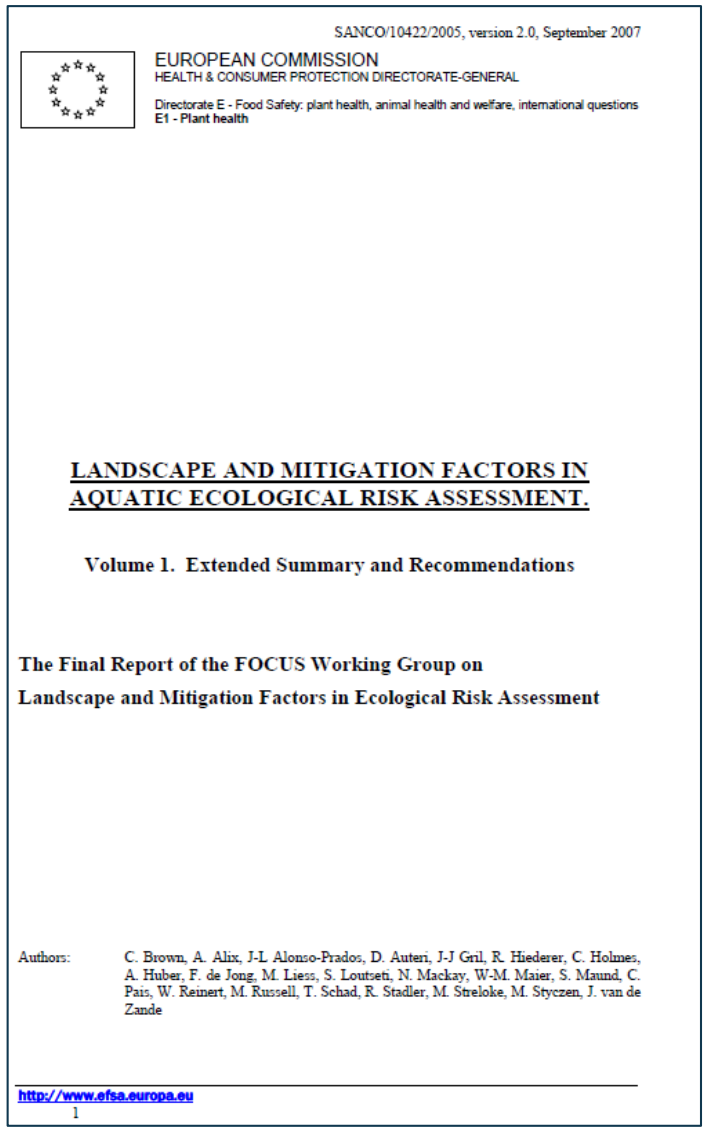
NC State University
2020 CERSA VFS Virtual Workshop

Run-off Mitigation – Regulatory Status in the EU

September 8th, 2020

Robin Sur
Bayer Crop Science
Monheim, Germany

FOCUS ‘Landscape and Mitigation’ (2007)



SANCO/10422/2005, version 2.0, September 2007

EUROPEAN COMMISSION
HEALTH & CONSUMER PROTECTION DIRECTORATE-GENERAL

Directorate E - Food Safety: plant health, animal health and welfare, international questions
E1 - Plant health

LANDSCAPE AND MITIGATION FACTORS IN AQUATIC ECOLOGICAL RISK ASSESSMENT.

Volume 1. Extended Summary and Recommendations

The Final Report of the FOCUS Working Group on Landscape and Mitigation Factors in Ecological Risk Assessment

