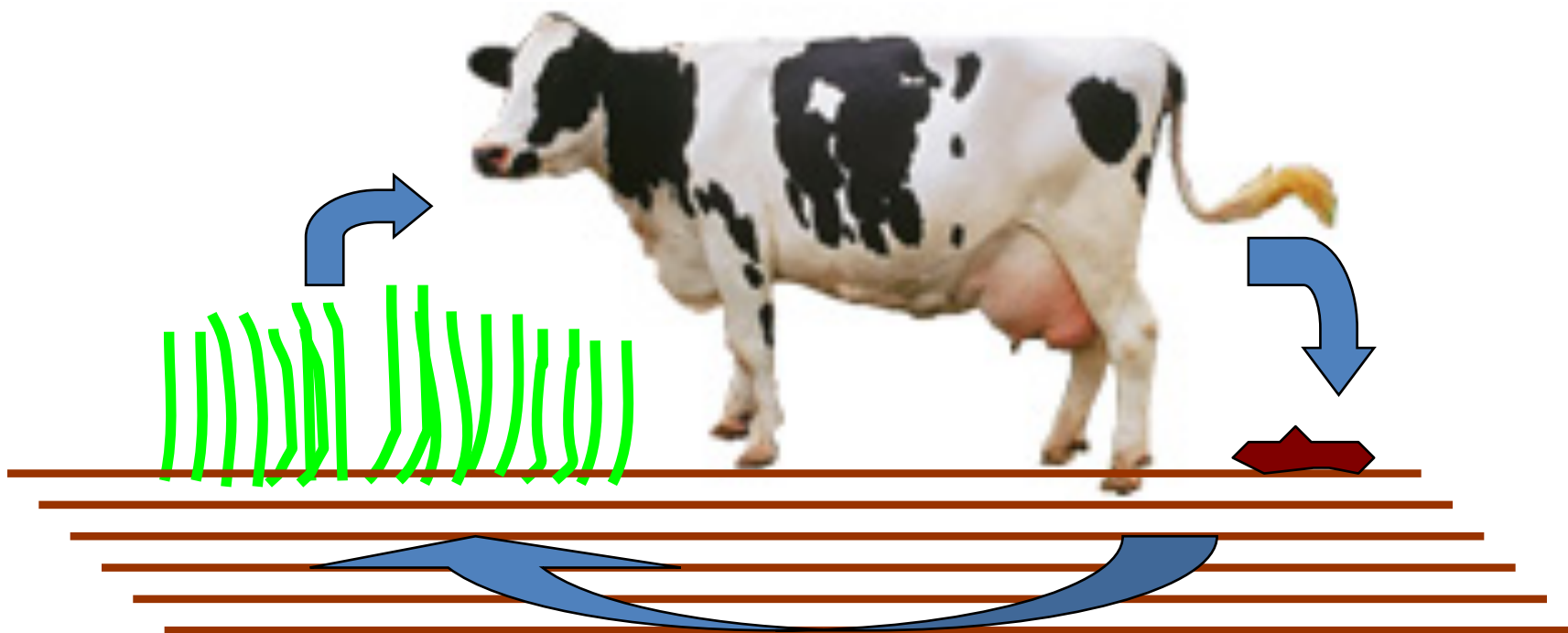


# Health of Soil, Plant and Animal



$\text{NH}_4^+$   $\text{NO}_3^-$   $\text{SO}_4^-$   $\text{H}_2\text{PO}_4^-$  K Ca Mg Fe Na Mn Cu Zn  
Co Mo Se

