The Conservation Effects Assessment Project (CEAP) Cropland Survey and Modeling System

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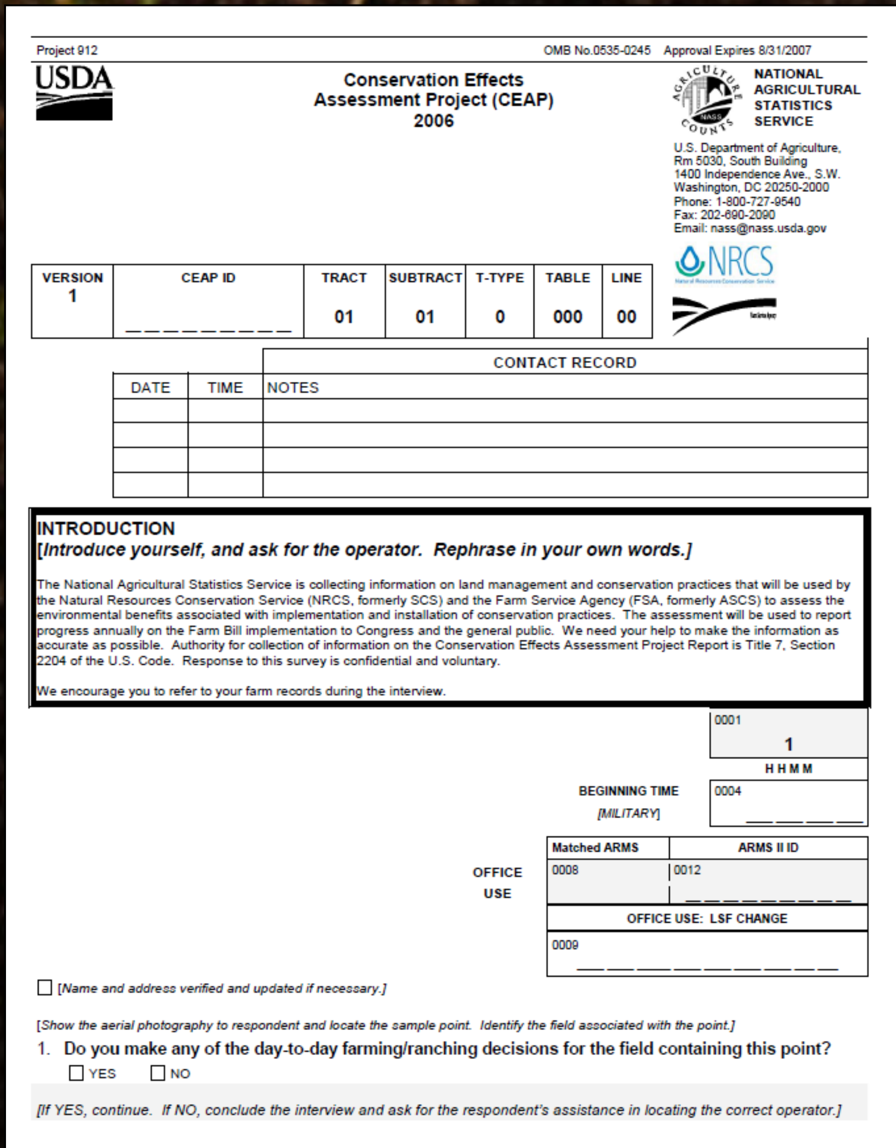
CEAP Cropland Goals

- Quantify current conservation practice adoption
- Estimate the benefits of current conservation practices on soil and water quality
- Identify outstanding conservation needs
- Explore means to better manage the agricultural landscape to improve soil and water quality

CEAP Cropland Assessment Components

1) Subset of National Resource Inventory (NRI) sample points, acreage weights
2) NASS collection of 3-years of detailed management information for the farm fields containing the NRI points
3) NRCS District office and FSA conservation practice plans and records
4) Site, soil, and weather data
5) Modeling of within-field environmental impacts with the APEX model
6) Nutrient and soil loss transport in the hydrologic system with SWAT model
7) Assessment of the adequacy of current conservation treatment
8) Estimates of the cost and impacts of additional conservation treatments

NASS Farmer Survey:



Project 912 OMB No.0535-0245 Approval Expires 8/31/2007

USDA

Conservation Effects Assessment Project (CEAP) 2006

NATIONAL AGRICULTURAL STATISTICS SERVICE

U.S. Department of Agriculture, Rm 5030, South Building
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Washington, DC 20250-2000
Phone: 1-800-727-9540
Fax: 202-690-2090
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NRCS

VERSION	CEAP ID	TRACT	SUBTRACT	T-TYPE	TABLE	LINE
1	_ _ _ _ _ _ _ _ _	01	01	0	000	00

CONTACT RECORD

DATE	TIME	NOTES

INTRODUCTION
[Introduce yourself, and ask for the operator. Rephrase in your own words.]

