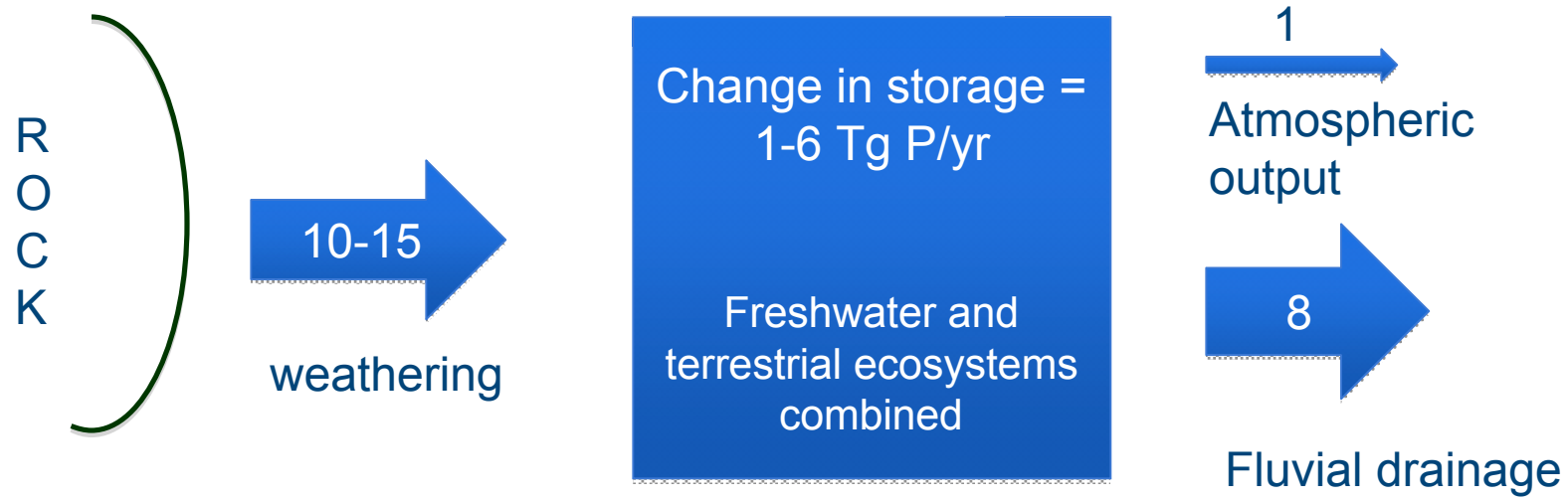
PREINDUSTRIAL GLOBAL TERRESTRIAL P FLUX

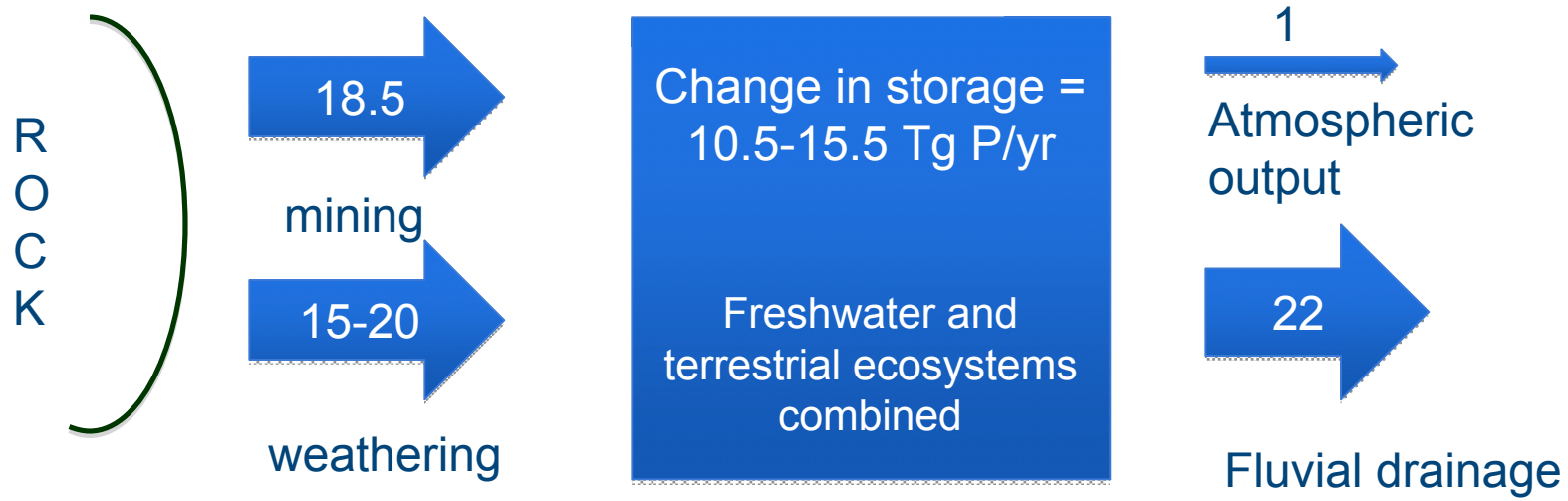


Change in storage =

10 – (1 + 8) = 1
to
15 – (1 + 8) = 6

Bennett et al. 2001

CURRENT GLOBAL TERRESTRIAL P FLUX



Change in storage =

