reference and the assessed land use situations.
- **Quality** refers to the capability of an ecosystem to deliver a service.



SELECTED RESULTS (NORDBORG ET AL.)

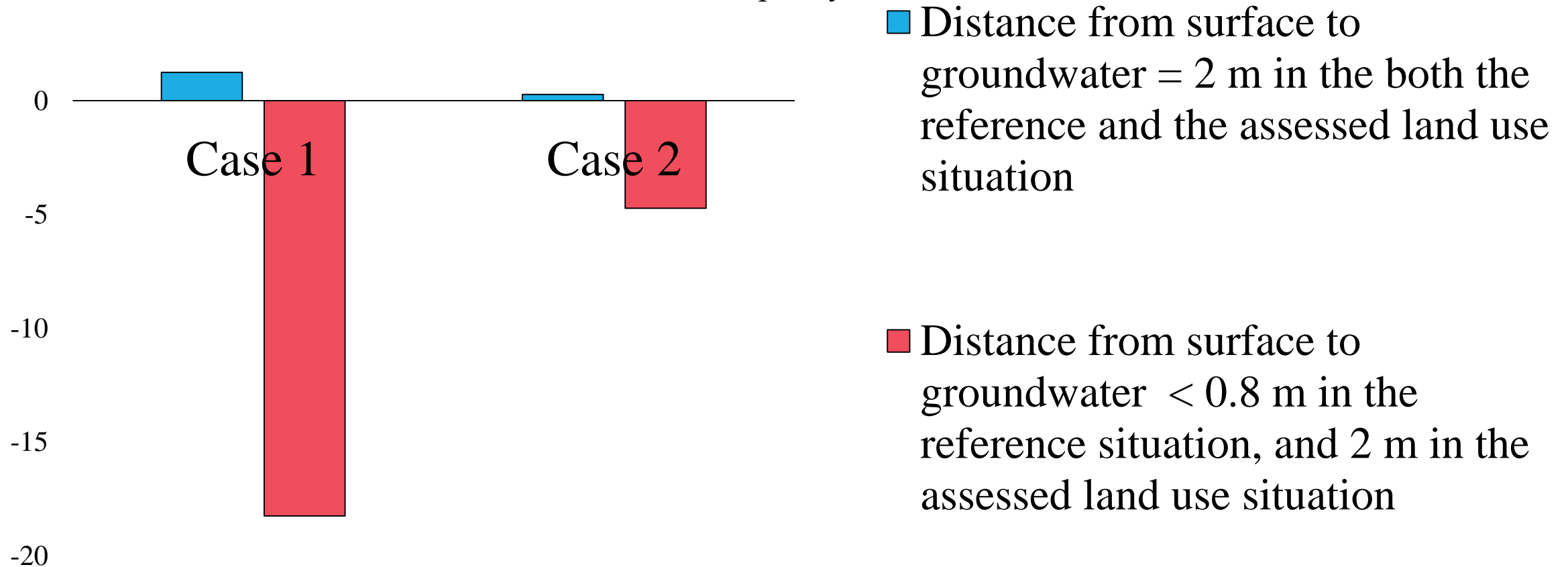
- **Lack of detailed support and guidance** in the UNEP-SETAC guideline regarding how reference conditions should be characterized in practice.
- The framework and methods are open for **interpretations**, hence many **subjective choices** have to be made.
- Implications in terms of comparability between studies, reproducibility and usefulness.

SELECTED RESULTS (NORDBORG ET AL.)

- The results and conclusions depend on **subjective choices** made in modelling the reference situation.
- Example concerning hydrological conditions, represented by the distance from surface to groundwater.
- **Hardly any data** for conditions today, even less for historic times.
- 55% of Swedish cropland have installed drainage systems, and many wetlands have been drained in the past to create new cropland.
- **Many different assumptions can be made:** we tested two.

SELECTED RESULTS (NORDBORG ET AL.)

Characterization factors for mechanical filtration capacity



IS A REFERENCE SITUATION AT ALL NECESSARY?

Soimakallio et al. (2015):

- A majority of studies reviewed (>700) **did not** assess land use impacts in relation to a reference situation.
- Arguments against:
 - Negative impacts are unrealistic in some cases.
 - Comparing with a situation that existed a long time ago is not relevant
- “The most environmentally relevant approach is to assess land use impacts in relation to a reference situation”

WHAT SHOULD THE REFERENCE SITUATION BE?

- Soimakallio et al. (2015) identified **four types** of reference situations
 - Zero baseline
 - Business as usual
 - Natural or quasi-natural steady state
 - Natural regeneration
- The UNEP-SETAC guideline on land use impact assessment (2013) mentions **three options**
 - Potential natural vegetation
 - Quasi-natural land cover (the natural mix of land cover)
 - The current mix of land uses
- Most biodiversity assessment methods recommend the PNV.

CRITICISM AGAINST THE PNV CONCEPT

- Chiarucci et al. 2010
 - **Impossible to model** due to methodological problems associated with its definition
 - The concept **should be abandoned** unless its utility is more clearly demonstrated
 - **Impossible to determine** the vegetation in the absence of human influence
 - There are **no stable endpoints** – ecosystems constantly change
 - Vegetation surveys are **not representative**
 - Some vegetation types that are considered “natural” may in fact be the results of **human influence over millennia**

TAKE-HOME MESSAGES

- Several different types of reference situations are possible
- The PNV concept has been strongly criticized
- Reference situations are challenging to model for several reasons
 - Required data may not be available or very limited
 - Problematic to use data from one place, to represent conditions at another place
 - Lack of support and guidance concerning how reference conditions should be characterized
 - Methods are open for interpretations
 - Many subjective choices have to be made
- The results and conclusions can be strongly influenced by the selected reference situation

Thank you for your attention!

maria.nordborg@chalmers.se