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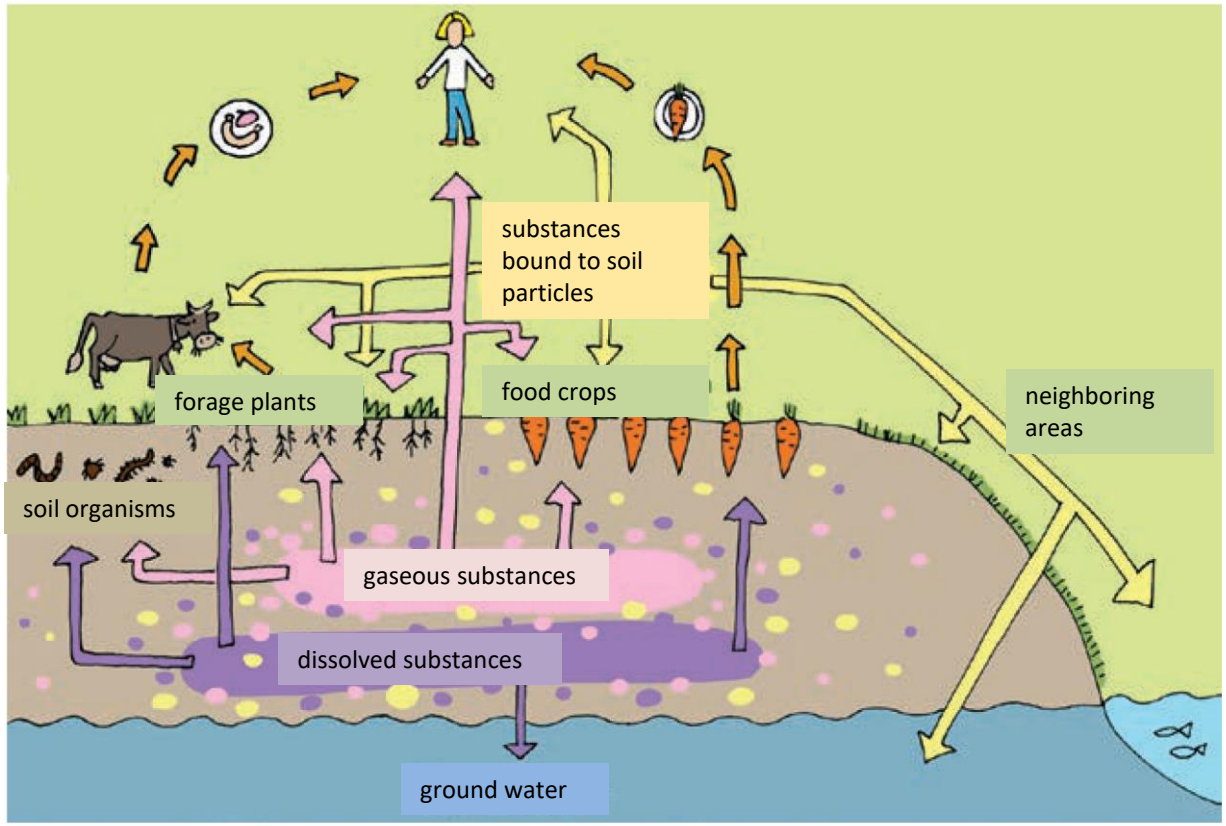
Ecological risk assessment: soil plant transfers



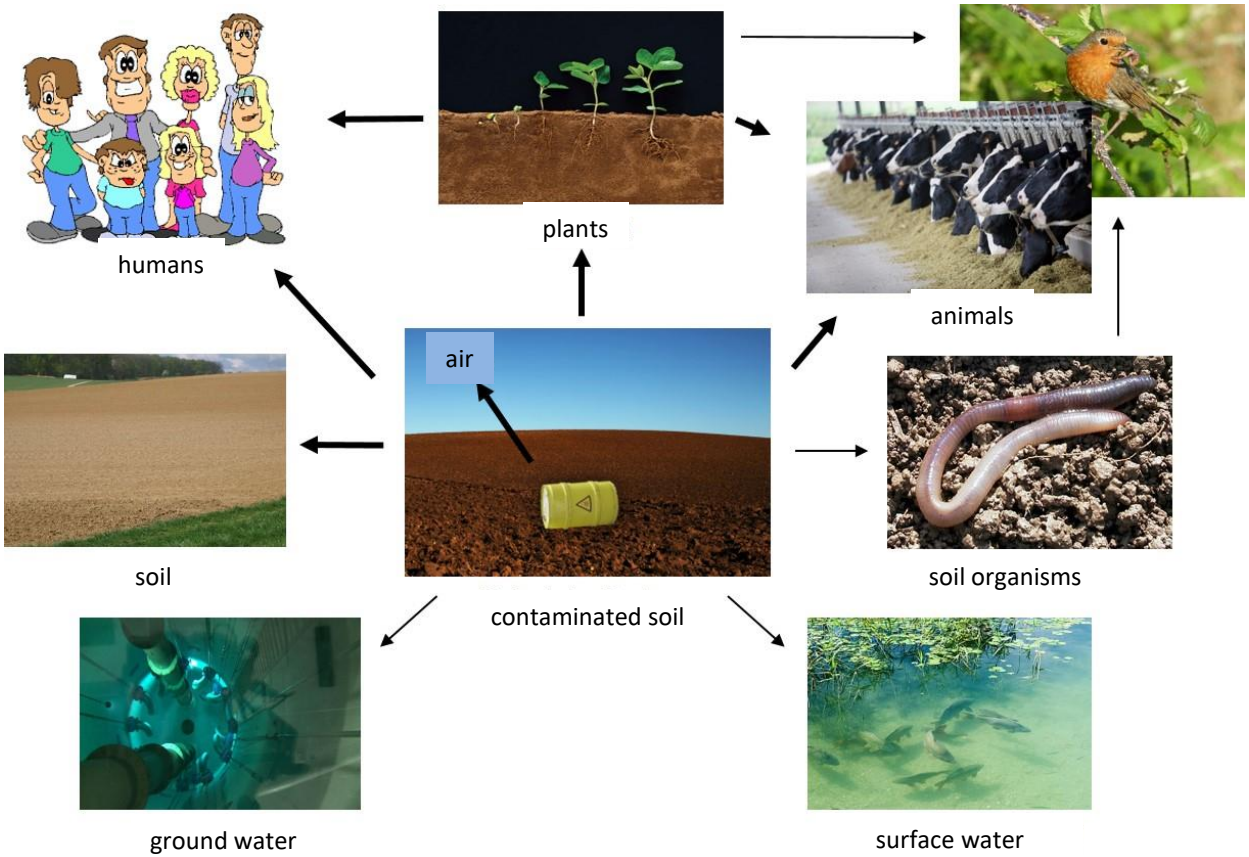
Rolf Krebs and Monika Hutter, ZHAW Zurich University of Applied Sciences