(15 + 18.5) – (1 + 22) = 10.5
to
(20 + 18.5) – (1 + 22) = 15.5

Bennett et al. 2001

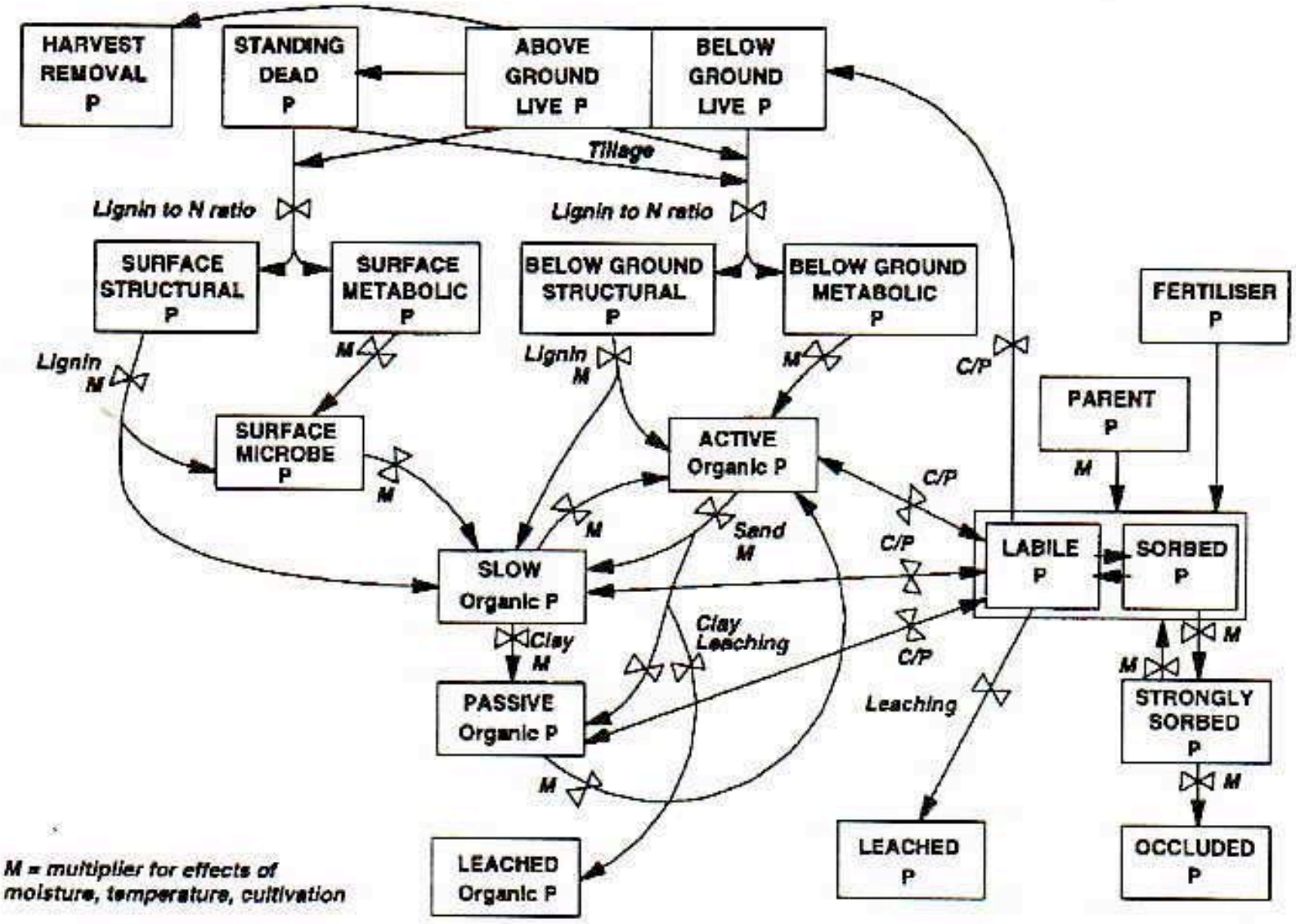
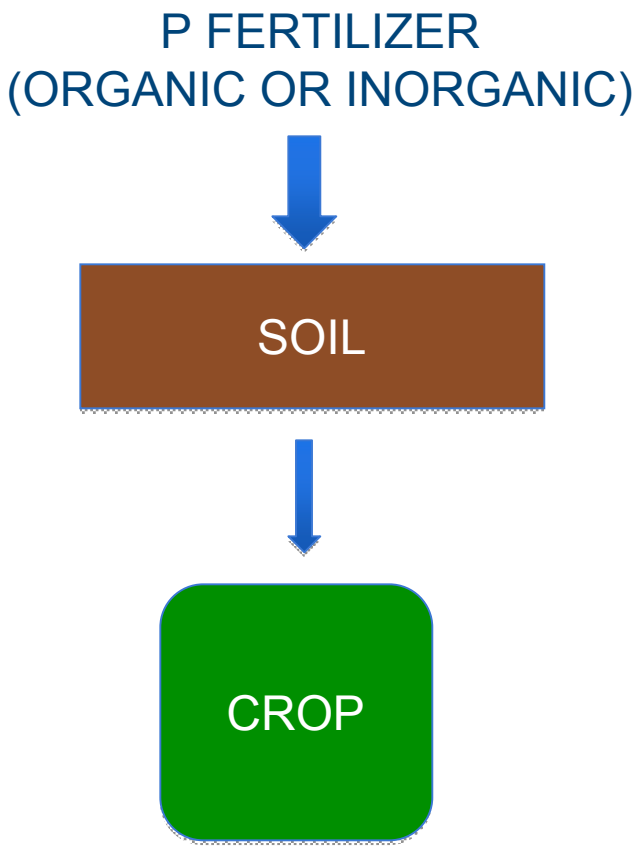
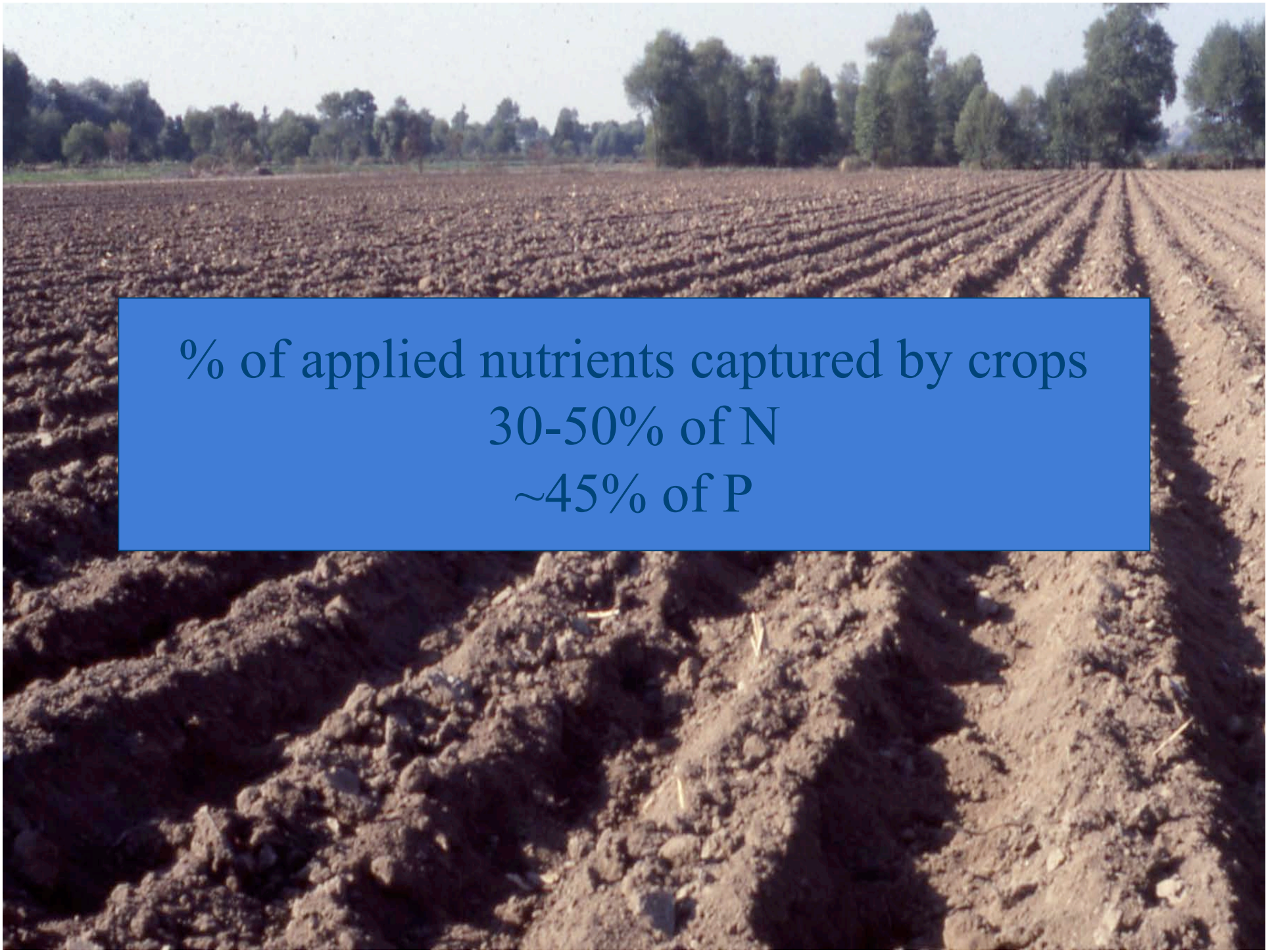
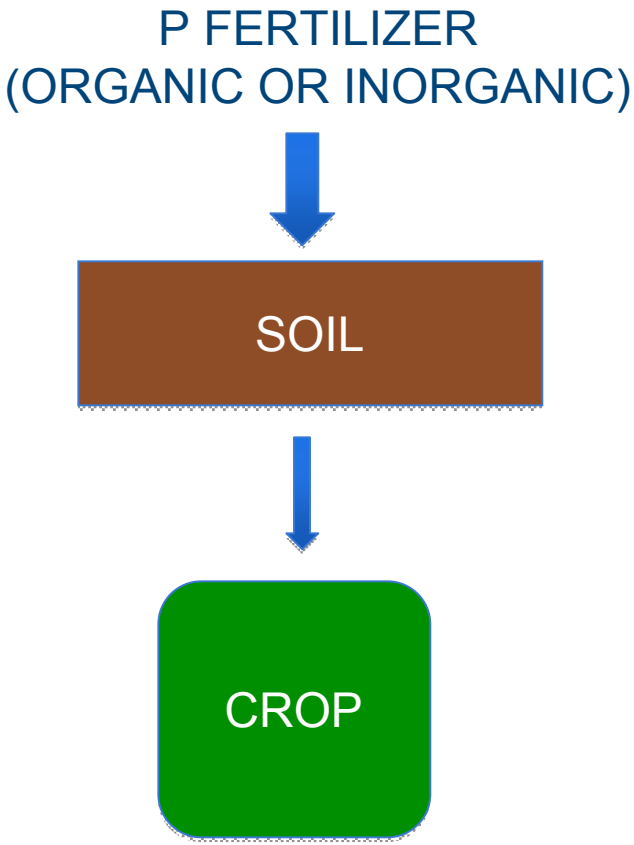