The National Agricultural Statistics Service is collecting information on land management and conservation practices that will be used by the Natural Resources Conservation Service (NRCS, formerly SCS) and the Farm Service Agency (FSA, formerly ASCS) to assess the environmental benefits associated with implementation and installation of conservation practices. The assessment will be used to report progress annually on the Farm Bill implementation to Congress and the general public. We need your help to make the information as accurate as possible. Authority for collection of information on the Conservation Effects Assessment Project Report is Title 7, Section 2204 of the U.S. Code. Response to this survey is confidential and voluntary.

We encourage you to refer to your farm records during the interview.

0001 1

BEGINNING TIME *[MILITARY]* H H M M 0004 __ __ __ __

OFFICE USE

Matched ARMS	ARMS II ID
0008	0012 _ _ _ _ _ _ _ _ _

OFFICE USE: LSF CHANGE

0009 __ __ __ __ __ __ __ __ __

☐ *[Name and address verified and updated if necessary.]*

[Show the aerial photography to respondent and locate the sample point. Identify the field associated with the point.]

1. **Do you make any of the day-to-day farming/ranching decisions for the field containing this point?**
☐ YES ☐ NO

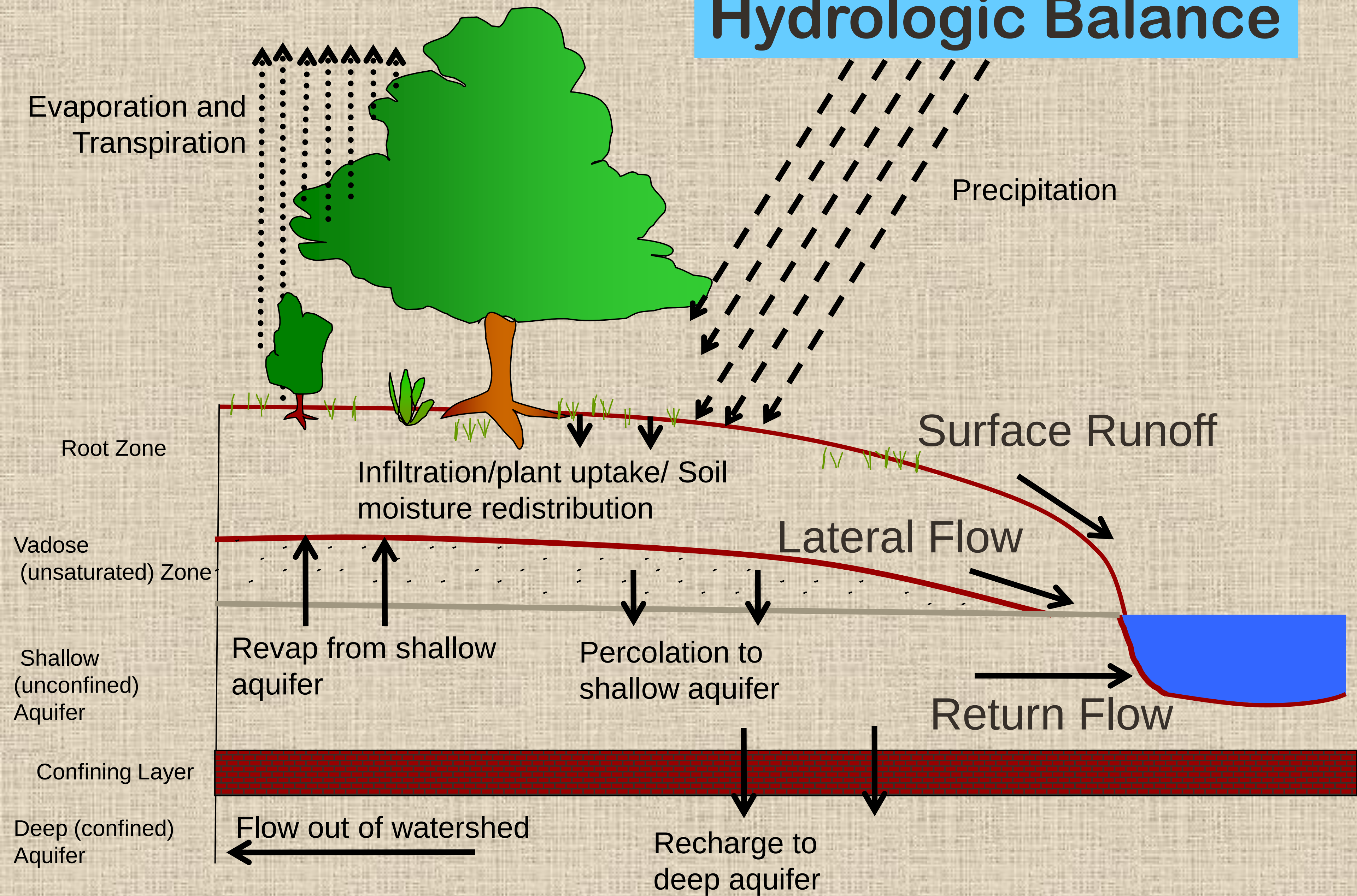
[If YES, continue. If NO, conclude the interview and ask for the respondent's assistance in locating the correct operator.]