**Start line of food chain is Soil.**

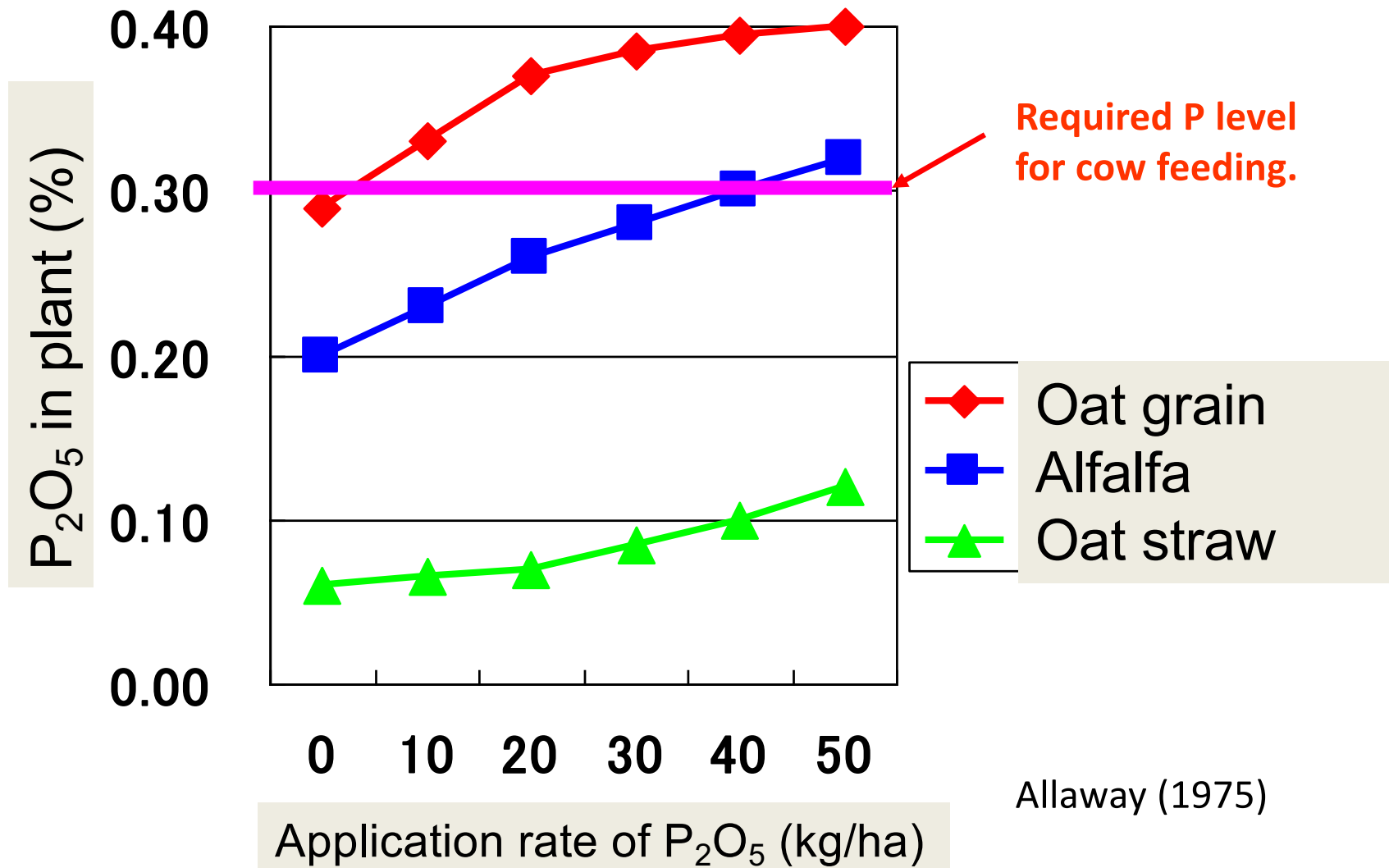
# Factors affecting the elementary composition of forage crops.

- Genetic factors:
  - Species of crops and grasses
- Growth state of plants.
  - In which state, are grasses fed to animals?
- Nutrient contents in soil.
  - In what land are grasses grown?

# Nutrient composition of Poaceae and legume grasses

	N %	K <sub>2</sub> O %	CaO %	MgO %
Poaceae	0.99	1.54	0.33	0.21
Legume	2.38	1.13	1.47	0.38

