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Design of an indicator-based agri-environmental direct payments system inspired by the LCA methodology

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LCA food, 13 October 2022

Introduction

Swiss government has agri-environmental goals

=> Promotion of sustainable and resource-efficient agricultural production

Current system of direct payments

1. Conservation of natural ressources
2. Promotion of particularly environmentally friendly production

…results in

Stagnation since ~ year 2000

- Agri-environmental goals not yet achieved ->

  => launch of project IDPS (Indicator-based Direct Payment System)

IDPS: Indicator-based Direct Payment System

Goals

- Elaborate suggestions enhancing the current system of direct payments to achieve agri-environmental goals
- Analysis of degree to which indicator-based frameworks can offer added value to agricultural policy

Procedure

(1) Develop indicators to assess environmental impacts (at farm level), functional unit: ha

(2) Specify damage costs (social costs)

(3) Derive payments from indicator values and damage costs

(4) Implementation in the model SWISSland to evaluate changes in farm structure (livestock, crops,..)

Concept

Indicators…

- ✓ "summarize"/ simplify complex information
- ✓ have to be applicable to all farm types and locations
- ✓ have to be valid and reproducable
- ✓ should be based on verifiable input data

IDPS must…

- ✓ aim at a compromise between accuracy/ completeness and feasability (implementation, controllability)
- ✓ account for policy-driven context:
  - verifiable input data
  - accepted by stakeholders
  - easy understandable for stakeholders

Development of indicators: LCA-thinking

Procedure (example: how to approximate)

1) Classification: identification of most important GHG from agricult. sector
2) Definition of elementary flows: Selection of five emission sources/sinks:
   - (i) methane (CH_4) emissions from ruminants by enteric fermentation
   - (ii) nitrous oxide (N_2O) emissions from agricultural soils
   - (iii) emissions from drained organic soils
   - (iv) carbon stored in trees
   - (v) CH_4 & N_2O emissions from stored slurry
3) LCI modelling: Parameterize process (use key driving variables)
4) Characterisation: CF_{N20}=265 & CF_{CH4}=28
5) Normalization: used for translation into payments (national mean)

IDPS: 3 variants of different complexity

detailed	medium	simple
GHG emissions	GHG emissions	climate & nutrients
ammonia emissions	ammonia emissions	
nitrate leaching	nitrate leaching	
P leaching		
plant protection products	plant protection products	plant protection products
erosion	erosion	soil protection
soil organic carbon	soil organic carbon	
biodiversity	biodiversity	biodiversity
quite complex/ major processes considered	same topics (ex. P) as for detailed variant, but simplified	merging of impacts strong simplification

Increasing feasibility (implementation/ controllability)

Increasing flexibility and accuracy

IDPS: GHG emissions for three variants

detailed	medium	simple
$GHG=\frac{e_1+e_2+e_3+e_4+e_5}{UAA}$ e_1: methane (CH_4) emissions from ruminants by enteric fermentation $e_1= 3.0 * \left(\frac{2*lac+2}{2*1.286*lac}\right) * LU_{dairy\ cow} + 3.0 * LU_{other\ ruminants}$ e_2: nitrous oxide (N_2O) emissions from agricultural soils e_3: emissions from drained organic soils e_4: carbon stored in trees e_5: CH_4 and N_2O emissions from stored slurry	similar to detailed system but parameterization terms e_1-e_4 simplified, term e_5 omitted. e_1: number of lactation neglected e_2: N_2O emissions from excretion of livestock neglected e_3: no dependency on depth of water table e_4: identical as in detailed variant e_5: omitted	**Climate and Nutrients indicator**: combines GHG emissions with ammonia emissions and nutrient leaching: $CN = 1 - k_1 \cdot \frac{LU}{ha} - k_2 \cdot \frac{N_{fert}}{ha}$ k_1=0.33, k_2=0.0025 e.g.: 1.5 LU/ha and 200 kg N/ha => CN=0 => no payments