Soil standards for lead in Switzerland

	Lead [mg/kg soil dm]
guide value	50
assessment value	
food crops	200
forage plants	200
remediation value	
agriculture & horticulture	2000
house & family gardens	2000

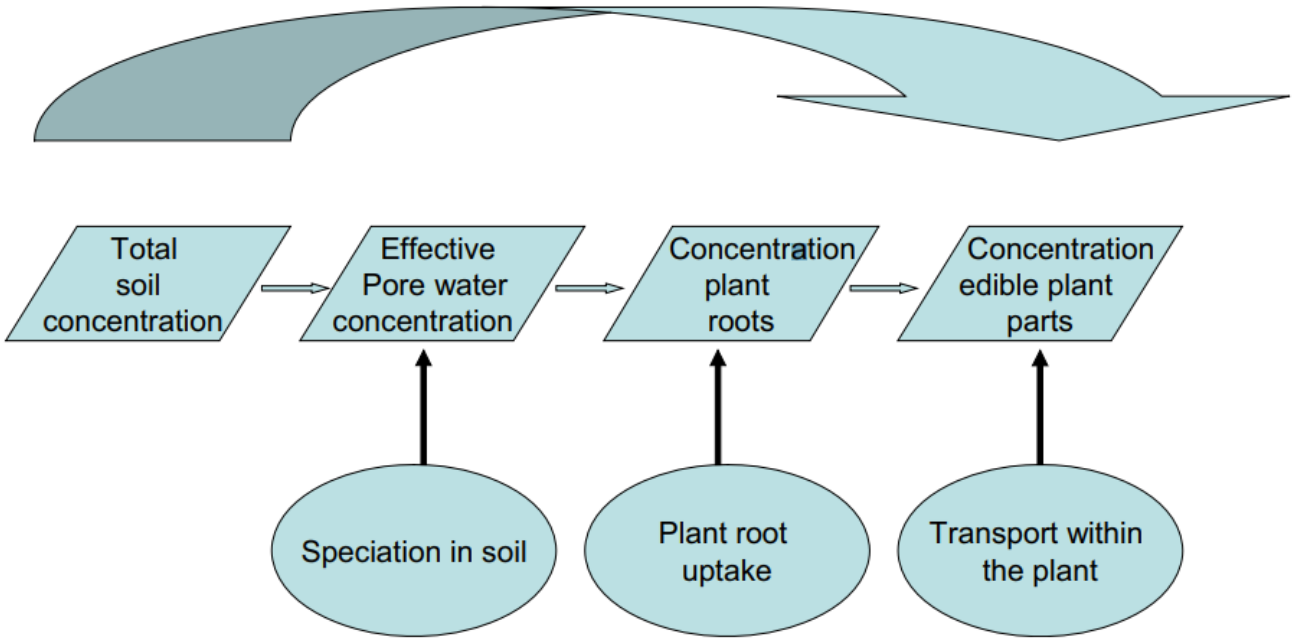
Swiss Ordinance relating to Impacts on the Soil: 1st July 1998. SR **814.12 Switzerland**, 1998

Transfer paths in soil



Reiser et al, 2019

From total soil concentration to concentration in plants



Swartjes, 2015

Determination of soil limits in food crops

corelation between soil and plant concentration:

Hämmann&Gupta, 1997:

$$C_{Pl} = \boldsymbol{a} + BCF \cdot C_{Bo}$$

C_{Pl} = concentration in plants [mg / kg dm]
C_{Bo} = concentration in soil [mg / kg dm]
BCF = bio concentration factor

