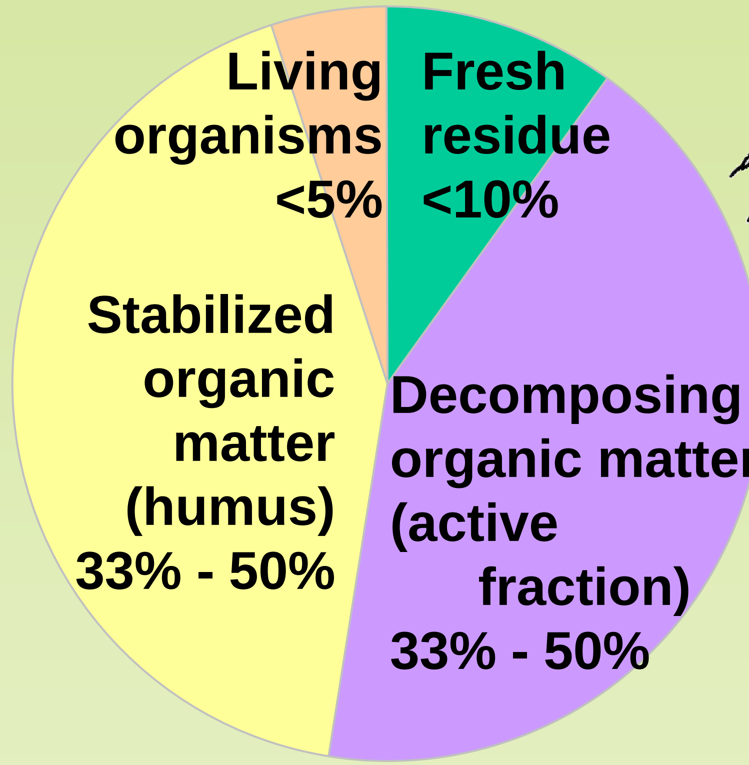
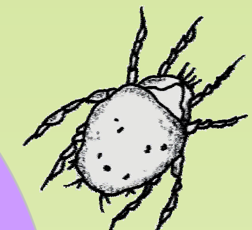
(SQ – 1)
Soil Biology
Primer

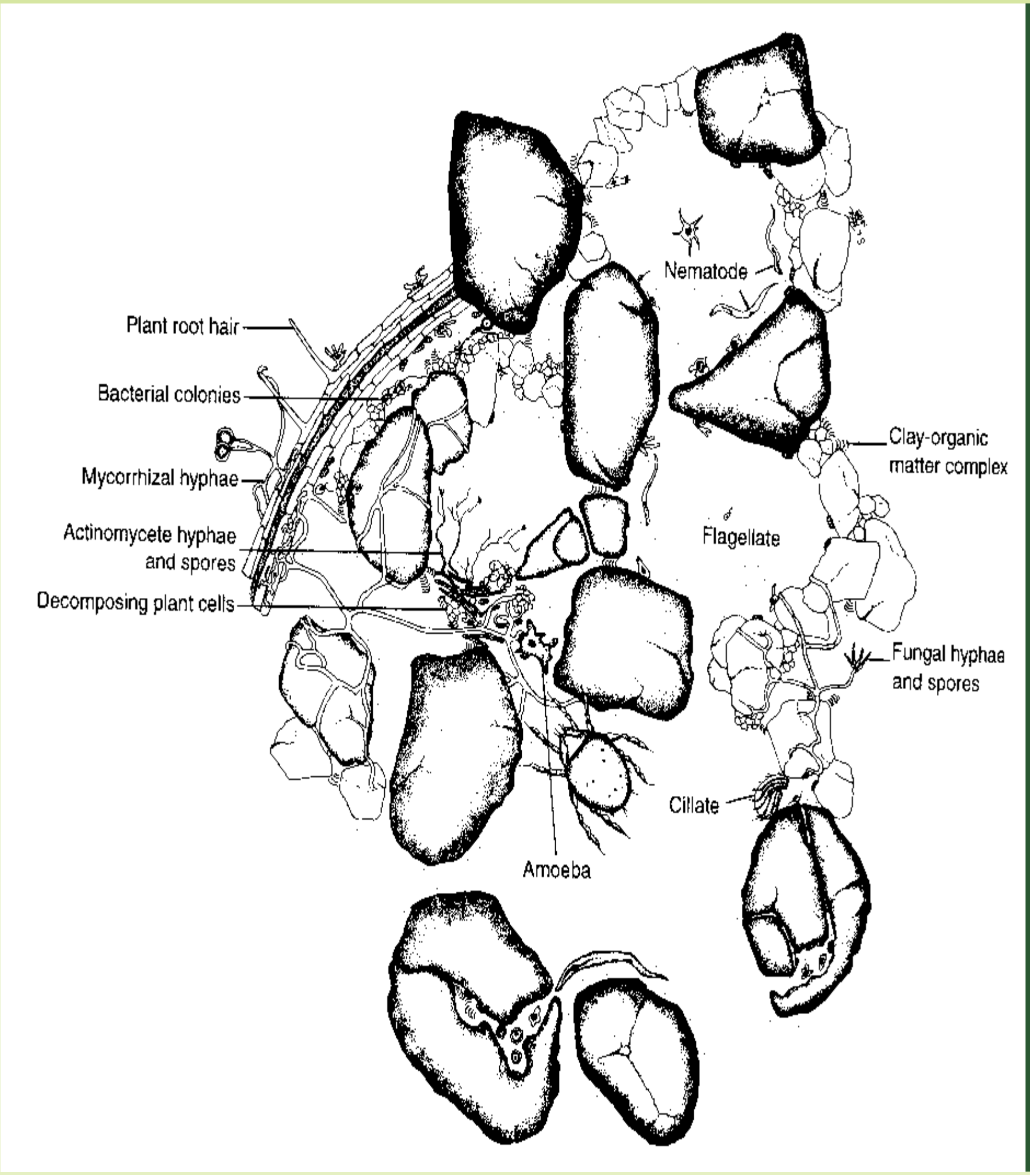
Components of Soil Organic Matter





Photos taken from the NRCS Soil Quality Institute website
Source: Soil Biology Primer

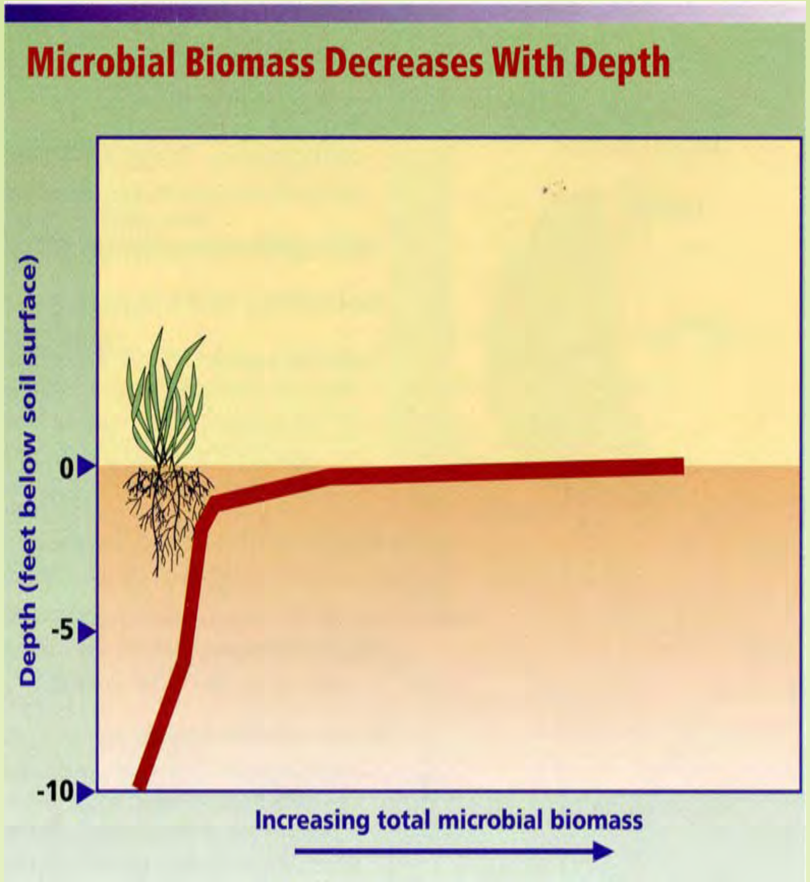
Rhizosphere



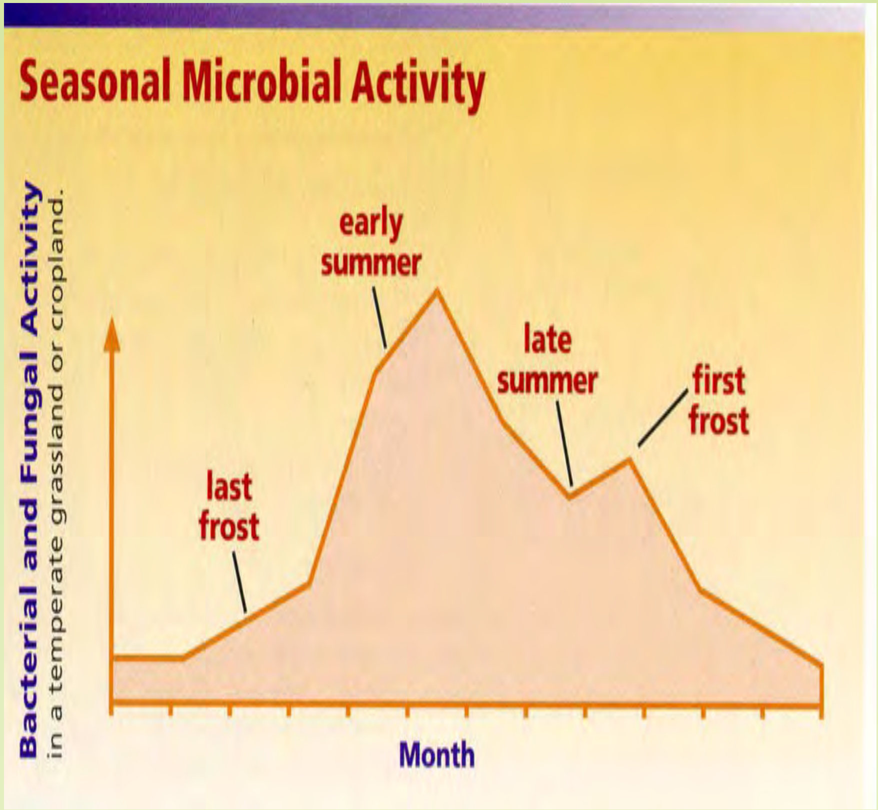
Typical Numbers of Soil Organisms in Healthy Ecosystems

	Ag Land	Prairie	Forest
	Organisms per gram (teaspoon) of soil		
Bacteria	**100 mil. -1 bil.**	**100 mil. -1 bil.**	**100 mil. -1 bil.**
Fungi	**Several yards**	**10s – 100's of yds**	**1-40 miles (in conifers)**
Protozoa	**1000's**	**1000's**	**100,000's**
Nematodes	**10-20**	**10's – 100's**	**100's**
	Organisms per square foot		
Arthropods	**< 100**	**500-2000**	**10,000-25,000**
Earthworms	**5-30**	**10-50**	**10-50 (0 in conifers)**

