Soil management affects copper and zinc export from vineyard plots (Rouffach, Alsace, France)

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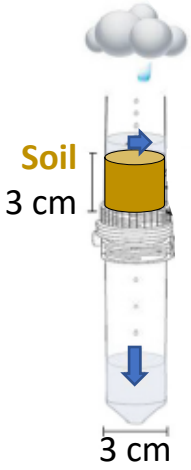
HS2.3.6 EDI

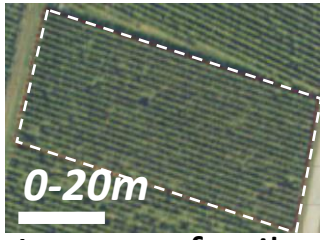
Micropollutants and pathogens in the soil-groundwater-river continuum: modelling, monitoring and mitigation

Why studying Copper (Cu) and Zinc (Zn) based fungicides ?

- Widely used in European vineyards to prevent fungal diseases both for conventional and organic farming systems
- their mobility controls total Zn & Cu accumulation in soil and off-site export with toxicity for terrestrial and aquatic trophic levels
- How improving prediction total Cu and Zn content in soil, accumulation and off-site ?
- Are predictive variables scale-dependant ?

Microcosms → Plot → Catchment → Europe

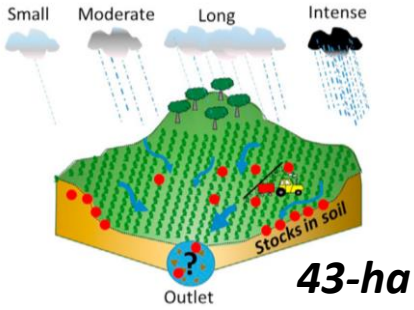




Impact of soil management on Cu & Zn exports ?

Meite et al. 2018 (Stoten)

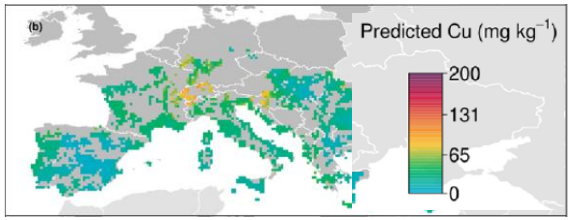
Soil types, aging, rainfall patterns



43-ha

Imfeld et al. 2020 (Stoten)