Figure 8. The pools and flows of phosphorus in the CENTURY model


P FERTILIZER
(ORGANIC OR INORGANIC)
SOIL
CROP


% of applied nutrients captured by crops
30-50% of N
~45% of P



Clay mineralogy

<u>High sorption capacity:</u>
Amorphous alluminosilicates
Fe oxides
Al oxides

<u>Moderate sorption capacity:</u>
Crystalline aluminosilicates
Humic compounds

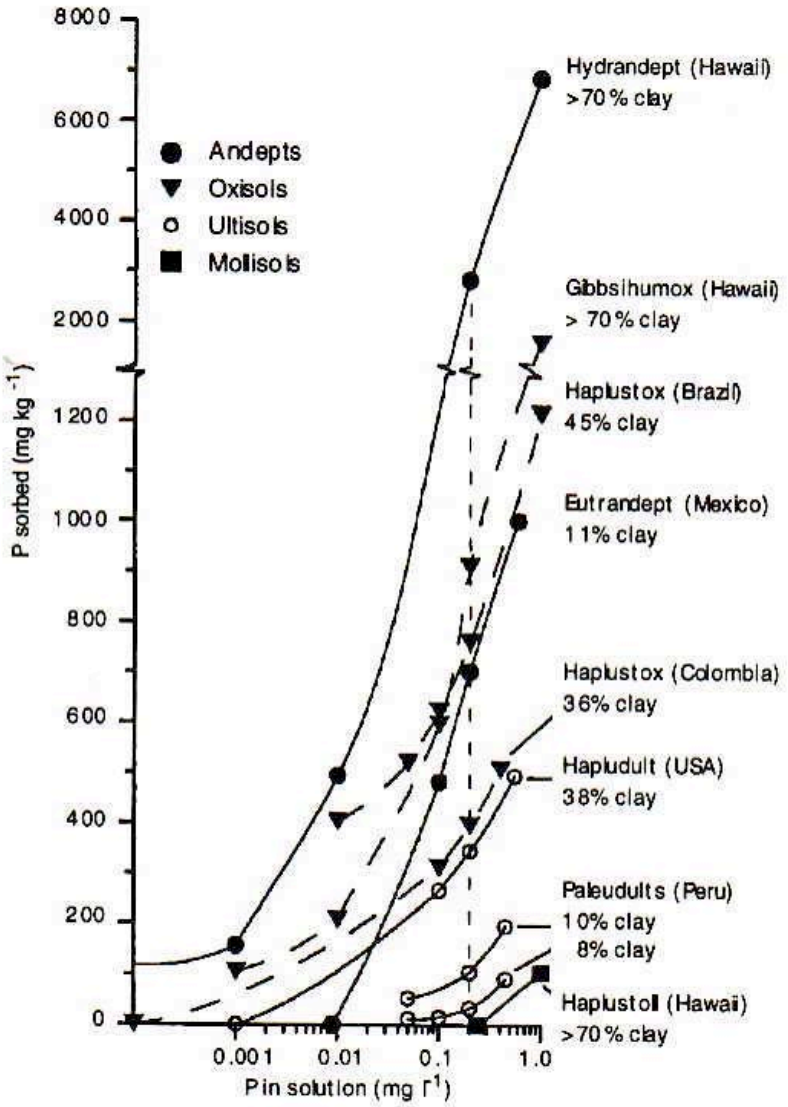
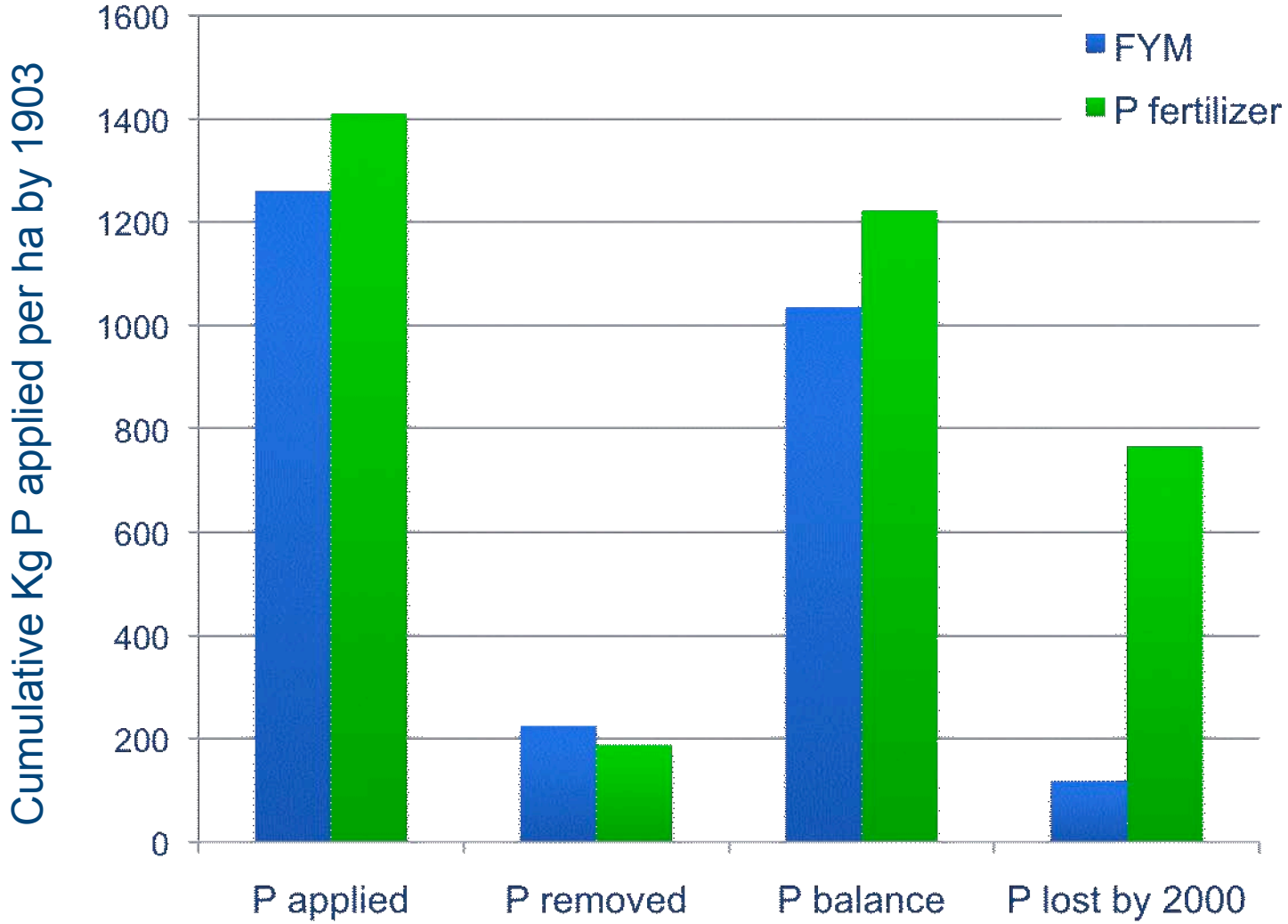
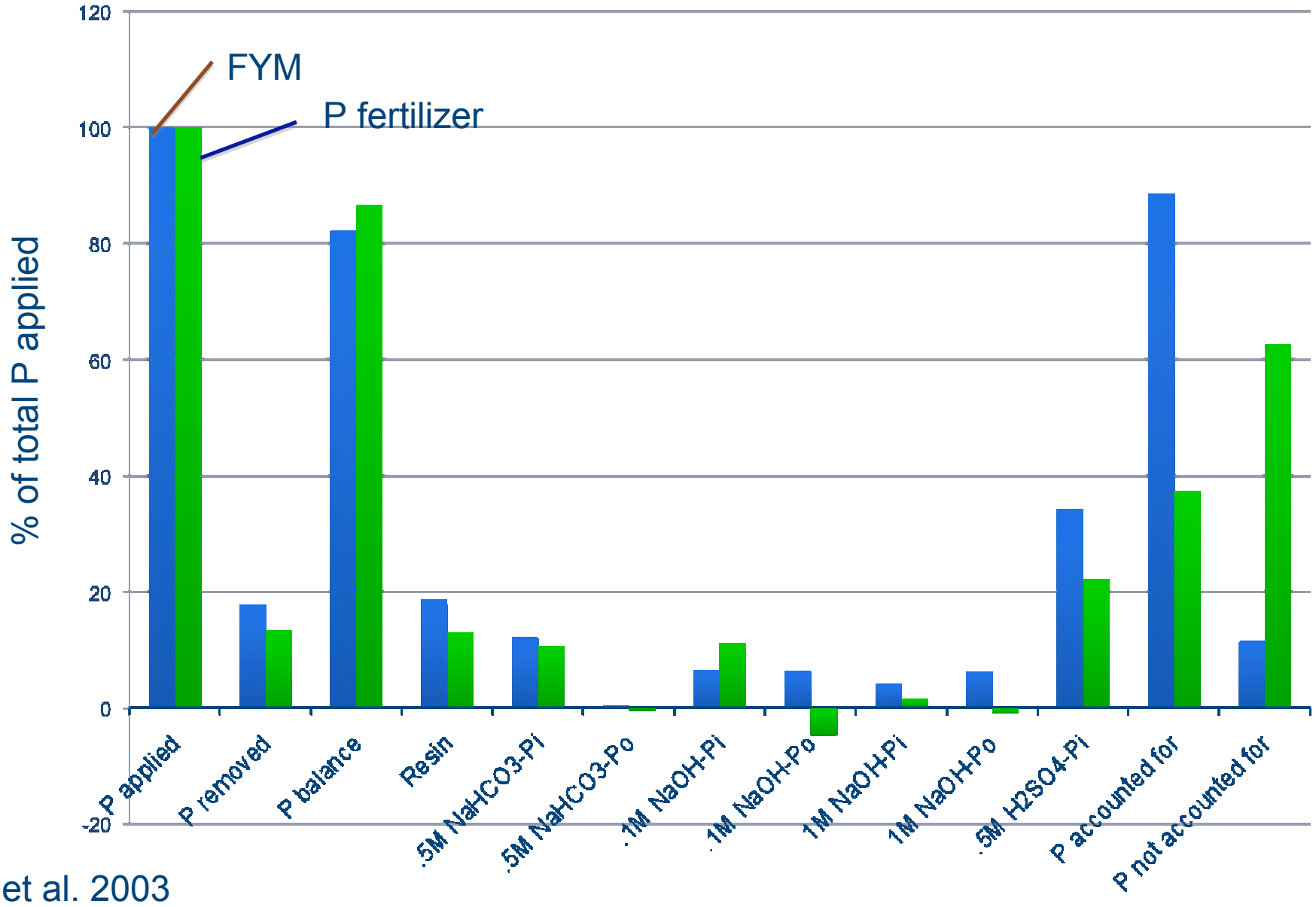