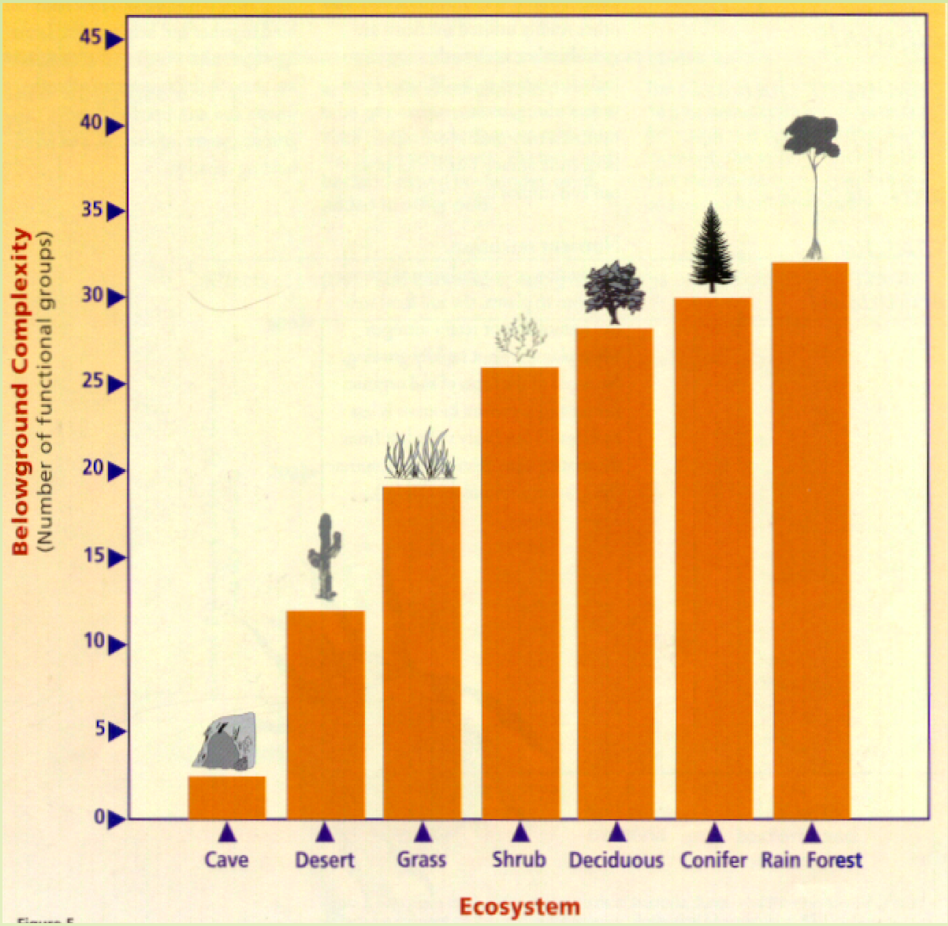
Microbial Biomass with Depth



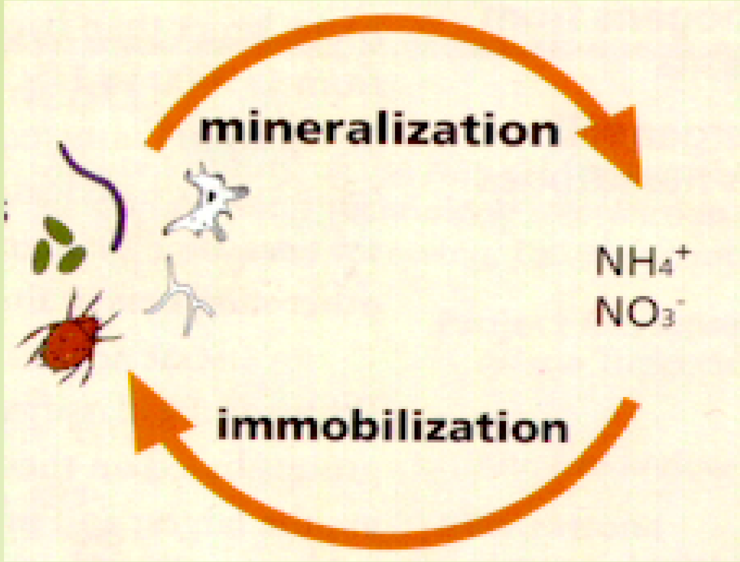
Seasonal Microbial Activity



Complexity of the Soil Food Web in Several Ecosystems

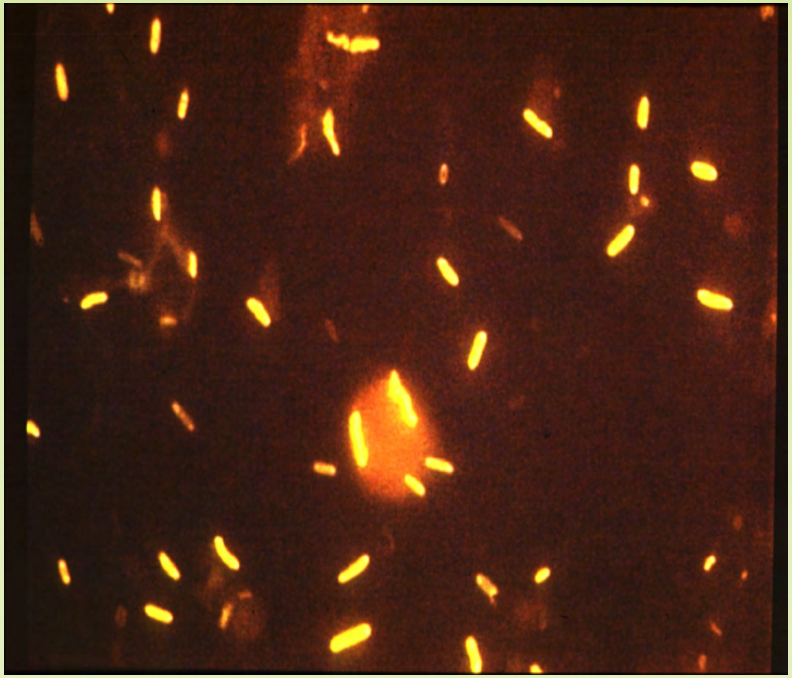


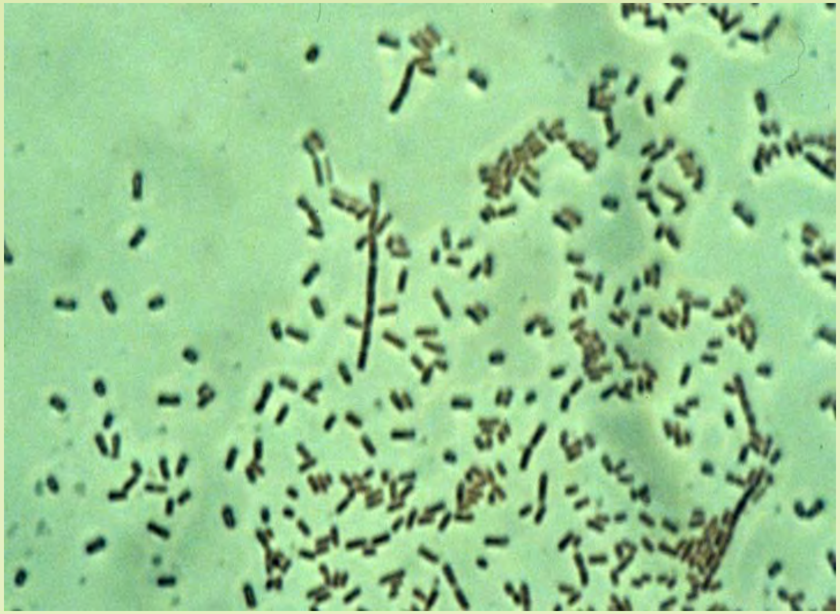
Mineralization and Immobilization



Organic nutrients are stored in soil organisms and organic matter.

Bacteria with fluorescent stain for counting

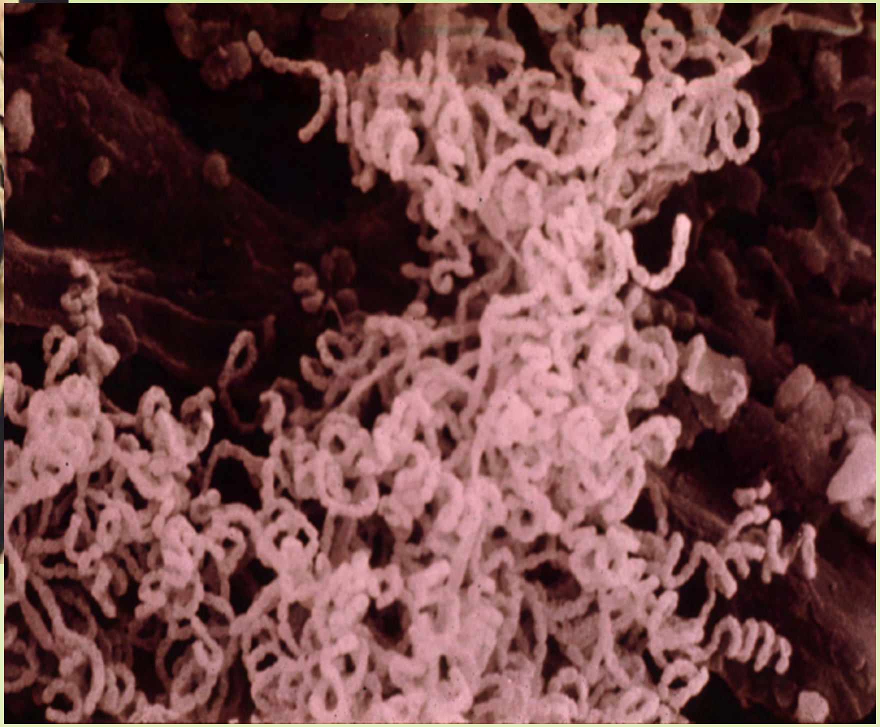




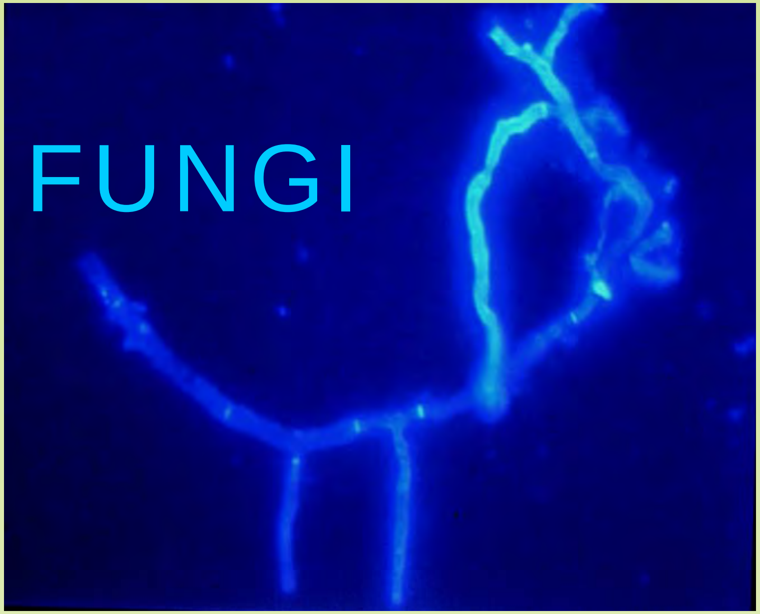
Nitrogen-fixing Bacteria

Nodules formed where *Rhizobium* bacteria infected soybean roots.

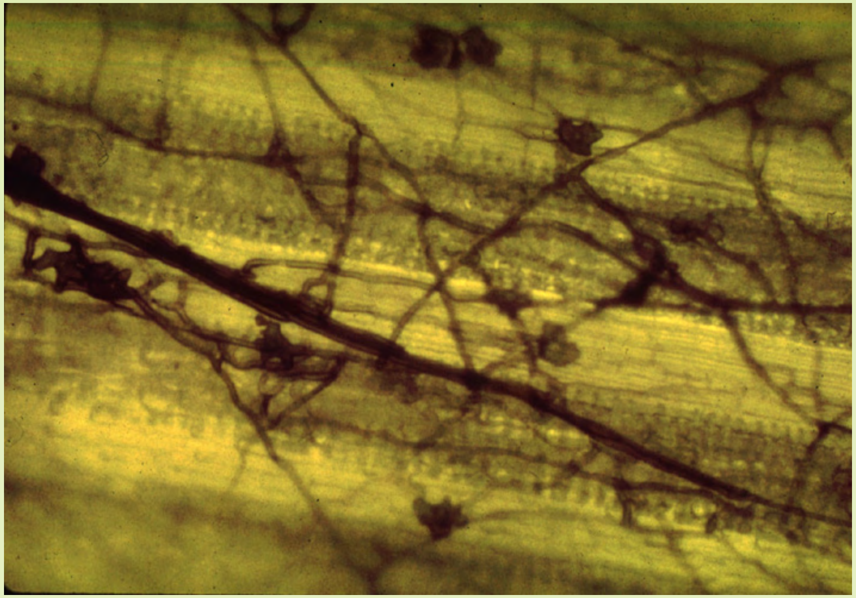
Actinomycetes (decomposers)



