A long-term field experiment: Effect of buffer strips on erosion and nutrient losses in boreal conditions

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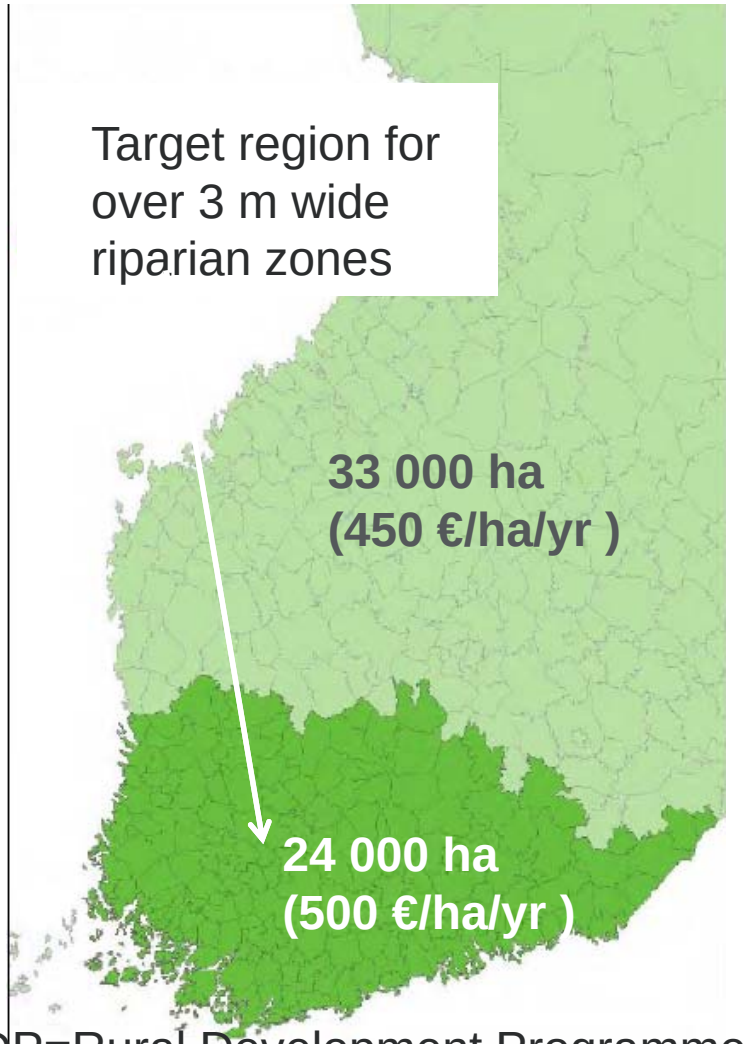
Presentation outline

- Current BS situation in Finland
- Lintupaju experimental site
- Results: surface runoff, erosion, PP, DRP and TN
- Rainfall simulation study in laboratory
- SWOT analysis

Current buffer strip situation in Finland



- **1 m wide edges** must be along main ditches and water courses on every farm (*basic regulation*)
- **3 m wide filter strips** must be along water courses on the *farms committed to environment payments*
- **Over 3 m wide riparian zones** under perennial vegetation are targeted to arable land along *water courses* and *main ditches*, on arable parcels in *Natura 2000 areas* and *groundwater areas*, and parcels bordering *a wetland* that are managed under an environmental contract. Vegetation is moved and removed from the zone annually or managed by grazing. (RDP)
- Neither fertilization nor plant protection are allowed.