Authors: C. Brown, A. Alix, J-L Alonso-Prados, D. Auteri, J-J Gril, R. Hiederer, C. Holmes, A. Huber, F. de Jong, M. Liess, S. Loutseti, N. Mackay, W-M. Maier, S. Maund, C. Pais, W. Reinert, M. Russell, T. Schad, R. Stadler, M. Streloke, M. Styczen, J. van de Zande

http://www.efsa.europa.eu
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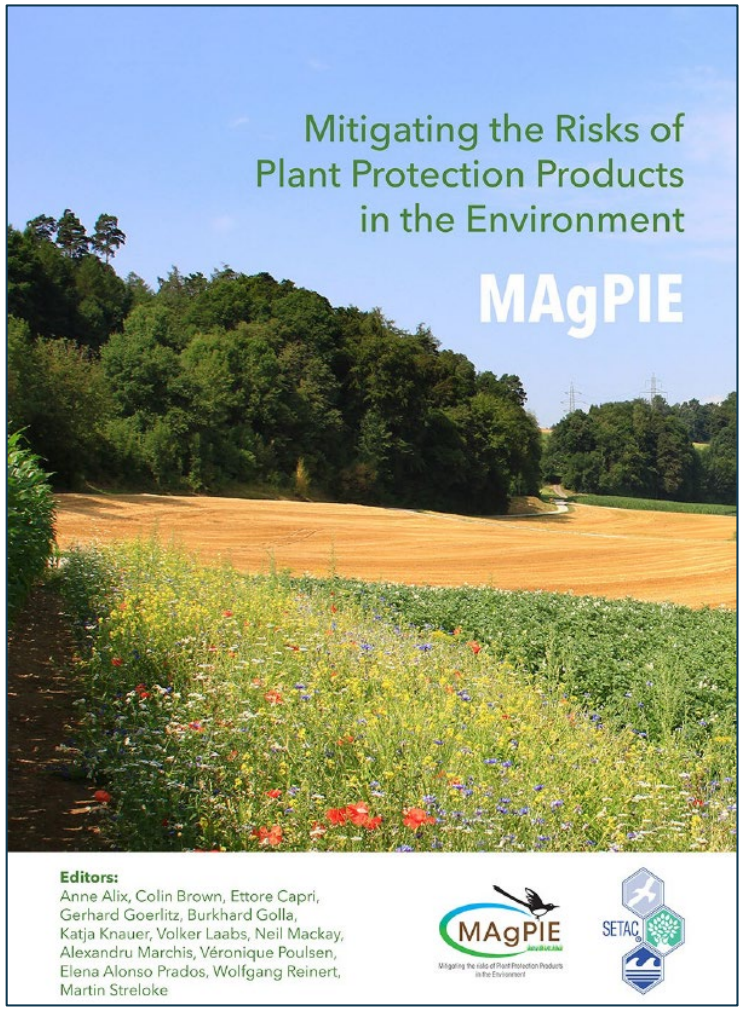
- Official EU Guidance for run-off mitigation
- Provides field-evidence based reduction factors for water and sediment
- No reference to VFSMOD (pesticide trapping component not available then)

Buffer width (m)	10-12	18-20
Reduction in volume of runoff water (%)	60	80
Reduction in mass of pesticide transported in aqueous phase (%)	60	80
n (for aqueous phase)	*36*	*30*
Reduction in mass of eroded sediment (%)	85	95
Reduction in mass of pesticide transported in sediment phase (%)	85	95
n (for sediment phase)	*19*	*11*

‘MAgPIE’ Workshop (2017)

