How well do past practices predict future practices?

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Why does the continuous or intermittent use of practices matter?

- Provision of environmental services
  - Many practices need to be used continuously over several years
- Baseline
  - Many environmental payments and offset rules are based on the practices that farmer previously carried out
  - Assumption: past practices are likely to be carried out in the future
- What empirical support for this assumption is available?

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Typology of Best Management Practices (BMPs)

- Structural – once implemented are usually kept in place for several years
  - In-field
    - To control overland flow: terraces, contour buffer strips
    - To control concentrated flow: grassed waterways, diversions
  - Edge-of-field to buffer and filter surface runoff
    - Riparian buffers
  - Wind erosion control practices
    - Windbreaks, cross wind trap strips
- Annual/ Management - conducted as part of crop production system each year
  - Residue and tillage management
  - Nutrient management
  - Pesticide management
  - Cover crops

This talk

1. What data to we have on the annual use of management BMPs?
   - National
   - Large region
   - Small region
2. What do we know about the factors that affect the use of management BMPs?
   - Factors that do not change from year to year: farm, farmer
   - Factors that affect relative profitability of farming practices
3. Concluding comments

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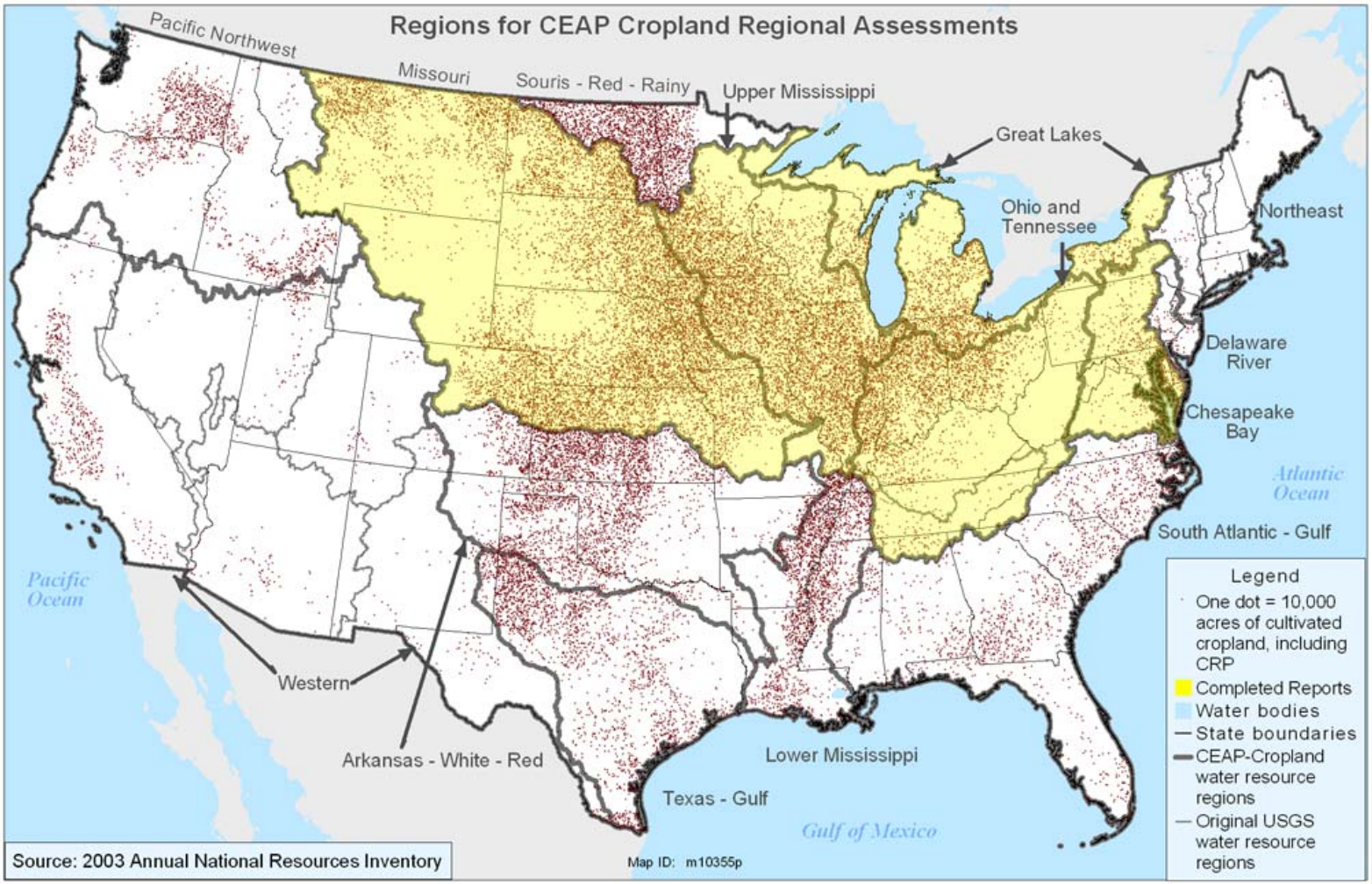
Data: nation-wide

