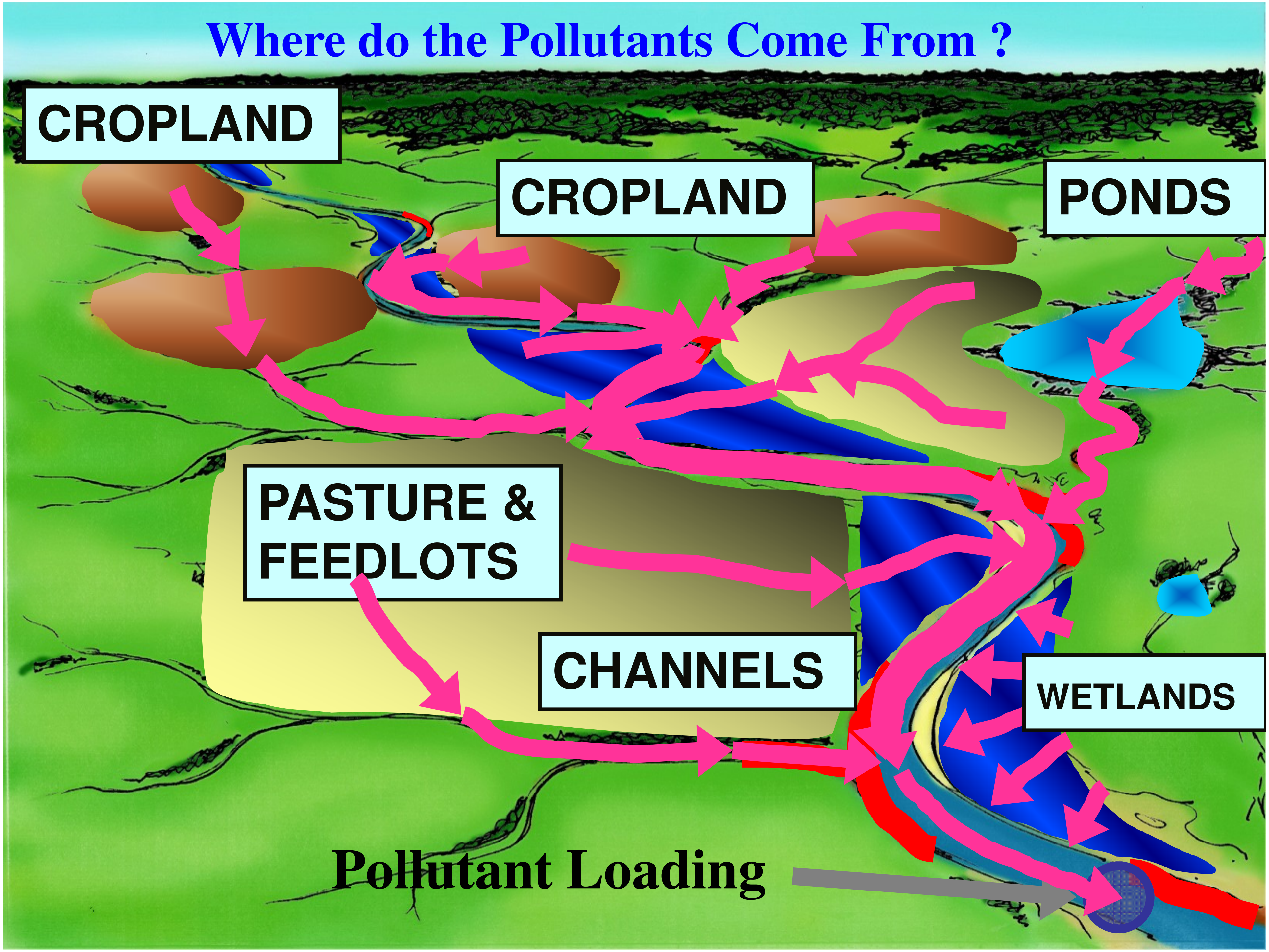
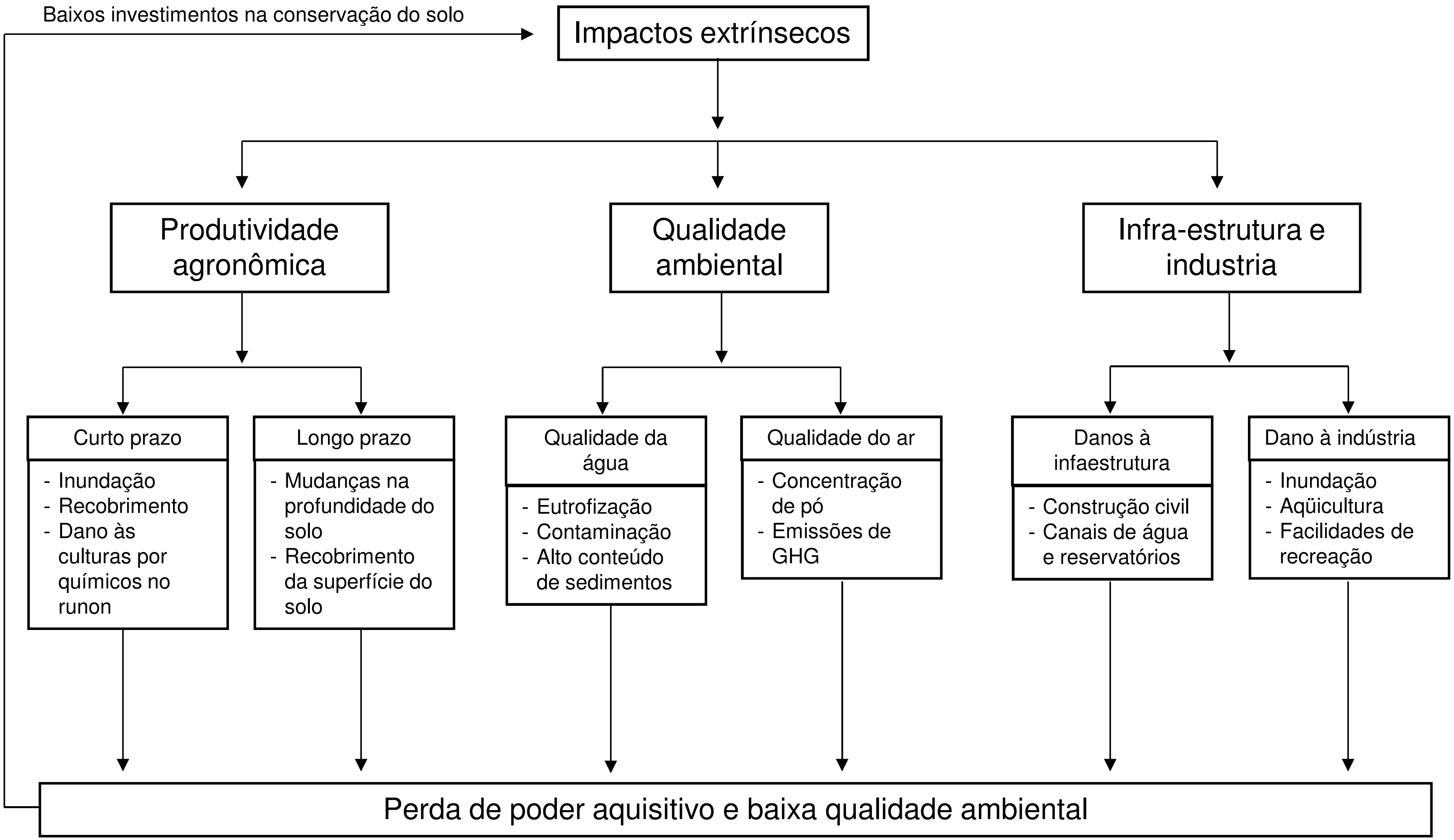

Where do the Pollutants Come From ?
CROPLAND
CROPLAND
PONDS
PASTURE &
FEEDLOTS
CHANNELS
WETLANDS
Pollutant Loading