Mitigating the risks of Plant Protection Products in the Environment

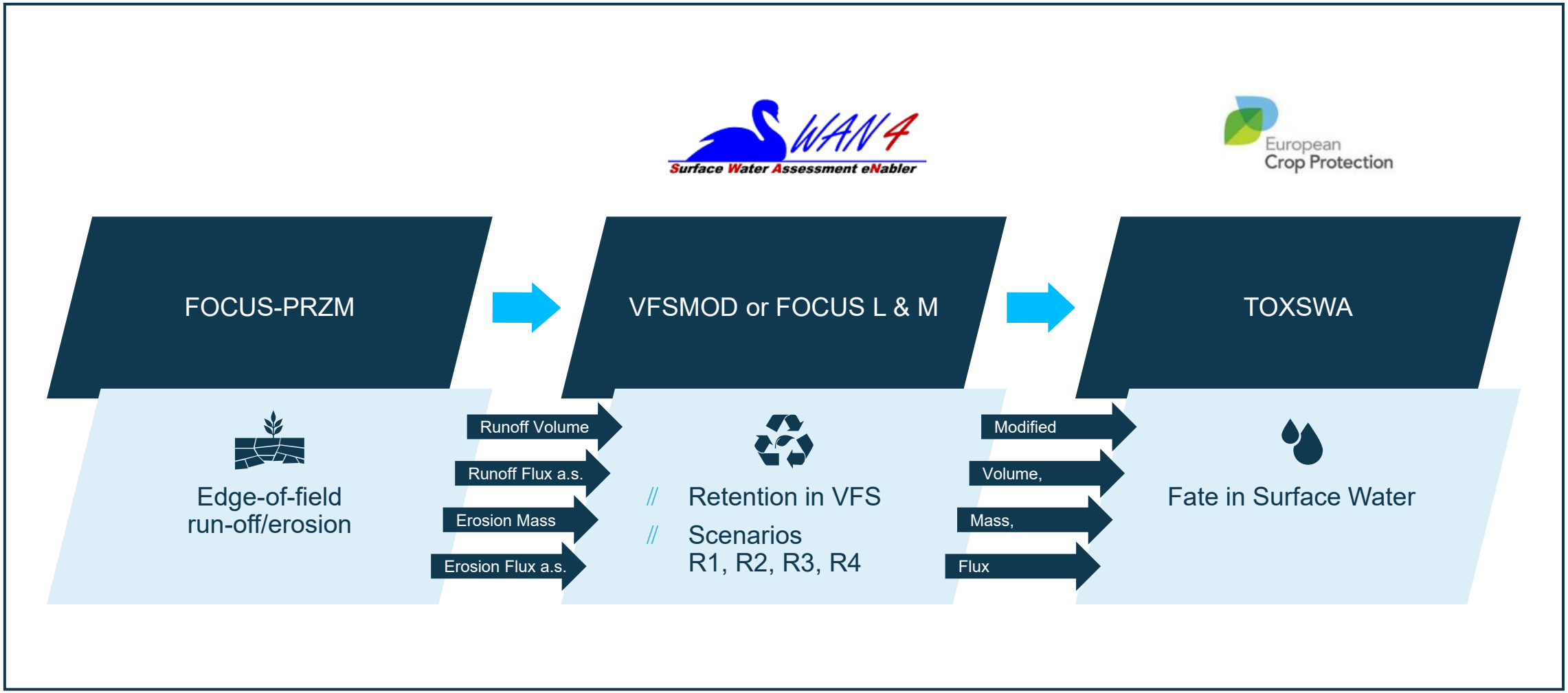


- Multi-stakeholder initiative on regulatory risk management
  - Recommendations from EU COM, EFSA, EU MS Authorities, Academia, CROs, Industry
  - Includes VFSMOD as recommended model
  - Adds 5m-VFS
  - Updates fixed reduction percentages