Reiser et al., 2019:

$$\log C_{Pl} = a + b \cdot \log C_{Bo} + c \cdot pH + d \cdot \log Ton + e \cdot \log C_{org}$$

C_{Pl} = concentration in plants [mg / kg dm]
C_{Bo} = concentration in soil [mg / kg dm]
C_{org} = organic carbon [%]
pH = pH value
Ton = clay content [%]
a…e = coefficients

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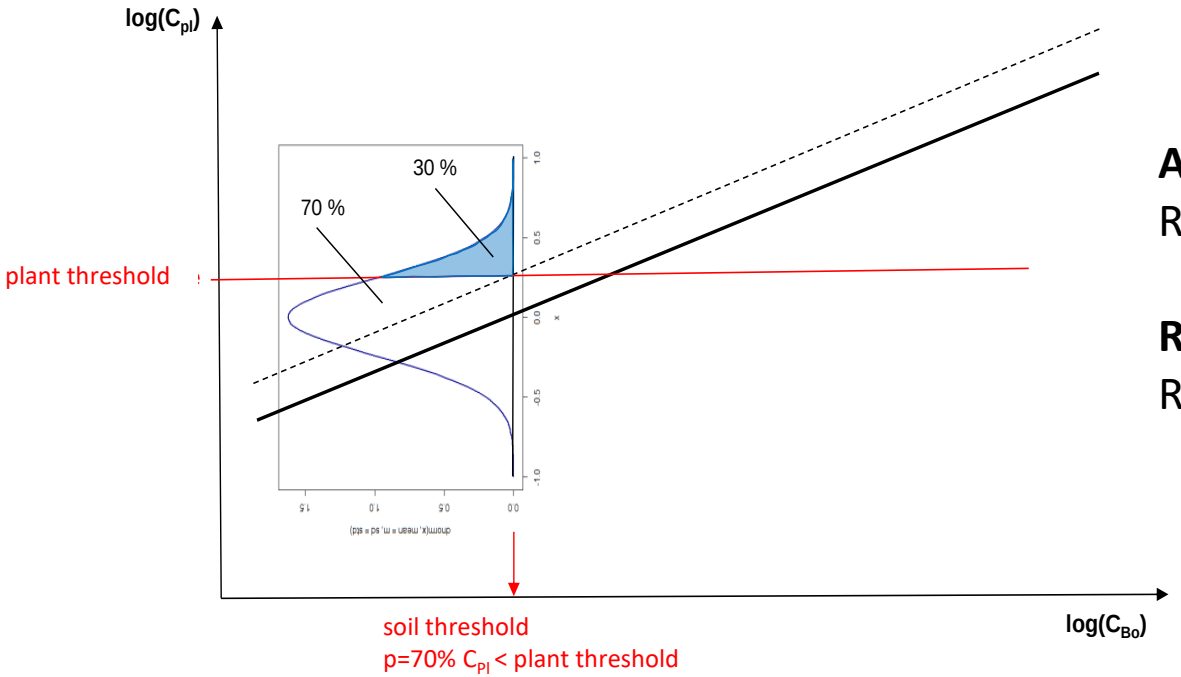
Determination of soil limits



Asssessment values:
Realistisc wort case scenario

Remediation values:
Realistic best case scenario

Reiser et al, 2019

lead: standards for food crops

Food Crops	[mg/kg] ms
leafy vegetables, cabbage, black salsify	0.3
other vegetables	0.1
cereal	0.2

Swiss Ordinance on contaminants in food
Kontaminantenverordnung, VHK, 817.022.15; 2016