- 44 pages
- Covers all aspects of crop production for 3 years.
- Tillage
- Fertilizers and manures
- Pesticides
- Irrigation
- All Conservation practices

APEX Model Components and Capabilities:

1) Daily time step simulation of hydrologic, N, P, and Carbon cycles
2) Soil profile split into 10 layers for modeling
3) Field divided into hydrologically connected sub-areas, representing cropping, conservation vegetation (strips and buffers), reservoirs/ponds
4) Channel characteristics for concentrated flow within/between sub-areas
5) Application of any nutrient material for which N, P, C, components can be characterized
6) Application of pesticides
7) Use of any equipment for which soil disturbance, biomass removal and plant population impact paraneters can be specified
8) Grazing of plant residue or live vegetation
9) Irrigation and soil and water salinity

Hydrologic Balance



The CEAP Cropland Surveys

2003-2006 National	18,691 sample points, cultivated cropland
2011 Chesapeake Bay	904 sample points, cultivated cropland Some overlap with 771 sample points from 2003-2006
2012 Western Lake Erie and Des Moines	1,019 sample points in WLE (492 in 2003-2006) 599 sample points in DSM (318 in 2003-2006) Cultivated cropland
2013 Sacramento Bay Delta	Approximately 844 sample points (111 in 2003-2006) Cultivated cropland, pastureland, and orchards/vineyards
2014 Lower Mississippi	Approximately 610 sample points (471 in 2003-2006) Cultivated cropland, pastureland, and orchards/vineyards
2015-2016 National	Goal is 30,000+ useable sample points Cultivated cropland, pastureland, and orchards/vineyards

* Each survey is an independently drawn subset of the overall NRI, and each sample point has an acreage expansion weight assigned for it specific to each survey.

Public issues where the CEAP system has been applied:

- Gulf of Mexico Hypoxia – Evaluation of goals and treatment cost
- Great Lakes Restoration Initiative – Goal setting and evaluation
  - Western Lake Erie - phosphorus load induced algae bloom
- BP Oil Spill – Search for small watersheds where non-point source treatment would yield locally measurable impacts
- Evaluation of nutrient loss trading – Lower MS cropland versus Upper MS municipalities
- Chesapeake Bay – status and agricultural load reduction studies
- USDA – National Conservation Program assessment
- Bio-energy: Switchgrass and corn residue production potential and impacts

CEAP Cropland Soil Health Indicators (+ or -)

- Carbon, Nitrogen, and Phosphorus storage (by layer)
- C:N ratio (proxy for microbial population health, by layer)
- P soil content – impacts microbial activity, future P adsorption
- Chemical buffering capacity
- Retained sediment
  - Rich soil surface layer (nutrients, residue, carbon, microbes)
  - Nutrient content, value in terms of fertilizer prices
- Water Balance (water holding capacity)
- Yield trends
  - Water stress
  - Nutrient stresses
- Salinity

Measurable Benefits from Soil Health

- Private:
  - Increased crop yields
  - Lower energy, fertilizer, irrigation, and machine inputs
  - Less expense to manage chemical, nutrient, and soil losses
- Public:
  - Lower food cost
  - Less nutrient and soil pollution of water bodies
  - Soil carbon sequestration (climate change offset)
  - Lower pesticide residue loss to air and water
  - Less use of scarce energy, water and other resources
  - Increased wildlife habitat and other ecological services
  - Less expenditure on crop insurance and other conservation programs

The CEAP Cropland Soil Quality Indicators

Indicator	Private Benefit	Public Benefit
Water Holding Capacity	Higher crop yields at lower cost	Lower food cost and decreased pollutant carrying runoff
Nitrogen and Phosphorus content	Lower fertilizer costs, higher yields	Lower food cost and less water pollution
Carbon content (organic matter)	Yields and profit Improved soil structure (less tillage energy requirement)	Lower food cost and increased chemical buffering capacity
C:N ratio	Microbial activity	Chemical Buffering Capacity
Retained Sediment	Crop Yields Nutrient Retention Profit	Food cost Offsite water quality damage
Surface P content	Buffering Capacity, Yields	Offsite farm losses

Three CEAP Treatment Adequacy Scoring Components

1) ACT (Avoid, Control, Trap):
   a) Each practice receives a score for each of the three components
   b) Nutrient management score depends on rate, timing, method, and form
   c) Tillage/Residue Management depends on Soil/Tillage Intensity Rating (STIR)
   d) Crops within rotation contribute to a residue production score

2) Water Flow Control:
   a) Overland (tillage, residue, terrace, contouring, etc.)
   b) Concentrated (grassed waterways, sediment control structures, diversions, etc.)
   c) Edge-of-Field (filter and buffer strips)

3) Field Level Loss Standards (model output evaluated):
   a) Loss of N in surface water ≤ 15 pounds per acre annually
   b) Loss of N in sub-surface water flow ≤ 25 pounds per acre annually
   c) Loss of P in water ≤ 3 pounds per acre annually
   d) Loss of sediment ≤ 2 tons per acre annually
   e) Soil C change ≥ 100 pounds per acre annually
   f) Wind erosion ≤ 4 tons per acre annually