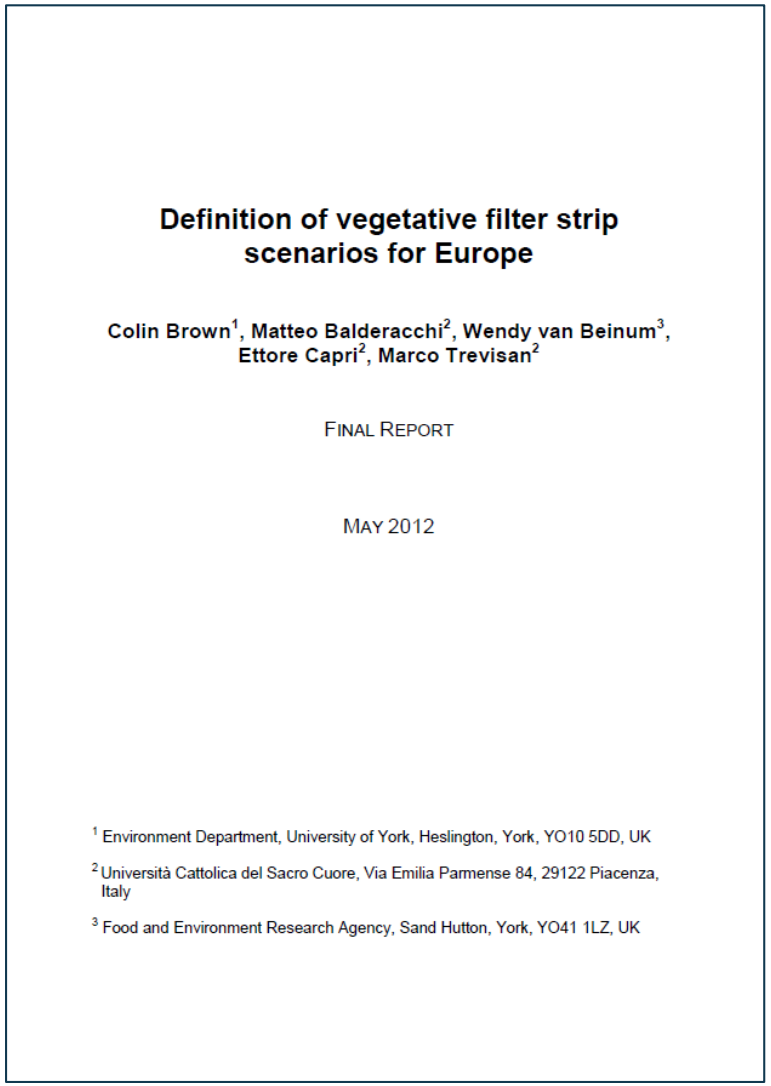
Runoff Mitigation Measure	Strength of Scientific Evidence*	Basic Mitigation Effectiveness[1]	Proposed Modeling Tools or Parameter Modifications
Edge-of-field measures			
5 m vegetated filter strip	+++	40%[2]	VFSMOD[14]
10 m vegetated filter strip	+++	65%[3]	VFSMOD
20 m vegetated filter strip	+++	80%[3]	VFSMOD
Edge-of-field bunds	+	40%[4]	Calculation of water retention, infiltration and environmental fate

Automated FOCUS Step 4 Calculation

The SWAN tool is recommended by the FOCUS L & M report



European VFS Scenarios for VFSMOD



Definition of vegetative filter strip scenarios for Europe

Colin Brown[1], Matteo Balderacchi[2], Wendy van Beinum[3], Ettore Capri[2], Marco Trevisan[2]

FINAL REPORT

MAY 2012

[1] Environment Department, University of York, Heslington, York, YO10 5DD, UK

[2] Università Cattolica del Sacro Cuore, Via Emilia Parmense 84, 29122 Piacenza, Italy

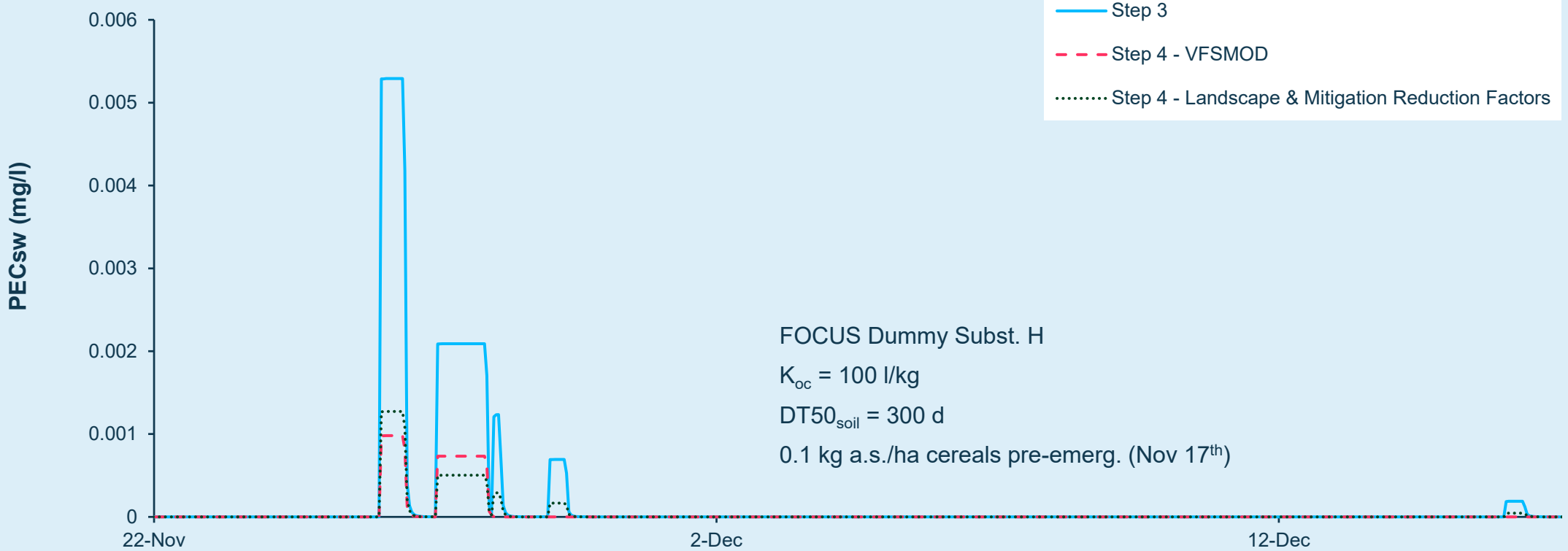
[3] Food and Environment Research Agency, Sand Hutton, York, YO41 1LZ, UK