Workshop: Evaluation of IDPS by stakeholders

detailed	medium	simple
Advantages		
✓ (reasonably) **complete** description of processes ✓ **flexibility** ✓ great **future potential** (e.g. through digitalisation)	suitable compromise between simple and detailed system	✓ **easy** to implement ✓ based on a **few key parameters** ✓ **low admin. burden** (data collection…)
Disadvantages		
– full implementation **challenging** – **demanding acquisition** of **data**/ high admin. burden – requires lot **know-how**	cumulates negative aspects of simple and detailed variant	– processes **poorly modeled** – **lack** of **flexibility** – **few options** for farmers to **reduce environ. impact**

Challenges

- High complexity/ time-consuming data acquisition may limit acceptance and understanding => promote awareness/ support farm managers
- stakeholder involvement, design of test phase

- Politically set environmental targets are not achieved => identify further levers (e.g. emission-reducing technologies and production methods)
- ensure compatibility of the current direct payment system with IDPS => critical verifications of overlaps and contradictory incentives

Conclusions

IDPS …

- ✓ demonstrates that existing indicator systems cannot be used => development of new indicators
- ✓ shows how LCA thinking can be applied for developing indicators
- ✓ is a flexible tool as it provides 3 variants of different complexity

Summary (in engl.) available in Gilgen et al., 2022, *Indikatorbasierte Direktzahlungen im Agrarumweltbereich*, Agroscope Science, 136.














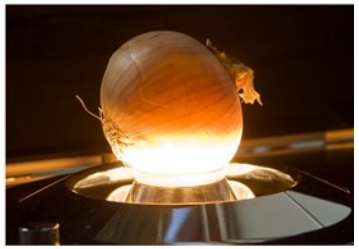

Thank you for your attention

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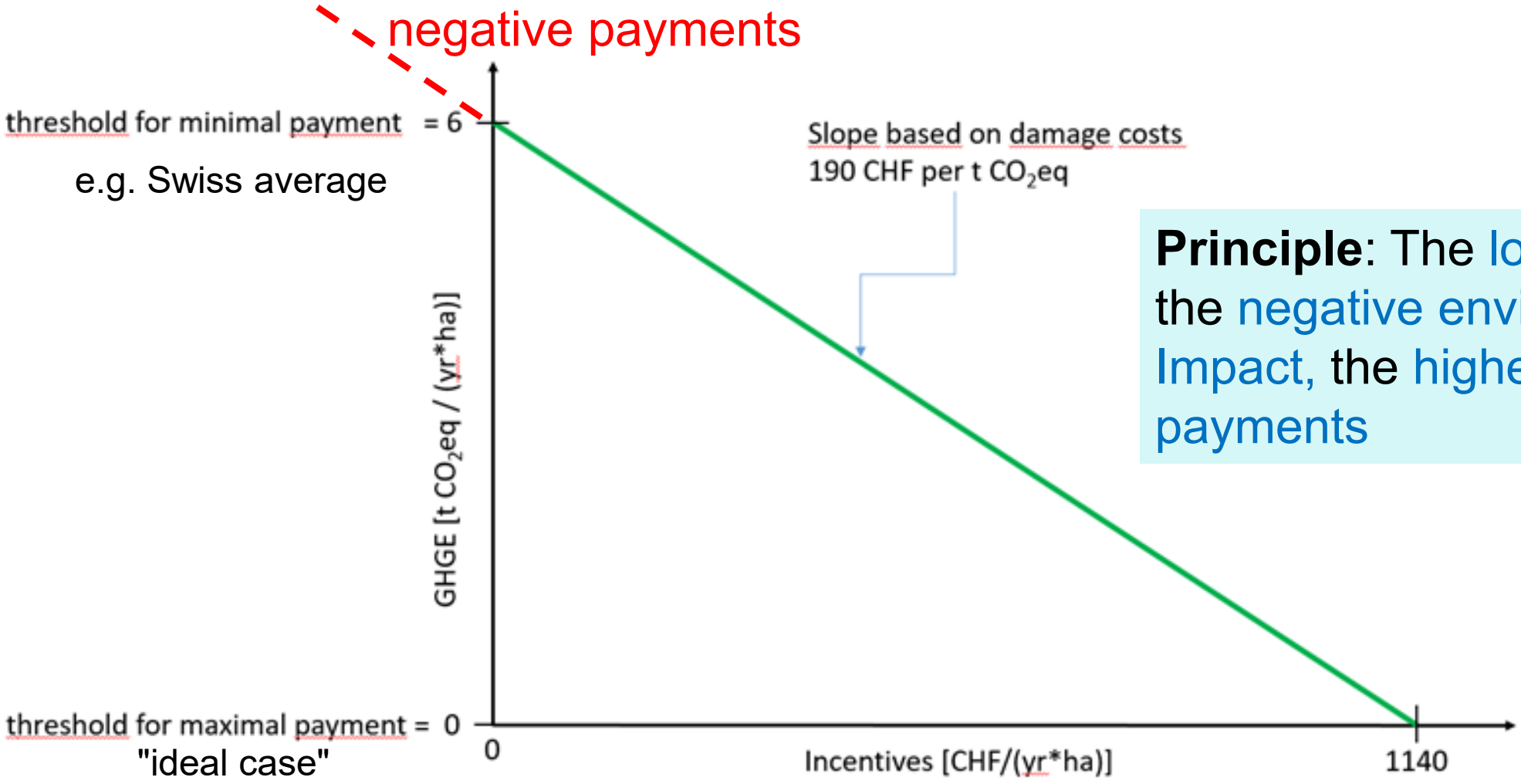
Conclusions