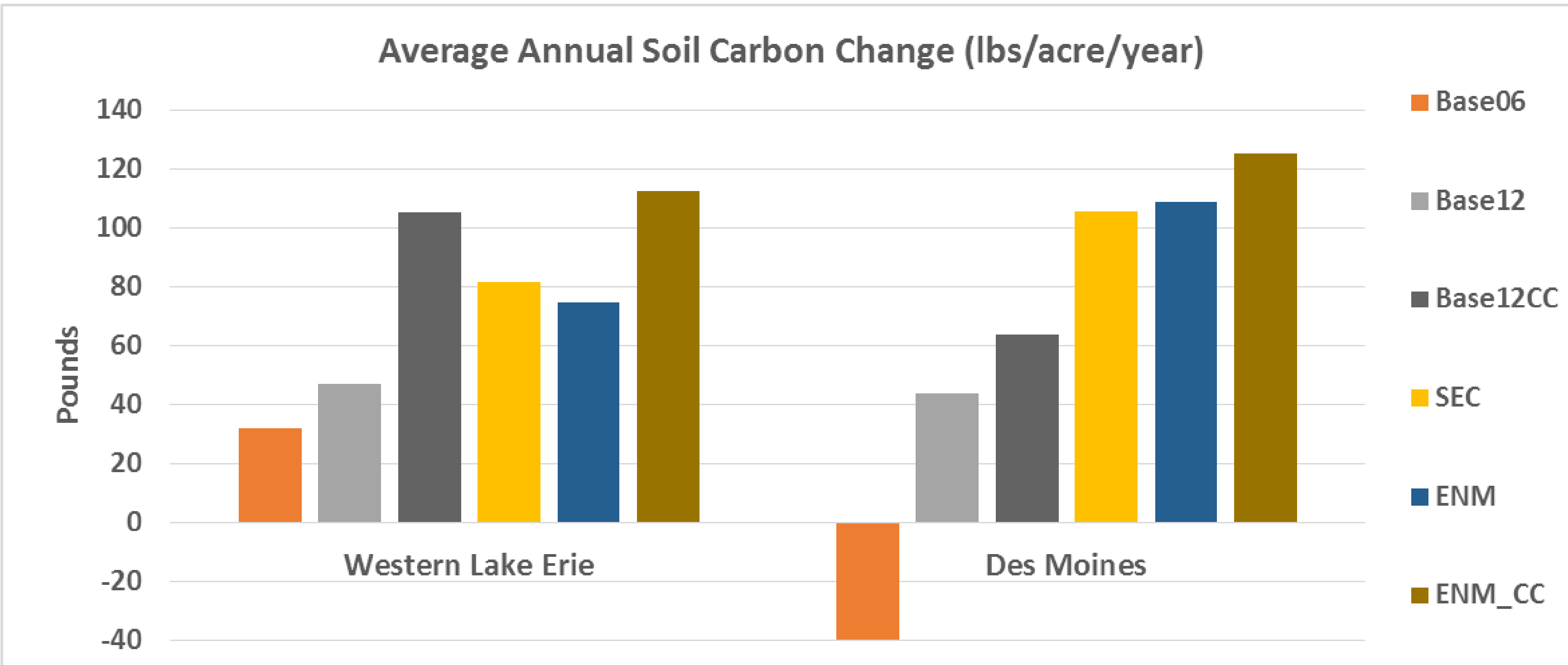
Conservation Treatment Scenarios

(Western Lake Erie – 0410 and Des Moines – 0710)

1) Base06 - practices in place during 2003-2006 survey period
2) Base12 - practices in place as of 2012 crop year
3) SEC – Structural erosion control practices
4) ENM – SEC + Nutrient Management practices
5) Base12cc – Baseline 2012 plus cover crops
6) ENMcc – ENM plus cover crops

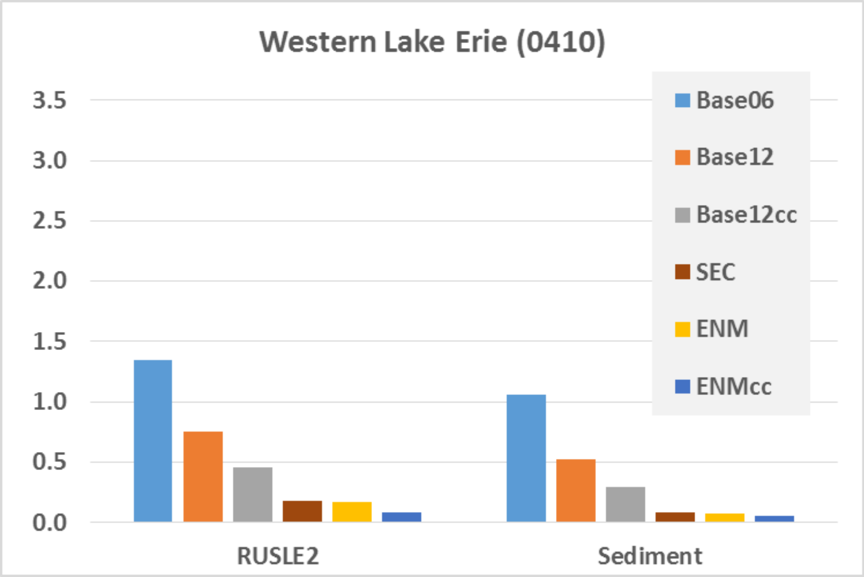
* Actual practices added for each post 2012 treatment scenario varied across farm fields according to baseline management, inherent characteristics, and baseline model output.