- Parameterization of EU VFS Scenarios
  - Aim for 90th percentile 'realistic worst-case' VFSMOD output
  - Use actual combinations of K_{sat}, Θ_{sat}, Θ_{FC} from soil taxonomic units (STU) representing FOCUS R scenario
  - Weighting of each combination of parameters by area of STU
  - Defaults for other parameters
  - To be used in model suite SWAN

Parameter	R1	R2	R3	R4
90th percentile from VFSMOD-W simulations (weighted by area)				
K_s (m s^{-1})	7.04×10^{-7}	2.79×10^{-6}	9.25×10^{-7}	1.52×10^{-6}
θ_s (cm^3 cm^{-3})	0.447	0.403	0.472	0.420
θ_{fc} (cm^3 cm^{-3})	0.395	0.312	0.385	0.372

Results FOCUS Step 4 Calculation

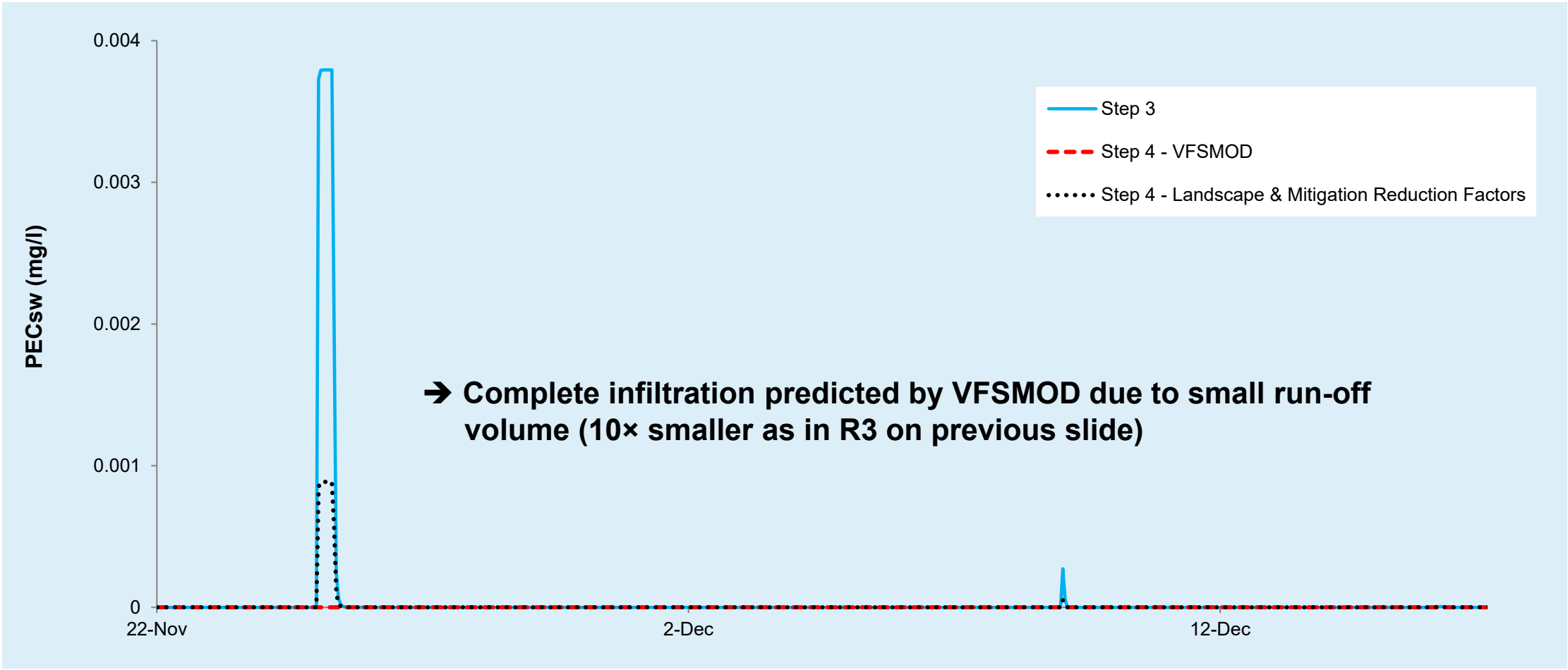
FOCUS R3-Stream Scenario with 20 m VFS



➔ **Similar pesticide removal by VFSMOD and FOCUS L & M approach**

Results FOCUS Step 4 Calculation

FOCUS R1-Stream Scenario with 20 m VFS



Regulatory Landscape Prevents Broad Adoption of VFSMOD

- VFSMOD not officially implemented on EU or zonal level, partly used at MS level
- Only limited authority feedback available as VFSMOD simulations not regularly submitted by notifiers
  - Regulatory prerequisites for acceptance not given
    - Run-off not considered (UK, Netherlands)
    - FOCUS Surface Water framework not implemented (Germany)
    - FOCUS R scenarios not relevant (Denmark, Sweden)
    - VFS not accepted for mitigation (Denmark, Sweden)
  - Alternative guidance for FOCUS Step 4 run-off reduction in place
    - FOCUS Landscape & Mitigation (e.g. Austria, Belgium, France, Spain)