Bacterial cells that grow like fungal hyphae

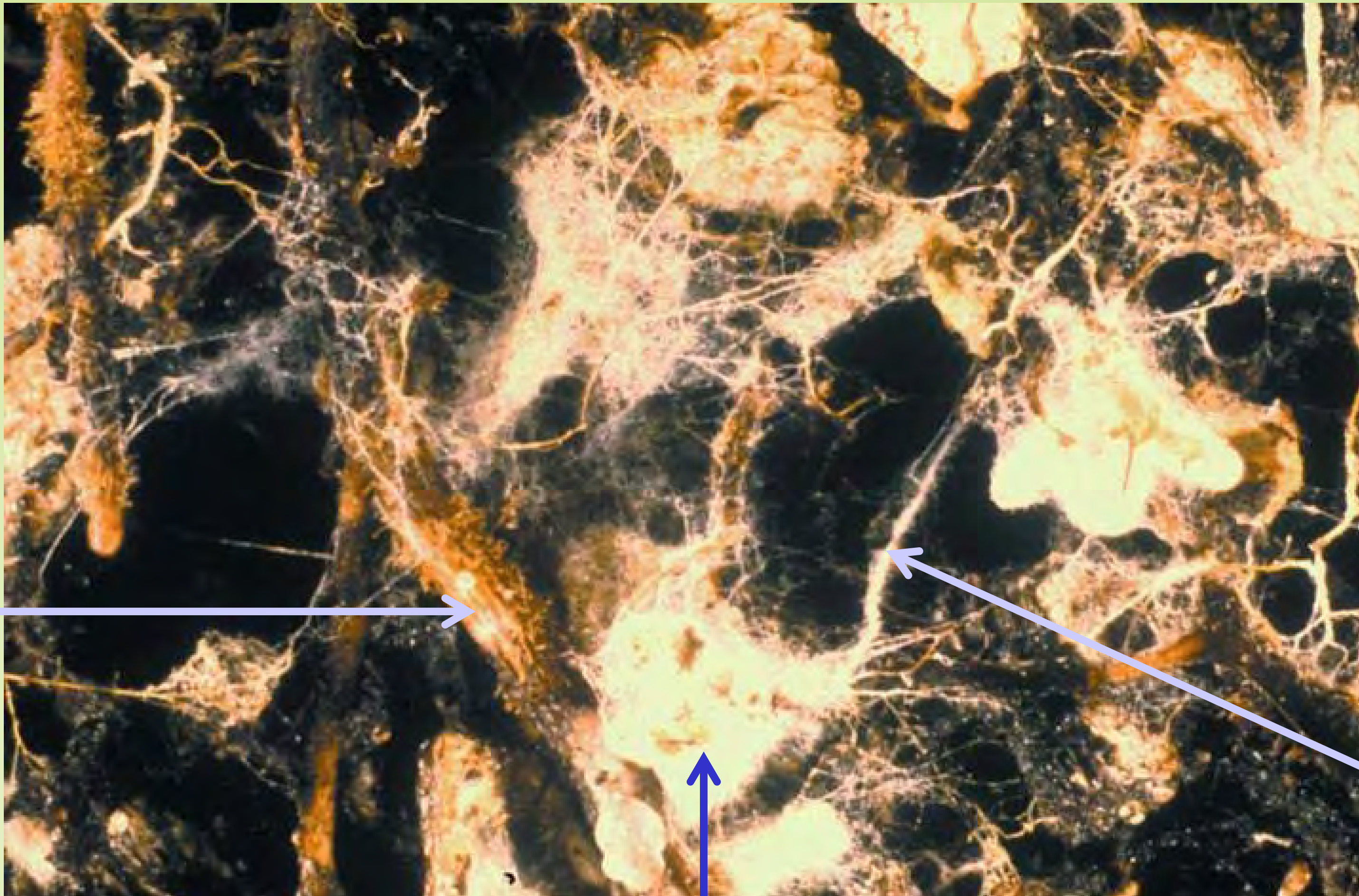


Mushrooms:The fruiting body of some fungi



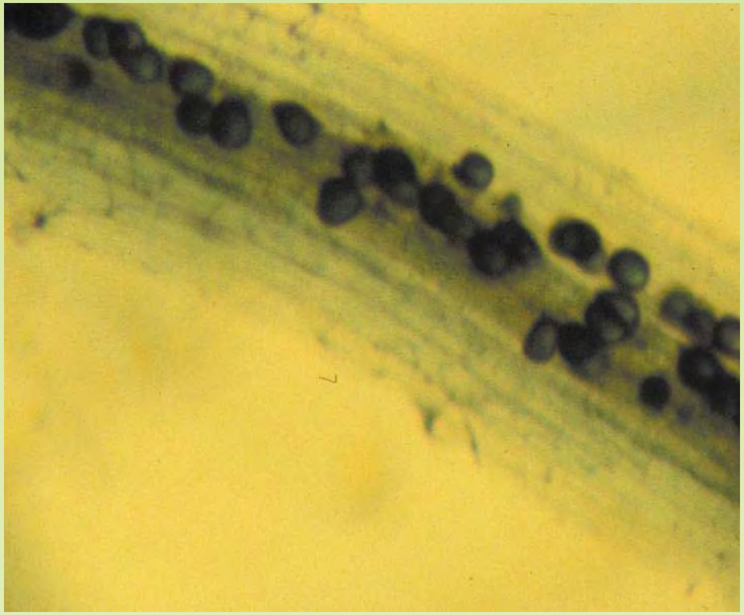
- Decompose carbon compounds
- Improve OM accumulation
- Retain nutrients in the soil
- Bind soil particles
- Food for the rest of the food web
- Mycorrhizal fungi

Mycorrhizae

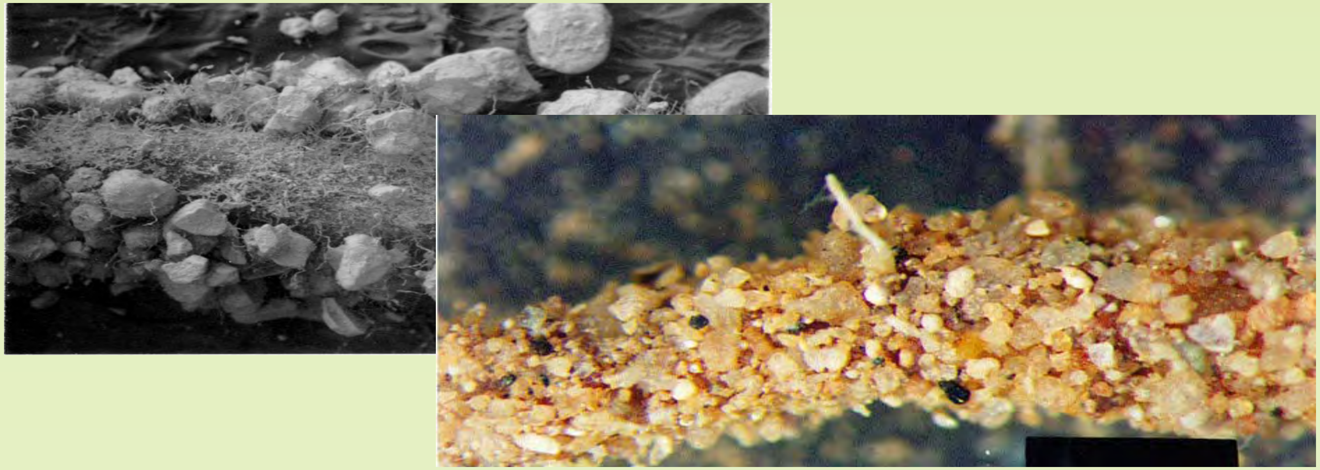


Ectomycorrhizae

Arbuscular Mycorrhizae (AM)



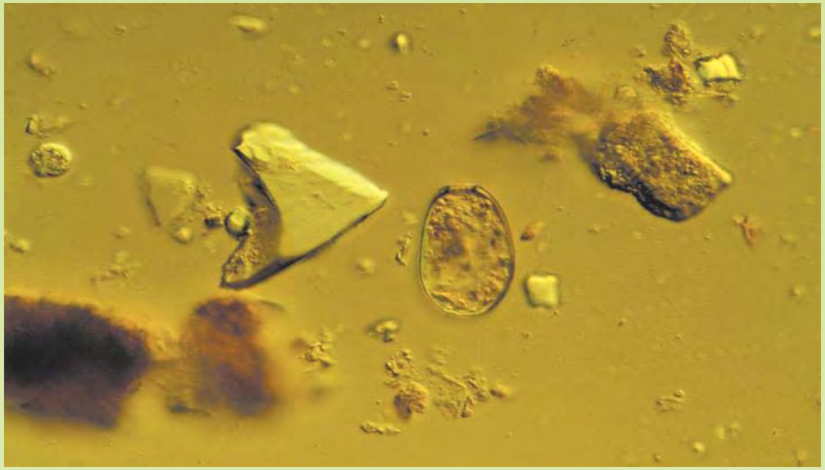
Mycorrhizal Fungi



Springtails (fungal feeders)

- Abundant in many soils.
- Feed on some disease-causing fungi.
- Jump by slamming their tail down.

PROTOZOA



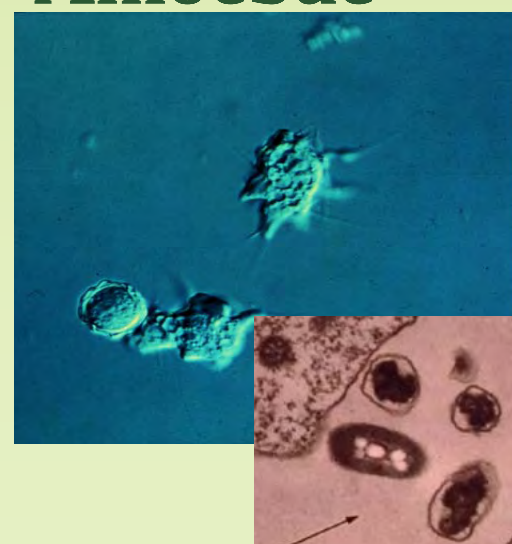
Ciliate

Flagellate

Soil-Dwelling “Vampires”

(amoebae that eat fungi)

Amoebae



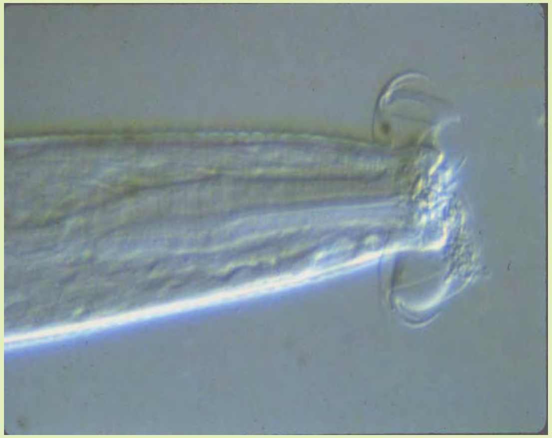
NEMATODES

Lesion-Feeding
Nematode

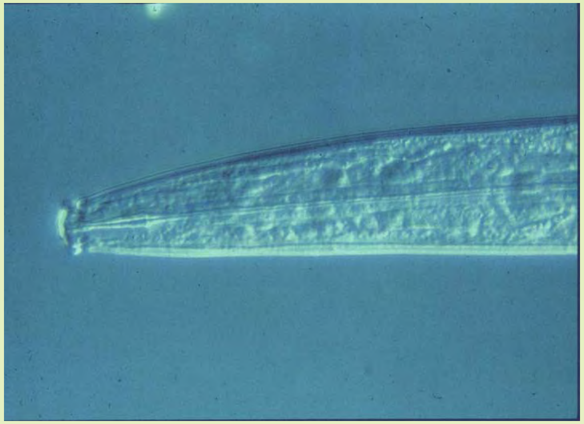
Root-Feeding
Nematode

Predatory
Nematode

Bacterial-Feeding
Nematode



Fungal-Feeding
Nematode

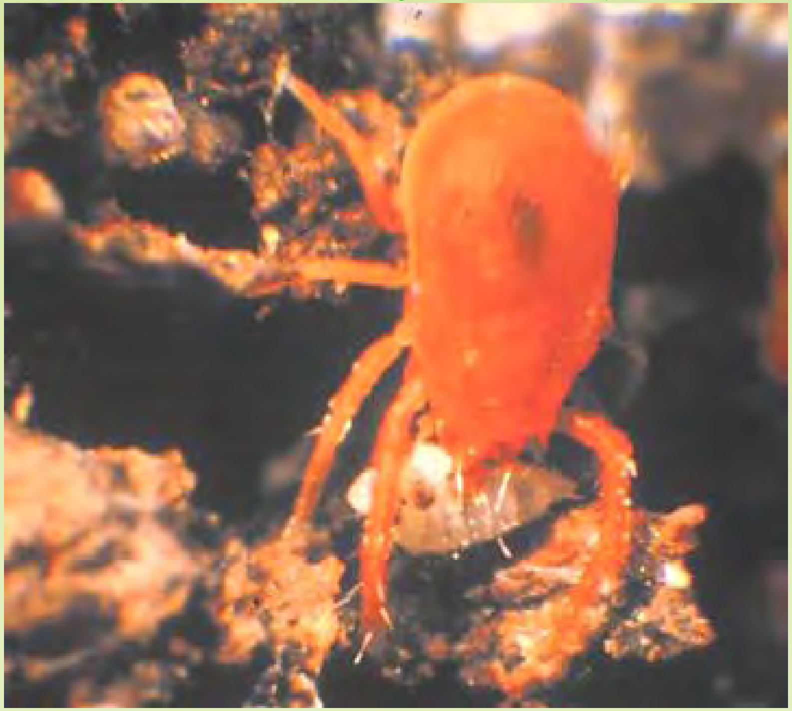


Herbivores

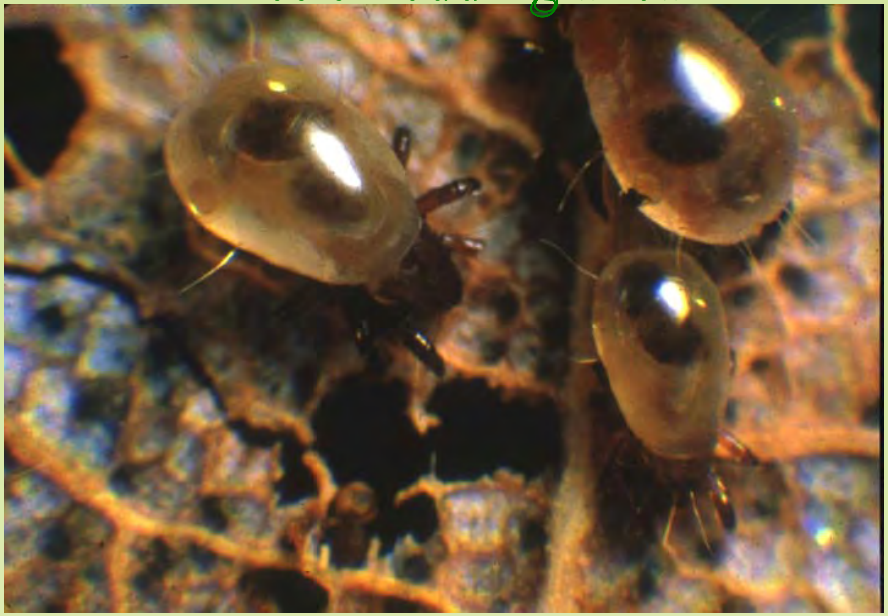
(Symphylan)