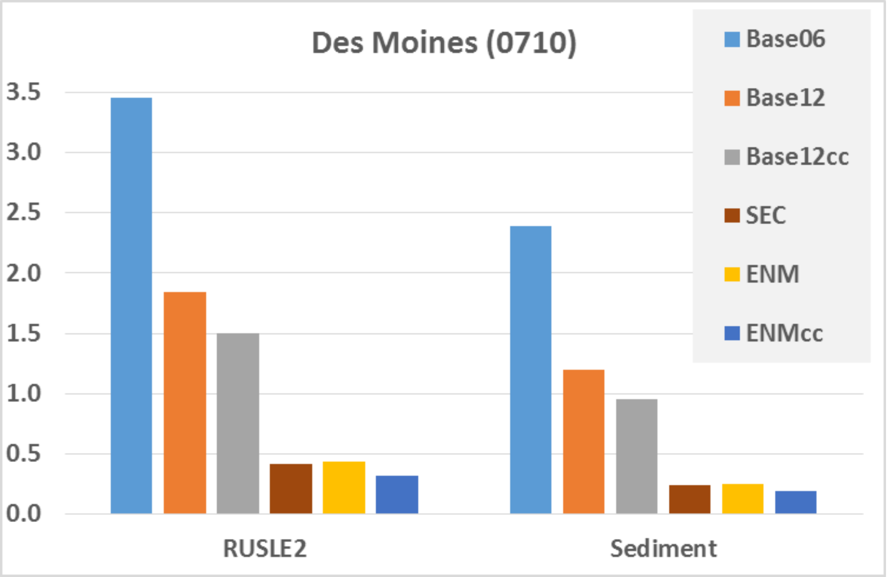
Sample Points:	2003-2006	2012
WLE	492	1019
DSM	318	599



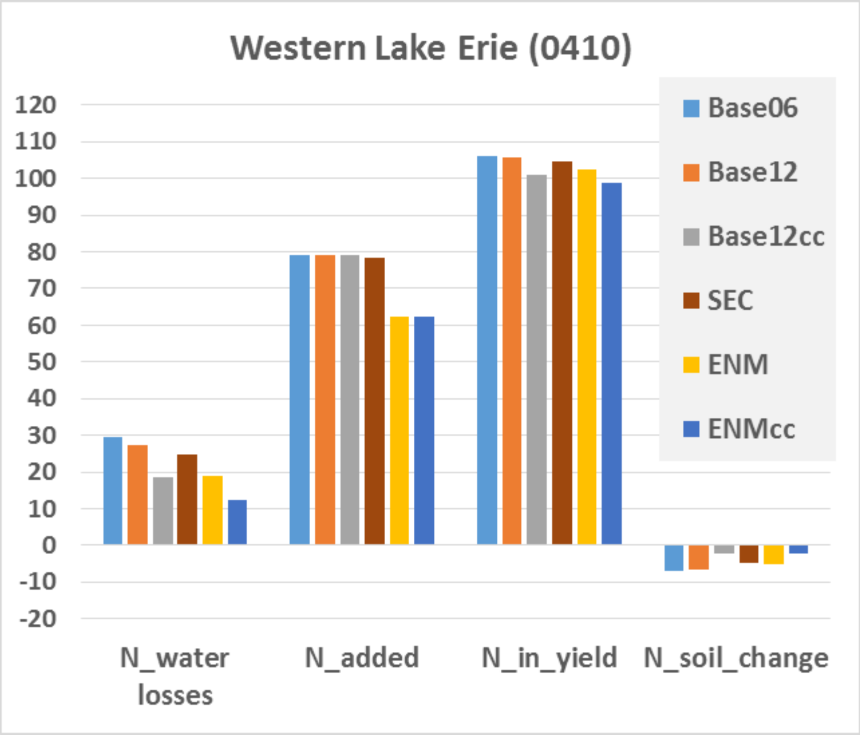
Average Annual Soil Carbon Change (lbs/acre/year)
Pounds
140
120
100
80
60
40
20
0
-20
-40
Western Lake Erie
Des Moines
Base06
Base12
Base12CC
SEC
ENM
ENM_CC