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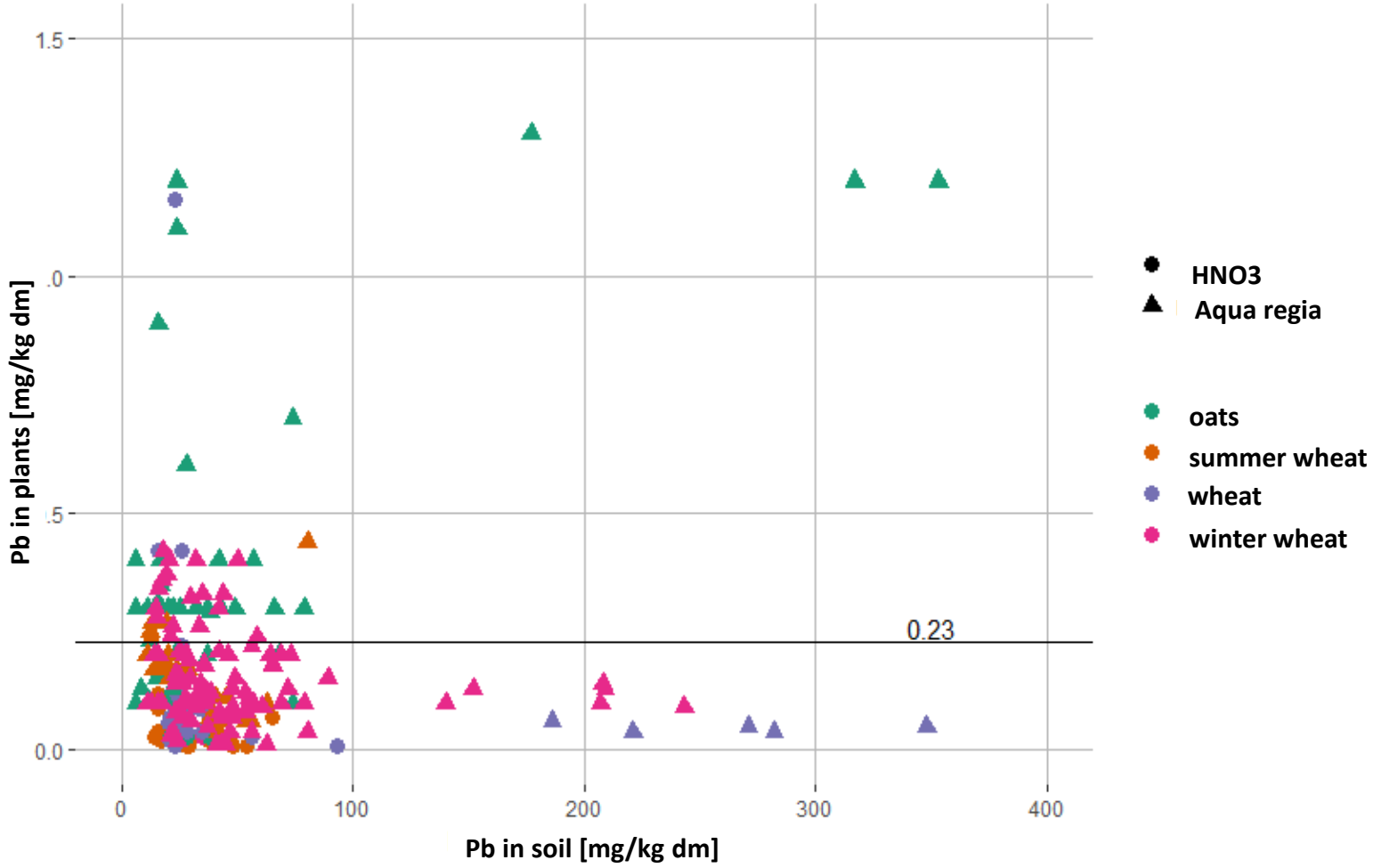
Assessment value for food crops: soil plant transfer in cereals