FOOD WEB & SOIL HEALTH

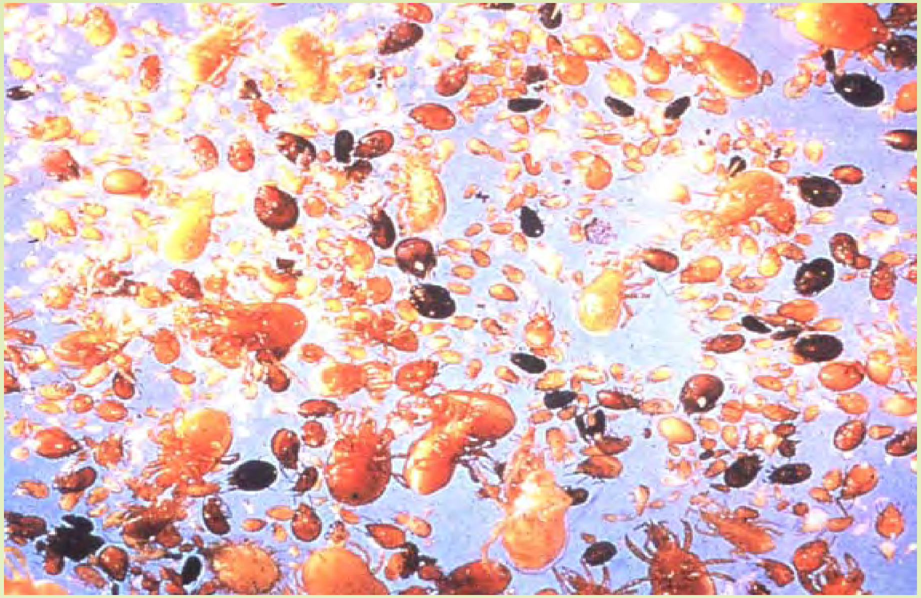
(Predatory Mite)