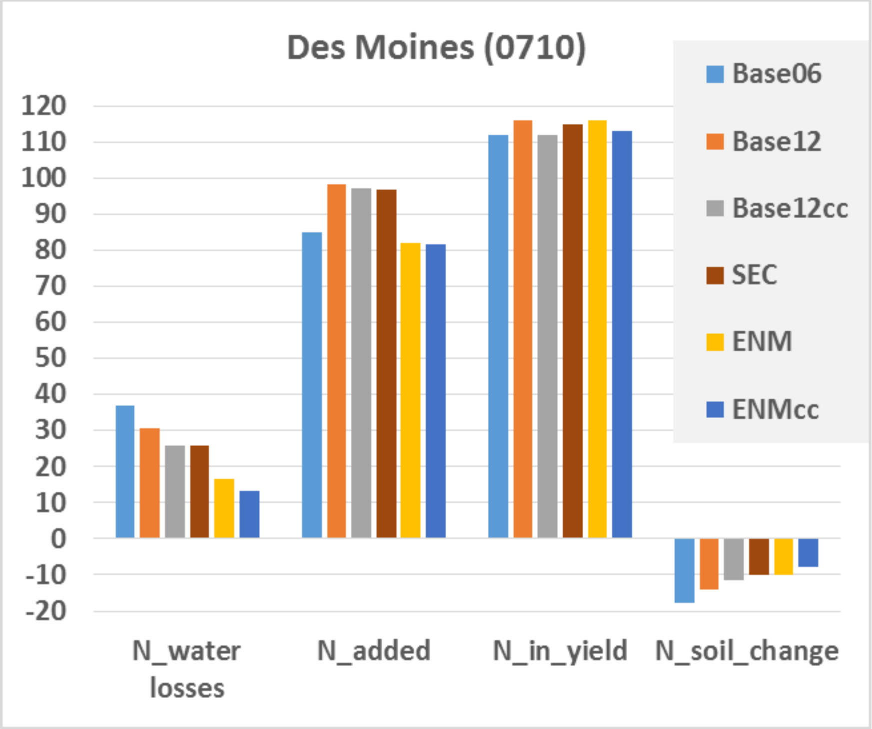
Soil Loss (tons/acre/year)



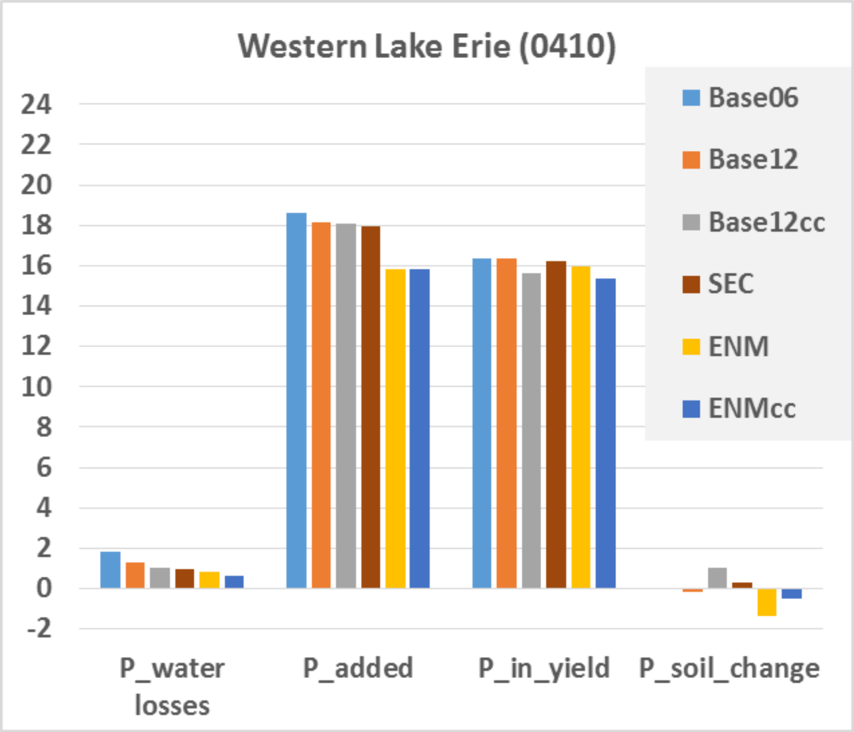


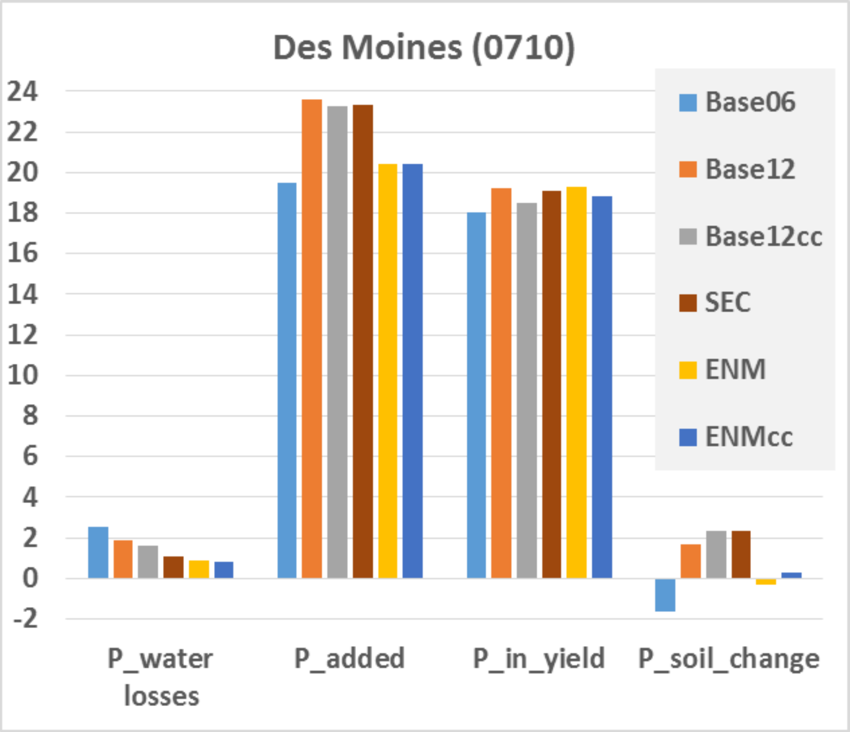
Nitrogen (pounds/acre/year)



