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ADDRESSING CHALLENGES OF EVALUATING RDP IMPACTS ON WATER QUALITY

Experiences from case studies in Germany and Greece

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Structure

- The case studies.
- The challenges.
- Approaches and indicators selected.
- Some results.
- How did the approaches and indicators perform?
- Recommendations.
- Future issues .

The case studies

- **Lower Saxony in Germany**
  - High uptake of AE measures (RDP M 214) related to nitrogen pollution from agriculture - particularly in area designated for drinking water protection.
  - Agricultural Advisory Services related to water protection are very important (RDP M 214, 114 and 323)
- **Plain of Thessaly in Greece**
  - Intensive (irrigated) crop production
  - Protection of groundwater from pollution caused by agriculture (RDP M 214)
    - Set aside
    - Crop rotation with non irrigated crops
    - Uncultivated field margins

Indicators -Evaluation challenges

Gross Nutrient Balance

- Lack of control groups to establish advanced and robust counterfactuals
- Estimation and testing the usability of the relevant data originated from different sources
- Quantitative assessment of water quality impacts of advisory measures

Mineral N content in the soil in autumn (Nmin)

- Testing of an alternative (non-CMEF) impact indicator
- Improvement in the micro-macro linkage and net impact assessment

Statistical analysis of GNB indicator (Germany)

- Comparison of nutrient balances of different sources
  - 129 model farms with intensive advisory service (2006 - 2012)
  - 1767 farms controlled for the fertilizer ordinance (reference farms)
  - 5239 farms of farm accountancy data - LAND-Data (1998 and 2001)
- Statistical analysis: propensity score matching
  - Comparison of model farms with non-receivers of advice out of the reference group
  - AEM participation and Advisory comparison within the control data of fertilizer ordinance
  - With-without AEM comparison within LAND-Data

Statistical analysis of Nmin indicator (Germany)

Micro level

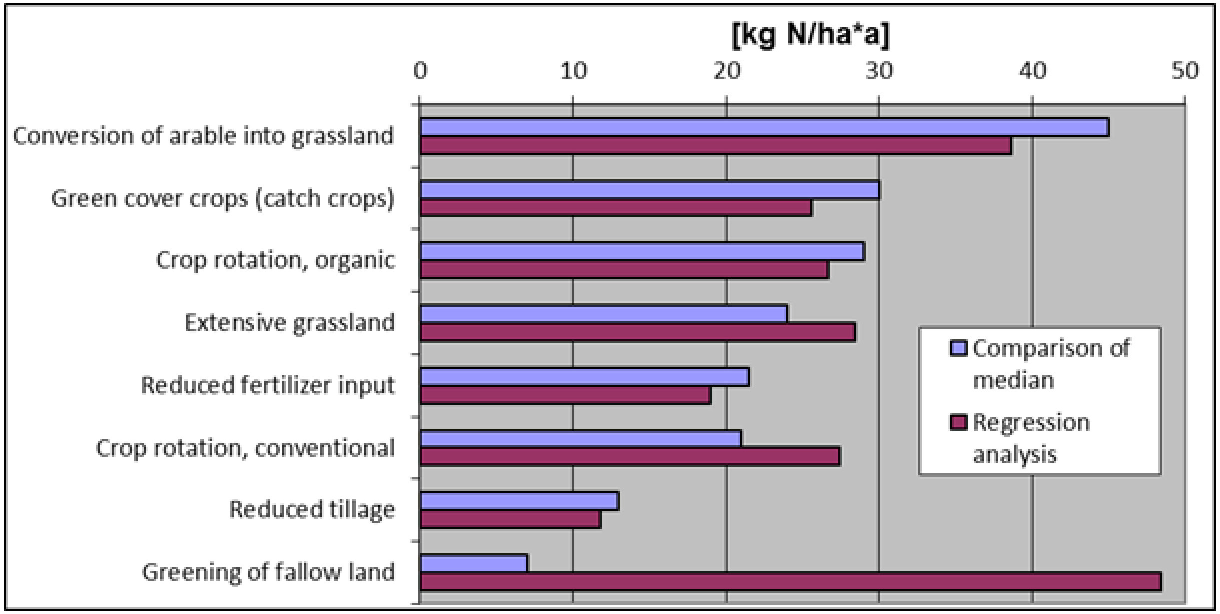
- Analysis of about 20,000 soil samples from the years 2000-2006
- Matching algorithm: random selection from stratified samples
- Statistical analysis by pairwise comparison and regression analysis at sub-measure level