Mites shredding a leaf

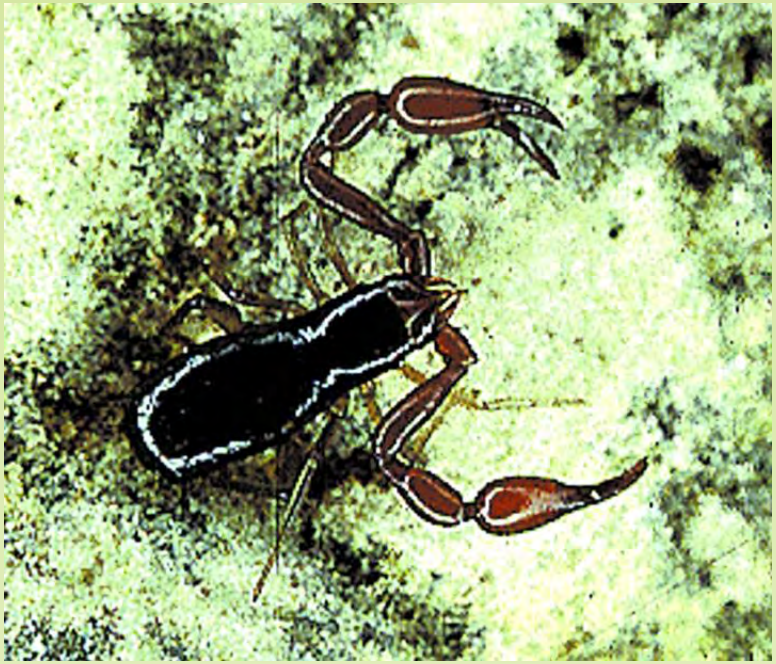


Mites and Biodiversity



Shredders:
millipedes

Predators: Pseudoscorpions



Rugose Harvester Ants

Wolf Spider

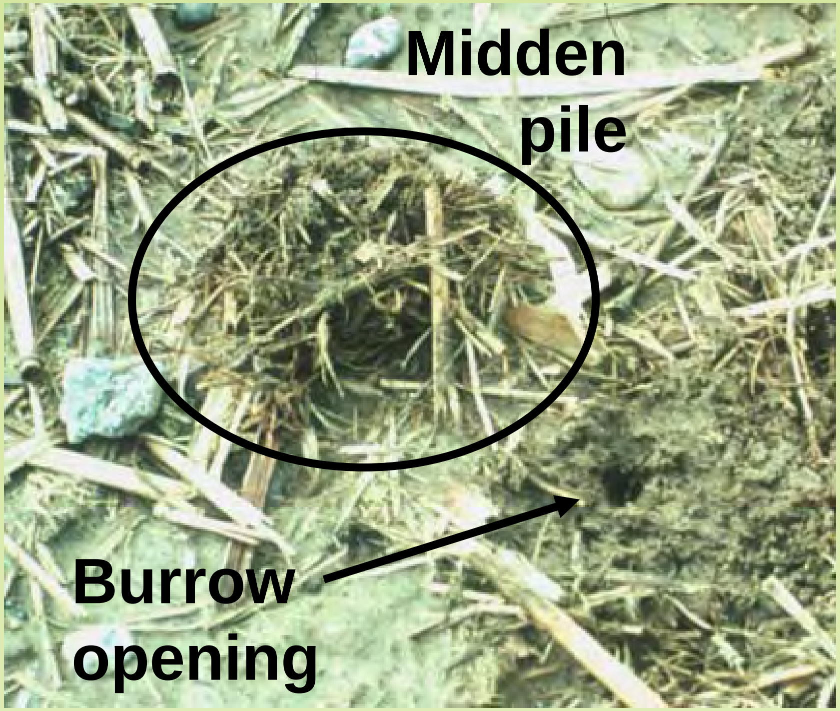
Centipedes

EARTHWORMS

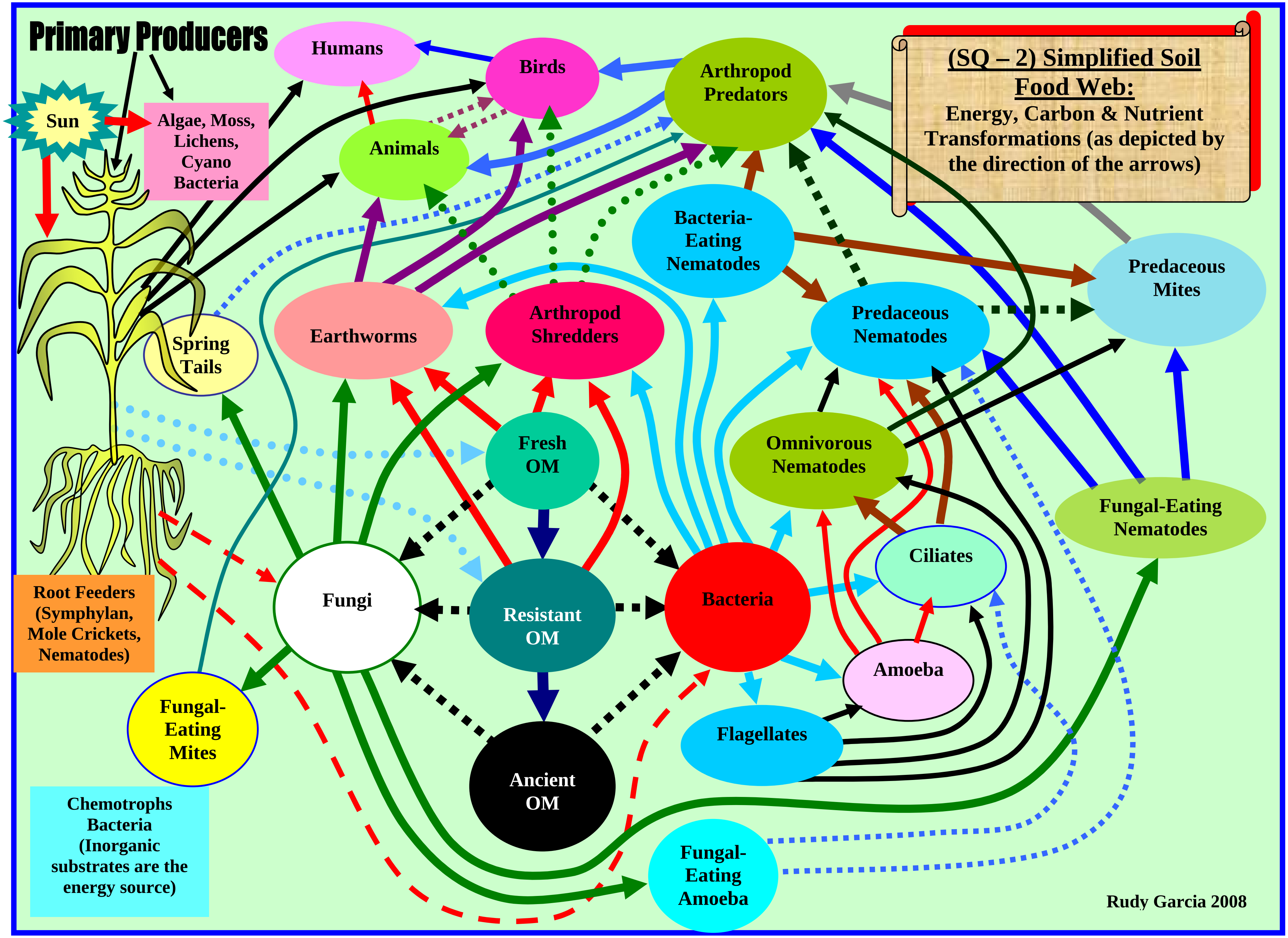
Earthworm burrow

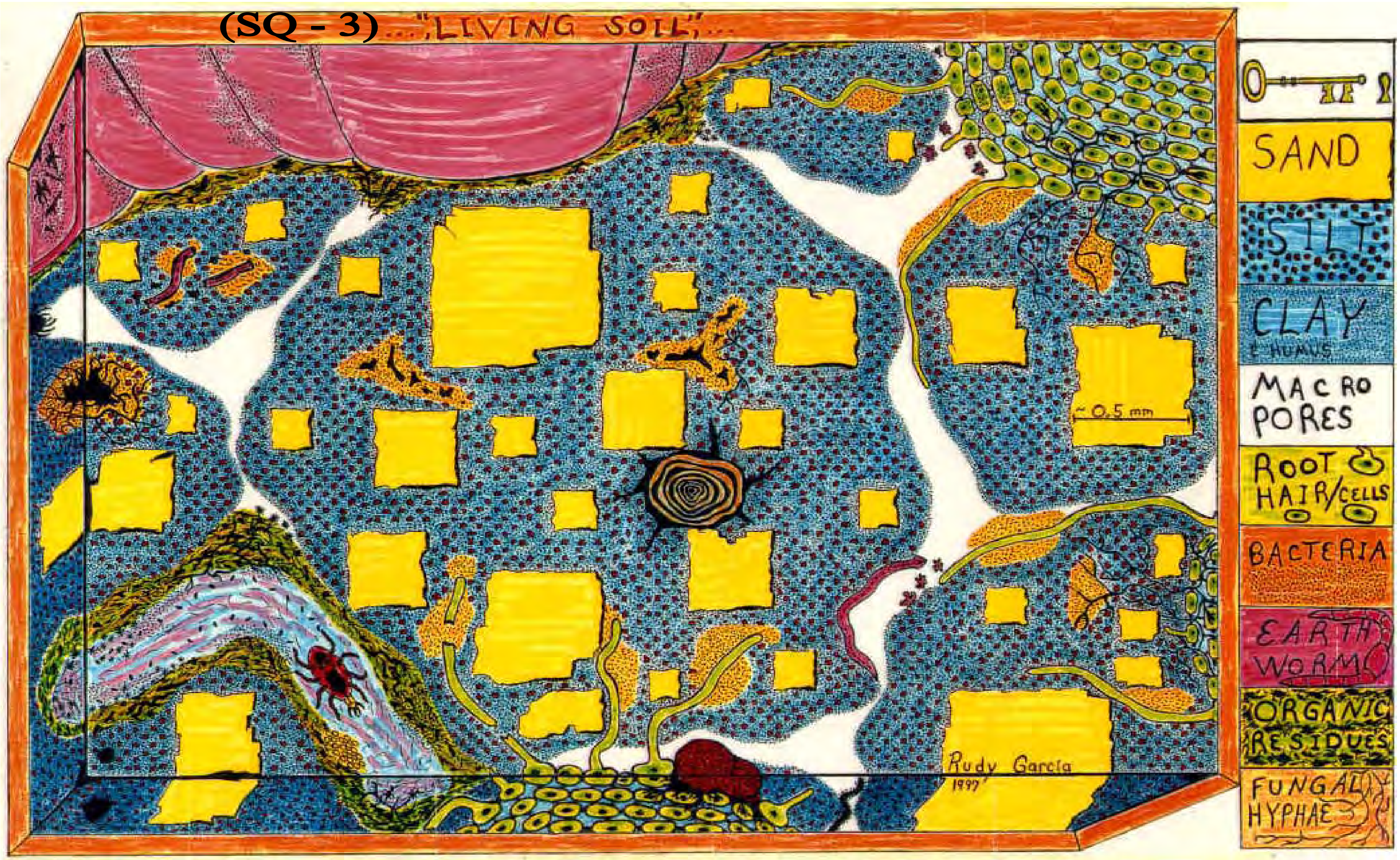
Vertical burrows

Earthworms bury litter



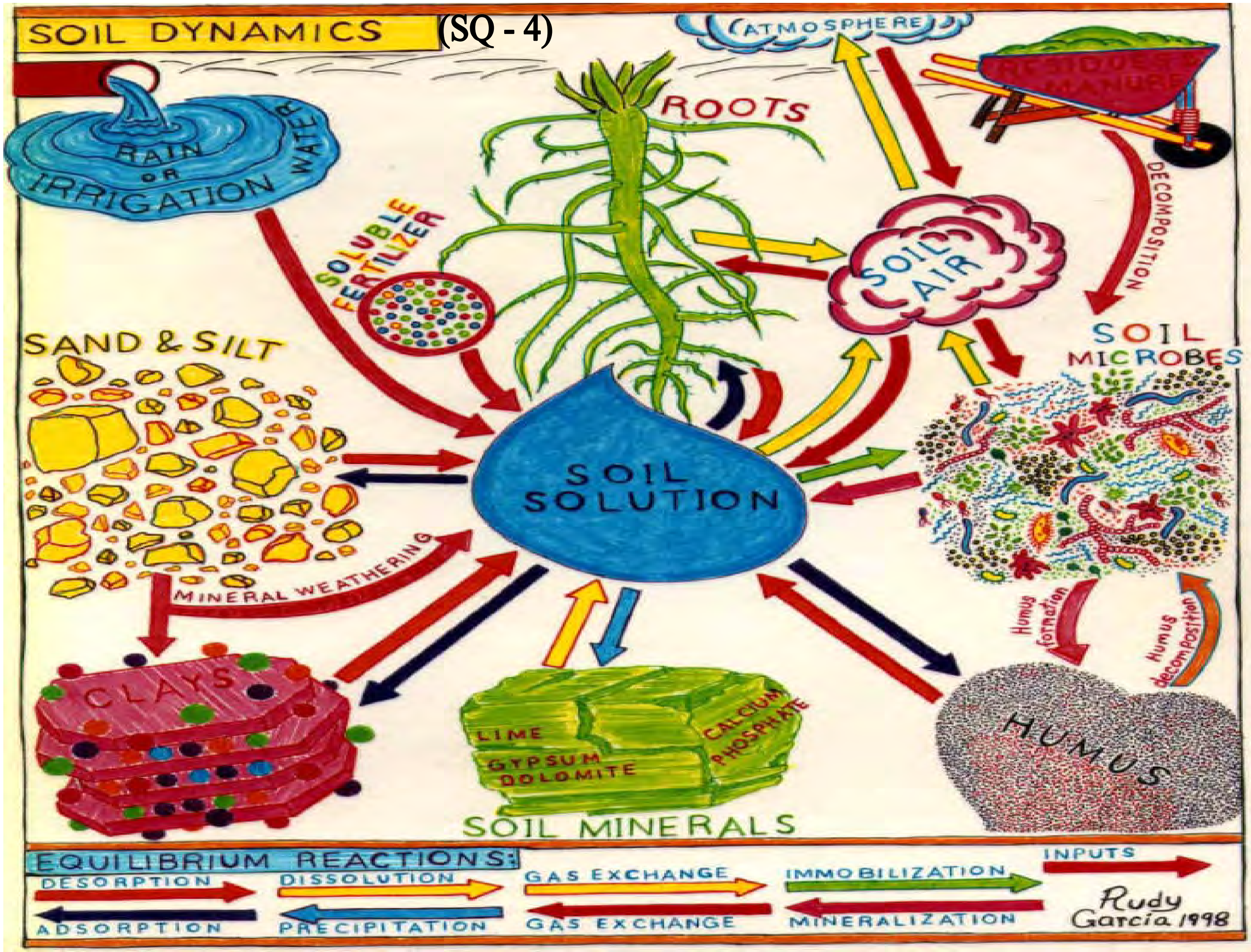
Earthworm casts

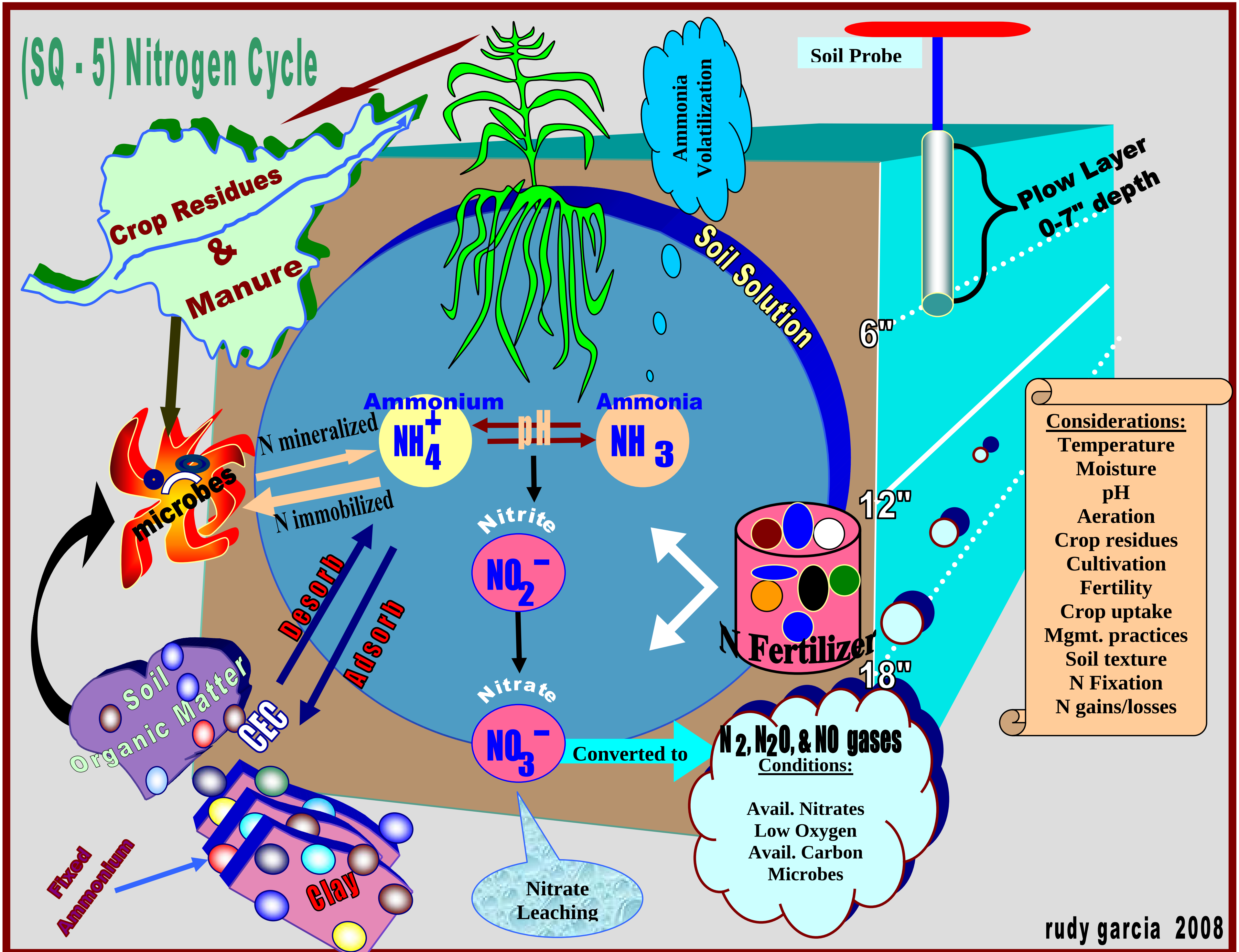

Primary Producers
Sun
Algae, Moss, Lichens, Cyano Bacteria
Humans
Birds
Animals
Arthropod Predators
(SQ – 2) Simplified Soil Food Web:
Energy, Carbon & Nutrient Transformations (as depicted by the direction of the arrows)
Spring Tails
Earthworms
Arthropod Shredders
Bacteria-Eating Nematodes
Predaceous Nematodes
Predaceous Mites
Fresh OM
Omnivorous Nematodes
Fungal-Eating Nematodes
Root Feeders (Symphylan, Mole Crickets, Nematodes)
Fungi
Resistant OM
Bacteria
Ciliates
Amoeba
Fungal-Eating Mites
Flagellates
Ancient OM
Chemotrophs Bacteria (Inorganic substrates are the energy source)
Fungal-Eating Amoeba
Rudy Garcia 2008



(SQ - 3) ..."LIVING SOIL"...
~0.5 mm
Rudy Garcia
1997
SAND
SILT
CLAY
& HUMUS
MACRO PORES
ROOT HAIR/CELLS
BACTERIA
EARTH WORM
ORGANIC RESIDUES
FUNGAL HYPHAE

(SQ - 4)


SOIL DYNAMICS
ATMOSPHERE
RESIDUES & MANURE
ROOTS
RAIN OR IRRIGATION WATER
SOLUBLE FERTILIZER
SOIL AIR
DECOMPOSITION
SOIL MICROBES
SAND & SILT
SOIL SOLUTION
MINERAL WEATHERING
Humus formation
Humus decomposition
CLAYS
LIME
GYPSUM
DOLOMITE
CALCIUM PHOSPHATE
SOIL MINERALS
HUMUS
EQUILIBRIUM REACTIONS:
DESORPTION
ADSORPTION
DISSOLUTION
PRECIPITATION
GAS EXCHANGE
GAS EXCHANGE
IMMOBILIZATION
MINERALIZATION
INPUTS
Rudy Garcia 1998

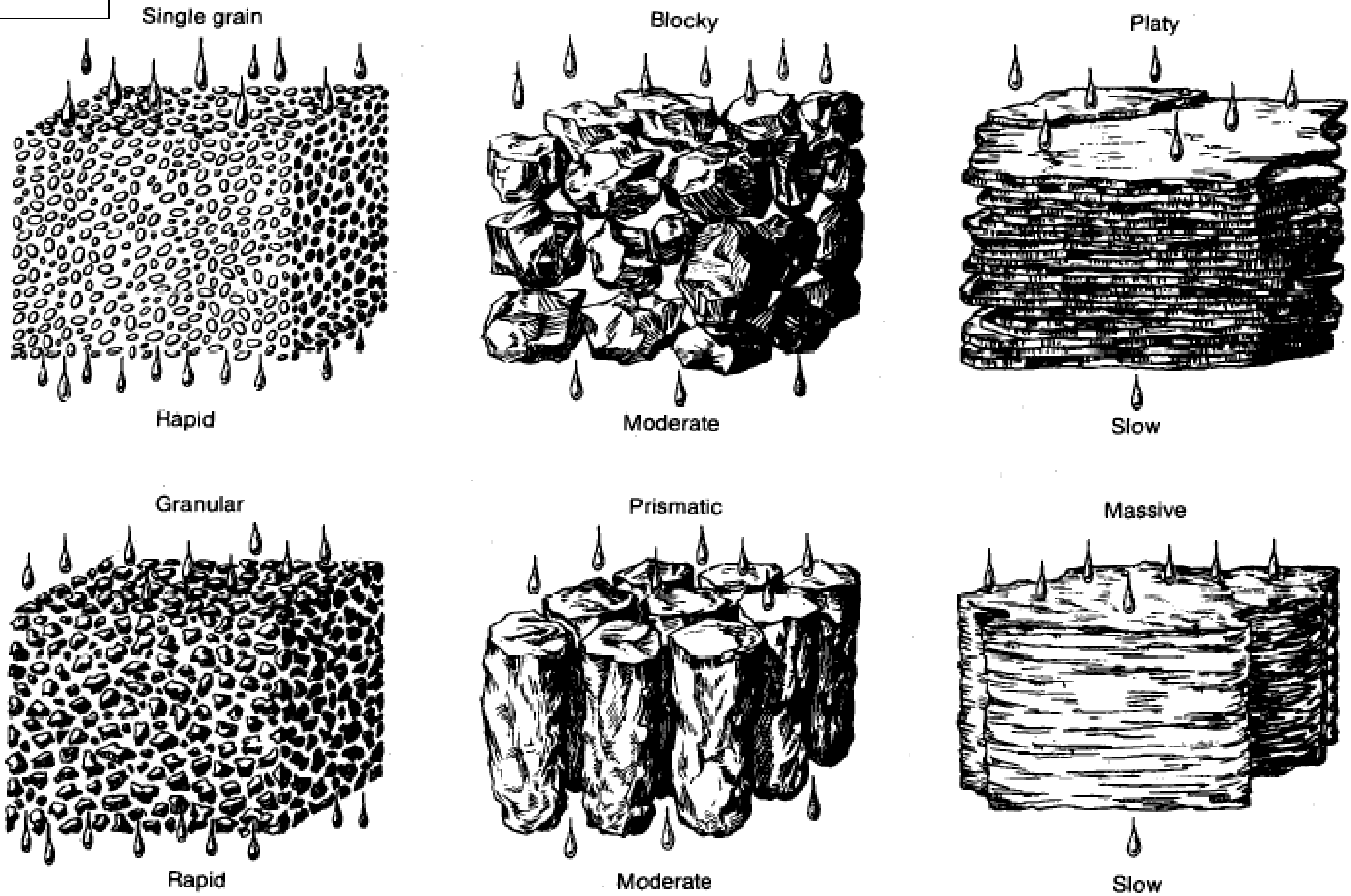


(SQ - 5) Nitrogen Cycle
Crop Residues & Manure
Ammonia Volatilization
Soil Probe
Plow Layer 0-7" depth
Soil Solution
6"
12"
18"
Ammonium
NH_4^+
pH
Ammonia
NH_3
N mineralized
N immobilized
microbes
Nitrite
NO_2^-
Nitrate
NO_3^-
Desorb
Adsorb
CEC
Soil Organic Matter
Clay
Fixed Ammonium
N Fertilizer
Converted to
N_2, N_2O, & NO gases
Conditions:
Avail. Nitrates
Low Oxygen
Avail. Carbon
Microbes
Nitrate Leaching
Considerations:
Temperature
Moisture
pH
Aeration
Crop residues
Cultivation
Fertility
Crop uptake
Mgmt. practices
Soil texture
N Fixation
N gains/losses
rudy garcia 2008

Figure 1-3.