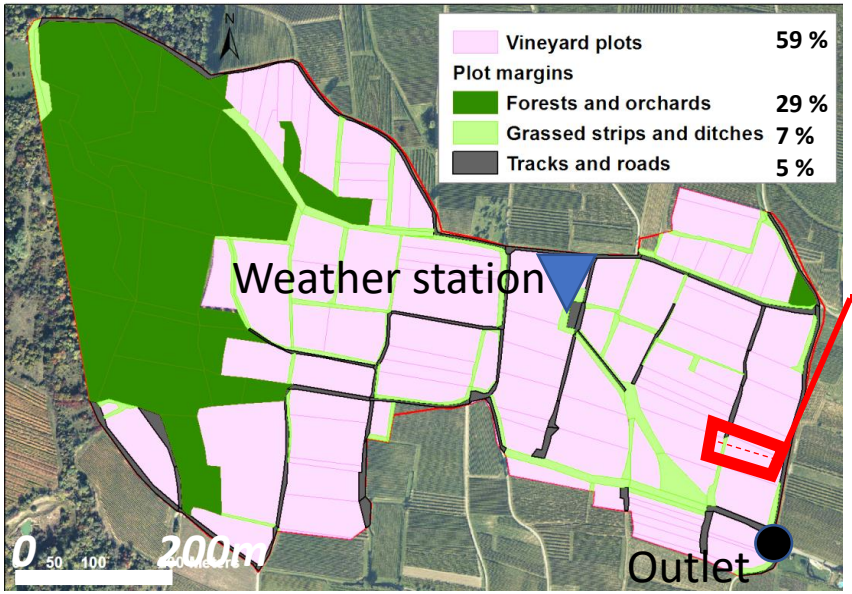
Rainfall patterns



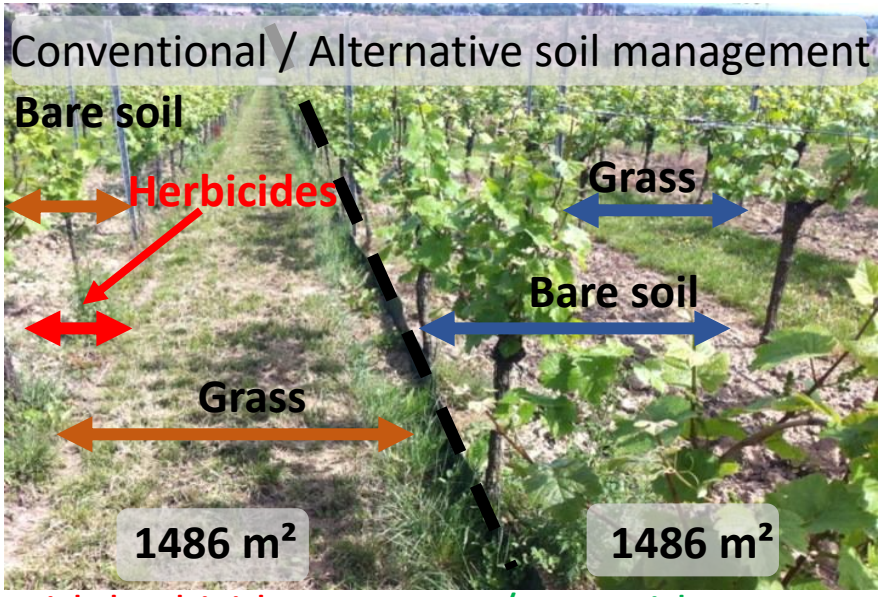
Droz et al. 2021 (ES&T)

Rain, aridity, soil organic carbon

Context:



Rouffach catchment: 43 ha, France (Alsace)



with herbicides / without

similar fungicides applications (synthetic + Cu)

without Metiram-Zinc (since 2014)

Sampling:

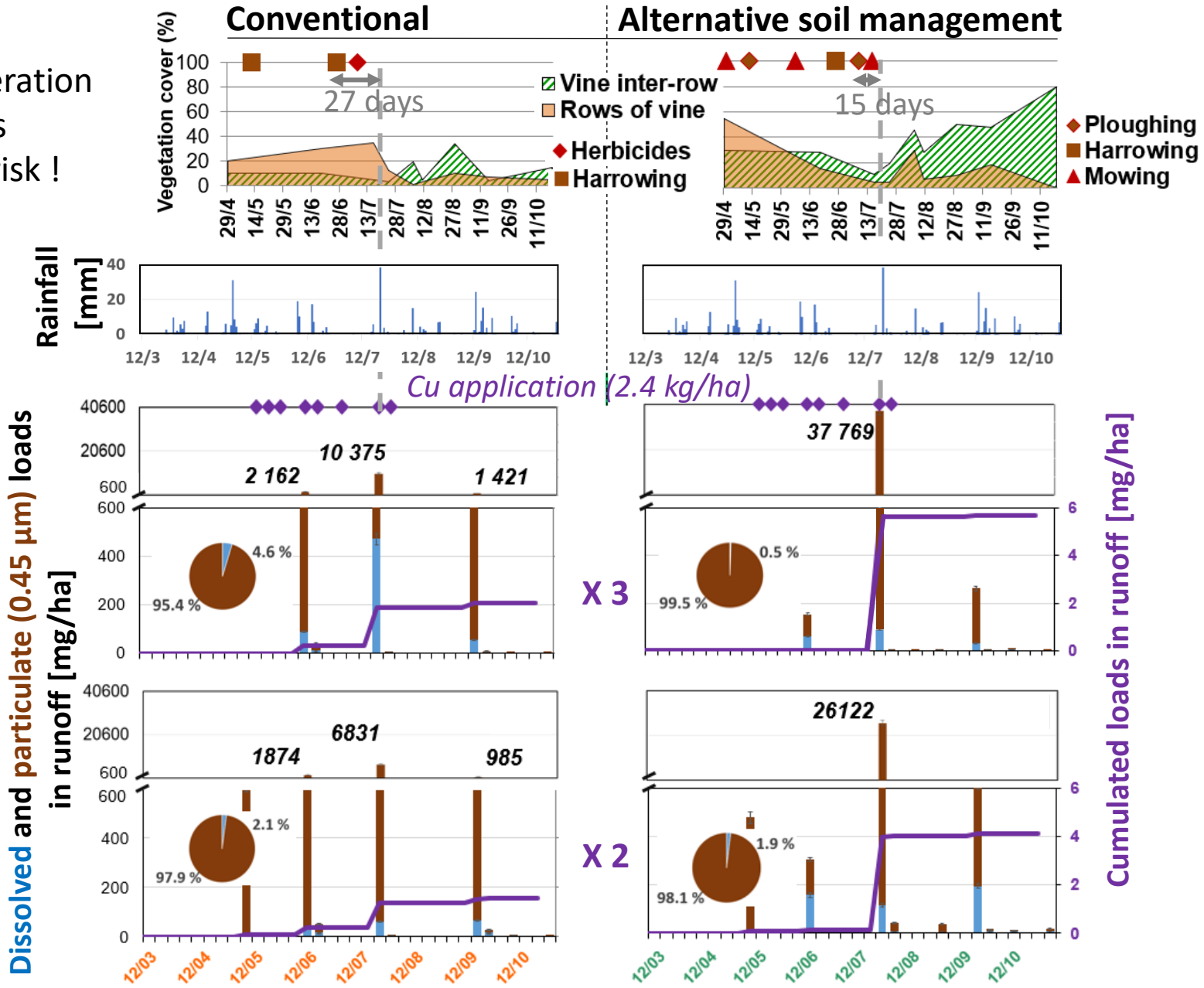
2015 & 2016: From March to October (Weekly runoff, Cu & Zn *(ICP-AES)*, vegetation and soil)[1]

