Integrated Approaches and Resources for Erosion Prediction and

Linda Oyer Scheffe, Ph.D.
USDA-NRCS, Lincoln, Nebraska

Integrated Approaches for Erosion Prediction and Control in Sustainable Farming Systems

Linda Oyer Scheffe, Ph.D.[1]

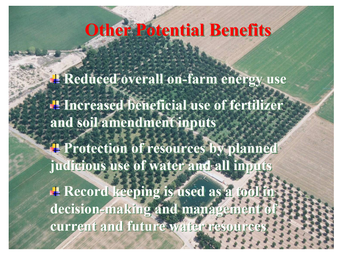
Global reduction in agricultural productivity due to soil erosion and degradation, depletion of irrigation water supplies, and competing land uses is limiting our capacity to meet increasing world-wide demand for food and fiber. The U.S. Department of Agriculture (USDA) estimated water (sheet and rill) erosion on cropland declined from 1.68 billion tons per year (4 tons/acre/year) in 1982 to 960 million tons per year (2.7 tons/acre/year) in 2007 in the United States. Despite this decline in erosion rates, water erosion remains one of the most important natural resource concerns. According to NRI, roughly 99 million acres (28% of all cropland) in the U.S. are eroding above soil loss tolerance (T) rates. Sustainable farming systems can be well suited to control soil loss due to water erosion. Integrated approaches are required to achieve a sustainable farming system of soil, water, air, plant, animal, and human resources. The key to sustainable management is to consider the entire system (ecosystem, whole farm, and watershed) and to think critically (connect the dots). Sustainable farm planning must be creative, flexible, and focus on energy flow through an integrated system. Sustainable system case-studies, field trials, on-farm demonstrations, farmer-to-farmer networks are all important approaches for effective technology exchange. Interdisciplinary teams that include farmers/ranchers and partners are essential in developing effective integrated sustainable farming systems. The USDA provides interagency resource inventory, research, technical assistance and training on "how-to" evaluate and understand site-specific field conditions, including chemical, biological and physical needed for sustainable system decision making. This enables us to evaluate and implement best management practices/approaches for erosion control within an integrated farming system. Considering how the farm fits into broader watershed management (e.g. off-site effects and resource opportunities) is also essential to problem-posing and problem-solving resource management success and development of sustainable communities. Improving soil quality is the key to improving soil, water, air, plant, and animal resources. Practical applications, integrated approaches, databases, and tools, as well as potential effects of conservation practices on soil erosion and soil quality from Natural Resources Conservation Service are provided.

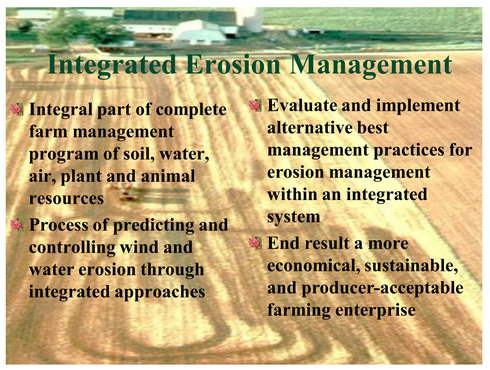
[1] Conservation Agronomist, USDA-NRCS, National Soil Survey Center, Lincoln, NE.

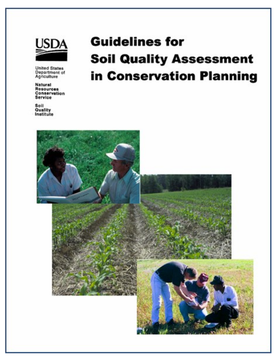
Build Soil Quality

- Minimize or eliminate tillage
- Apply nutrients according to soil, plant, tissue tests and nutrient budget
- Increase on-farm nutrient cycling, plant species diversity
- Maintain ground cover year round by using cover crops and mulches and by leaving crop residues in field
- Manage/protect soil organisms preserve biodiversity
- Rotational grazing, prescribed grazing

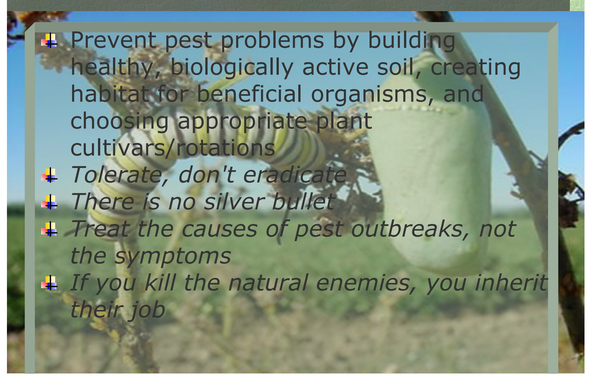
Sustainable Farming – Maximize Biodiversity