Types of Soil Structure and Their Effect on Downward Movement of Water

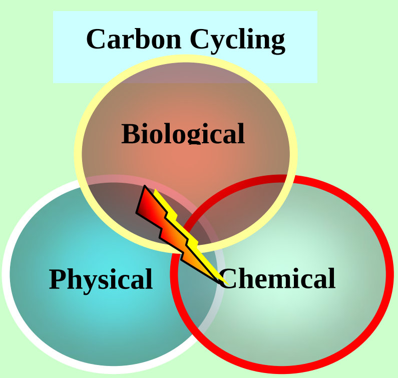
(SQ – 6)



(SQ – 7) Soil Quality Considerations*: i.e., is it Aggrading, Sustaining or Degrading

Assessing **Soil Quality** & **Soil Health** is a function of many complex interactions, inputs and management factors such as :

- Climate
- Crops & Yield (i.e., biomass produced)
- Soil type
- Water Quality/Supply
- Irrigation Water Management
- Tillage Operations
- Fertilizer & Pest Management
- Crop Rotations
- Residue Management
- Soil Amendments: Manure, mulch, effluent, gypsum, etc.
- Cover crops



Soil pH

	pH
V. Strongly Alkaline	9.0
	8.5
Slightly Alkaline	8.0
	7.5
Neutral	7.0
Mod. Acid	6.5
	6.0
Very Strongly Acid	5.5
	5.0
	4.5
Ultra Acid	4.0
	3.5

Salinity Class (dS/m) $EC_{1:1}$ and Microbial Response

Salinity Class (dS/m) $EC_{1:1}$	Microbial Response
Strongly Saline > 6.07	Few halophilic organisms are active
Moderately Saline 3.16 – 6.07	Salt tolerant microbes predominate
Slightly Saline 1.71 – 3.16	Major microbial processes influenced
V. Slightly Saline 0.98- 1.71	Selected microbial processes affected
Non Saline 0 – 0.98	Few Organisms affected

Soil Respiration At optimum temp. & moisture

Soil Respiration	Lbs. CO_2-C/ac/day
Unusually High Soil Activity	> 64
Ideal Soil Activity	32 – 64
Med. Soil Activity	16 – 32
Mod. Low Soil Activity	9.5 – 16
Very Low Soil Activity	< 9.5
No Soil Activity	0

Aggregate Stability (> 0.25 mm)

% Organic Matter	% Water Stable Aggregates	% Clay	% Water Stable Aggregates
12	85	80	86
8	81	60	82
4	77	40	78
2	75	30	74
1.2	70	20	70
0.8	66	10	65
0.4	53	5	60

RUSLE2

Soil Tillage Intensity Rating

STIR is based on Field Operations (tillage) & its soil disturbing actions (Invert, Mix, Lift, Shatter, Aerate & Compaction).

Lower STIR values = reduced soil erosion

Soil Conditioning Index (SCI)

SCI = (OM x 0.4) + (FO x 0.4) + (ER x 0.2)

If the rating is (+), the system is predicted to have increasing soil OM

If the rating is (-), the system is predicted to have declining soil OM

IMPORTANT!!! Use the Farm Record Form (Case Study) guide to assist in evaluating Soil Quality Trends: i.e., is Soil Quality Aggrading, Sustaining or Declining with current cropping system

OM = Organic Matter
FO = Field Operations
ER = Soil Erosion

(*References: NRCS Soil Quality Test Kit Guide & Soil Quality Guide: Assessment & Applications for Field Staff) rudy garcia 2008

SQ – 8a. Benefits of Conservation Tillage

Environmental:

- **Reduces soil erosion from both water and wind (90% erosion reduction can be expected when using a no-till instead of intensive tillage system).**
- **Increases organic matter (each tillage trip oxidizes some organic matter; research shows continuous no-till can increase organic matter in the top 2 inches of soil about 0.1% each year).**
- **Improves water quality (when combined with irrigation water management, crop nutrient management, integrated pest management, conservation crop rotation, in integrated system, conservation tillage plays an important role in improving both runoff to streams, rivers, and lakes as well as water that finds its way into aquifers).**
- **Improves wildlife habitat (the crop's residue provides food and shelter. In addition, if combined with other needed habitat, such as grassy cover and woody areas, wildlife may increase significantly).**
- **Other benefits include reduced soil compaction, utilization of marginal land, some harvesting advantages, and conservation compliance.**

Economic:

- **Yields are good, if not better, than reduced or intensive tillage system when managed properly.**
- **Optimizes soil moisture (improved infiltration and increased organic matter are especially important on droughty soils and may help the crop through a persistent dry period. Tillage reduces available moisture by about ½" per trip).**
- **Saves time (On a 1000 acre farm, an additional 100 hours are needed for every pass (example based on 18' disk, 160 hp FWD). Many growers take advantage of the time savings by exploring other "opportunities").**
- **Reduces fuel consumption (no-till can reduce fuel use by 3.5 gallons/acre compared to intensive tillage).**
- **Reduces overall production costs (NMSU reports that irrigated wheat yields in Clovis are comparable between conventional and conservation tillage, but production costs for conservation tillage are lower by as much as $50 per acre).**
- **Reduces machinery wear (less machinery means fewer pieces need to be replaced. Economists report this amounts to a $5/acre reduction in costs).**

Conservation Tillage and Crop Residue Management

Integrated IWM Field Handbook
SQ-8b

What is Residue Management/Conservation Tillage

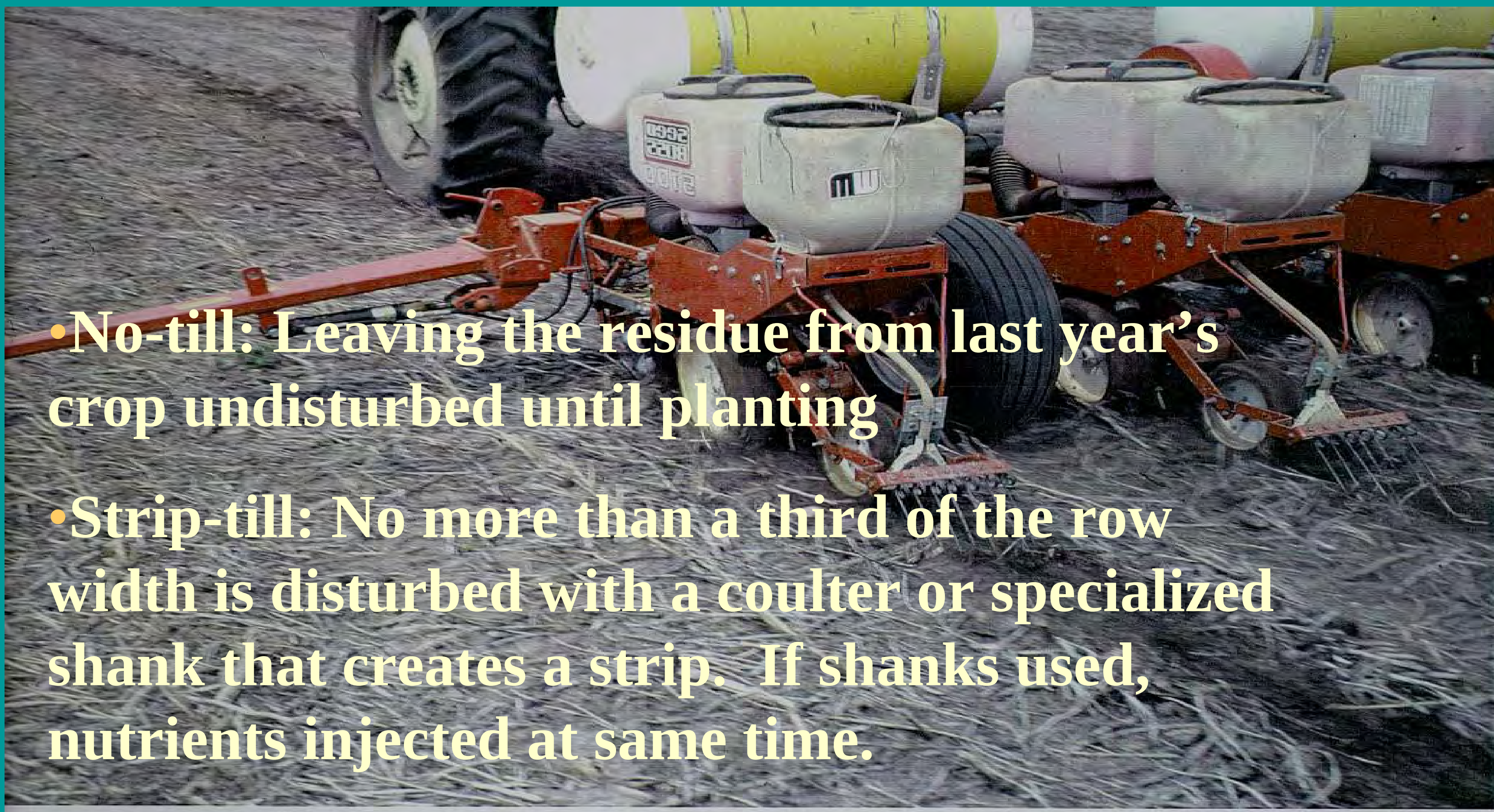
- **Any tillage or planting system that maintains at least 30% crop residue cover on soil surface (leaves about a third of soil covered after planting).**

Residue Management, Mulch-Till

This full-width tillage system usually only includes one or two tillage passes.

Yet after planting, at least a third of the surface remains covered with residue.

Residue Management, No-Till & Strip-Till



- **No-till: Leaving the residue from last year's crop undisturbed until planting**
- **Strip-till: No more than a third of the row width is disturbed with a coulter or specialized shank that creates a strip. If shanks used, nutrients injected at same time.**

Why Use a Conservation Tillage System? Environment:

1. Reduce sheet and rill erosion.
2. Reduce wind erosion.

Residue Cover, % on Any Day	Erosion Reduction, % While Residue is Present
10	30
20	50
30	65
40	75
50	83
60	88
70	91
80	94

Why Use a Conservation Tillage System? Environment:

3. Maintain or improve soil organic matter content and tilth.

- Each tillage trip oxidizes some organic matter
- Continuous no-till can increase organic matter in top 2 inches of soil about 0.1% each year.

Why Use a Conservation Tillage System? Environment:

4. Conserve soil moisture. (Improved infiltration and increased organic matter; tillage reduces available moisture by about 1/2” per trip)

Residue reduces evaporation:

Surface Cover %	Relative Potential Evaporation
0	1.00
10	0.90
20	0.78
30	0.70
40	0.67
80	0.58

Why Use a Conservation Tillage System? Environment:

5. Manage snow to increase plant available moisture.
6. Improves water quality
7. Provide food and escape cover for wildlife.