Baixos investimentos na conservação do solo
Impactos extrínsecos
Produtividade agronômica
Qualidade ambiental
Infra-estrutura e industria
Curto prazo
- Inundação
- Recobrimento
- Dano às culturas por químicos no runon
Longo prazo
- Mudanças na profundidade do solo
- Recobrimento da superfície do solo
Qualidade da água
- Eutrofização
- Contaminação
- Alto conteúdo de sedimentos
Qualidade do ar
- Concentração de pó
- Emissões de GHG
Danos à infaestrutura
- Construção civil
- Canais de água e reservatórios
Dano à indústria
- Inundação
- Aqüicultura
- Facilidades de recreação
Perda de poder aquisitivo e baixa qualidade ambiental

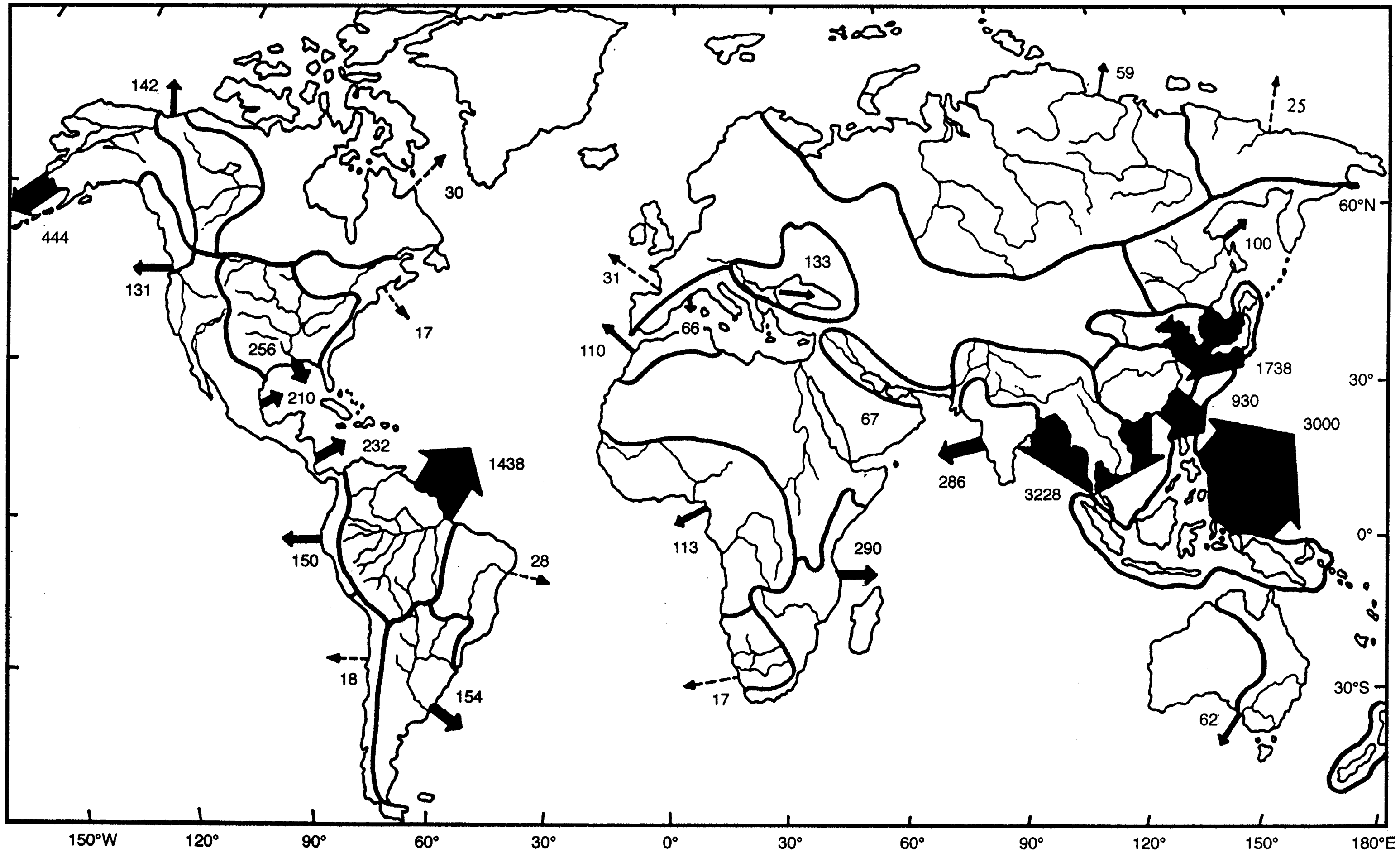
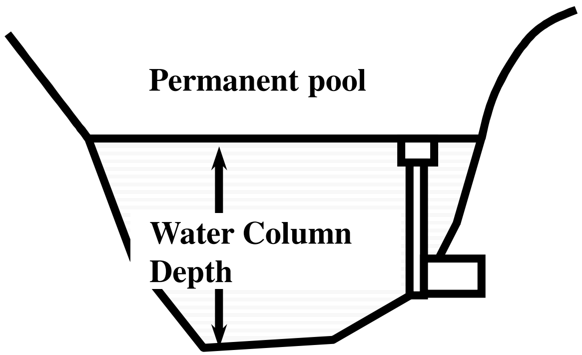
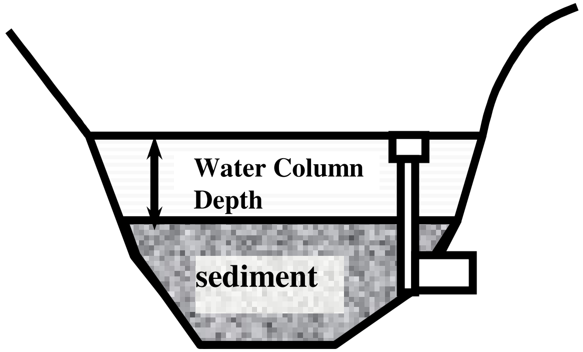


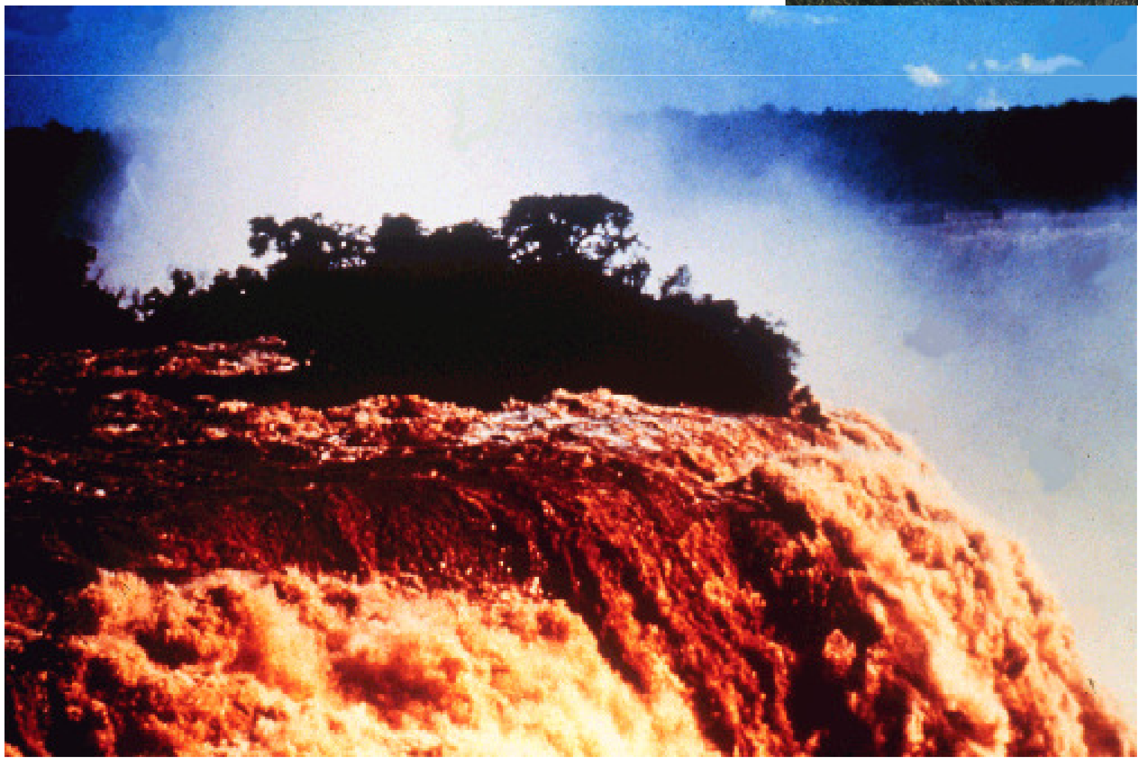

**Fig. 11.1.** Annual discharge of suspended sediment from various drainage basins of the world. Width of the arrows corresponds to relative discharge; numbers refer to average annual input in millions of tons. Source: Milliman and Meade (1983).