# Application rate of P and P concentration in forage.



# Homeostasis among cations in plant

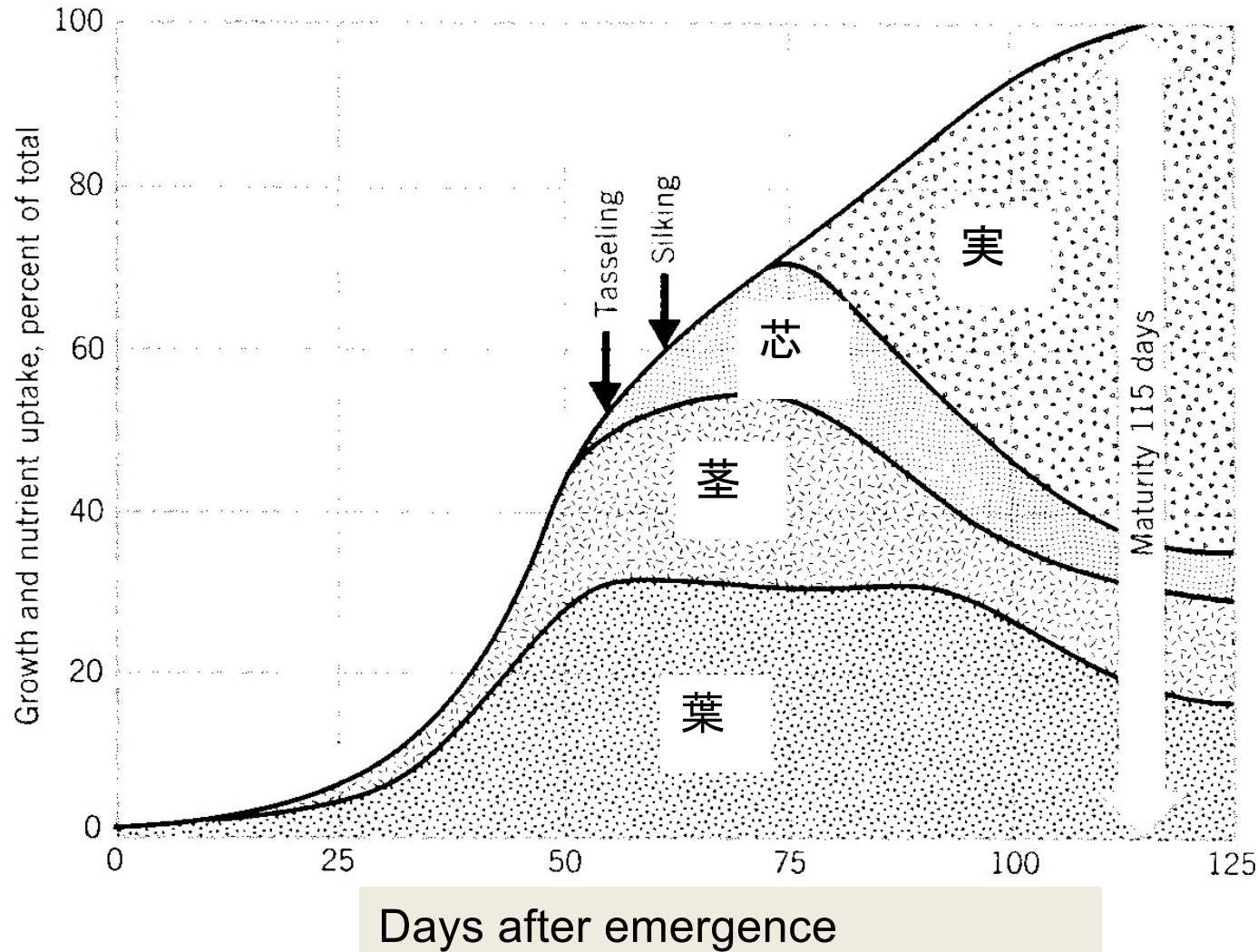
- Competition between cations
- Ca, Mg and K
- Ca and Mg

Example:

