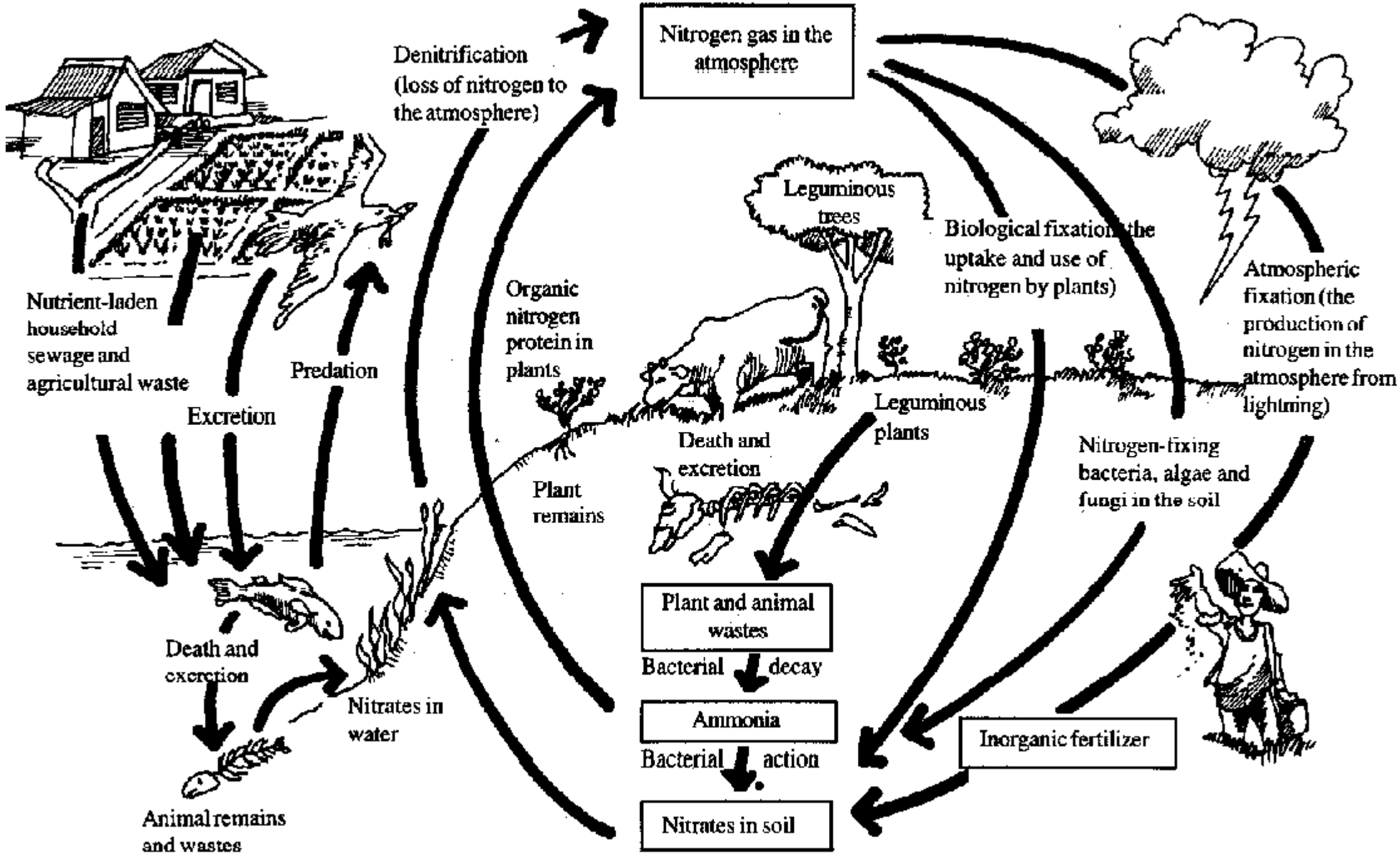
SOIL: The Major Anions

Nitrogen, Phosphorus and Sulfur

Nitrogen – NH_4^+, NO_3^-

Roles

- Vegetative growth
- Protein and enzyme formation
- Chlorophyll production
- Mobile


Nitrogen gas in the atmosphere
Denitrification (loss of nitrogen to the atmosphere)
Leguminous trees
Biological fixation (the uptake and use of nitrogen by plants)
Atmospheric fixation (the production of nitrogen in the atmosphere from lightning)
Nutrient-laden household sewage and agricultural waste
Excretion
Predation
Organic nitrogen protein in plants
Plant remains
Death and excretion
Leguminous plants
Nitrogen-fixing bacteria, algae and fungi in the soil
Death and excretion
Nitrates in water
Plant and animal wastes
Bacterial decay
Ammonia
Bacterial action
Inorganic fertilizer
Animal remains and wastes
Nitrates in soil

Nitrogen – NH_4^+, NO_3^-

Sources

- Ammonium Sulfate – 21% N, 24% S
- Protein Meals – Variable
- Compost and manures – Variable
- Enzymatically digested fish – 2-3% N
- Symbiotic and free living Nitrogen fixers

Phosphorus – P 3-

Roles

- Reproductive growth
- Part of genetic material
- Energy storage and transfer
- Early root growth
- Aids blooming and fruiting
- Speeds crop maturity
- mobile

Phosphorus – P 3-

Deficiency

- Stunted growth
- Reddening or purpling of leaves
- Poor or no flowering or fruiting

Excess

- Tie up of other nutrients
- Poor growth

Phosphorus – P 3-

Sources

- Hard Rock Phosphate – 24-30%, up to 30% Ca. Long term source
- Colloidal, Reactive Phosphate - ~20% P_2O_5, ~20% Ca
- MAP Mono-Ammonium Phosphate – 11% N, 52% P_2O_5
- Bone Meal – 21-30% P_2O_5, 1-4% N, 20-30% Ca
- Compost, animal manures – 0.5-3% P_2O_5

Sulfur – S--

Roles

- Production of S containing proteins
- Chlorophyll production
- Nodulation of legumes
- Seed production

Sulfur – S--

Deficiency

- Symptoms similar to N deficiency
- Overall pale green color of leaves

Excess

- Symptoms of other anion deficiencies due to suppression

Sulfur – S--

Sources

- Elemental Sulfur – 90-92% S
- Ammonium Sulfate – 21% N, 24% S
- Gypsum – 22-24% Ca, 17-18% S
- Sul-Po-Mag/K-Mag – 22% K2O, 11% Mg, 20-22% S
- Magnesium Sulfate - ~10% Mg, 14% S
- Potassium Sulfate – 50% K2O, 18% S