Manage Pests Ecologically



- Prevent pest problems by building healthy, biologically active soil, creating habitat for beneficial organisms, and choosing appropriate plant cultivars/rotations
- *Tolerate, don't eradicate*
- *There is no silver bullet*
- *Treat the causes of pest outbreaks, not the symptoms*
- *If you kill the natural enemies, you inherit their job*

Develop Conservation Plan

- Use integrated approach to inventory resources and develop conservation plan for whole farm
- Choose and apply conservation practices, technologies, approaches to address identified resource concerns and take advantage of opportunities
- Not only think outside the box, but step outside the box

Integrated Erosion Tool

- Each agronomic, including water and wind erosion, model currently contains it own databases
- Most utilize similar data
  - Soil map unit and component data
  - Climate location data on temperature, precipitation and wind energy
  - Crop and plant data, Crop Management Scenarios
  - Tillage, pesticide, nutrient and manure application, planting and harvest operations
- NRCS has been developing, trying to maintain and serve up separate databases for each model; now transitioning to one database (Land Management Operations Database) and developing an integrated erosion tool

Achieving Sustainable Farming: Perspective and Attitude is Everything

- Interconnected system comprised of soil, water, air, plant, animal, and human components/ resources, constantly changing, interacting, through which energy is flowing
- Team members must come to the table/field in active listening/learning mode and with open mind, keen observational skills, and be ready to adapt to change
- Proactively become involved in every step; only hands-on experience changes paradigms

Other Considerations

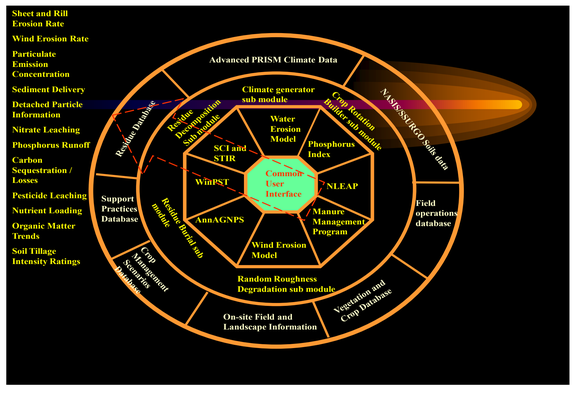
- Take an inventory; think about every field/pasture/stream/well
- What are the natural resources on my farm? In my watershed?
- What crops and rotations can I grow/use?
- Besides using crop residues and cover crops, what other practices can I apply to build soil quality? To recycle nutrients? To use water efficiently? To reduce disease/pest problems?
- Have I minimized runoff and leaching? Am I protecting soil, water, air, plant, animal resources?
- How can I integrate livestock/wildlife on my farm?
- Which practices would contribute to an environmentally and economically sound farm?
- Have I taken a soil, water, tissue test? Am I making the best use of compost, animal manure, legumes as nutrients for plants and to build soil quality?
- How can I conserve/produce energy or reduce energy use?

Develop a Case Study/Conservation Plan

Producer Sustainable Workshops

Resource Inventory Includes:

- Irrigation Water Samples
- Soil Samples
- Plant Tissue Samples
- Irrigation System evaluation
- Soil Texture, Structure and, most importantly, Aggregate Stability
- Tillage Operations
- Fertility Inputs
- IPM
- Cover Crops
- Crop Rotations



Keys to Achieving Sustainable Farming

- use integrated systems approach (ecosystem, whole farm, watershed); use integrated tools to assess resource concerns
- problem-posing, problem-solving
- actively seek resource, watershed, marketing opportunities
- resource efficient and resource conserving
- technology "exchange" vs. "transfer"
- develop whole farm conservation plan creatively and flexibly, step outside the box
- consider on-site and off-site effects
- focus on keeping energy flow through the integrated system
- reemphasize biological factors, improve biodiversity
- improving soil quality is key to improving soil, water, air, plant, and animal resources
- case studies, field trials, on-farm research/demonstrations, farmer-to-farmer networks
- interdisciplinary teams including producers and partners
- farmers need to demand quality service
- recordkeeping is tool in decision-making and management of current and future resources
- need user friendly fact sheets, brochures on integrated systems

USDA