Over dose of potassium → Mg deficiency

Over dose of calcium → Mg deficiency

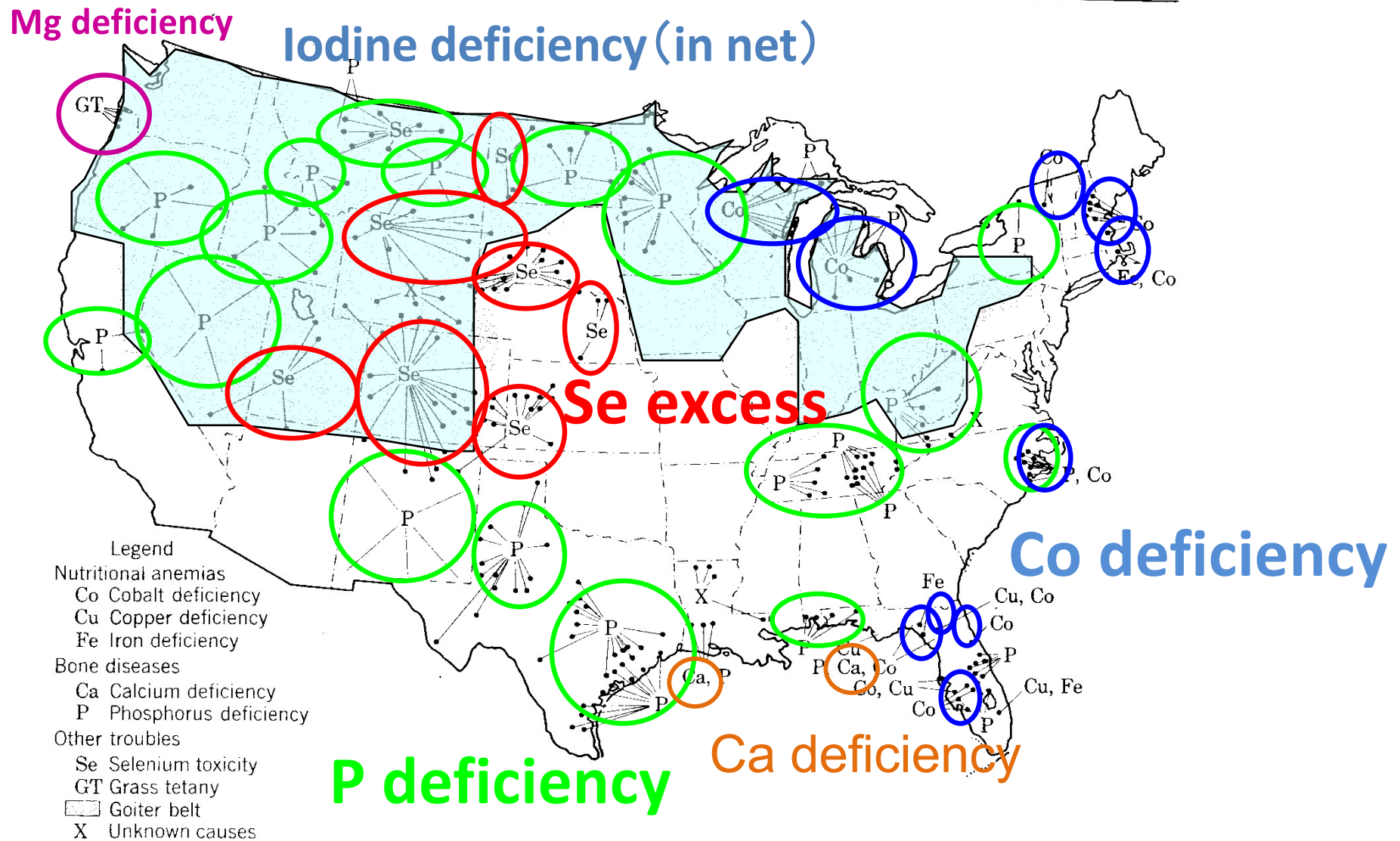
# Translocation of N with the growth of maize.



**Figure 13-5**

Part of the nitrogen, as well as phosphorus, potassium, and some other nutrients, are translocated from vegetative tissue to the grain during the later part of the growing season. An amount of nitrogen equal to about one-half the nitrogen in the corn grain was absorbed during the time the grain was produced. A similar amount of nitrogen was translocated from the other organs to the grain during the same period. (Data from Hanway, 1960.)

# Occurrence of mineral nutritional diseases in animals



**Figure 13-6**

Occurrence of mineral nutritional diseases in animals. The dots show the approximate locations of the observed deficiency. The lines not terminating in dots indicate a generalized area where specific locations have not been reported. The goiter region is also a generalized area.

# Distribution of animal disease related to soil nutrients

- Phosphate deficiency Bone disease
- Iodine deficiency Thyroid disorder
- Selenium deficiency

Keshan disease (China), Kaschin-Beck disease (Russia, north-east China) in human.