## Clean Pond




## Sediment



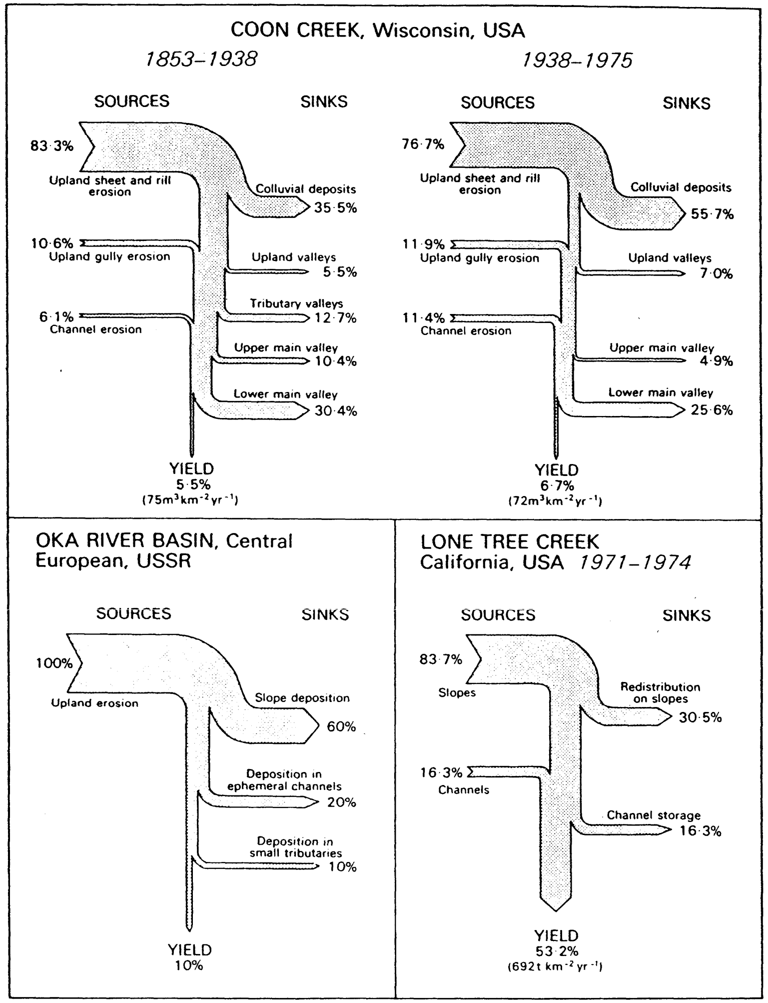



**Figure 3.14** Tentative sediment budgets for Coon Creek, Wisconsin (360 km$^2$), 1853–1938 and 1938–1975; Lone Tree Creek, California (1.74 km$^2$); and the Oka River, USSR. Based on data presented by Trimble (*100*), Lehre (*54*), and Zaslavsky (*125*).

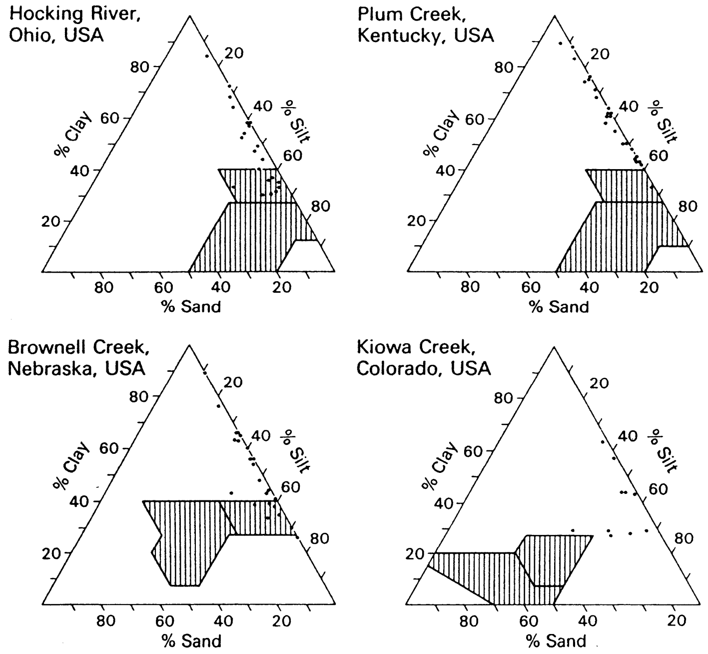



**Figure 3.10** Comparison of the particle size composition of suspended sediment and soils in four U.S. drainage basins. Textural classes of the dominant soils are denoted by shaded zones on the trilinear plots. Based on data from Flint (*35*), Anttila (*5*), and Mundorff (*66,67*).

**Table 3.5** Enrichment of clay and pollutants in suspended sediment transported by a headwater tributary of the Menomonee River, Wisconsin, US [based on Novotny et al. (*70*)].

| Constituent | Soil | Suspended Sediment | Enrichment Ratio |
|---|---|---|---|
| Clay (%) | 27 | 91 | 3.4 |
| Total P | 810 | 1700 | 2.1 |
| Pb | 19 | 39 | 2.0 |
| Zn | 69 | 280 | 4.0 |
| Cu | 25 | 45 | 1.8 |
| Cr | 29 | 56 | 1.9 |
| Ni | 17 | 45 | 2.6 |

All chemical elements expressed in parts per million.

Young et al. (1986)

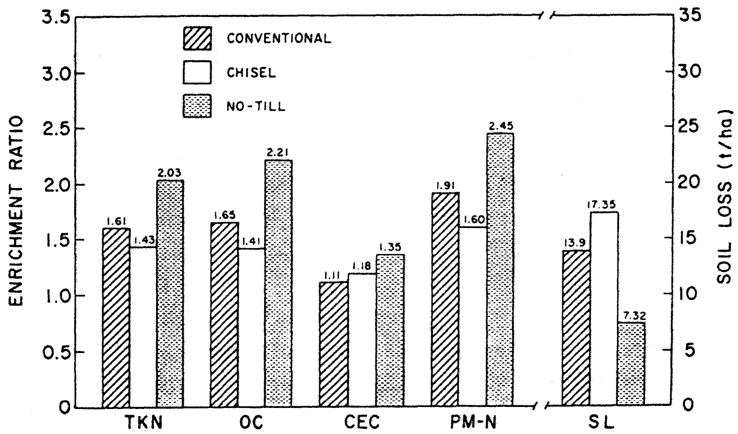



**Fig. 2—Soil losses and enrichment ratios from three tillage practices on row crops on Russell silt loam. Values above the bars are enrichment ratios or soil loss.**