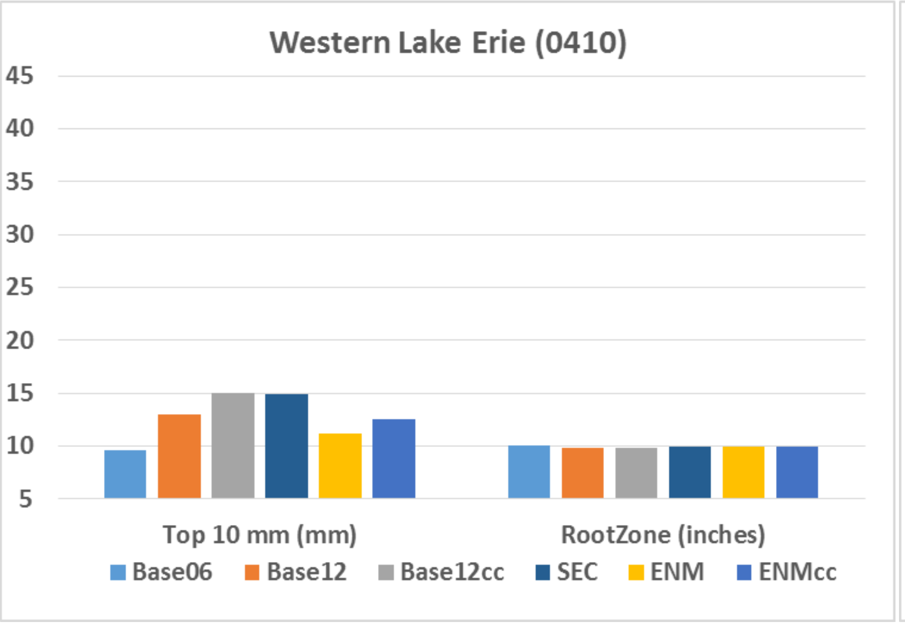


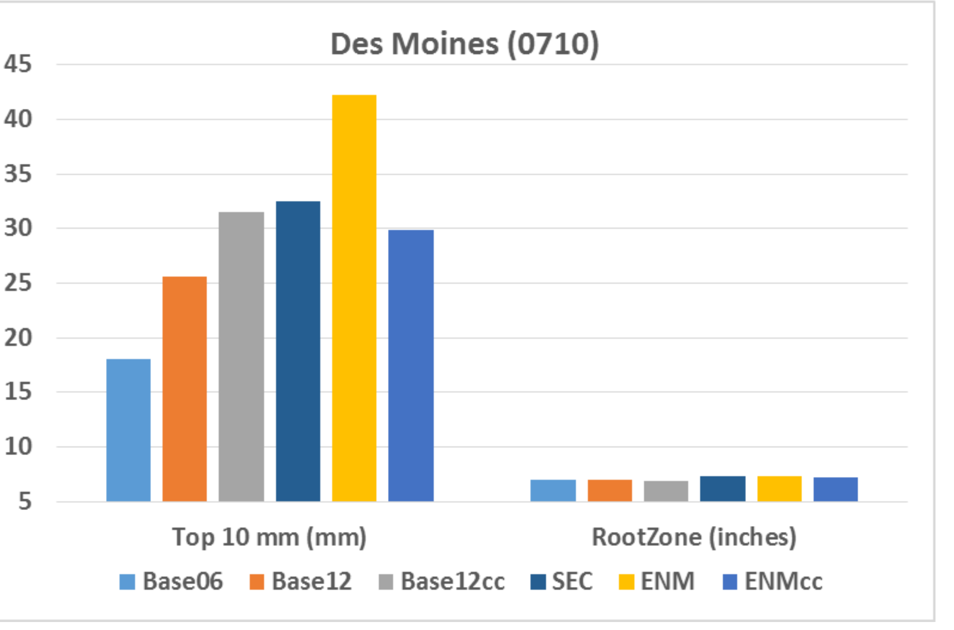
Phosphorus (pounds/acre/year)





Soil Water


Western Lake Erie (0410)
45
40
35
30
25
20
15
10
5
Top 10 mm (mm)
RootZone (inches)
Base06
Base12
Base12cc
SEC
ENM
ENMcc