Circulatory organ disorder, Muscular dystrophy, reproduction disorder

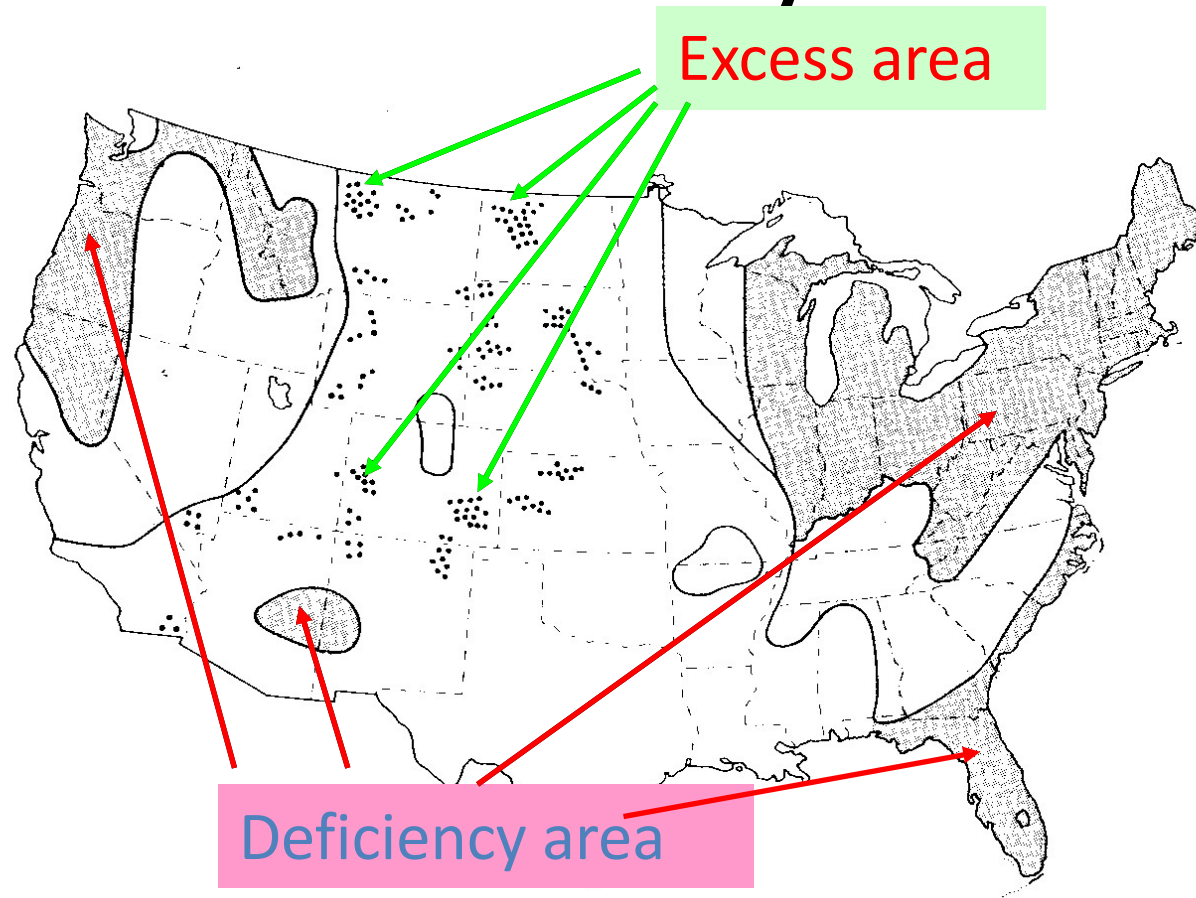
- Selenium excess: due to Se accumulating plants (e. g. *Astragalus bisulcatus*)






# Distribution of animal disease related to soil nutrients (2)

- Calcium deficiency      Decrease in milk production
- Magnesium deficiency  
    grass tetany, grass stagger
- Cobalt deficiency:      Vitamin B<sub>12</sub> deficiency, malnutrition
- Copper deficiency:      Repression in iron transport, Hematopoiesis disorder, anemia
- Molybdenum excess:      Diarrhea, fur color fading

# Occurrence areas of selenium deficiency and excess



-  Where selenium levels are too low to meet requirements of farm animals
-  Where selenium is adequate to meet requirements of farm animals
-  Where selenium is both adequate and inadequate in same locality
- Where selenium toxicity may be a problem