RDP=Rural Development Programme for Mainland Finland 2014–2020

Lintupaju Experimental Field

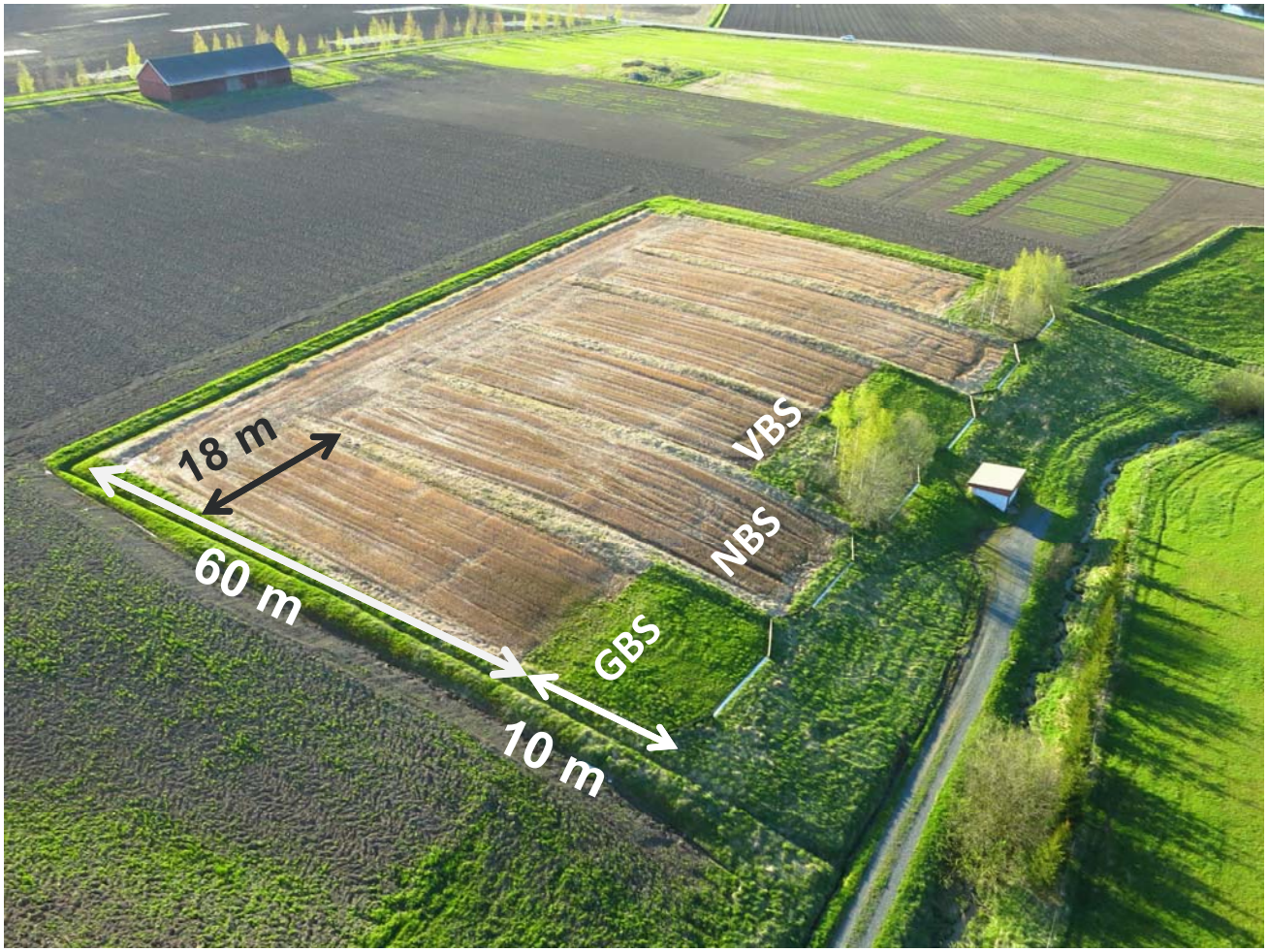


Fig. Jaakko Heikkinen, Luke

A 6-plot field was established on a clay soil in 1989-1990

Buffer strip (BS) experiments started in 1991

(1) NBS = No buffer strip
(2) GBS = Grass buffer strip
(3) VBS = Vegetated buffer strip (scrubs, trees, herbs)

AnaEE (pan-European research infrastructure)?