- ARMS (Agricultural Recourse and Management Survey)
  - Selected years, crops, states
  - Limited attempts to gather information on continuous use of conservation tillage
- CTIC (Conservation Technology Information Center)
  - Tillage systems by county, yearly 1989 – 2002, 2004
  - County-average use of specific tillage systems in a given year for a given crop and county, but no data on continuous use
- NRI (National Resources Inventory)
  - 1982 – 1997, once every 5 years information on some BMPs
  - CEAP NRI (Conservation Effects Assessment Project)
    - Cropland farmer surveys
    - Collected 2003 - 2006
    - Data on 3-year period for the fields associated with NRI data points

NRI CEAP regions



Source: http://www.nrcs.usda.gov, downloaded 04/2012

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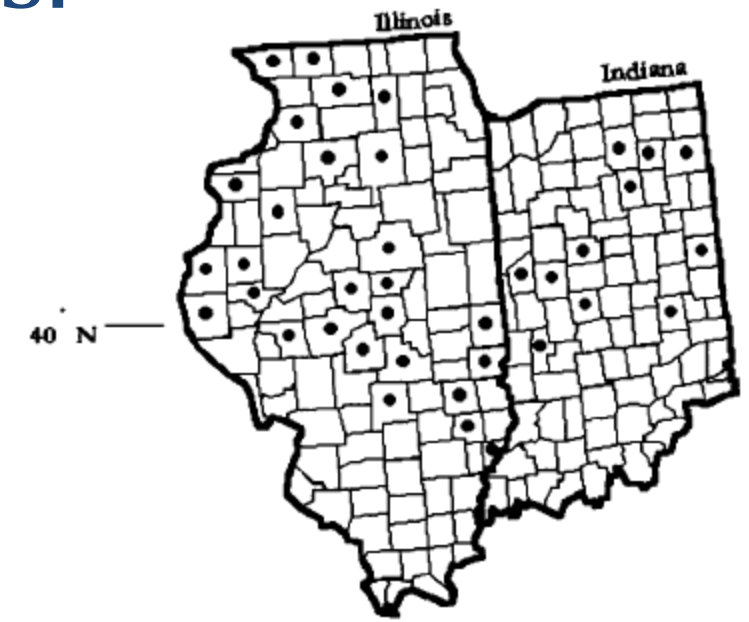
NRI-CEAP: Ohio-Tennessee river basin report (NRCS, 11/2011)

- Cropped acres data
  - 2,124 sample points representing 25.0 million cropped acres
  - Rotations: 78% in corn-soybean rotation, 5% corn only, 5% soybean only
- Average annual tillage intensity for crop rotation meets criteria for
  - No-till: 52%
  - Mulch till: 41 %
  - Continuous conventional tillage: 4%
- Similarly high average annual use of conservation tillage in the UMRB (NRCS, draft 06/2010)