    - Country-specific overall reduction efficiency (Italy)
  - Not accepted: Czech Rep., France, Belgium

➔ **Inconsistent regulatory landscape prevents broad adoption**

Use of VFSMOD for Environmental Safety Assessments

Regulatory Implementation

- Poland: Accepted for regulatory risk management
- Spain (INIA): Currently working on implementaton (Southern Zone Workshop May 2020)
- Germany: Used alongside EXPOSIT run-off model to decide on buffer effectiveness
- Case-by-case decisions by EU Member States
- Model Suites
  - SWAN (ECPA)
  - GERDA (Germany, not yet adopted)

Non-regulatory Use (stewardship, advisory)

- France (IRSTEA): BUVARD tool to help sizing VFS under French conditions
- Norway (NIBIO, JKI): SMARTCROP (SYNOPS-WEB) for environmental impact assessment https://www.nibio.no/en/projects/smartcrop
- Germany
  - NRW: H_2Ot-Spot-Manager (SYNOPS-WEB) for agronomic advisory http://synops.julius-kuehn.de/login
- Model Suites
  - SWAT (USDA)
  - MIPP (INRA)

Overcoming Hurdles for the Regulatory Implementation of VFSMOD

Regulatory Policy

- Currently, no officially adopted EU guidance document on VFSMOD available
- When FOCUS L & M proposed fixed pesticide reduction fractions, no mechanistic alternative was available (pesticide reduction not yet implemented in VFSMOD)
- Draft COM / EFSA guidance on mitigation expected for Q1 / 2021
  - Role of VFSMOD unclear
  - Implementation of VFSMOD generally not a priority (existing alternative)