Experiments 1991–2016

1. Conventional tillage (autumn ploughing and sowing in spring) 1991–2001

3. No-till 2006–2016

2. Pasture 2003–spring 2006

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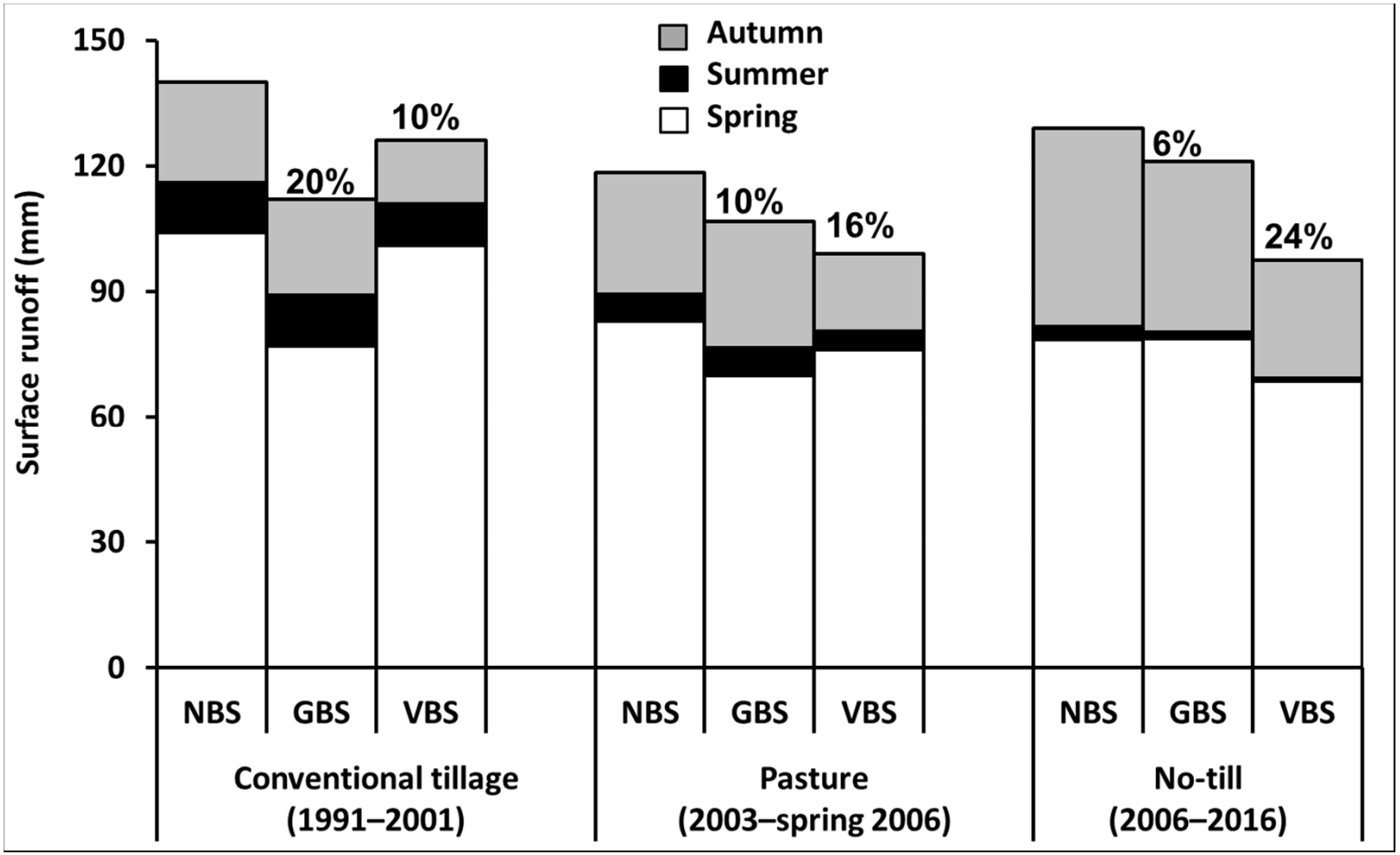
Current situation on VBS and NBS