**Figure 13-11**  
Areas where forages and feed crops contain various levels of selenium. (Data from Allaway, 1975.)

# Little Big Horn, Montana

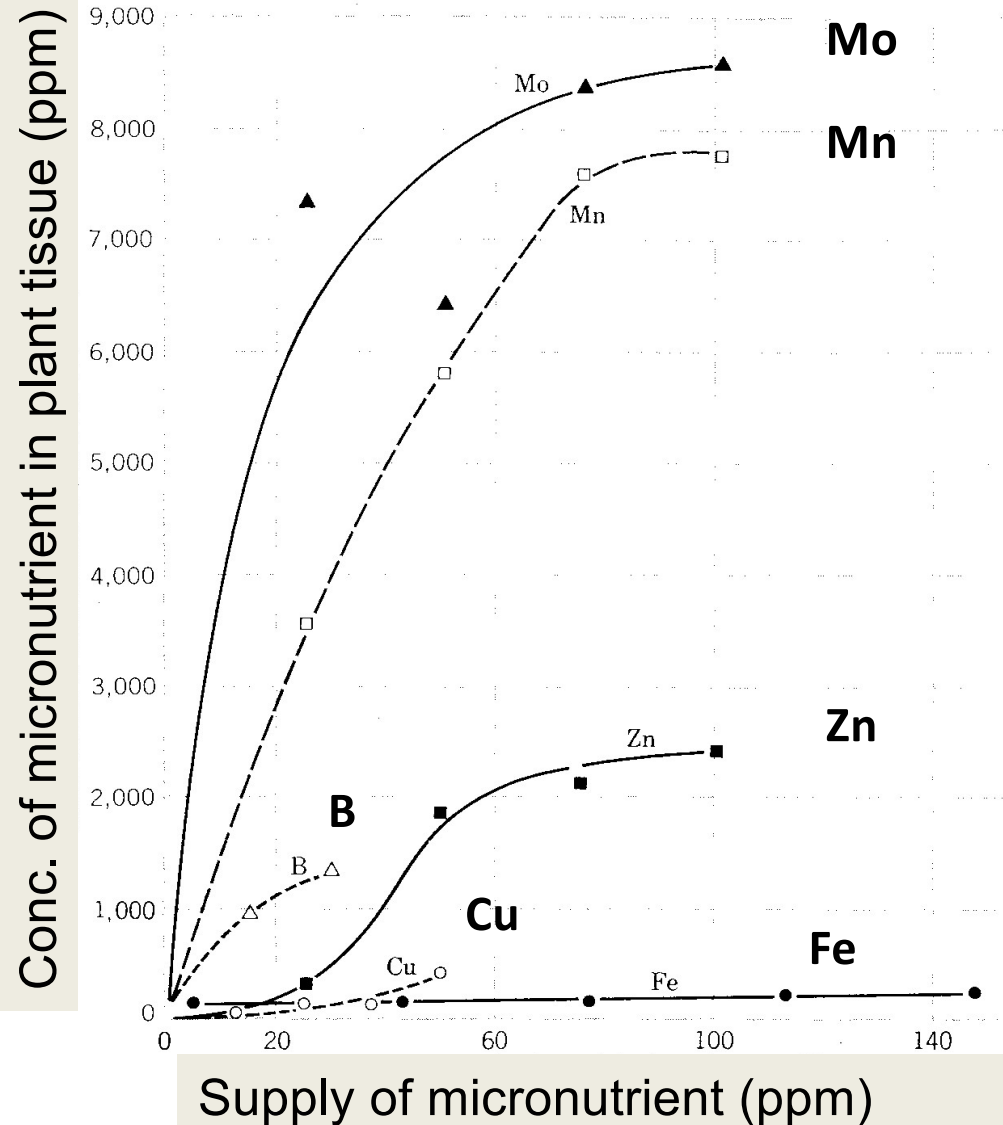


George Custer's fateful day at the Little Big Horn River in Montana on June 25, 1876. Enroute to the battle site, a legume selenium accumulator, *Astragalus bisulcatus*, was in its palatable stage. The horses of the cavalry division likely grazed on it and got peculiar symptoms similar to selenium toxicity.