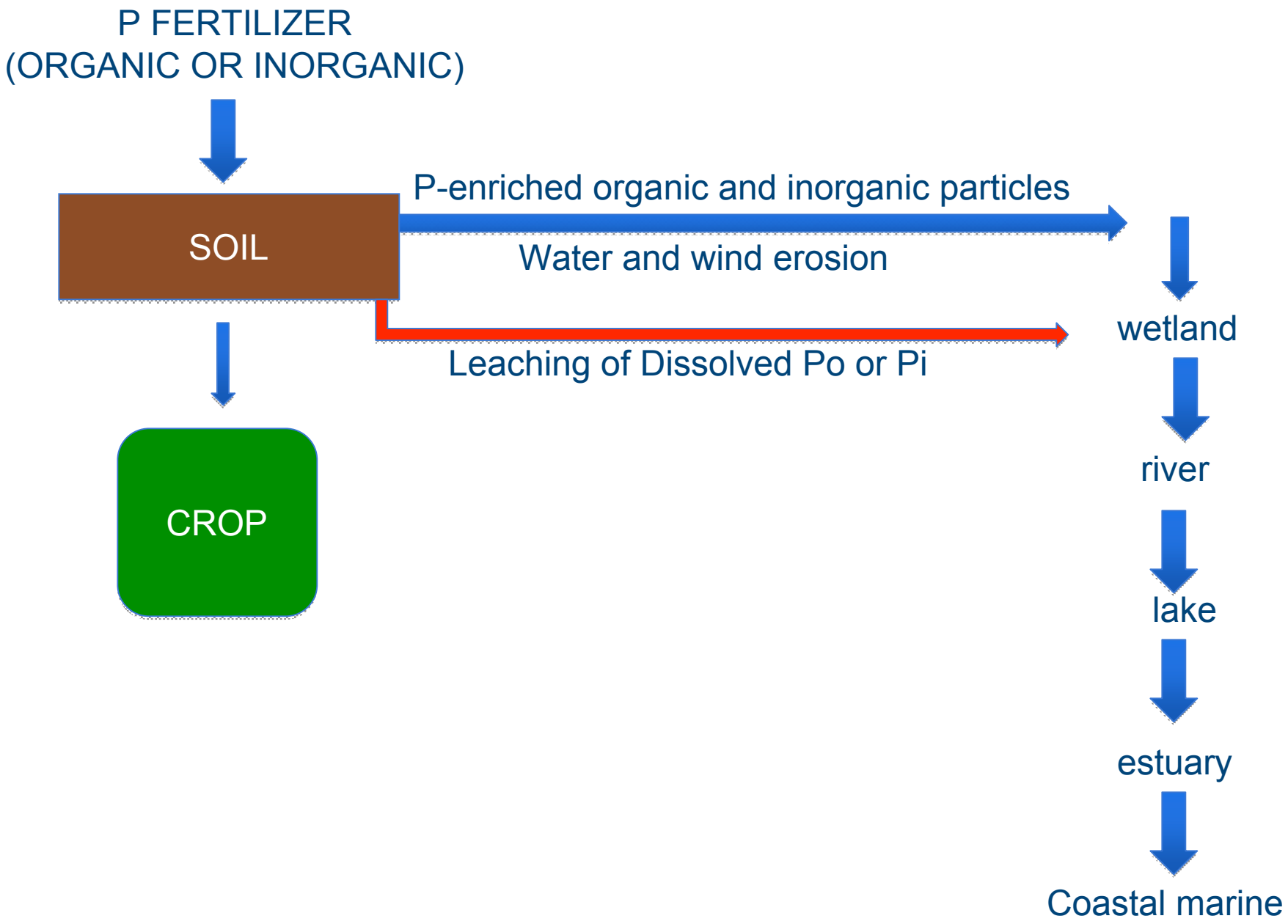
Figure 2. Examples of P sorption isotherms determined by the method of Fox and Kamprath (1970). Source: Sanchez and Uehara (1980).