Reiser et al, 2019

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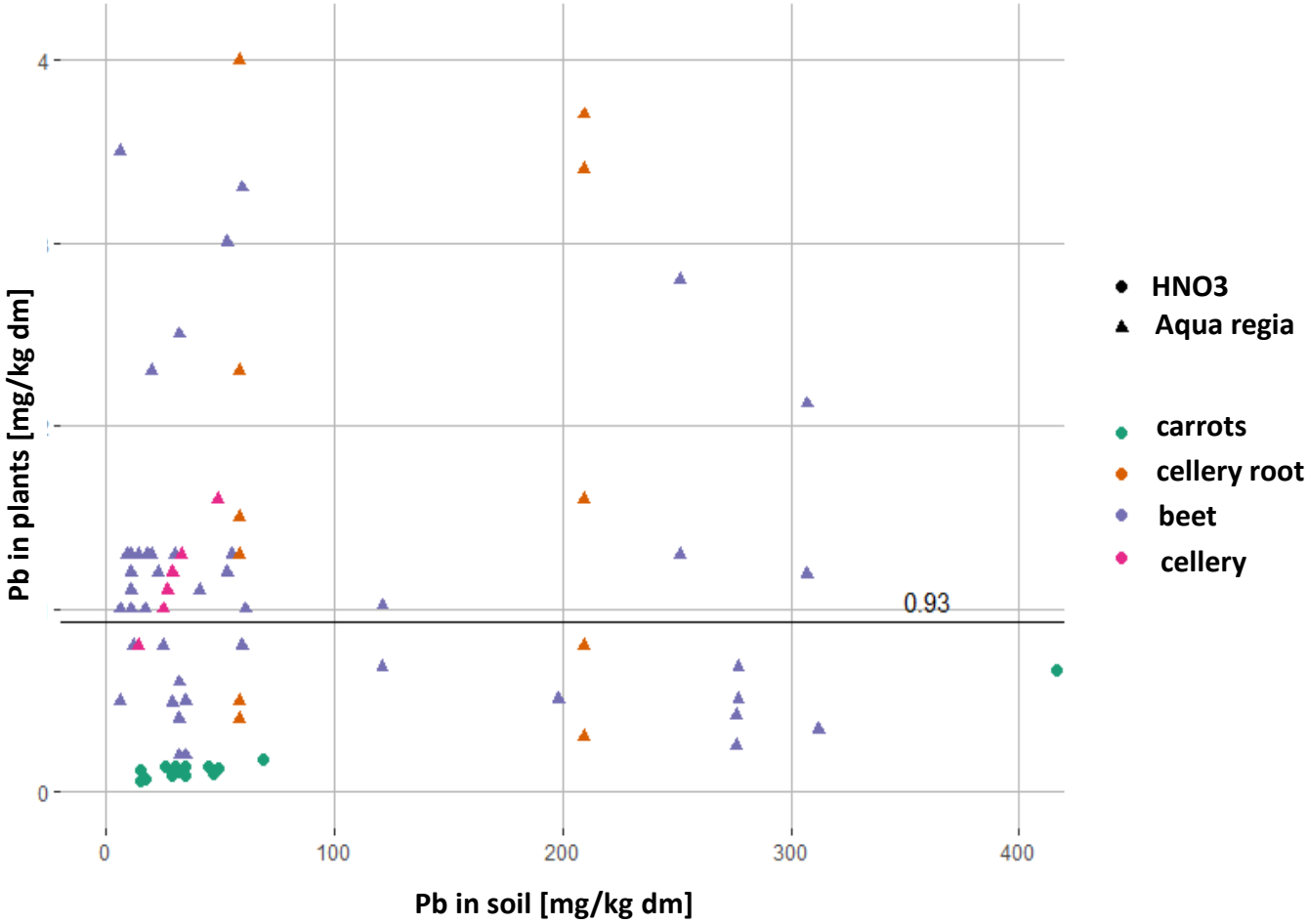
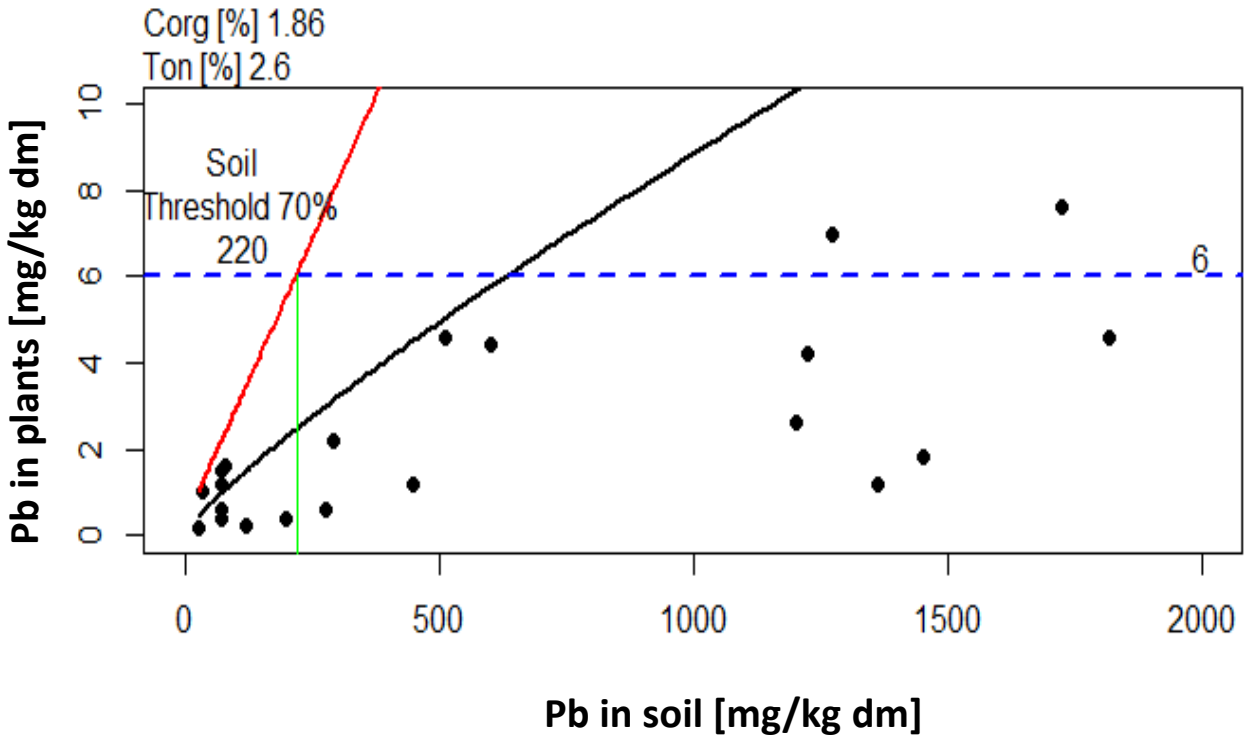
Assessment values for food crops soil plant transfer in root and tuber vegetables



Reiser et al, 2019

Assessment value for food crops: soil plant transfer in lettuce



Reiser et al, 2019

Determination of soil limits in forage plants

$$C_{Fu} = (1-d) \cdot (a_1 C_1 + a_2 C_2 + \ldots + a_n C_n) + d \cdot C_{Bo}$$

$$\sum_{k=1}^{n} a_k = 1$$

C_{fu} = concentration in forage [mg / kg dm]
C_{Bo} = concentration in soil [mg / kg dm]
$C_{1\ldots x}$ = contaminant concentration in plant 1…x [mg / kg dm]
d = proportion of soil in forage related to dm
a = proportion of plant species in plants

Reiser et al, 2019

lead: standards for forage plants

Forage plants	[mg/kg] dm
gras	0.1

Estimated tolerance threshold for ruminant in feed, European Food Safety Authority (EFSA), 2004