Why Use a Conservation Tillage System? Economic:

1. **Yields - are as good, if not better**
2. **Saves time and labor**

On a 1000-acre farm, an additional 100 hours needed for every pass (example based on 18' disk, 160 Hp FWD)

Why Use a Conservation Tillage System? Economic:

3. **Reduces fuel consumption**

   No-till can reduce fuel use by 3.5 gal/ac

4. **Reduces machinery wear**

   Less machinery means fewer pieces need to be replaced. Up to a $14/acre cost reduction

Differences in residue cover between Conservation Tillage practices

- No-till leaves the most surface residue
  - With high residue crops, e.g. corn, wheat , sorghum, 75 % +
  - With low residue crops, e.g. soybeans, cotton, residue cover is   significantly less
    - a cover crop may be needed to meet residue goals
    - In some climates, some residue cover may carry over from year to year
  - Winter annuals also add to surface residue

Differences in residue cover between practices, continued:

- Mulch-till residue levels can be significantly less than no-till
- With high residue crops, 30-50 % possible
- With low residue crops, difficult to retain 30 percent
- May need cover crop to achieve residue goals

Management of Residue

- Surface residue must be evenly distributed
- Residue decomposes with time
- If target is 40 percent cover after planting, will need more over winter
- May need to control winter weeds in dryland areas to help conserve soil moisture in spring

Management of Crop Residue, continued:

- Crop residue and moisture level impacts soil temperature - less variation
- Under no-till, soil temperatures will be cooler
  - May be critical in cool, wet springs
  - May be justification for strip-till
- Less extremes in soil temperature under no-till may result in increased root growth and improved soil biological activity

Residue Management - Irrigation

Surface residue

- slows flow - especially with furrow
- increases opportunity time, water holding capacity, random roughness (structure)
- decreases surface evaporation
- cools seedbed temperature

Residue Management - Irrigation

- More difficult - small seeded vegetables
- More requirements for incorporation of pesticides
- Management techniques may need modification
  - especially with furrow irrigation.

Potential Problems from Residue

- Residue may float off of field
- Accumulate in fence rows and road ditches
- If not evenly distributed can cause planting/weed problems
- May have cool, wet soils at planting

Low Residue Crops (i.e., Vegetables)

- Residue orientation and row orientation become more important
- Leave as much residue standing as possible
- Orient rows perpendicular to prevailing wind direction

Benefits of Increasing Organic Matter

- Soil aggregate stability increases
- Plant available water increases
- Cation exchange capacity of soil increases

Crop Residue and Microorganisms

- Provides an energy source for microorganisms
- As surface residue increases, microorganisms increase
- Through their life processes, they return humus to the soil
- When residue is plowed under, residue is rapidly consumed and microorganism processes end

Crop Residue and Microorganisms, continued:

- Microorganisms utilize surface residue slowly, remain active for longer periods, and significantly improve soil humus
- When soils are tilled, it is similar to stirring a fire.
- Argentina cropping systems – “aggression” (years of tillage) vs. “recuperation” (years of no-till)
- $C0_2$ is one of the greenhouse gases

Microorganisms can tie-up Nitrogen, continued:

- Microorganisms utilize N during decomposition process
- N is temporally tied-up, but released during growing season
- Under no-till systems, N release is more evenly distributed during growing season compared to conventional systems.
- No-till systems do not have typical flush of N released as in conventional systems

Soil Properties - Soil Structure

- Surface soil becomes more granular and friable with continuous residue management systems

- Extent of change is dependent on the residue management practice used, climate, and soil

Soil Properties - Soil Structure, continued:

- Changes apparent in about 3-5 years with no-till/strip-till and ridge-till
- Type of soil and climate strongly influence the rate of this change

Expected Changes in Soil Structure with Residue Mgt. Systems

- Improved soil aggregate stability
- Improved water holding capacity
- Increased granular structure at the surface
- Less surface ponding of rainfall

Soil Properties - Infiltration

- Major benefit from Residue Mgt.
- No-till/Strip-till and Ridge-Till
  - improved soil structure
  - slowed runoff
  - leaves old root and macropore structure undisturbed
  - fastest way to improve soil quality

Soil Properties - Infiltration, continued:

- Mulch-Till
  - full width tillage disturbs macropores
  - slows runoff due to increased surface roughness
  - chisel can break-up shallow compaction layers

Role of Macropores

- Develop from decayed root channels and earthworms
- If open to the surface infiltration may be significantly increased
- May be direct conduit for contaminants
- Full-width tillage disturbs macropores to depth of tillage

Soil Properties - Compaction

- Compaction created by tillage and vehicle traffic can be corrected

- Other compacted layers occur naturally and may or may not be correctable

Soil Properties - Crusting

- Serious concern in soils low in organic matter, like NM
- More prevalent on soils excessively tilled
- Can interfere with crop emergence
- May require operation to break crust

Soil Properties - Crusting, continued:

- Residue mgt. Practices can reduce crusting - especially no-till
  - Surface residue absorbs impact of falling raindrops
  - Organic matter is increased
  - Improved aggregate stability

Water Quality - Sediment

- Sediment is number 1 pollutant
- Creates physical problems
- Potential hazard to fish and wildlife

Water Quality - Sediment, continued:

- Residue mgt. practices can result in a major benefit through:
  - reduced soil erosion, improved aggregate stability, and increased organic matter
- Greater amount of surface residue, the greater the reduction in soil erosion
- As erosion is reduced, sediment delivery is generally reduced

Water Quality - Nutrients

- Phosphorus attached to soil is slow to move in the soil profile
- But soil attached phosphorus can move with surface runoff
- Residue mgt. practices reduce soil erosion, improve infiltration, and reduce runoff

Water Quality - Nutrients, continued:

- Nutrients that are dissolved but not infiltrated the soil can move freely in surface runoff

- Nitrate-nitrogen can move freely as water percolates through the soil

Water Quality - Nutrients, continued:

- Residue mgt. practices often increase water infiltration - care must be taken when applying nitrogen
- If nitrogen is fall applied, consider nitrification inhibitor
- Apply nitrogen as close as possible when crop needs are greatest

Water Quality - Nutrients, continued:

- Use caution when manure is surface applied
- Avoid applying on frozen ground
- Injecting manure reduces risk of surface runoff, but there are tradeoffs
- With mulch-till, manure may be incorporated using one of the planned tillage trips

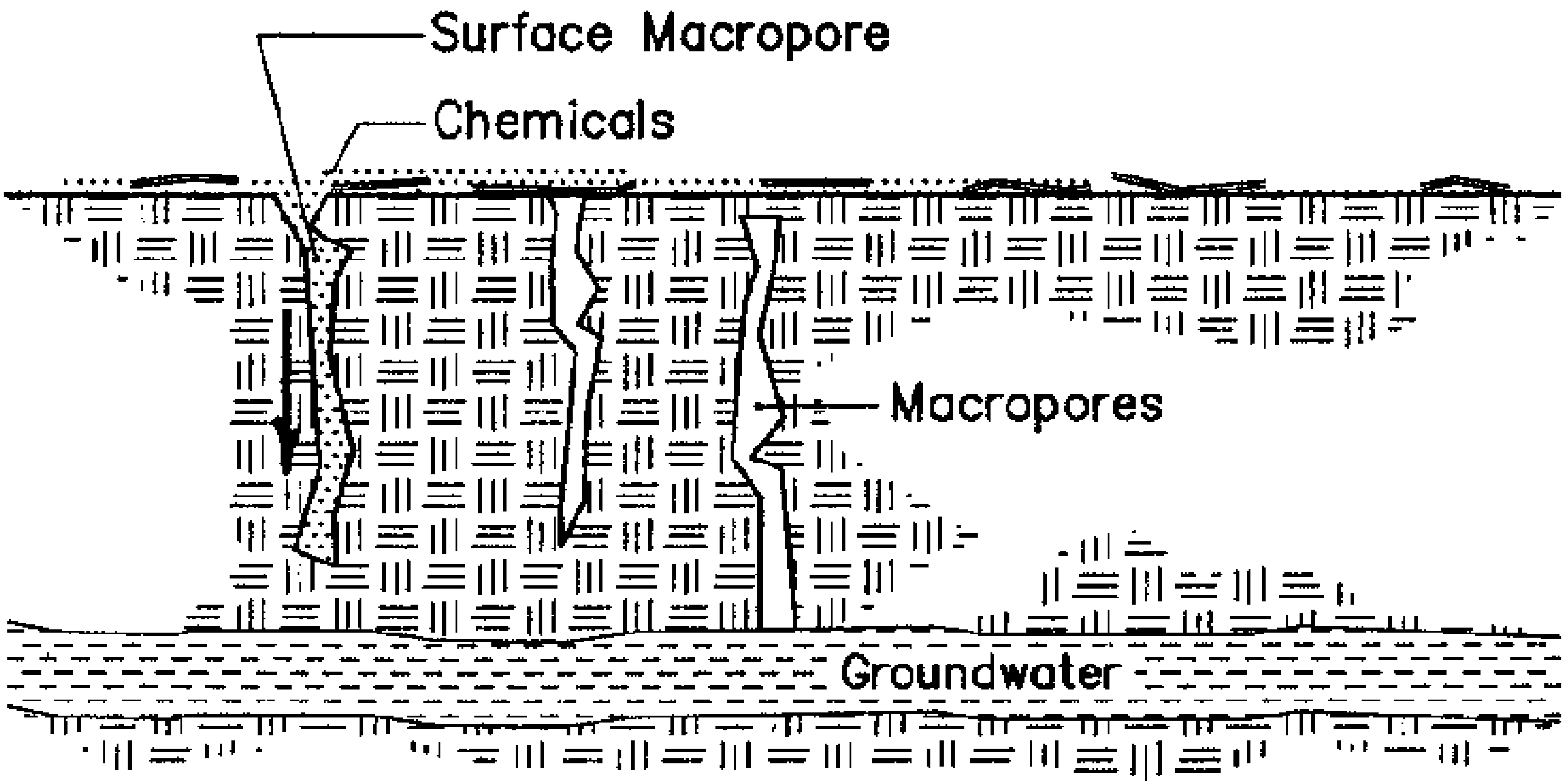
Water Quality - Pesticides

- Pesticides can be soluble or attach quickly to soil particles
- If soluble, can move with surface runoff
- If attached to soil particles, can move offsite via erosion

Water Quality - Pesticides, continued:

- Residue mgt. practices reduce erosion, surface runoff, and sediment delivery
- Increase infiltration which may be detrimental where shallow groundwater exists
- Extensive macropores, open to the surface raise some concern

Water Quality - Pesticides, Macropores and Solute Movement



Water Quality - Pesticides, Macropores, continued:

- Earthworm channels contain large amounts of O.M.
- This O.M. material can help absorb pesticides
- Earthworm channels have increased microorganism activity

Water Quality - Pesticides, Macropores, continued:

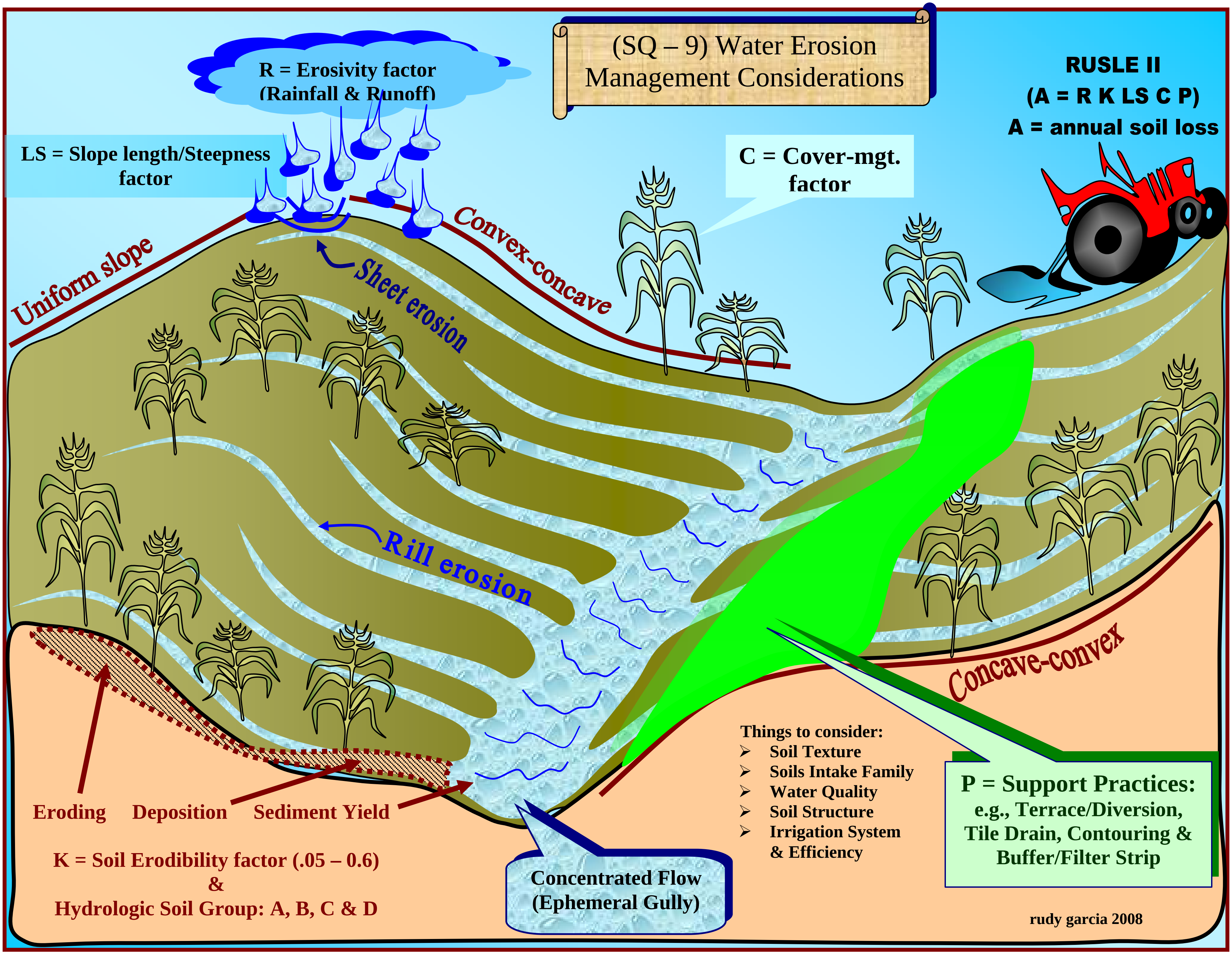
- Timing and amount of precipitation important
- With small rain pesticide moves into soil profile
- If large storm occurs before pesticide enters soil, direct entry into macropore is possible
- Avoid surface application of a pesticide, especially if highly soluble, just prior to an imminent storm if not immediately incorporated