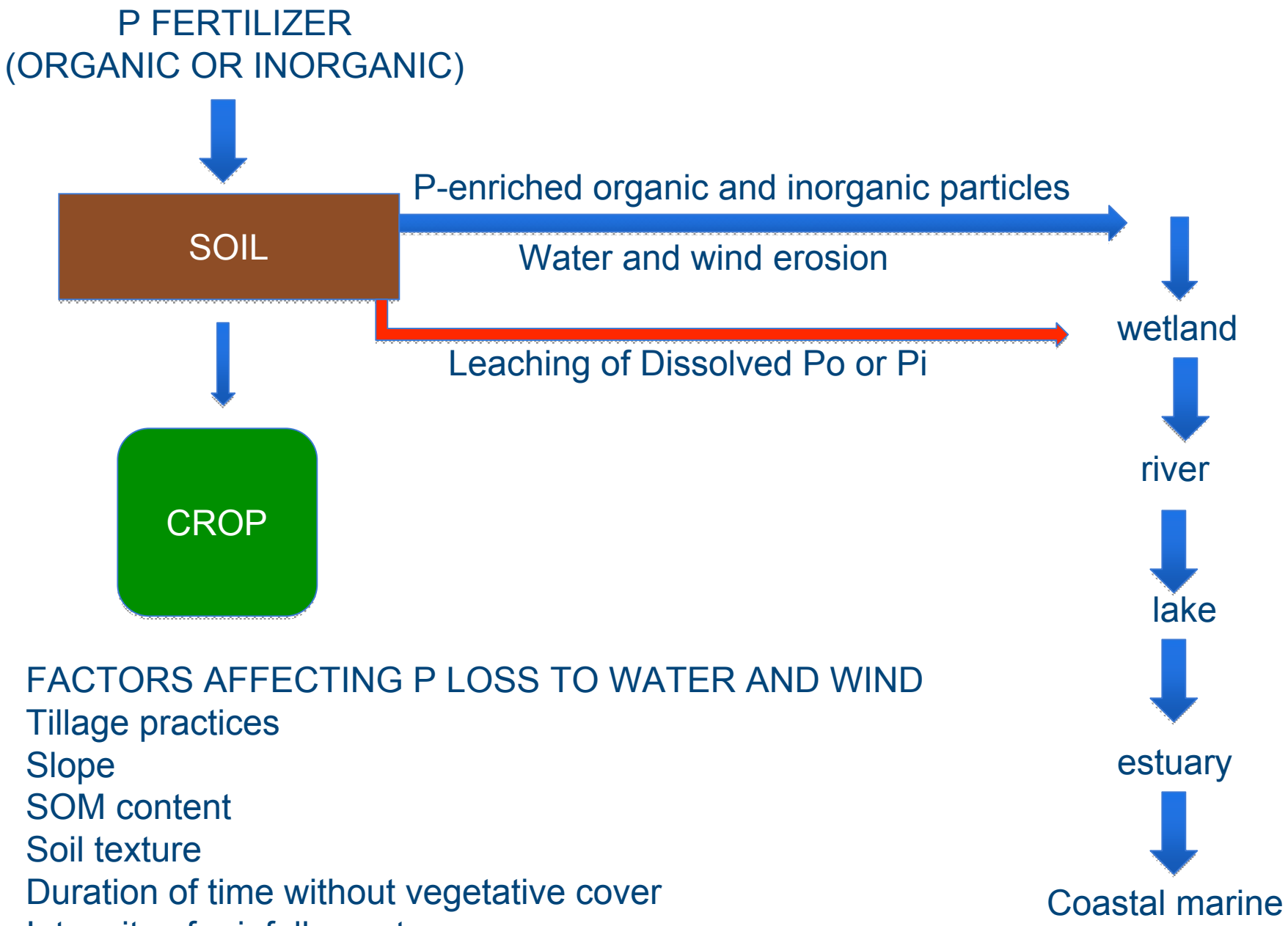
Cumulative P additions as Farm Yard Manure (FYM) or P fertilizer by 1903 And P removal in wheat, potato and barley harvests to present at Exhaustion Land Plots—Rothamsted Research, U.K. (Blake et al. 2003)





Blake et al. 2003


P FERTILIZER
(ORGANIC OR INORGANIC)
SOIL
P-enriched organic and inorganic particles
Water and wind erosion
Leaching of Dissolved Po or Pi
CROP
wetland
river
lake
estuary
Coastal marine



FACTORS AFFECTING P LOSS TO WATER AND WIND

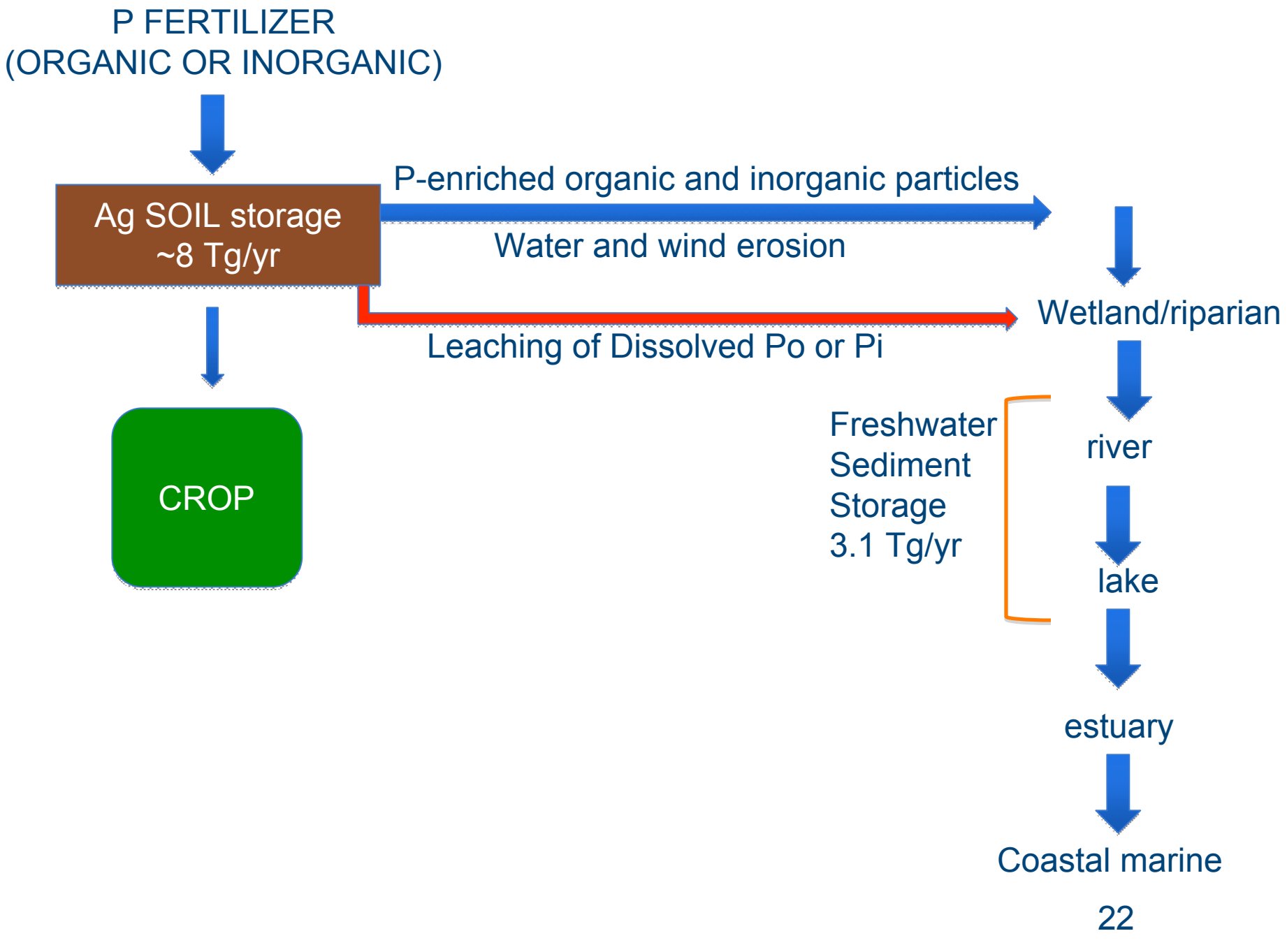
Tillage practices
Slope
SOM content
Soil texture
Duration of time without vegetative cover
Intensity of rainfall events