➔ Southern Zone Workshop (May 2020) may result in MS driven initiative for an EFSA guidance

Scientific Scrutiny

- Limited number of datapoints and pesticides for validation of pesticide trapping equation
  - Addressed in Reichenberger et al. (2019)

➔ Further activities ongoing to create trust (Remobilization of residues, improved sediment trapping, water table depth, see talk from Prof. Munoz-Carpena)

Conclusions

- Vegetated Filter Strips (VFS) are largely accepted across the EU for regulatory risk mitigation
- The regulatory assessment of the VFS performance relies mainly on fixed empirical reduction factors
- Some member states have officially adopted VFSMOD, whereas others use it on a case-by-case basis
- The MAgPIE multi-stakeholder working group has endorsed the regulatory use of VFSMOD
- Ag advisors already rely on VFSMOD for VFS planning
- Official EU guidance needed (EFSA) for broader acceptance of VFSMOD

Thank you!

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Related Poster Presentations on CERSA Workshop

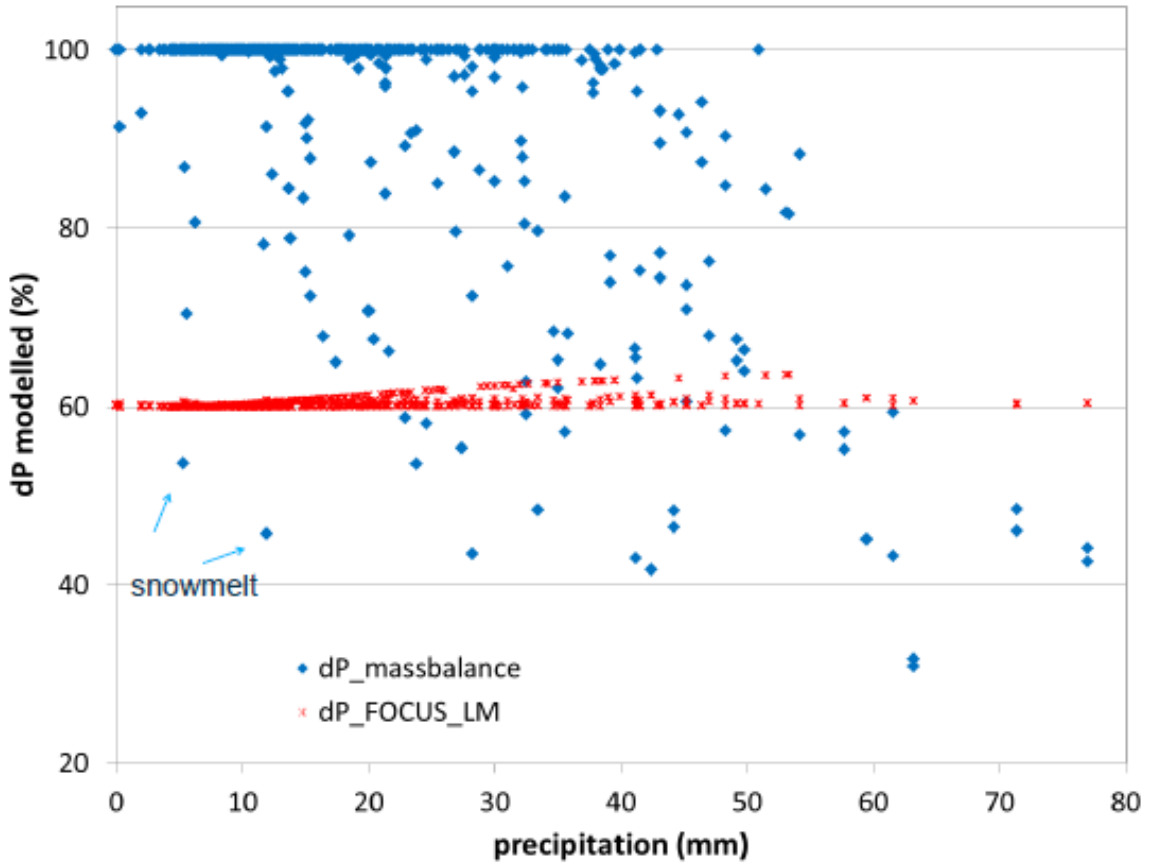
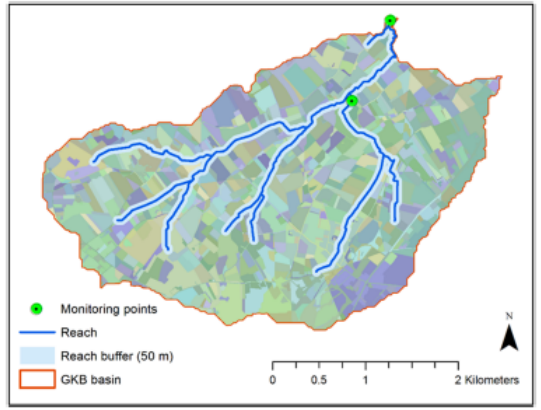