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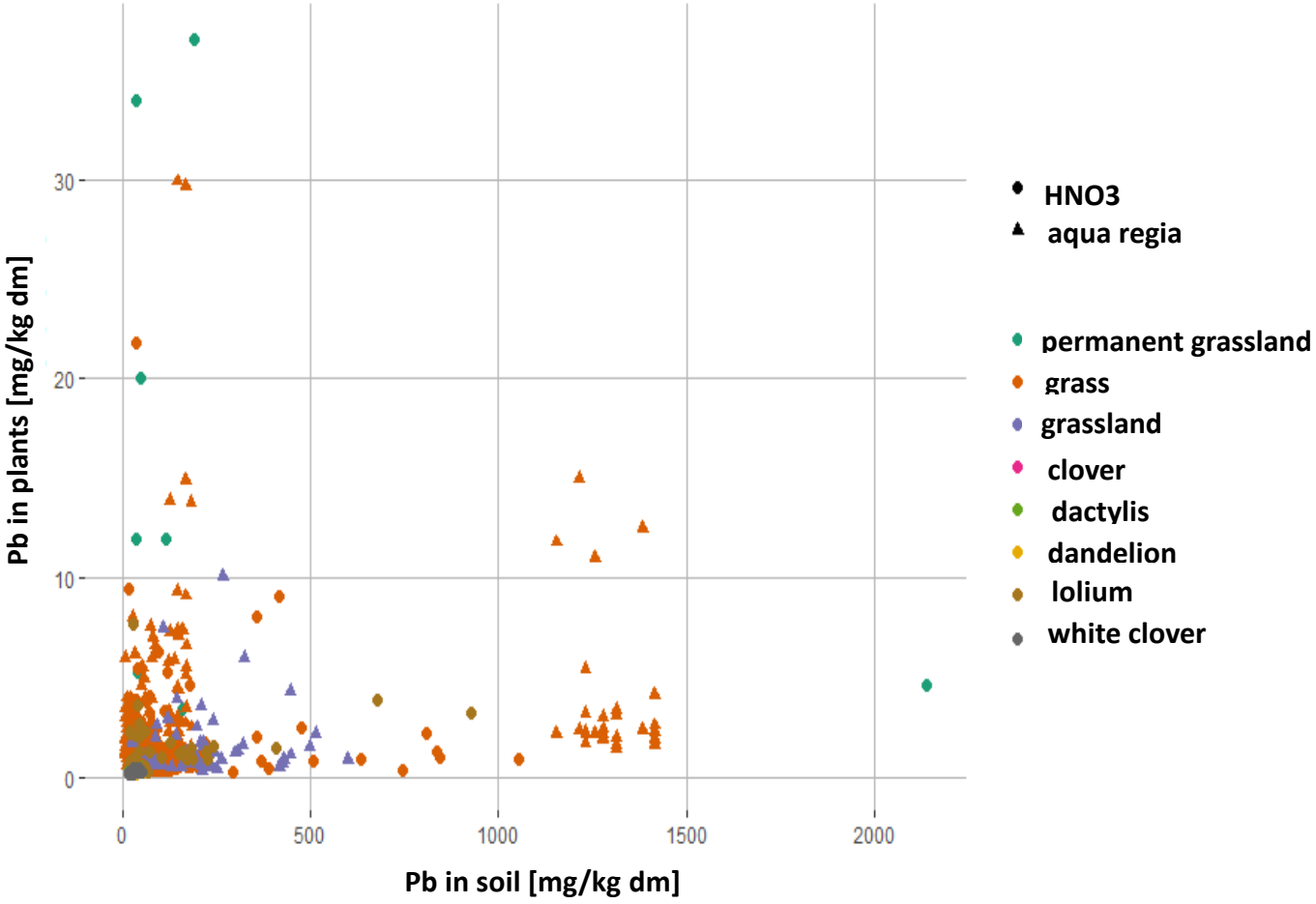
Assessment value for forage plants soil – plant transfer in gras