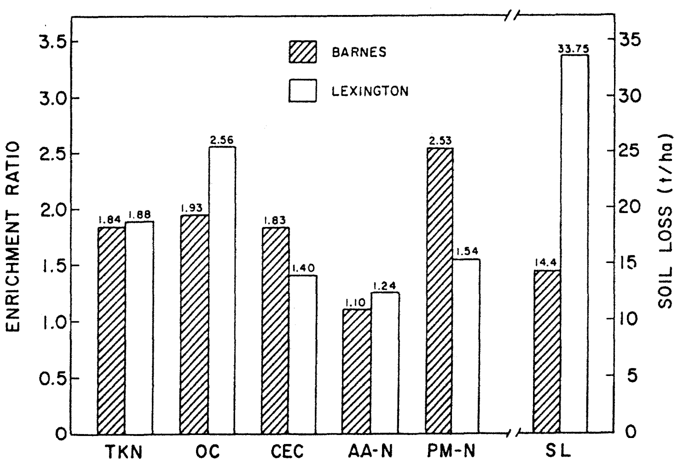



**Fig. 3—Comparison of soil losses and enrichment ratios from fallow plots of Barnes loam (Minnesota) and Lexington silt loam (Mississippi). Values above the bars are enrichment ratios or soil loss.**

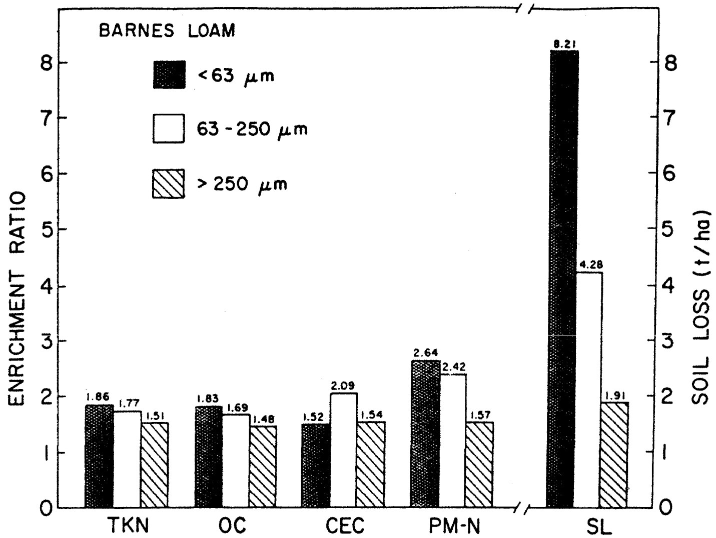



**Fig. 5—Soil losses and enrichment ratios of various size classes of eroded aggregates on a Barnes loam. Values above the bars are enrichment ratios or soil loss.**

$MO + microrganismos + O_2 \rightarrow CO_2 + H_2O + mais\ microrganismos$

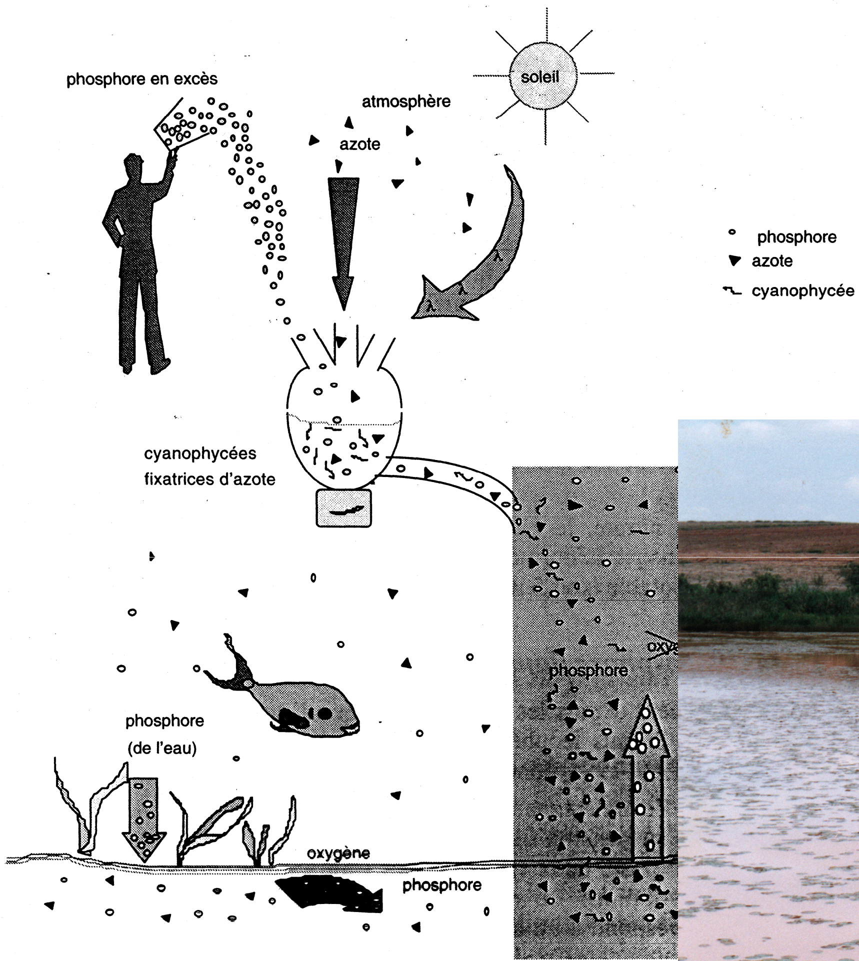



*FIGURE 8.7 – Rôle du phosphore dans l'eutrophisation (d'après Barroin La Recherche 1991).*

Crescimento de algas e vegetação aquática

Depleção de oxigênio dissolvido

Aumento da turbidez

Degradação da qualidade da água

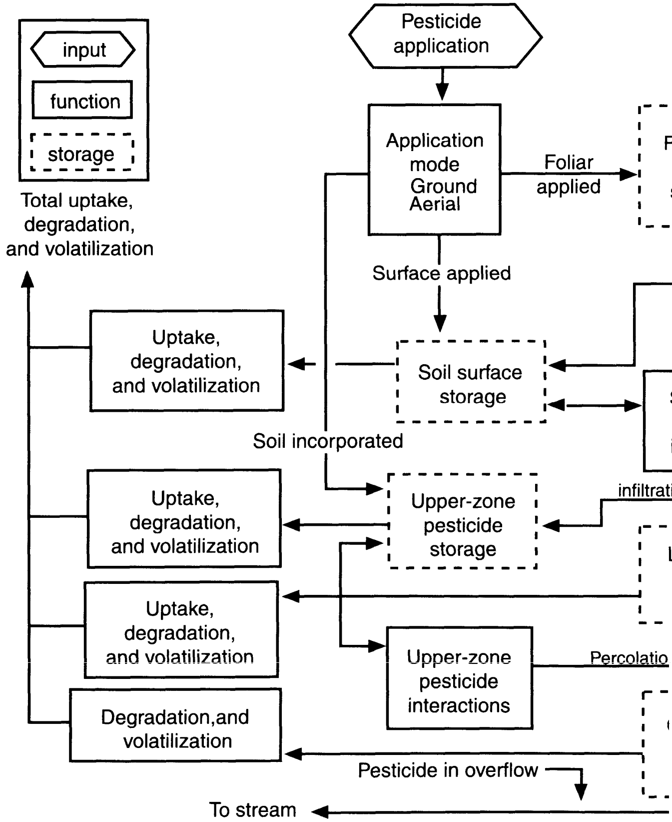



**FIGURE 5.1** Pesticide transport and transformation in the soil-plant environme
American Society for Agronomy, Crop Science Society of America, and Soil Sci