Table 5. Effect of fertilizer P application on the loss of P in surface runoff.

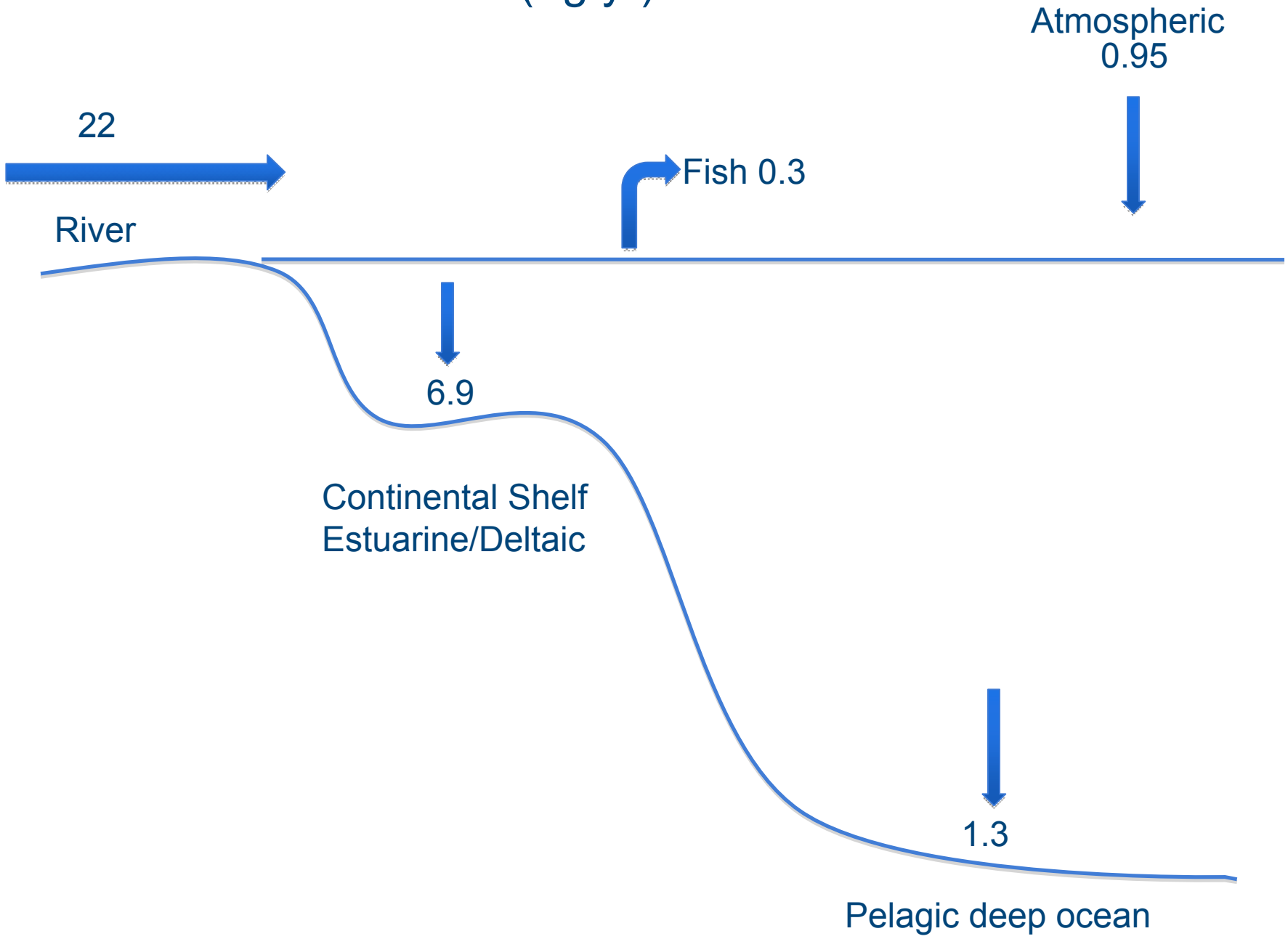
Land use	Fert. Appld.	P losses				Fert. loss	
		Solub.	Partic.	Solub.	Partic.	Solub.	Partic.
		kg ha^{-1} y^{-1}		mg l^{-1}		%	
Contour corn [1]	40	0.12	0.45	0.19	0.71		
	66	0.15	0.76	0.25	1.27	0.1	1.2
Grass [2]	0	0.01	0.20	0.01	0.06		
	75	0.04	0.29	0.03	0.14	0.04	0.1
No till corn for silage [3]	0	0.70	1.30	0.23	0.43		
	30	0.80	1.00	0.39	0.49	0.3	+23.1+
No till corn for grain [3]	0	1.10	2.20	0.23	0.46		
	30	1.80	1.60	0.57	0.51	2.3	+27.3+
Conventional corn [3]	15	0.30	15.10	0.07	3.57		
	30	0.20	17.50	0.11	9.71	+3.3+	16.0
Wheat/fallow [4]	0	0.20	1.40	0.30	1.80		
	54	1.20	2.90	3.70	7.40	1.9	2.8
Grass [5]	0	0.50	0.67	0.18	0.24		
	50	2.80	2.74	0.98	0.96	4.6	4.1

+ Percent decrease in P loss from fertilised compared to check treatment
[1] Burwell et al. (1977) Minnesota; [2] McColl et al. (1977) New Zealand; [3] McDowell and McGregor (1984) Mississippi; [4] Nicholaichuk and Read (1978) Western Canada; [5] Sharpley and Syers (1979) New Zealand