Reiser et al, 2019

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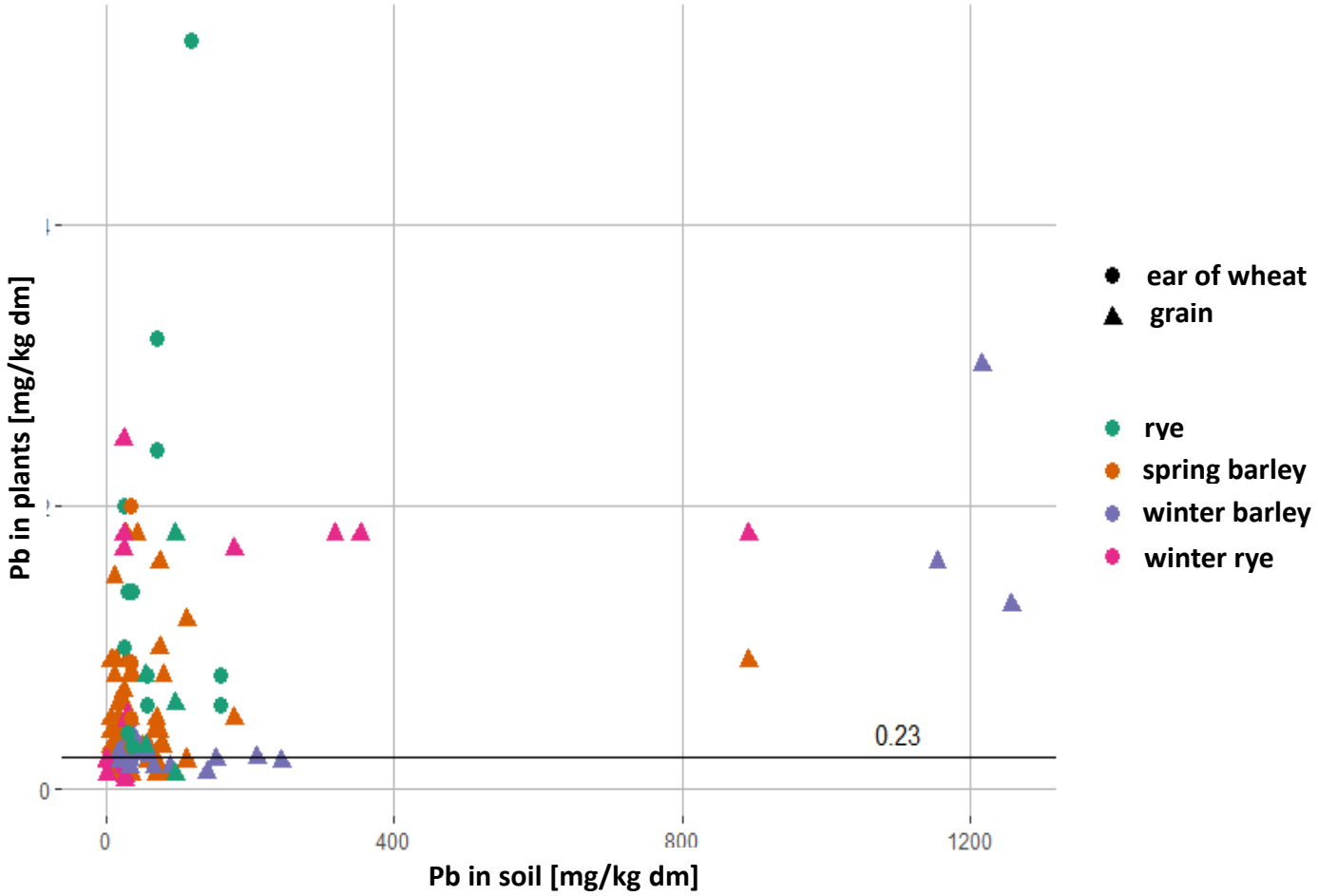
Remediation value: soil – plant transfer in cereal



Reiser et al, 2019

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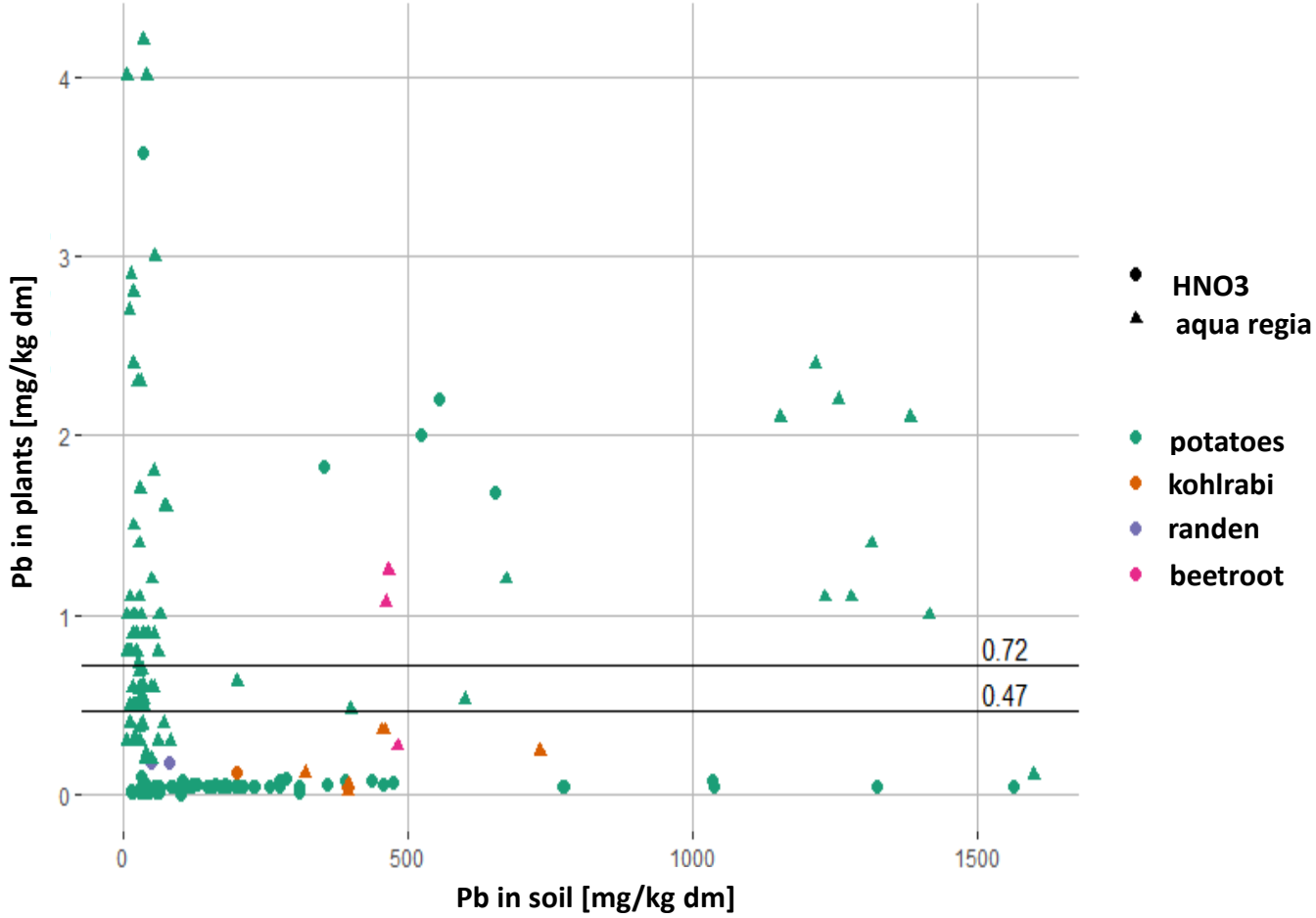
Remedation value: soil plant transfer in vegetables