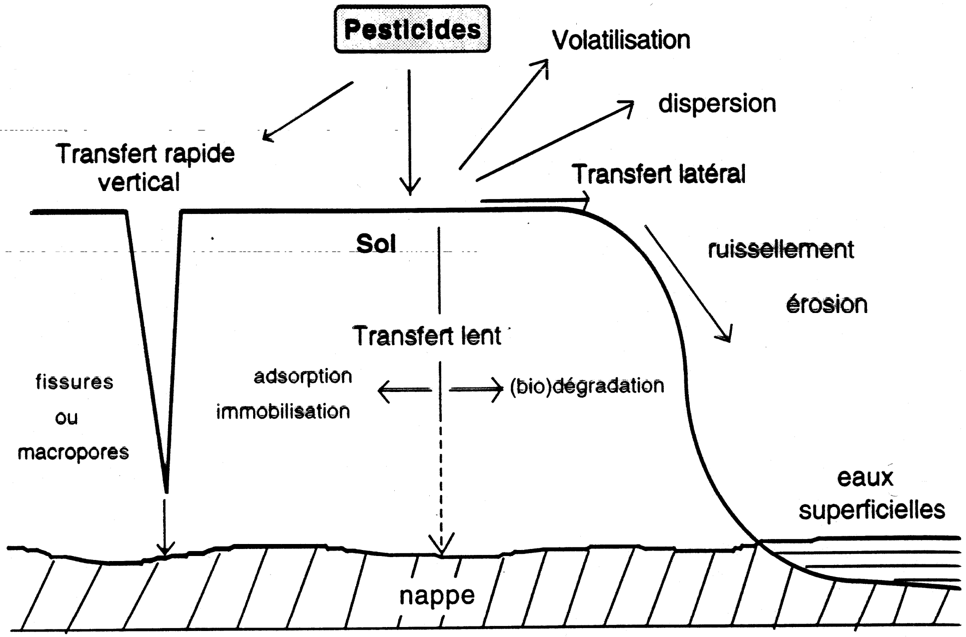



*FIGURE 9.1 – Devenir des pesticides dans les sols.*

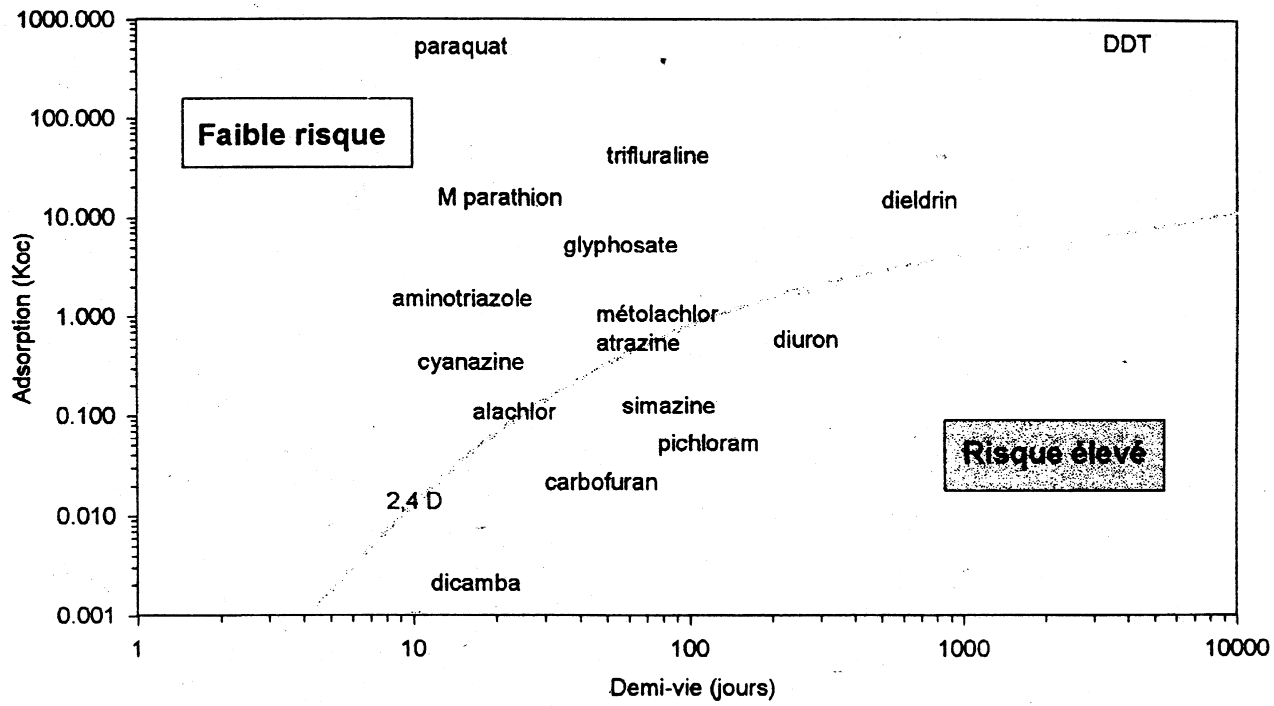



*FIGURE 9.3 – Évaluation des risques de pollution par lixiviation des pesticides en fonction de leur demi-vie et de leurs coefficients d'adsorption (Barriuso* et al. *1991).*

**TABLE 5.2**
**Sorption Coefficients and Half-Lives of Pesticides Used In Florida**

| Pesticide (common name) | Sorption Coefficient (ml/g of organic chemical) | Half-Life (days) |
|---|---|---|
| | **Nonpersistent** | |
| Dalapon | 1 | 30 |
| Dicamba | 2 | 14 |
| Chloramben | 15 | 15 |
| Metalaxyl | 16 | 21 |
| Aldicarb | 20 | 30 |
| Oxamyl | 25 | 4 |
| Propham | 60 | 10 |
| 2,4,5-T | 80 | 24 |
| Captan | 100 | 3 |
| Fluometuron | 100 | 11 |
| Alachlor | 170 | 15 |
| Cyanazine | 190 | 14 |
| Carbaryl | 200 | 10 |
| Iprodione | 1,000 | 14 |
| Malathion | 1,800 | 1 |
| Methyl parathion | 5,100 | 5 |
| Chlorpyrifos | 6,070 | 30 |
| Parathion | 7,161 | 14 |
| Fluvalinate | 100,000 | 30 |
| | **Moderately Persistent** | |
| Picloram | 16 | 90 |
| Chlormuron-ethyl | 20 | 40 |
| Carbofuran | 22 | 50 |
| Bromacil | 32 | 60 |
| Diphenamid | 67 | 32 |
| Ethoprop | 70 | 50 |
| Fensulfothion | 89 | 33 |
| Atrazine | 100 | 60 |
| Simazine | 138 | 75 |
| Dichlorbenil | 224 | 60 |
| Linuron | 370 | 60 |
| Ametryne | 388 | 60 |
| Diuron | 480 | 90 |
| Diazinon | 500 | 40 |
| Prometryn | 500 | 60 |
| Fonofos | 532 | 45 |

(*continued*)

**TABLE 5.2 (continued)**

| Pesticide (common name) | Sorption Coefficient (ml/g of organic chemical) | Half-Life (days) |
|---|---|---|
| | **Moderately Persistent** | |
| Chlorbromuron | 996 | 45 |
| Azinphos-methyl | 1,000 | 40 |
| Cacodylic acid | 1,000 | 50 |
| Chlorpropham | 1,150 | 35 |
| Phorate | 2,000 | 90 |
| Ethalfluralin | 4,000 | 60 |
| Chloroxuron | 4,343 | 60 |
| Fenvalerate | 5,300 | 35 |
| Esfenvalerate | 5,300 | 35 |
| Trifluralin | 7,000 | 60 |
| Glyphosphate | 24,000 | 47 |
| | **Persistent** | |
| Fomesafen | 50 | 180 |
| Terbacil | 55 | 120 |
| Metsulfuron-methyl | 61 | 120 |
| Propazine | 154 | 135 |
| Benomyl | 190 | 240 |
| Monolinuron | 284 | 321 |
| Prometon | 300 | 120 |
| Isofenphos | 408 | 150 |
| Fluridone | 450 | 350 |
| Lindane | 1,100 | 400 |
| Cyhexatin | 1,380 | 180 |
| Procymidone | 1,650 | 120 |
| Chloroneb | 1,653 | 180 |
| Endosulfan | 2,040 | 120 |
| Ethion | 8,890 | 350 |
| Metolachlor | 85,000 | 120 |

# Custos dos impactos intrínsecos e extrínsecos da erosão do solo

**Table 2.** Estimated annual economic and energetic costs (per hectare) of soil and water loss from conventional corn assuming a water and wind erosion rate of 17 tons $ha^{-1}$ $year^{-1}$ over the long term (20 years).