Water Quality - Pesticides, continued:

- Mulch-till provides opportunity to make a tillage pass to incorporate a pesticide or for row cultivation

Conservation Tillage – Bottom Line

- *Helps keep topsoil, nutrients (P), and crop protection products on your fields and out of creeks, streams and lakes*
- *If you properly manage crop rotation, soil conditions, irrigation, equipment selection and adjustments, plant nutrients, and weed control, it helps improve yields and soil productivity*


(SQ – 9) Water Erosion
Management Considerations
RUSLE II
(A = R K LS C P)
A = annual soil loss
R = Erosivity factor
(Rainfall & Runoff)
LS = Slope length/Steepness
factor
C = Cover-mgt.
factor
Uniform slope
Convex-concave
Sheet erosion
Rill erosion
Concave-convex
Eroding
Deposition
Sediment Yield
K = Soil Erodibility factor (.05 – 0.6)
&
Hydrologic Soil Group: A, B, C & D
Concentrated Flow
(Ephemeral Gully)
Things to consider:
Soil Texture
Soils Intake Family
Water Quality
Soil Structure
Irrigation System
& Efficiency
P = Support Practices:
e.g., Terrace/Diversion,
Tile Drain, Contouring &
Buffer/Filter Strip
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(SQ – 10) Water Erosion Management Considerations (Assessment Guide)

Soil Texture	Avail. Water (in./ft.)	Irr. Range (cb)
Sands	0.5	30-40
Loamy Sands	1.0	
Fine Sands	1.25	
V. F. Sands		
L. F. Sands		
Loamy Very Fine Sands		
Sandy Loam	1.5	40-50
Fine Sandy Loam		
Very Fine Sandy Loam	2.0	50-60
Loam		
Silt Loam		
Silt		
Sandy Clay Loam	2.2	60-70
Silty Clay Loam		
Clay Loam		
Sandy Clay	2.0	70-80
Silty Clay		
Clay		

Silt Loam: Irrigated at 55 cb

Soils Intake Family	Inches Applied 1.0	2.0	3.0
	Infiltration Time (Hrs)		
0.1	2.8	10.5	22.3
0.3	1.0	3.5	6.8
0.5	0.63	2.0	3.8
0.75	0.48	1.5	2.8
1.0	0.33	1.0	1.8
1.25	0.28	0.8	1.5
1.5	0.23	0.7	1.3
1.75	0.20	0.6	1.1

0.6 Intake; 2.5” applied and 2.6 hrs. to infiltrate

Surface Irrigation System – Graded Border Program:

INPUTS:

- CFS = 7.5
- Net application depth (2”)
- % field slope (0.001’/ft.)
- Soil Intake (0.6)
- Manning’s (n = .15)
- Field Width (436’)
- Field Length (600’)

RESULTS:

- Appl. Efficiency (81%)
- Runoff = 0.11”

Infiltration Assessment (Water Quality)

SAR	Degree of Restriction on Use (ECiw in dS/m): None	Slight to Moderate	Severe
0 – 3	> 0.7	0.7 – 0.2	< 0.2
3 - 6	> 1.2	1.2 – 0.3	< 0.3
6 - 12	> 1.9	1.9 – 0.5	< 0.5
12-20	> 2.9	2.9 – 1.3	< 1.3
20-40	> 5.0	5.0 – 2.9	< 2.9

SAR = 4, ECiw = 1.1 dS/m (restriction on use: slight)

Soil Structure	Downward movement of H_2O
Single Grain	Rapid
Granular	
Blocky	Moderate
Prismatic	
Platy	Slow
Massive	

Soil is Granular (Rapid)

Hydrologic Soil Group (HSG) Undrained soils	Runoff Potential
A	Lowest
B	
C	
D	Highest

B soil group

(K Factor) Soil Erodibility [1/]	
Clay	0.1 – 0.2
Sand	0.05 – 0.15
Silt Loam	0.25 – 0.35
Silt	0.4 - 0.6

Low Erodibility ---------- High Erodibility

.25-.35

Example Assessment: Irrigated with Hi-Flow Turn Out

- Soil: Silt Loam
- Soils Intake Family: 0.6
- SAR is 4 & ECiw is 1.1 Slight restriction on use
- Soil Erodibility potential is moderate to high
- HSG is B and has a moderate infiltration rate
- Soil Structure: Granular
- **Runoff is 0.11” (erosion is not observed)**

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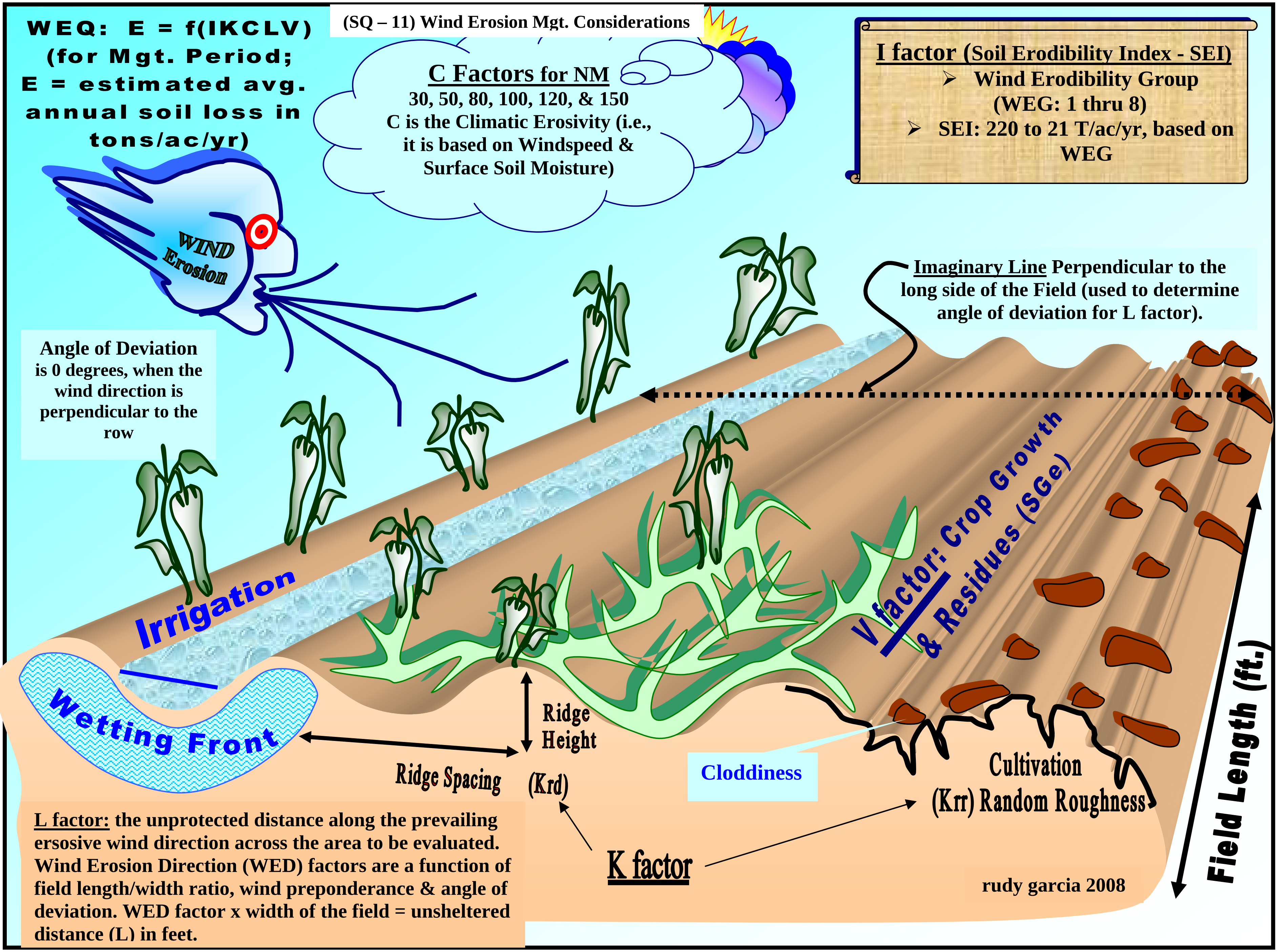
1/ Clay is resistant to detachment (low erodibility potential). Sand is easily detached (low erodibility potential due to large dense particles). Silt Loam is moderately detachable (moderate to high erodibility potential). Silt is easily detached (high erodibility potential; is easily transported).


(SQ – 11) Wind Erosion Mgt. Considerations
WEQ: E = f(IKCLV) (for Mgt. Period; E = estimated avg. annual soil loss in tons/ac/yr)
C Factors for NM
30, 50, 80, 100, 120, & 150
C is the Climatic Erosivity (i.e., it is based on Windspeed & Surface Soil Moisture)
I factor (Soil Erodibility Index - SEI)
➢ Wind Erodibility Group (WEG: 1 thru 8)
➢ SEI: 220 to 21 T/ac/yr, based on WEG
WIND Erosion
Angle of Deviation is 0 degrees, when the wind direction is perpendicular to the row
Imaginary Line Perpendicular to the long side of the Field (used to determine angle of deviation for L factor).
Irrigation
V factor: Crop Growth & Residues (SGe)
Wetting Front
Ridge Height
Ridge Spacing
(Krd)
Cloddiness
Cultivation
(Krr) Random Roughness
K factor
Field Length (ft.)
L factor: the unprotected distance along the prevailing ersosive wind direction across the area to be evaluated. Wind Erosion Direction (WED) factors are a function of field length/width ratio, wind preponderance & angle of deviation. WED factor x width of the field = unsheltered distance (L) in feet.
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(SQ – 12) Wind Erosion Management Considerations (Assessment Guide)

E = f (IKCLV): E = estimated avg. annual soil loss in tons/ac/yr; f = relationships are not straight-line mathematical calculations; I = soil erodibility index; K = soil surface roughness factor; C = climatic factor; L = unsheltered distance; V = vegetative cover

I

WEG	SEI T/ac/yr
1	220
2	104
3	56
4	56
4L	56
5	38
6	21
7	21
8	0

K

K = Krd x Krr

Krd	Krr
1	1
.9	.9
.8	.8
.7	.7
.6	.6
.5	.5
.4	.4

Lower Krd factor = lower soil erosion

Lower Krr factor = lower soil erosion

C

NM C factors
30
50
80
100
120
150

Lower C factor = lower soil erosion

Mo.	%EWE
Jan	4.1
Feb	23.7
Mar	26.8
Apr	17.6
May	11.0
Jun	1.6
Jul	.4
Aug	.2
Sep	.9
Oct	1.3
Nov	5.0
Dec	7.6

L

WED Factor
1.00
3.00
5.00
7.00
9.00
11.00
13.00

Multiply the WED factor times the Width of the Field to determine the Unsheltered Distance (L) in feet.

The smaller the unsheltered distance, the lower the soil erosion

V

Lbs/acre of residues or growing crops

Refer to the Small Grain equivalents (SGe) curves found in the NRCS National Agronomy Manual (NAM), Part 502, Figures a-1 through d-8.

Higher residue = lower soil erosion

The SGe expresses the effectiveness of residue or growing crops in resisting wind erosion.

- WEG = Wind Erodibility Group
- SEI = Soil Erodibility Index (I) for irrigated soils
- Krd = Soil Ridge Roughness factor (is a function of Ridge height & Spacing, Angle of deviation & SEI)
- Krr = Random Roughness (rr) factor (Krr is a function of Cloddiness, as created by tillage & SEI)
- C is a function of windspeed & surface soil moisture
- % EWE = % Erosive Wind Energy (values are for Las Cruces, NM)

- WED = Wind Erosion Direction factor (Reference: Tables 502-8A thru 502-8E of the NRCS NAM). WED factors are a function of field length/width ratio, wind preponderance and angle of deviation.
- V factor relates the kind, amount & orientation of vegetative material to its equivalent in lbs/ac of small grain residue in reference condition Small Grain Equivalent (SGe)

e.g. calculation: A fine textured soil was irrigated 3x during 45 days. 12% of the annual EWE occurs during this period. Therefore: Texture Wetness Factor (TWF) = 3; No. of irrigations during period = 3; Nonerodible Wet Days = 3 x 3 = 9; Irrigation Factor (IF) = (45 – 9) ÷ 45 = .80; Adjusted EWE = (.80) (12%) = 9.6%

Note: angle of deviation is 0^0, when wind is perpendicular to the row

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NOTE: NRCS will be using WEPS (Wind Erosion Prediction System) to make wind erosion assessments

(SQ – 13) Soil Health-Quality Assessment