Top-soil (first 5 cm, mean +/- SD): **103.6 ± 19.1** and **70.8 ± 7.8** kg **Cu** ha^{-1}

70.8 ± 16.4 and **63.9 ± 7.8** kg **Zn** ha^{-1} [1]*Imfeld et al. 2020*

Result summary (for 2015):

Each operation increases erosion risk !



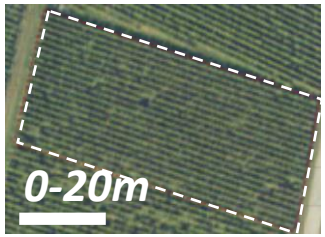
Export coefficient: from 0.001 to 0.05% of historical Cu and Zn in the top-soil

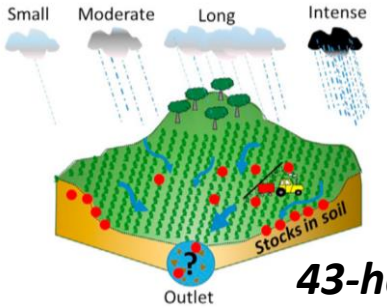
Take home messages:

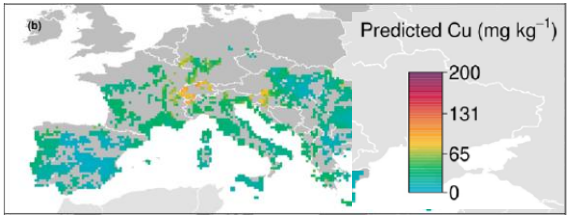
- Significant impact of soil management strategy on erosion risk and Cu & Zn part. loads
- Cu and Zn loads are rainfall patterns and soil managment strategy dependant
  →*in 2016 (opposite rank) Cu and Zn loads Conventional = 10 x Alternative management*
- Yearly Cu application less then 3% of top-soil historical content and only 0.05% of export
  → Cu accumulation (such as Zn before Metiram-Zinc stop)[1, 2, 3]
- Argue for alternative scenarios without Cu[3] and Zn **and** without synthetic fungicides (contaminating soil and water)[1,2]
- Potential of multi-scale studies to understand ongoing processes and support regulation

Microcosms → Plot → catchment → Europe

Processes ? | **Soil manag. ?** | **Rainfall patterns?** | **EU variability and regulation ?**







Meite et al. 2018 (Stoten)[1] | *Imfeld et al. 2020 (Stoten)[2]* | *Droz et al. 2021 (ES&T)[3]*

Thank you for your attention

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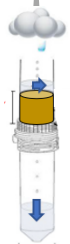
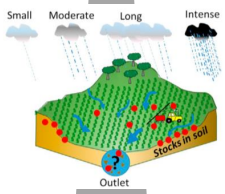
References:

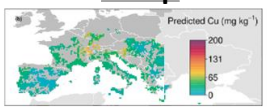
Microcosms



Catchment



Europe



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