Mean annual surface runoff



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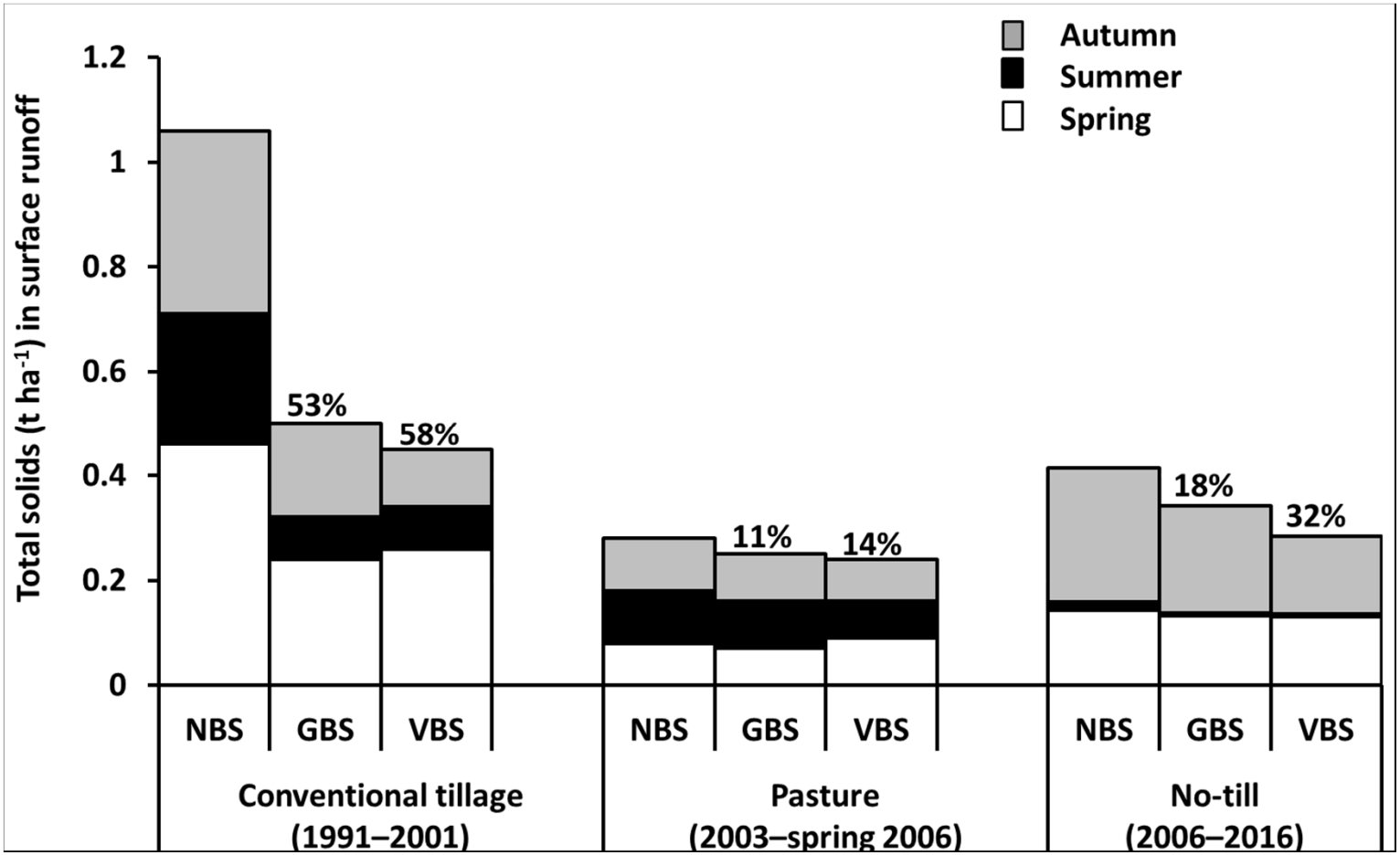
Mean annual load of total solids in surface runoff