# Occurrence area of cobalt deficiency

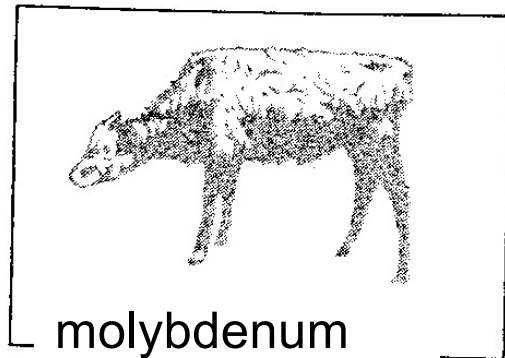
- Estuarine plain formed on sandy soil.
- Sandy soil deposited by glacier.
- Podzolic soil.

# Response of micronutrient contents in plant to the supplied micronutrient (ppm)

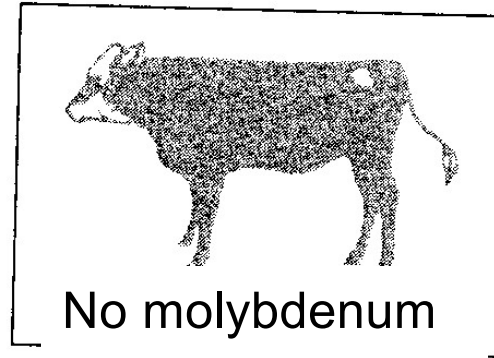


The iron and copper content of tomato leaflets was little affected by a large increase in supply of nutrient in the growing medium. (Beeson, 1955)

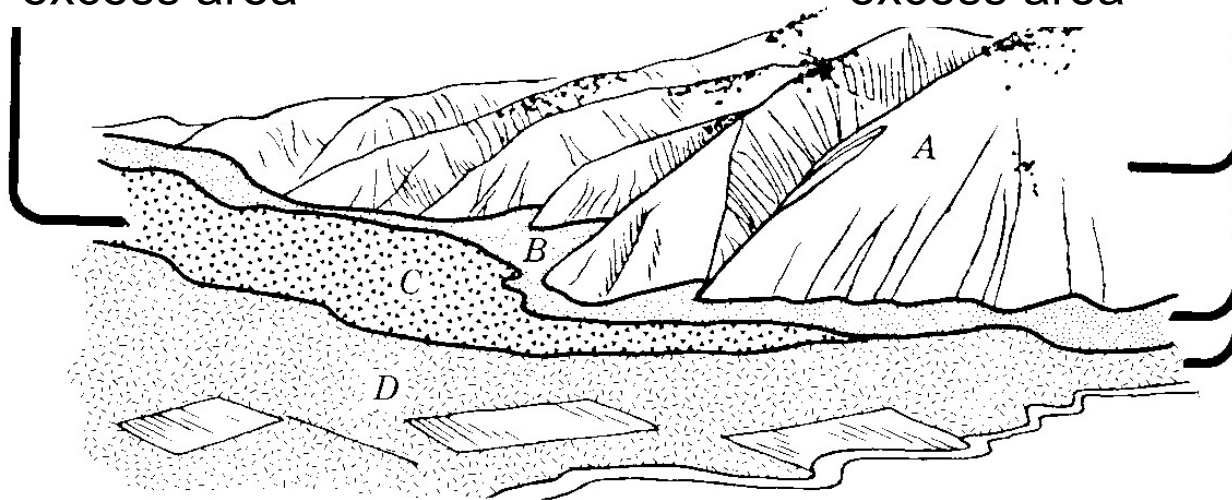
# Occurrence of molybdenum excess



molybdenum  
excess area



No molybdenum  
excess area



Area C: Parent material is rich in Mo and wet. → Mo toxicity occurs.  
Area A, B: well drained soils in which Mo is not readily available to plants.  
Area D is wet, but soils formed from low Mo parent materials.

# Micronutrient deficiency in domestic animals frequently occurring in Japan

Deficiencies in

Co: Vitamin B<sub>12</sub> deficiency, anemia, decrease in milk production, growth retardation.

Cu: Anemia, Lowering in reproduction

Se: White muscle disease (Vitamin E deficiency),  
Reproduction disorder

Zn: Growth retardation, Reproduction disorder

# Nitrate excess, nitrogen excess

- Due to the reductive condition in the stomach of ruminant animals, nitrate is easily reduced into nitrite.
- Nitrite causes **Methemoglobinemia**.
- Excess application of nitrogen fertilizer to forage crops should be avoided.