Macro level

- Years 2008-2013: Nmin values only available at aggregated level of water protection cooperatives (treated as single observation)
- (Missing information: farm structure, type of AE measure applied)
- Statistical analysis: pairwise comparison
- Micro-macro linkage: Micro level data is aggregated to the same level to allow comparison

Results Nmin indicator (Lower Saxony, Germany)

Results at micro level: positive, stat. significant impact of measures



Reduction potential of AE measures - difference of median (kg N/ha)

Results at macro level: detailed valuable statistical analysis not possible

- structural data and information on type of AE measure is missing
- Limited explanatory power

Results nutrient balances (Lower Saxony, Germany)

Impact of advisory service

- N balances of reference group lower than that of the model farms → treatment (advisory service) is increasing the N balances
- comparison within control data shows better results but more information on farm structure and management needed to improve matching

Agri-environmental measures

- N balances of participants slightly reduced
- Comparison not conducted at sub-measure level → experience of evaluator shows more robust results

Approaches and Indicators GR

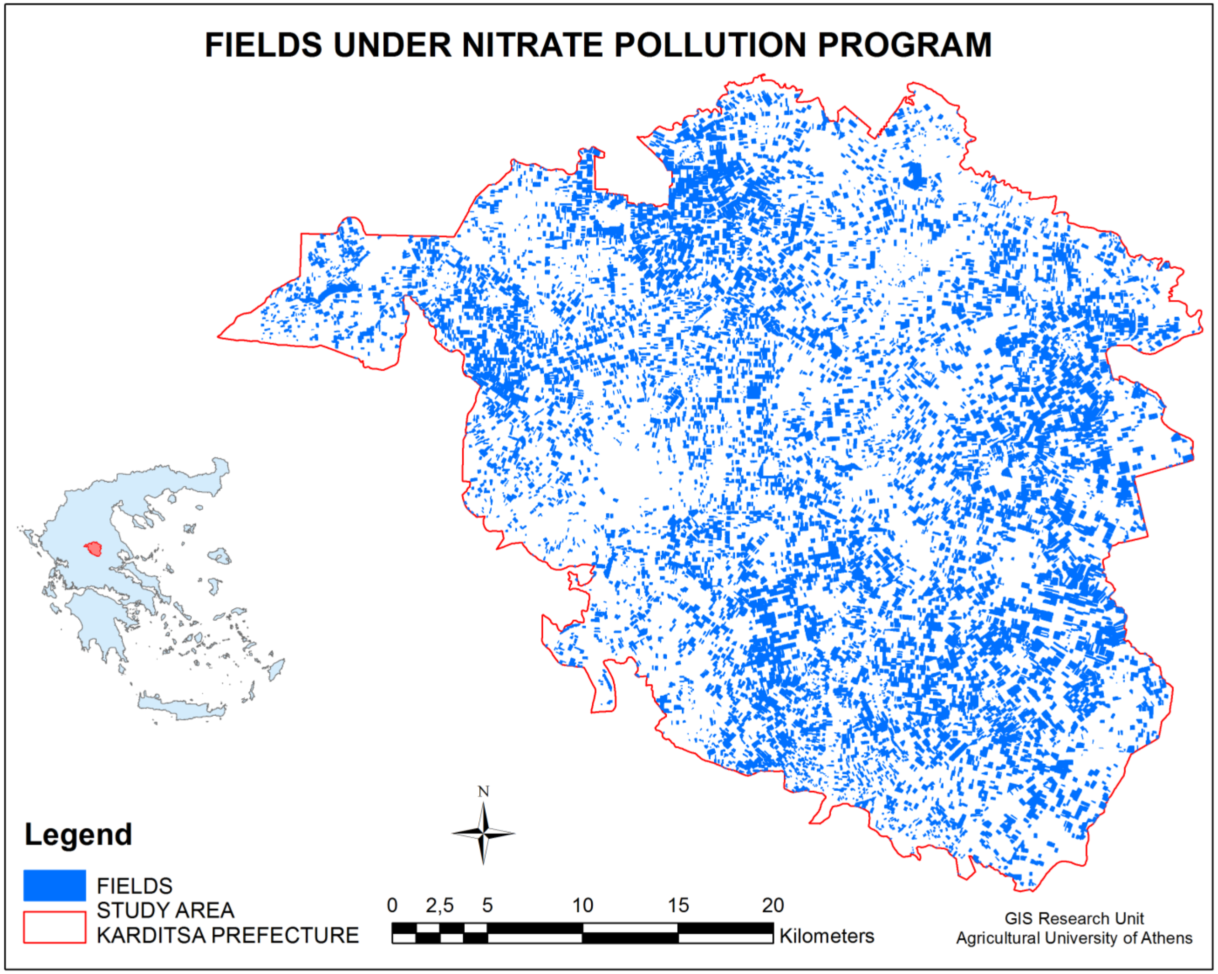
Indicators	Approach
• Gross Nitrogen Balance (Parcel level) • Water use/ha	• Spatial data concerning farm land uses and practices combined with the application of a biophysical model . • Geo-referenced IACS data (2011) for participants and non participants.