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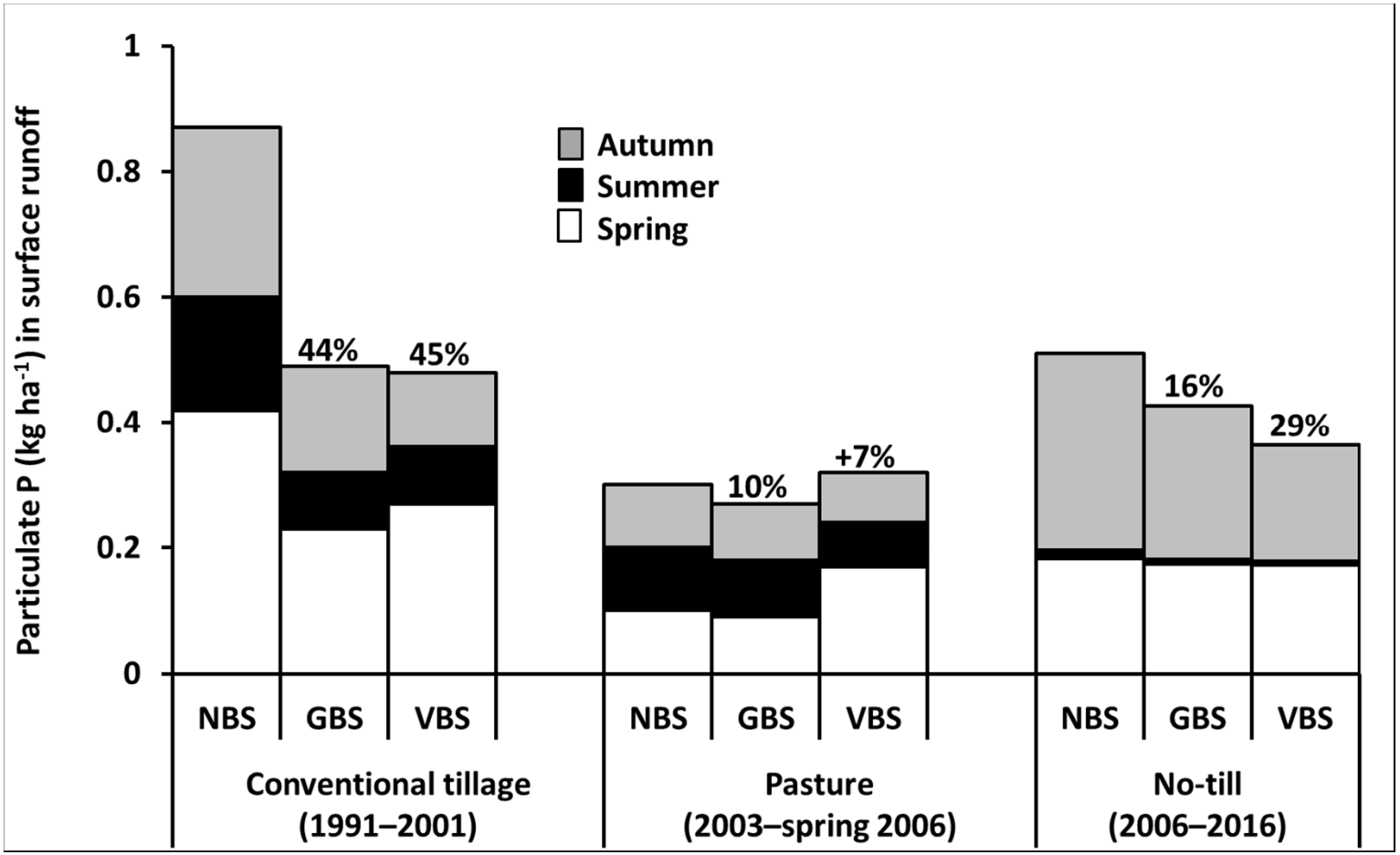
Mean annual load of particulate P in surface runoff