Sharpley et al. 1995

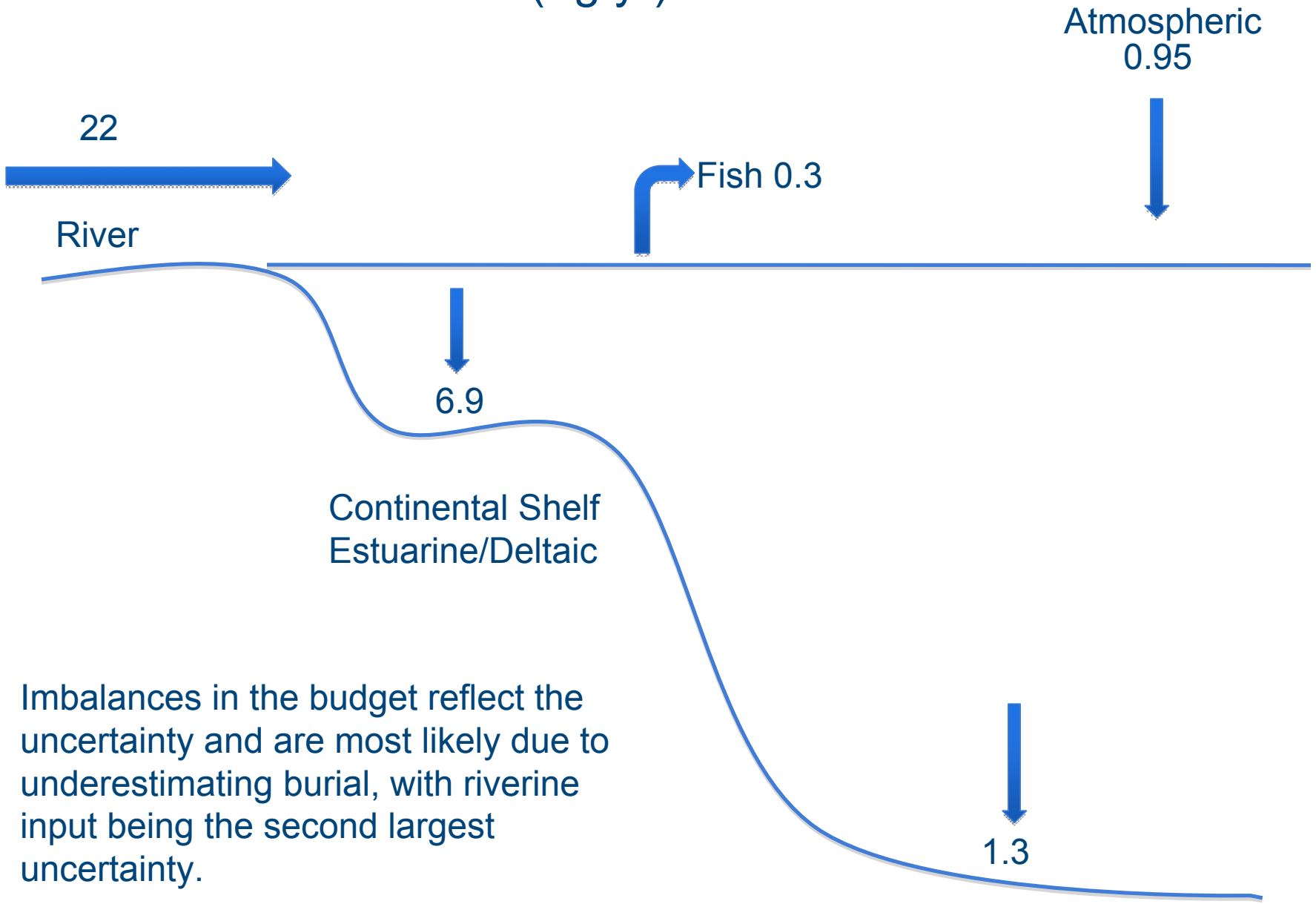

P FERTILIZER
(ORGANIC OR INORGANIC)
Ag SOIL storage
~8 Tg/yr
P-enriched organic and inorganic particles
Water and wind erosion
Leaching of Dissolved Po or Pi
CROP
Wetland/riparian
Freshwater
Sediment
Storage
3.1 Tg/yr
river
lake
estuary
Coastal marine

Global ocean P fluxes—(Tg/yr)



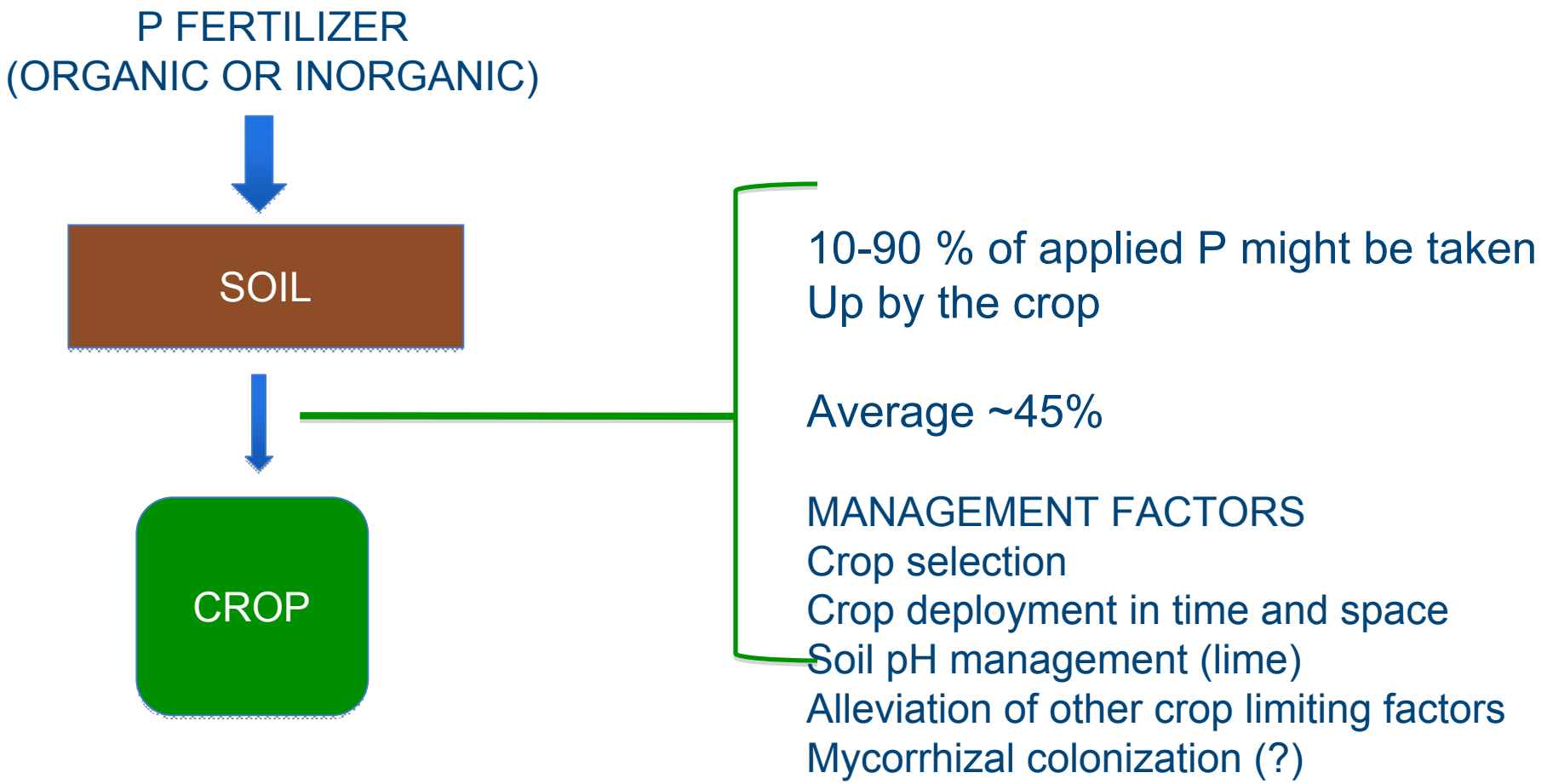
(Howarth et al. 1995)