Evaluation challenges

Greece/Plains of Thessaly

- Establishment of robust causal linkages at micro level
- Establishment of consistent micro-macro linkages in evaluation results.
- Net impact: Distinguish between Cross Compliance, CAP changes. Identify possible deadweight loss.

Thessaly, Greece



-Focus on only 4 soil classes and
4 important crops
cotton, maize, cereals and fodder plants.
-DiD not possible -Only participants /non participants
-Apply biophysical model

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Results (Thessaly, Greece) 1

-GNB and consequently N-loss to underground water through leaching is estimated to be significantly reduced since farmers in the participating farms use reduced quantities of N-fertilisers.

-Set aside was not preferred as an option.

Soil Class	kg N applied/ ha/year	GNB/ha
I	-12%	-14%
II	-19%	-26%
III	-18%	-20%
IV	-23%	-23%
Total	***-19%***	***-27%***

Results (Thessaly, Greece) 2

- **Water use/ha**

-Fields participating in the AEM, seem to use more irrigation water on the average per ha, than the non participants, ranging from 0.2% to an impressive 12%, depending on the soil class, and an overall average of 3.2%.

Soil Class	Fields participating in the AE action	Fields non-participating in the AE action
	Water use m^3/ ha	Water use m^3/ ha
I	2,589.58	2,308.72
II	2,456.48	2,451.19
III	2,032.53	1,898.69
IV	1,592.21	1,587.61
Total	2,092.76	2,028.51

Results (Thessaly, Greece) 3

Micro and macro consistency considered only in an intuitive manner:

- Up-scaling based on actual distribution of crops across soil classes.
- Assumption that each crop type is equally distributed across soil classes.

- Differences of the outcomes when using the scaling up of micro results and the macro approach have not been insignificant.
- Thus inconsistencies could affect the reliability of the macro approach.
- Further elaboration using better statistical techniques at the micro level could provide more insights on the issue

Performance of approaches used (1)

DE/Lower Saxony - Combination of various data sources

- **Farm + Measure level**

- **Strengths**
- Nmin can be an alternative impact indicator
- Use existing monitoring data
- Propensity score matching even with less data yields better results than a naïve approach.
- **Weaknesses**
- Use and combination of different data sources difficult due to different data qualities and degree of reliability
- Careful selection of reference situation necessary to achieve significant results
- Panel data not available for reference group → DiD analysis not possible
- Good quality data for the reference group to construct robust counterfactuals is rarely available

Performance of approaches used (2)

GR/ Geo-referenced land parcel data + Biophysical model with spatial reference

Parcel+ Measure level

Strengths

- IACS /LPIS is, in principle, an available data source
- Spatially explicit approaches improve causality linkages
- Use of existing available data
- Unambiguous and understandable results.

Weaknesses

- Limited access to IACS/LPIS data (no different time points =>no DiD).
- Farm level could not be examined
- Water quality data irregular.
- Dependence on GIS expertise.
- The estimation of deadweight loss was impossible.

Recommendations DE 1

Nmin

- Disaggregated data sets are essential for the successful application of the evaluation method.
- Due to the high degree of variation, large sample sizes with a variety of variables related to the farm structure and management practices are required.

GNB

- Harmonisation of calculations from different sources e.g. nitrogen balances, could reduce difficulties to combine different data sets with varying accuracy and reliability.
- PSM requires a good data availability and quality as well as (panel) data of several years.

Recommendations GR 1

Methodological

- Spatial explicit approach has a great potential if data accessible.
- Need to connect the analysis at the decision level
- A dynamic model including more parameters could yield more accurate results.
- Caution with macro approach when differentiation is high.

Policy

- The refusal of the Commission to accept reduction of inputs as an agrienvironmental action is well founded.
- There is a need to re think environmental protection measures. Focus on impacts. E.g. result based payments, result dependent payments

Key issues for evaluation of water protection measures

Future issues:

- Ensure accessibility and integration of spatial data (INSPIRE)
- Incorporate monitoring and impact evaluation in the design of the specific measures.
- Explore systematic sampling & standards for sampling to improve the validity of future analysis
- Use of results in participative evaluation exercises.