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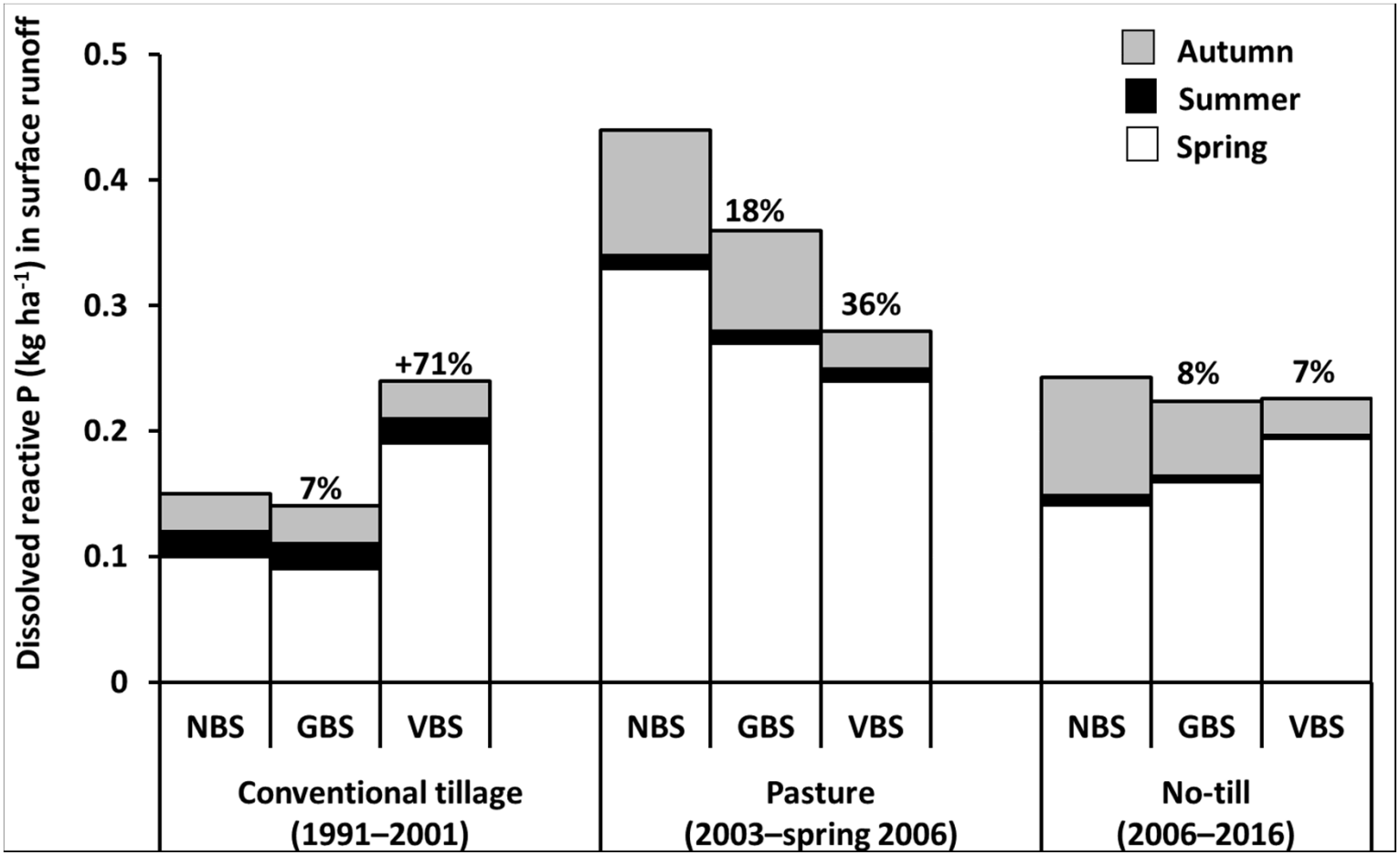
Mean annual load of DRP in surface runoff