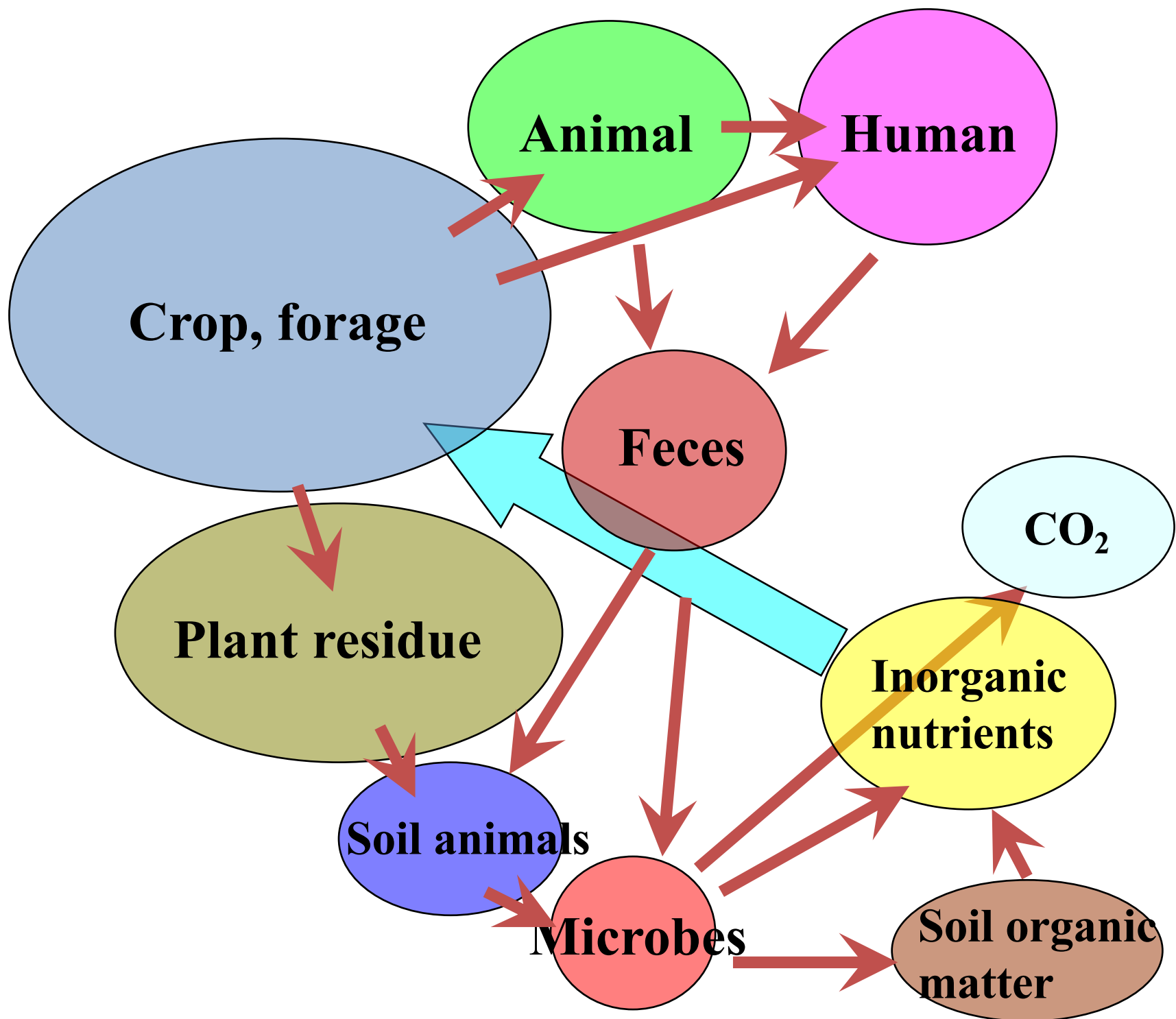
# Soil as dormancy site of pathogen.

- Plant: Chlorosis (Fusarium disease),  
Nematodes
- Animals: Anthrax, Brucellosis, BSE

To solve and prevent these diseases, it is preferable to use the biological function of soil.

# Summary

- Soil is the vital point of material circulation. Saprophytes has a great role in the circulation.
- Soil has a great impact on the health of domestic animals and human through the food and environment.



Soil is the vital point of material circulation