| Factors | Annual quantities lost | Cost of replacement (dollars) | Energetic costs ($10^3$ kcal) | Yield loss after 20 years of erosion (%) |
|---|---|---|---|---|
| Water runoff | 75 mm* | 30† | 700‡ | 7* |
| Nitrogen | 50 kg§ | | 500‖ | |
| Phosphorus | 2 kg§ | 100§ | 3‖ | 8¶ |
| Potassium | 410 kg§ | | 260‖ | |
| Soil depth | 1.4 mm* | 16# | – | 7** |
| Organic matter | 2 tons* | – | – | 4†† |
| Water holding capacity | 0.1 mm* | – | – | 2‡‡ |
| Soil biota | – | – | – | 1§§ |
| Total on-site | | 146 | 1460 | 20‖‖ |
| Total off-site | | 50¶¶ | 100 | |
| Grand total | | 196# | 1560 | |

*Table 3. †The cost of replacing this much water by ground-water irrigation based on 1992 dollars (*118*). The value is reduced by 40% because it is assumed that water erosion accounts for 60% of U.S. erosion (*119*). However, if rainfall were abundant, then this replacement cost would not be necessary. ‡Energy required to pump ground water from a depth of 30 m (*120*). §Total nutrients loss, based on the results of Troeh *et al.* (*50*). ‖Energy required to replace the fertilizers lost (*121*). ¶Based on the total loss of 340 tons $ha^{-1}$ of soil over 20 years and the mineralization and availability of the nutrients in this soil. #Estimated. **Based on reduced productivity of about 6% per loss of 2.5 cm of soil (*122*). ††Organic matter content of the soil was assumed to decline from 4 to 3% over this period, resulting in a 4% decline in productivity. ‡‡After the loss of 17 tons $ha^{-1}$ $year^{-1}$ of soil, the water holding capacity was assumed to decline 1.9 mm and productivity declined 2%; with severe erosion over time, plant-available water may decline 50 to 75% (*17, 123*). §§Reductions in soil biota were assumed to reduce infiltration of water and reduce organic matter recycling. ‖‖ Percentages do not add up because the impacts of the various factors are interdependent and some overlap exists (for example, organic matter is interrelated with water resources, nutrients, soil biota, and soil depth). This loss would occur if lost nutrients and water were not replaced. ¶¶Table 4.

USA → perda de $4x10^9$ Mg de solo e $130x10^9$ Mg de água. $ano^{-1}$→ U$S 27 bilhões (20 bilhões para reposição de nutrientes, 7 bilhões para perda de água e solo)

Pimentel et al. (1995)

**Table 4.** Damages by wind and water erosion and the cost of erosion prevention each year.

| Type of damage | Cost (millions of dollars) |
|---|---|
| *Wind erosion** | |
| Exterior paint | 18.5 |
| Landscaping | 2,894.0 |
| Automobiles | 134.6 |
| Interior, laundry | 986.0 |
| Health | 5,371.0† |
| Recreation | 223.2 |
| Road maintenance | 1.2 |
| Cost to business | 3.5 |
| Cost to irrigation and conservation districts | 0.1 |
| Total wind erosion costs | 9,632.5 |
| *Water erosion‡* | |
| *In-stream damage* | |
| Biological impacts | No estimate |
| Recreational | 2,440.0 |
| Water-storage facilities | 841.8 |
| Navigation | 683.2 |
| Other in-stream uses | 1,098.0 |
| Subtotal in-stream | 5,063.0 |
| *Off-stream effects* | |
| Flood damages | 939.4 |
| Water-conveyance facilities | 244.0 |
| Water-treatment facilities | 122.0 |
| Other off-stream uses | 976.0 |
| Subtotal off-stream | 2,318.0 |
| Total water erosion costs | 7,381.0 |
| Total costs of wind and water erosion damage | 17,013.5§ |
| Cost of erosion prevention‖ | 8,400 |
| Total costs (on and off-site)¶ | 44,399.0 |
| Benefit/cost ratio | 5.24 |

*(*95–97, 129*). †Health estimates are partly based on Lave and Seskin (*130*). ‡(*93, 96, 97, 129*). §Agriculture accounts for about two-thirds of the off-site effects. ‖See text. ¶The total on-site costs are calculated to be $27 billion (see Table 3 and text).