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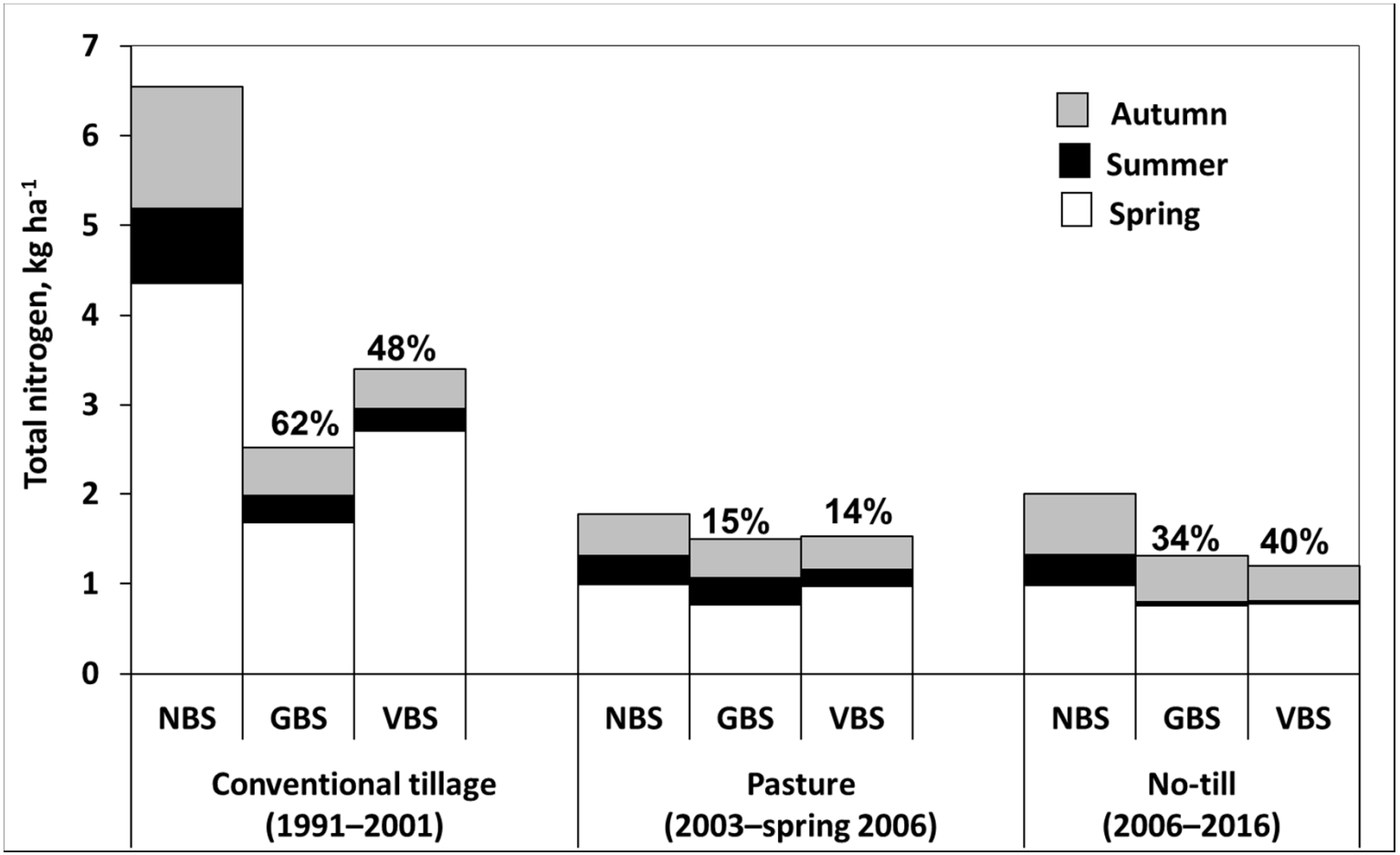
Mean annual load of total N in surface runoff