Des Moines (0710)
45
40
35
30
25
20
15
10
5
Top 10 mm (mm)
RootZone (inches)
Base06
Base12
Base12cc
SEC
ENM
ENMcc

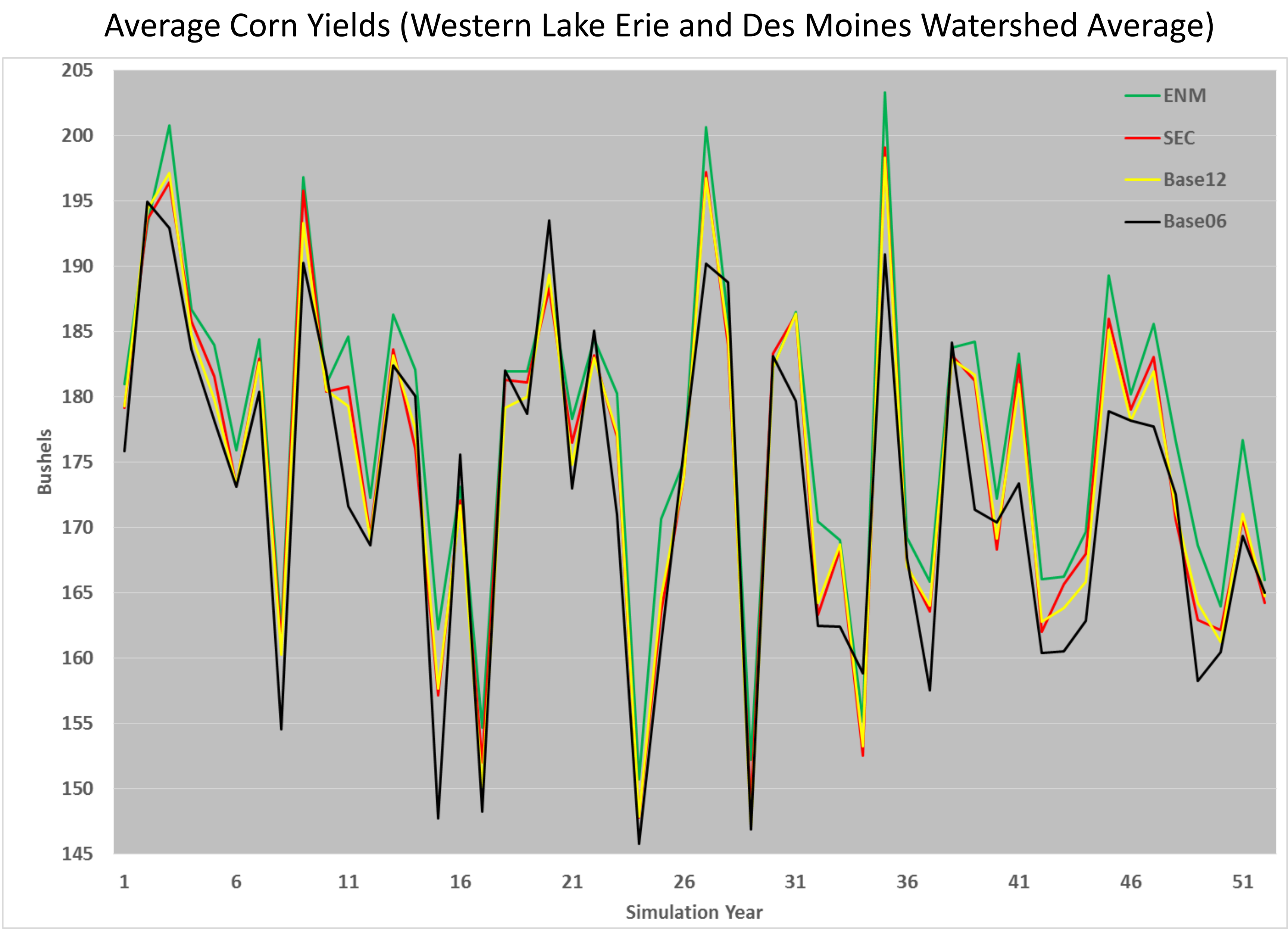
Soil Component Change is Small over 52 Year Baseline Simulation (average per-acre)								
			Pounds		Average Annual Change (lbs/acre/year)			
Watershed[a]	Soil	Carbon	Nitrogen	Phosphorus	Soil	Carbon	Nitrogen	Phosphorus
0410	20,888,874.4	115,198.6	10,002.5	7,618.0	-3,069.5	-349.0	-38.127	0.536
0710	22,083,639.6	135,937.1	11,859.2	5,790.1	-4,846.7	-222.4	-16.104	3.462

[a] 0410 = Western Lake Erie, average depth modeled 65.3 inches.

0710 = Boone-Raccoon (Des Moines), average depth modeled 71.8 inches.

Depth change (inches) over 52 year simulation:

0410	-0.499
0710	-0.819


Average Corn Yields (Western Lake Erie and Des Moines Watershed Average)
205
200
195
190
185
180
175
170
165
160
155
150
145
Bushels
1
6
11
16
21
26
31
36
41
46
51
Simulation Year
ENM
SEC
Base12
Base06