Reiser et al, 2019

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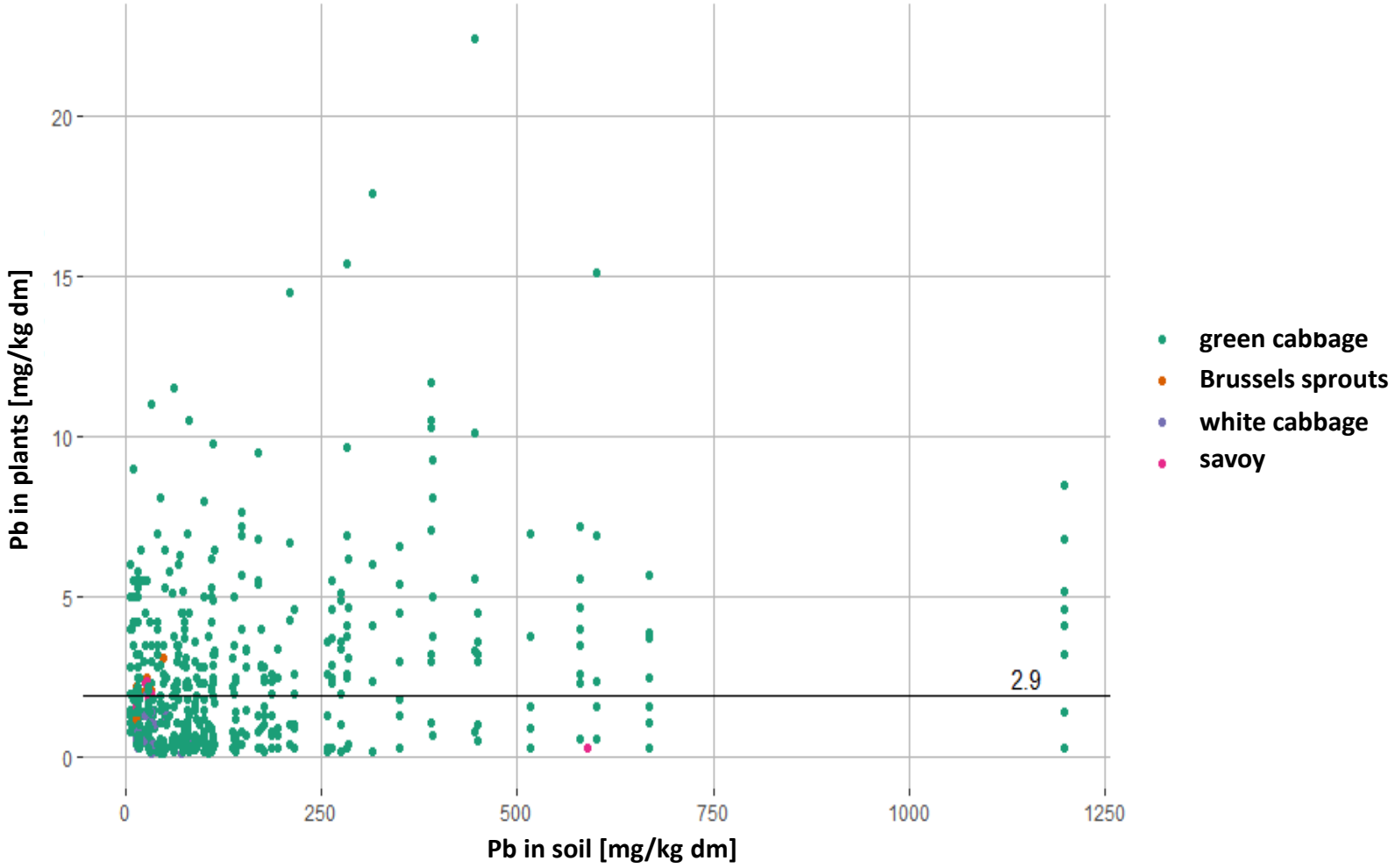
Remediation value: soil plant transfer in leafy vegetables



Reiser et al, 2019

soil standards for lead in Switzerland

The soil plant transfer is often not the determining factor in the risk assesment of lead contamination in soil

However: the estimated take up of lead from young children by drinking water and food is exceeding the reference value. The reduction of lead in food could contribute to risk reduction. But there was not enough data for soil plant transfer to establish new soil limits for lead.


Thank you for your attention…