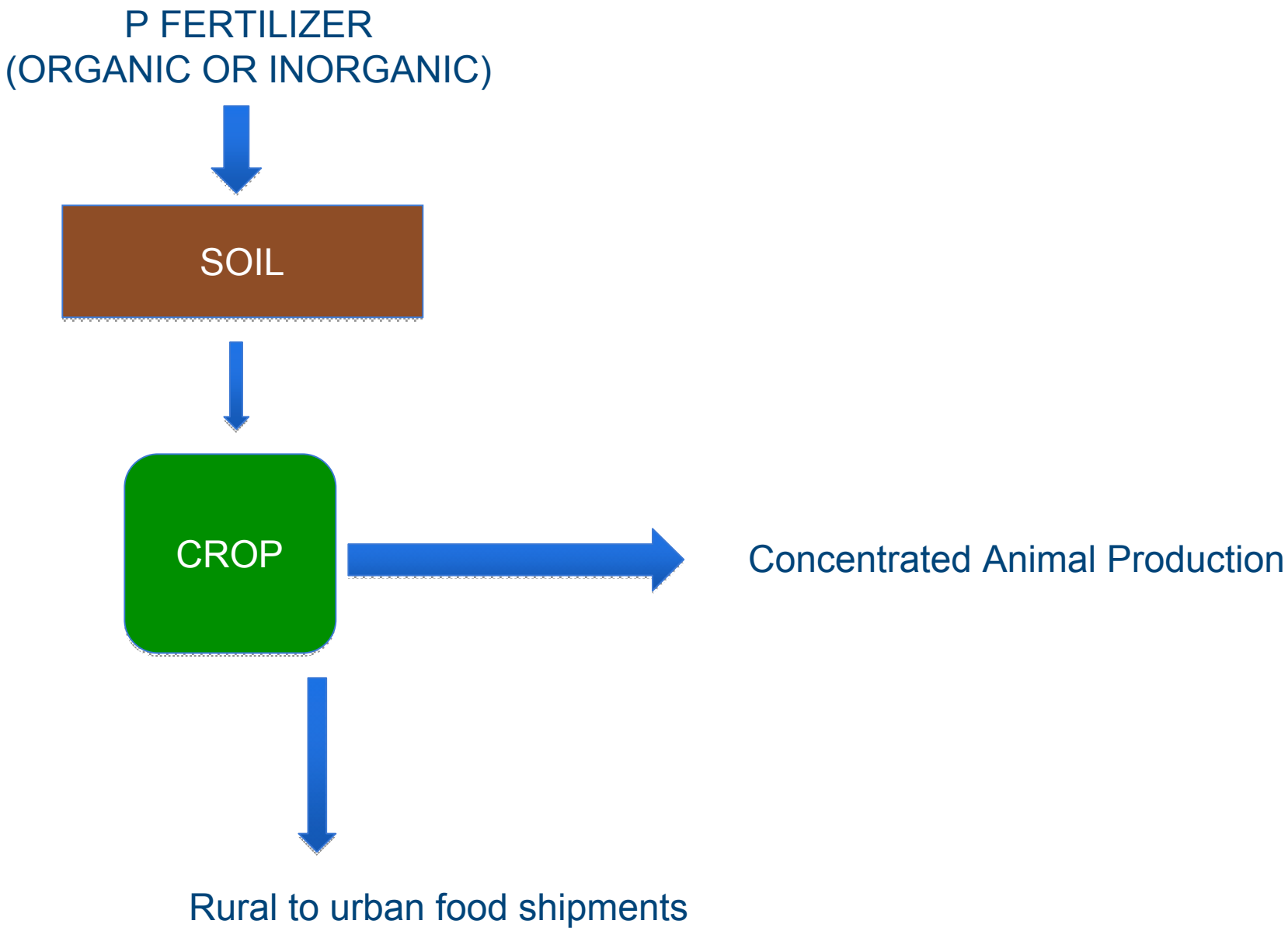
Global ocean P fluxes—(Tg/yr)



Imbalances in the budget reflect the uncertainty and are most likely due to underestimating burial, with riverine input being the second largest uncertainty.

(Howarth et al. 1995)


P FERTILIZER
(ORGANIC OR INORGANIC)
SOIL
CROP
10-90 % of applied P might be taken
Up by the crop
Average ~45%
MANAGEMENT FACTORS
Crop selection
Crop deployment in time and space
Soil pH management (lime)
Alleviation of other crop limiting factors
Mycorrhizal colonization (?)


P FERTILIZER
(ORGANIC OR INORGANIC)
SOIL
CROP
Concentrated Animal Production
Rural to urban food shipments

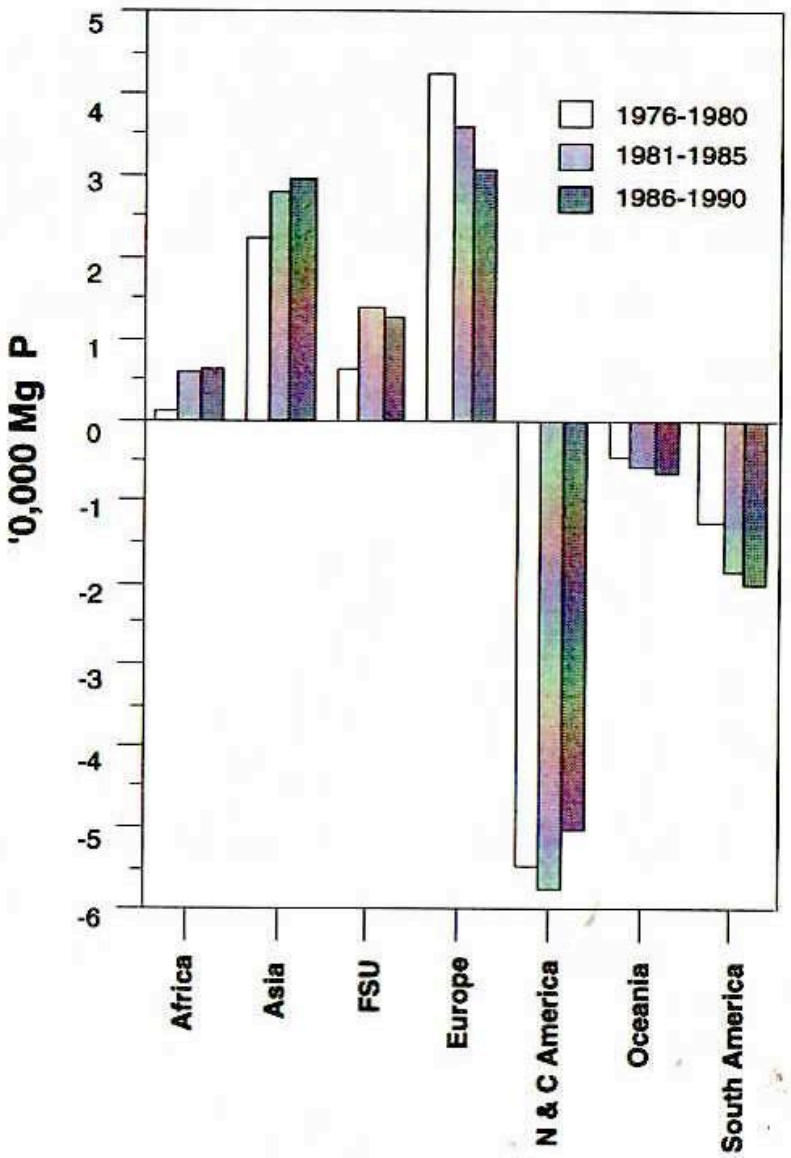


Figure 3. Regional net P balances (total P in imports - total P in exports) for crop commodities averaged over 1976-1980, 1981-1985, and 1986-1990.

Beaton et al. 1995

Optimize the utility of P fertilizers, a scarce, non-renewable, non-substitutable and Highly valuable resource, rather than simply try to find the most effective sinks.