# Riparian Buffer System

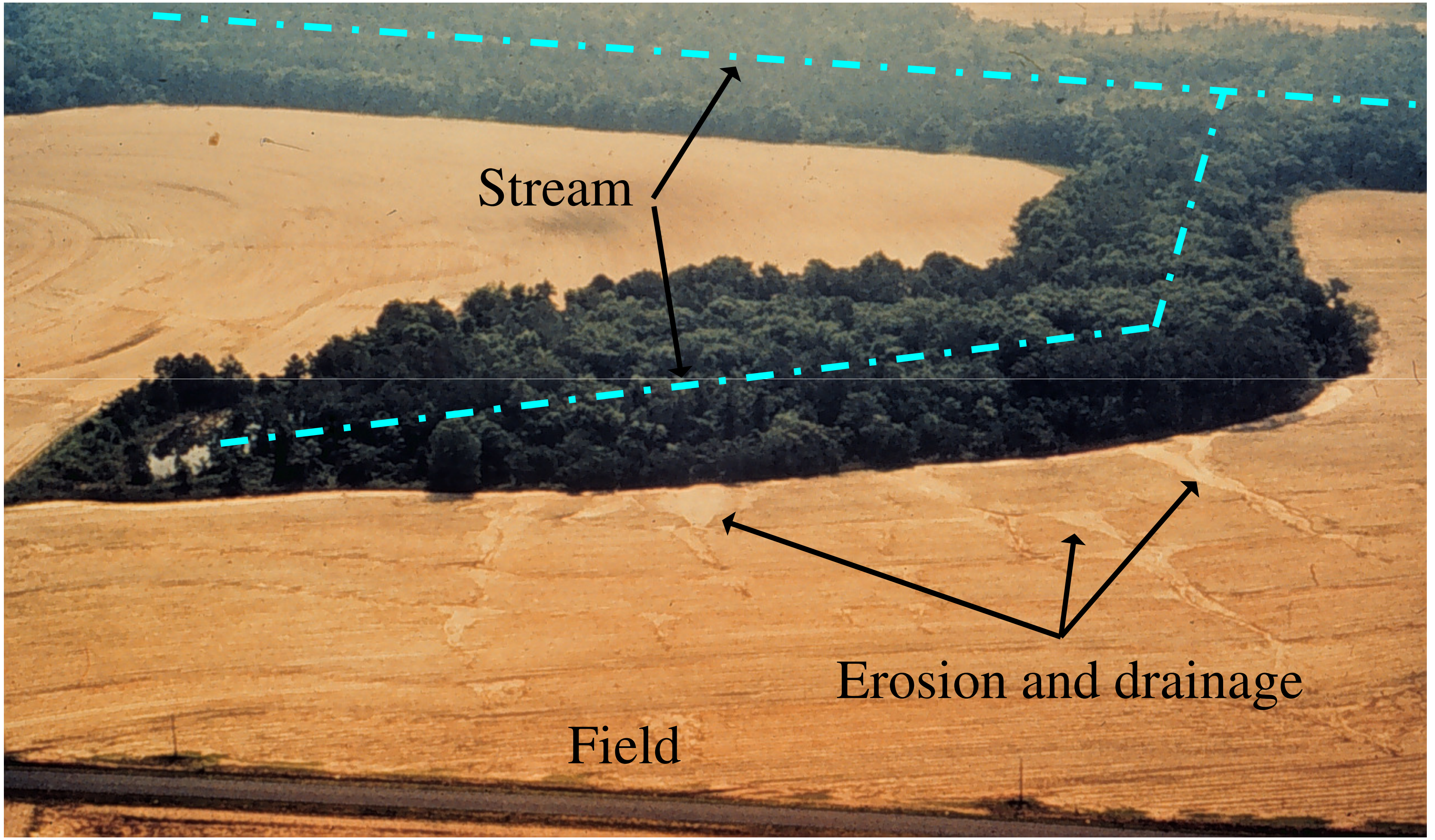
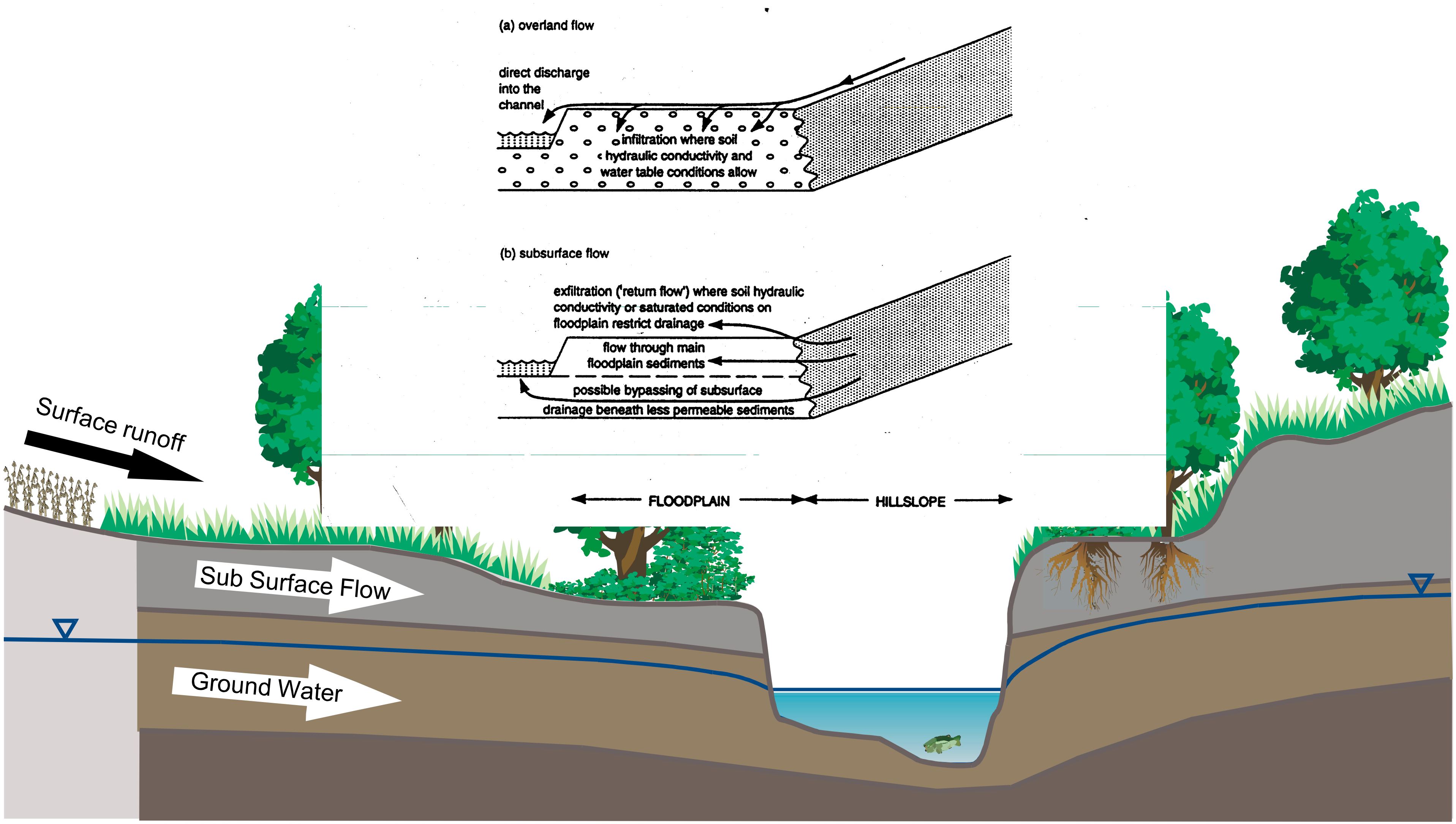
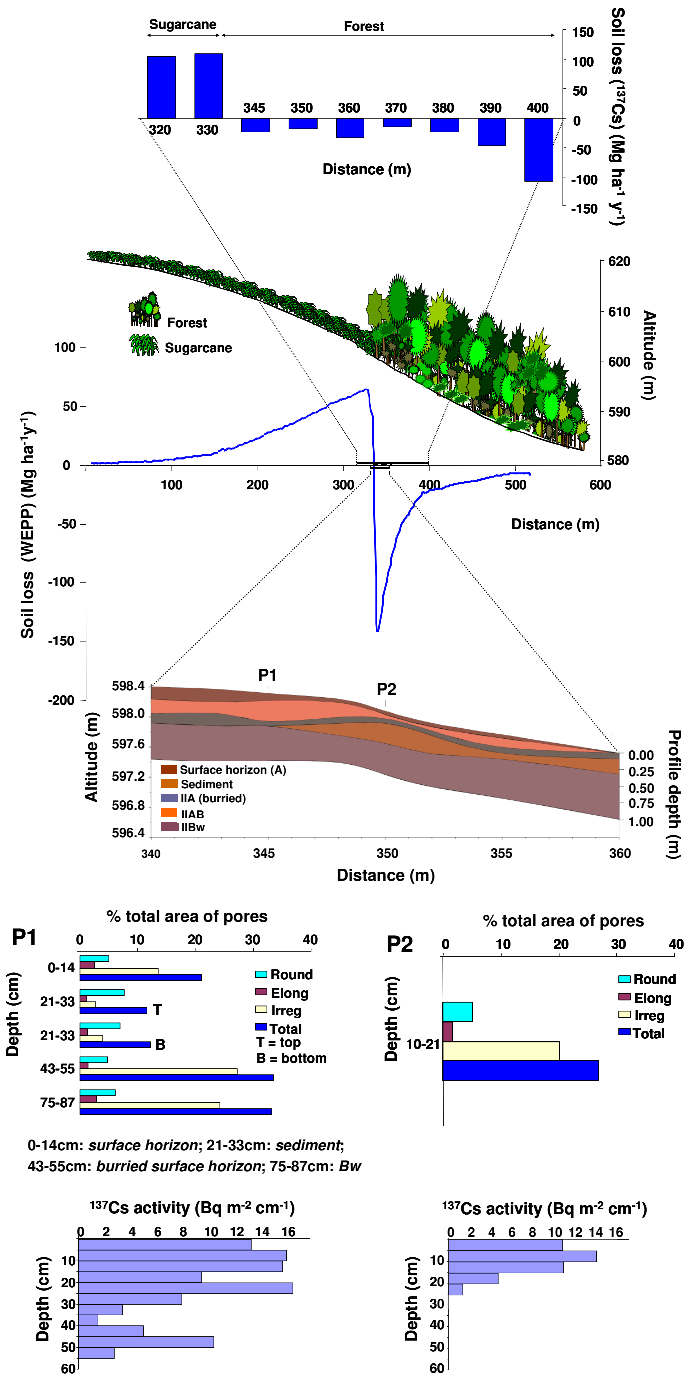


**Figure 6**. Summary of main flow paths by which hillslope discharge moves through a floodplain to reach the channel: (a) for surface water inputs from upslope; (b) for subsurface water inputs from upslope.



# Sediments retention in riparian ecosystems using 137Cs technique, WEPP model and morphological studies



# AGNPS: A nonpoint-source pollution model for evaluating agricultural watersheds

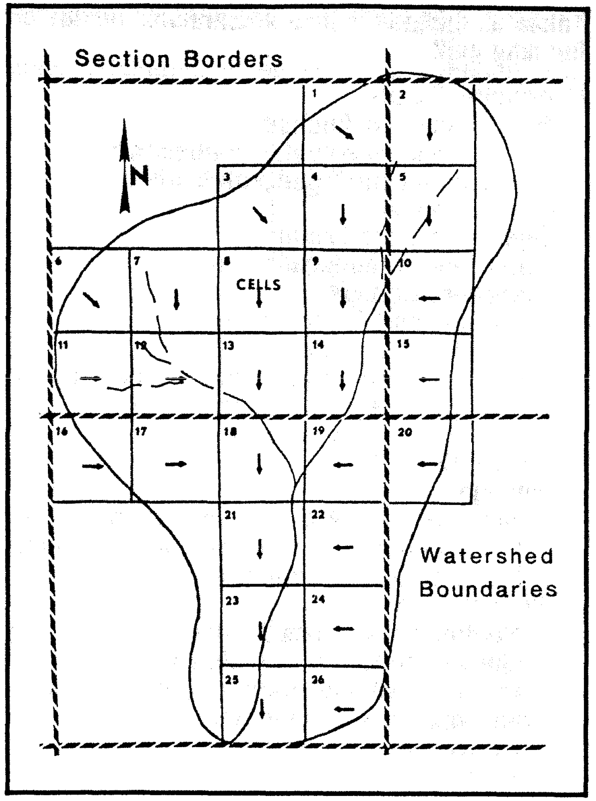



Figure 1. Sample watershed showing subdivision into cells.