Fig. 1: Predicted pesticide reduction efficiency (ΔP) by a 10m-VFS for a dummy compound with K_{oc} = 1000 L/kg. dP_FOCUS_LM: fixed efficiencies according to FOCUS (2007). dP_massbalance: SWAN-VFSMOD simulation with a mechanistic mass balance trapping equation (Reichenberger et al., 2019)

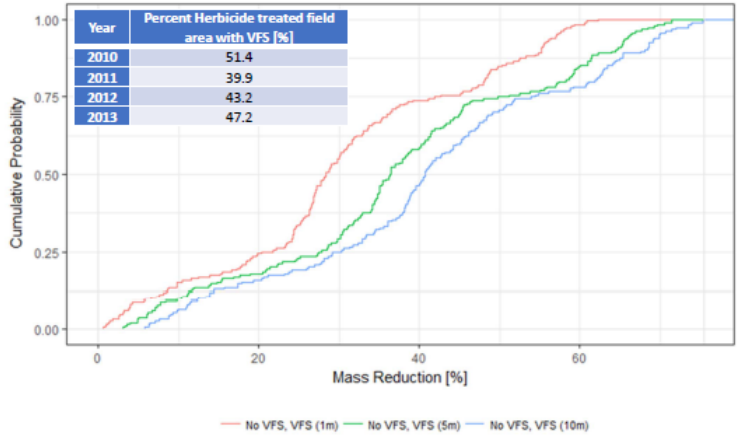
Sur et al. (2019)

Vegetative Buffer Strip Simulation

- VFSs were simulated on all field within 50 m of streams
  - 40% to 51% of pesticide-treated fields had VFSs
- Three buffer widths were simulated: 1 m, 5 m, and 10 m
  - Median long-term effectiveness in total mass reduction ranged from 28% (1 m buffer) to 41% (10 m buffer)
  - Maximum effectiveness was as high as 75%



Year	Percent Herbicide treated field area with VFS [%]
2010	51.4
2011	39.9
2012	43.2
2013	47.2



Winchell et al. (2020)

Comparison of Empirical Reduction Factors with VFSMOD

EU ‚FOCUS Landscape & Mitigation (2007)‘

- Fixed empirical reduction factors for water and sediment from field studies
- Pesticide retention then calculated from phase distribution (dissolved/particle-bound)
- No dependence on event magnitude or other environmental conditions
- Underestimates efficiency for small and overestimates it for large runoff events
- Conceptually weak as statistical (fixed) mitigation is combined with a variable, event-based run-off model
- Broad regulatory acceptance in EU-28

VFSMOD

- Mechanistic model to predict VFS efficiency
  - Physically-based overland flow (kinematic wave) and infiltration (Green-Ampt)
  - Physically-based sediment trapping (University of Kentucky sediment filtration algorithm)
  - Empirical or mechanistic pesticide retention
- Reduction efficiency depends on event magnitude and environmental conditions
- Opportunity to identify unsafe uses in contrast to fixed percentages
- Interest in EU-28 regulatory use but limited acceptance yet

Regulatory Run-off Modelling

Example: EU Surface Water Modelling for Pesticides