IDPS …

- ✓ demonstrates that existing indicator systems cannot be used => development of new indicators
- ✓ LCA thinking
- ✓ is a flexible tool as it provides 3 variants of different complexity
- ✓ examine

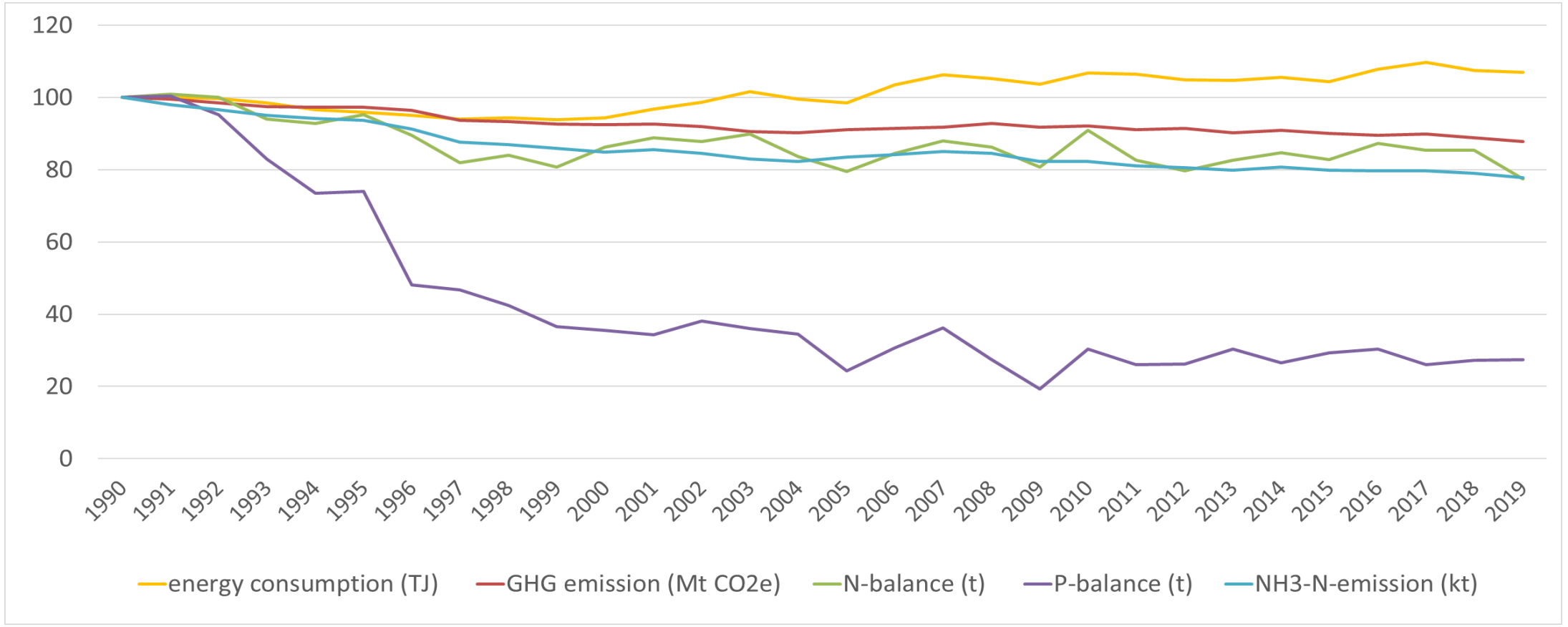
- ✓ is a promising approach for enhancing current direct payment system with ecologically driven incentives
- ✓ needs a close involvement of all stakeholders for further developments and possible future operationalization and implementation
- ✓ IDPS is not sufficient to achieve current Agri-Environmental Objectives