Data: regional studies: Hill (JSWC, 2001)

- Continuous no-till
- Corn-soybean rotations, 1995 - 2000
- Randomly selected 450 fields in each surveyed county



State/ counties surveyed	% fields that have been no-tilled continuously for the indicated number of years				
	2	3	4	5	6
IL/ 18	44	30	22	19	13
IN/ 11	41	25	18	14	9
MN/ 10	9	7	3	3	n/a

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Data: regional studies: Napier and Tucker (EM, 2001)

- 1,011 primary farm operators, 3 watersheds (OH, IA, MN)
- Surveyed in the fall 1998-winter 1999 about farming practices in the preceding 5 years
- 18 practices, including
  - Tillage: fall, no-till, chisel plowing, ridge till, deep moldboard
  - Fertilizer application: fall application, soil testing, winter application of manure, banded in furrow, side-dressing, use of nitrification inhibitor
  - Contour planting, buffer strips
  - IMP, precision farming, crop rotations, mechanical weed control

Tillage systems: frequency of use (%) in the preceding 5 years

State / farmers surveyed	Every year	Every other year	Never	Other pattern
No-till				
OH / 105	51	14	19	16
IA / 355	12	7	57	24
MN / 551	2	1	82	14
Chisel plowing with 1/3 ground surface covered with residue at planting				
OH / 105	29	19	25	27
IA / 355	32	16	25	27
MN / 551	51	15	23	10
Deep moldboard plowing				
OH / 105	22	8	47	23
IA / 355	6	5	44	45
MN / 551	53	9	25	12

Source: Napier and Tucker, EM, 2001

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Factors affecting the use of BMPs: a glance from mostly static model studies

1) Little change from year to year (Prokopy et al., JSWC, 2008; Lichtenberg et al., AJAE, 2010; Hoag et al., NRCS, 2012)
   - Natural features of the farm
     - (+) Proximity to water bodies, high slope
   - Farmer characteristics
     - (+) Education, Information, Environmental awareness, Networking
     - (-, +) Farmer's age/ Experience
   - Attributes of the farm operation
     - (-, +) Tenure, farm size, off-farm labor
2) May change significantly from year to year
   - Weather
   - Relative profitability (e.g., Hoag et al., NRCS, 2012)
     - Crop and production input prices
     - BMP – specific incentives

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Practice baseline is dependent on the land use baseline

- Complex interactions between rotation, tillage, and fertilizer management are not well understood
- Wu and Babcock (AJAE, 1998):
  - 539 NRI sample points, cropland farmer surveys, Central Nebraska basin, 1989-1991, corn producers
  - Farmers rotating crops are likely to use conservation tillage
  - Rotating crops and/or adopting conservation tillage decrease N fertilizer rates
- De La Torre Ugarte et al. (EM, 2004):
  - In the Corn Belt, the incentives to induce conservation tillage on continuous corn could be more than 3 times higher than for a corn-soybeans rotation

BMP-specific incentives

- Cross- BMP payment effects: how does the payment for one BMP affect the use of other BMPs? (Lichtenberg, JARE, 2004)
  - 592 farmers, Maryland, 1995, impact of receiving cost-share funds
  - 12 BMPs, both annual and structural
  - Complements (reducing the cost of one increases the probability of using every practice in the group)
    - Critical area seeding, cover crops, waterways
  - Substitutes (reducing the cost of one reduces the probability of using the other)
    - Strip-cropping and terraces
- Post-payment effects:
  - (+) Education effect (Napier and Tucker, JSWC, 2001)
  - (-) Land problem has been addressed (Corbett, SC, 2002)
  - (+, -) Cost of adopting practice (Hoag et al., NRCS, 2012)
  - (-) Crowding out incentives (Prokopy et al., JSWC, 2008; Gneesy et al., JEP, 2011)

Concluding comments

- We know very little about the year-to-year use of BMPs at the national level
- Few site-specific studies found a great variation in continuity of annual practices
- Research is critically needed to improve our ability to predict year-to-year use of BMPs