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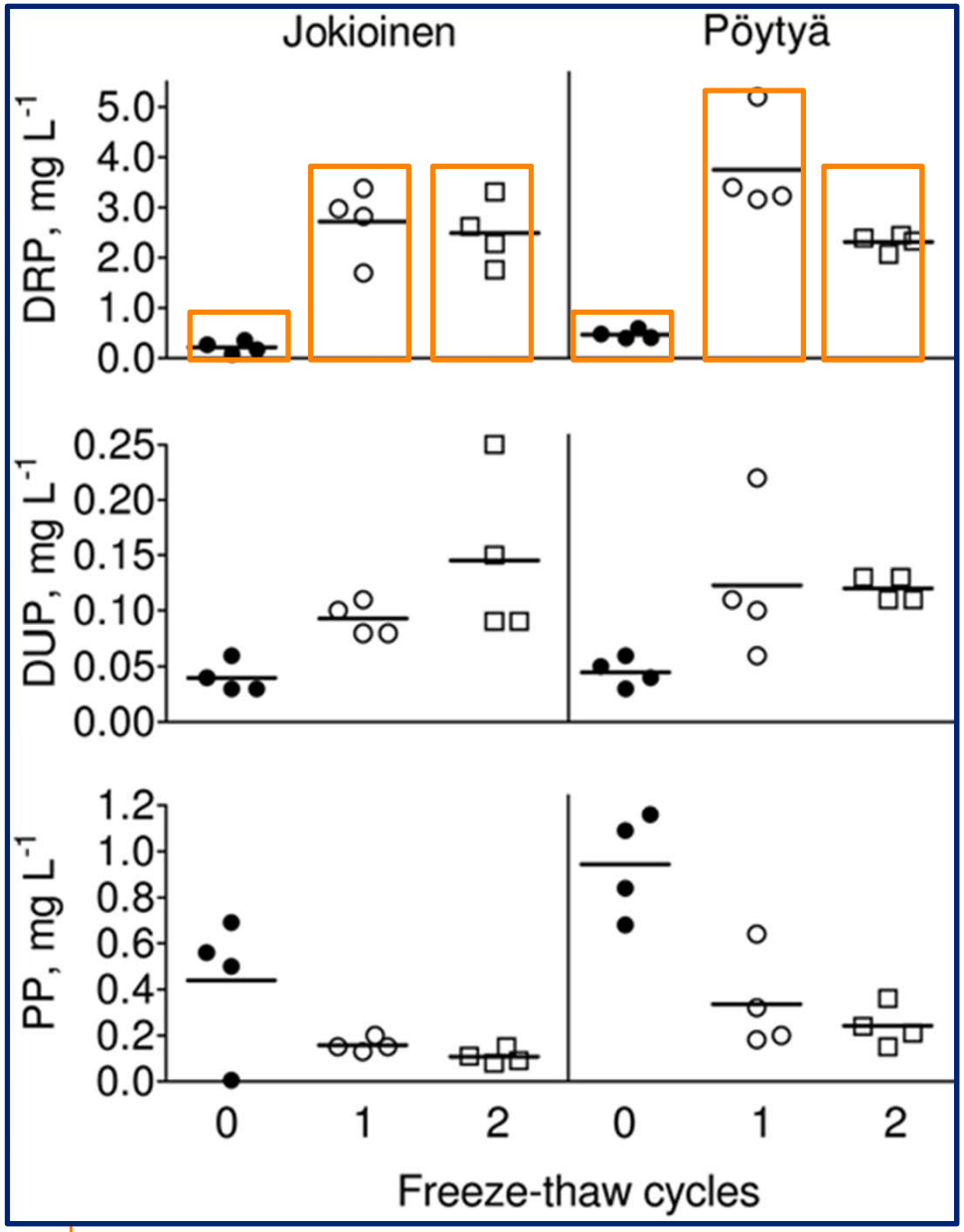
P concentrations in simulated surface runoff water



0 = Before Freezing
1 = After 1 freezing abnd thawing event
2 = After 2 freezing and thawing events

Uusi-Kämppä et al., J. Environ. Qual. 41: 420–426 (2012)

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SWOT analysis for buffer strip results

Strengths

- Effective in retaining soil particles, particle P and TN in surface runoff.
- Protection against erosion on steep slopes
- Use of manure, fertilisers and plant protection products is not allowed on BSs (near watercourses).

Weknesses

- Most runoff exists in winter and spring when BSs are not effective in retaining nutrients.
- In spring high DRP losses from BSs due to frozen broken plant tissues.
- Increased DRP losses due to high P content in soil surface.

Opportunities

- Annual moving of plants and removing swath delays the increase of P content in soil surface.
- Nutrient retaining may be increased for a while on VBSs under trees.
- Narrow BS may be sufficient for pasture and no-till fields.

Threats

- Nutrient losses may increase in drainage water.
- Shading may increase erosion risk due to loss of plant cover under the trees.
- Exceptionally severe weed infestations

Thank you!

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