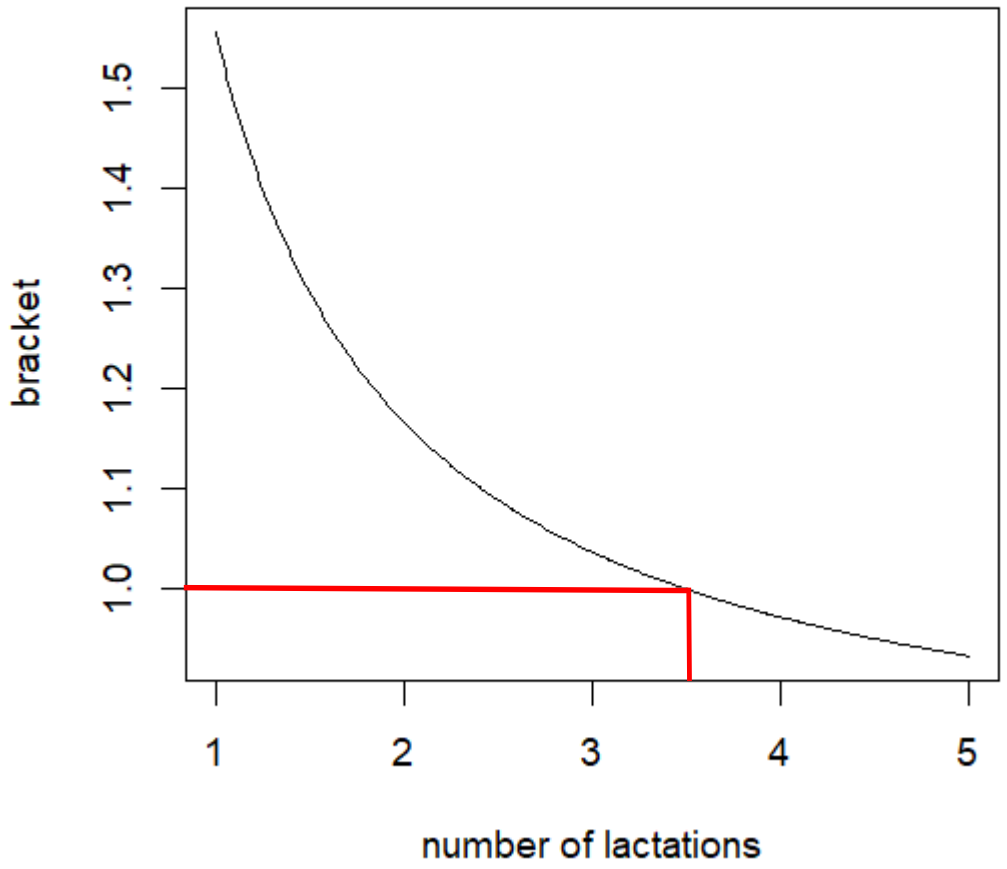
Conversion GHG emission to payment level



Principle: The lower the negative environm. Impact, the higher the payments

Introduction




bracket
1.0
1.1
1.2
1.3
1.4
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1
2
3
4
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number of lactations