**Table 1. Input data file.**

| Column Number | Data |
|---|---|
| | *Watershed Input* |
| 1 | Watershed identification |
| 2 | Cell area (acres) |
| 3 | Total number of cells |
| 4 | Precipitation (inches) |
| 5 | Energy-intensity value |
| | *Cell Parameter* |
| 1 | Cell number |
| 2 | Number of the cell into which it drains |
| 3 | SCS curve number |
| 4 | Average land slope (%) |
| 5 | Slope shape factor (uniform, convex, or concave) |
| 6 | Average field slope length (feet) |
| 7 | Average channel slope (%) |
| 8 | Average channel side slope (%) |
| 9 | Mannings roughness coefficient for the channel |
| 10 | Soil erodibility factor (K) from USLE |
| 11 | Cropping factor (C) from USLE |
| 12 | Practice factor (P) from USLE |
| 13 | Surface condition constant (factor based on land use) |
| 14 | Aspect (one of 8 possible directions indicating the principal drainage direction from the cell) |
| 15 | Soil texture (sand, silt, clay, peat) |
| 16 | Fertilization level (zero, low, medium, high) |
| 17 | Incorporation factor (% fertilizer left in top 1 cm of soil) |
| 18 | Point source indicator (indicates existence of a point source input within a cell) |
| 19 | Gully source level (estimate of amount, tons, or gulley erosion in a cell) |
| 20 | Chemical oxygen demand factor |
| 21 | Impoundment factor (indicating presence of an impoundment terrace system within the cell) |
| 22 | Channel indicator (indicating existence of a defined channel within a cell) |

**Table 2. Output at the watershed outlet or for any cell.**

*Hydrology Output*
- Runoff volume (inches)
- Peak runoff rate (cubic feet/second)
- Fraction of runoff generated within the cell

*Sediment Output*
- Sediment yield (tons)
- Sediment concentration (ppm)
- Sediment particle size distribution
- Upland erosion (tons/acres)
- Amount of deposition (%)
- Sediment generated within the cell (tons)
- Enrichment ratios by particle size
- Delivery ratios by particle size

*Chemical Output*
- Nitrogen
  - Sediment associated mass (pounds/acre)
  - Concentration of soluble material (ppm)
  - Mass of soluble material (pounds/acre)
- Phosphorus
  - Sediment associated mass (pounds/acre)
  - Concentration of soluble material (ppm)
  - Mass of soluble material (pounds/acre)
- Chemical Oxygen Demand
  - Concentration (ppm)
  - Mass (pounds/acre)

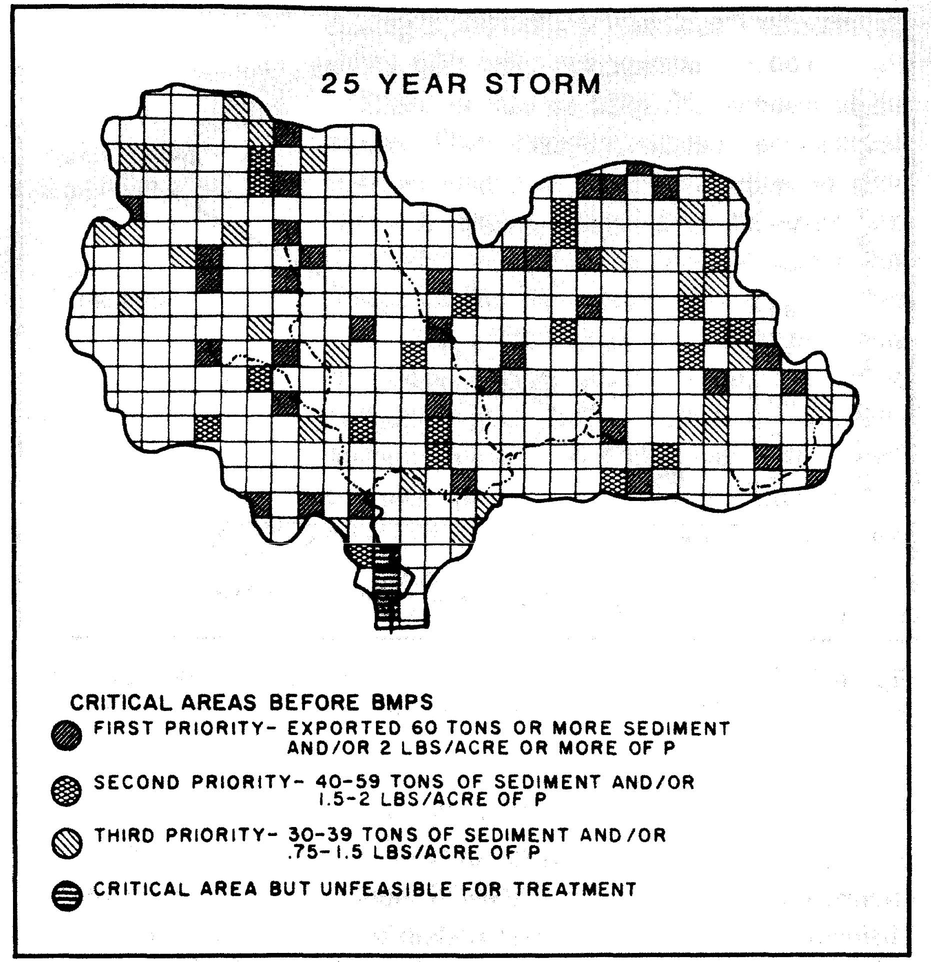



**Figure 6. Estimated discharge of sediment and phosphorus by cells in Salmonson Creek watershed, Big Stone County, Minnesota.**

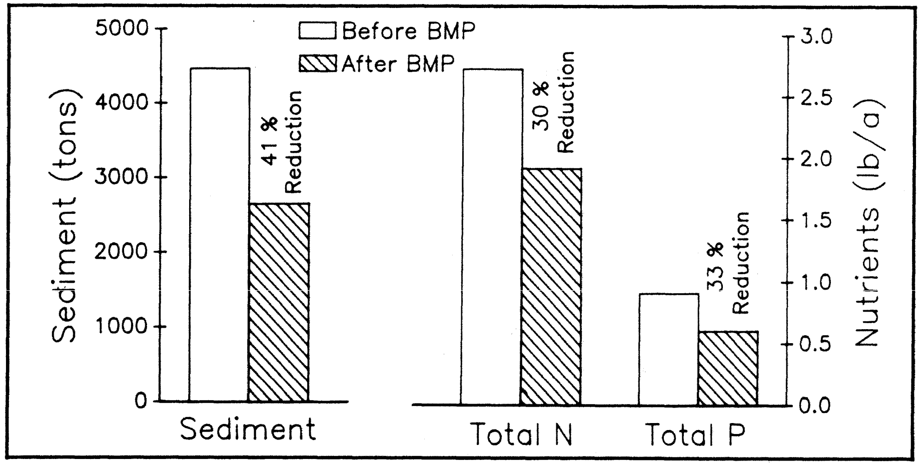



**Figure 7. Estimated sediment and nutrient yields from a 25-year, 24-hour storm before and after implementation of best management practices.**

Disponível no site: http://www.ars.usda.gov/Research/docs.htm?docid=5199