Economics of Soil Health Practices

Cover Crops and No-Till

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Goals for Today

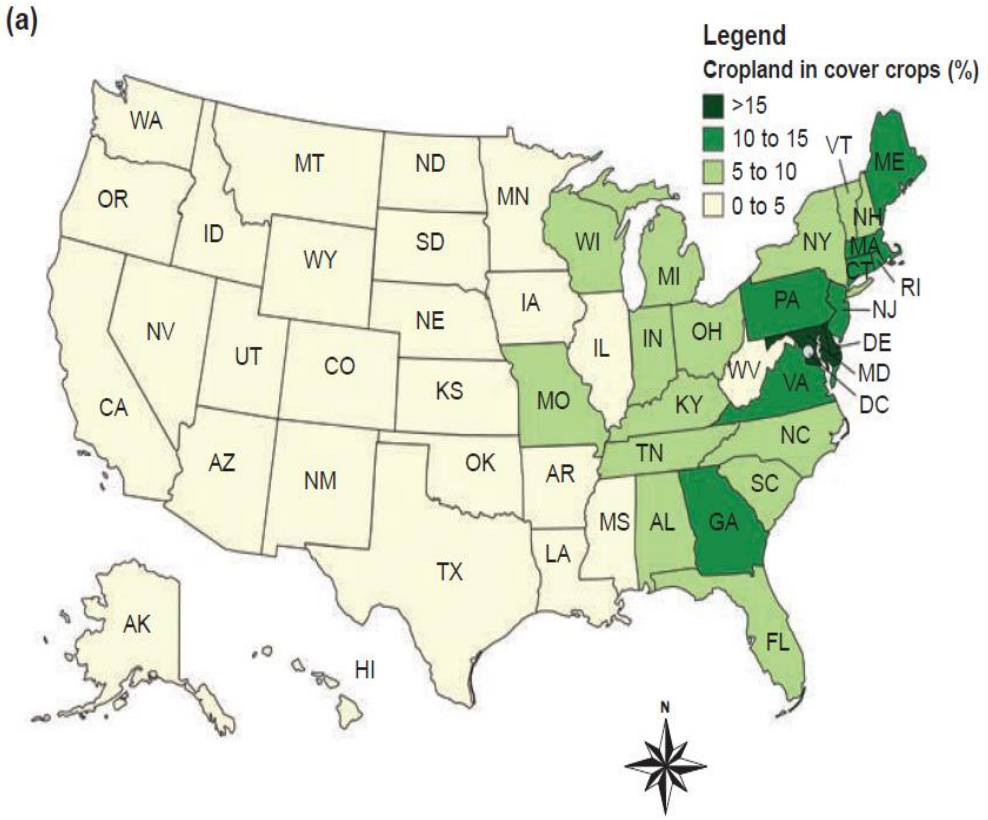
- Soil health practice adoption in the US
  - Cover crop and no-till
- Important economic dimensions to consider when deciding to adopt
- General findings from economic literature
- Policy discussions & issues

Introduction

- Soil health is now viewed as a key element in enhancing agricultural productivity, environmental sustainability, and food system resilience
  - Natural climate solution since ↑ C in soils
- Strong interest in promoting practices that improve soil health:
  - Cover crops and no-till systems

Cover Crop Adoption

- Cover crop adoption % in 2017 is ~4% of total cropland acres



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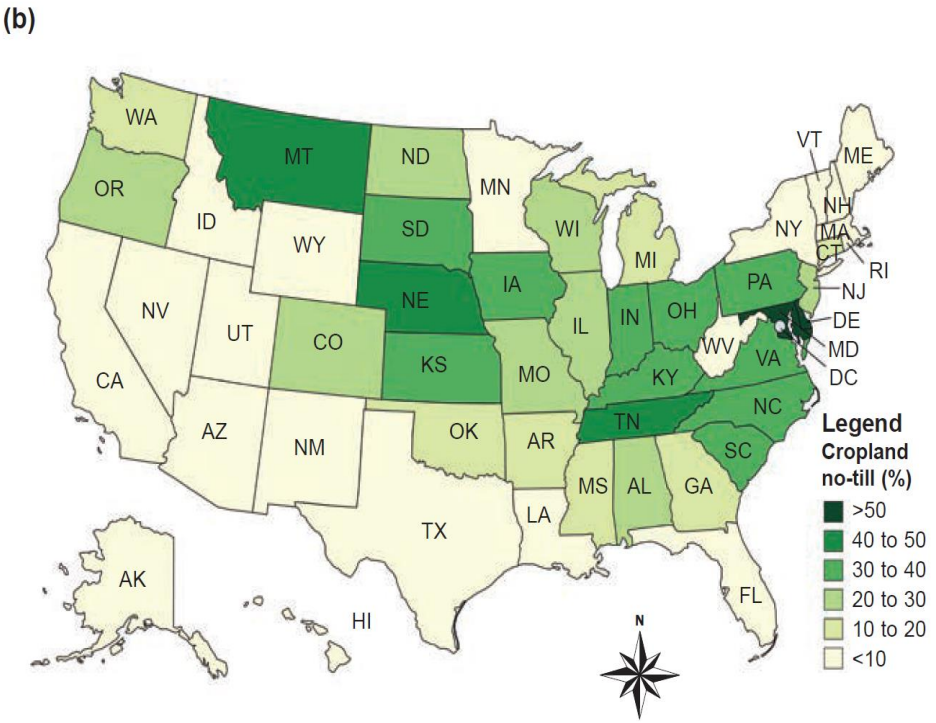
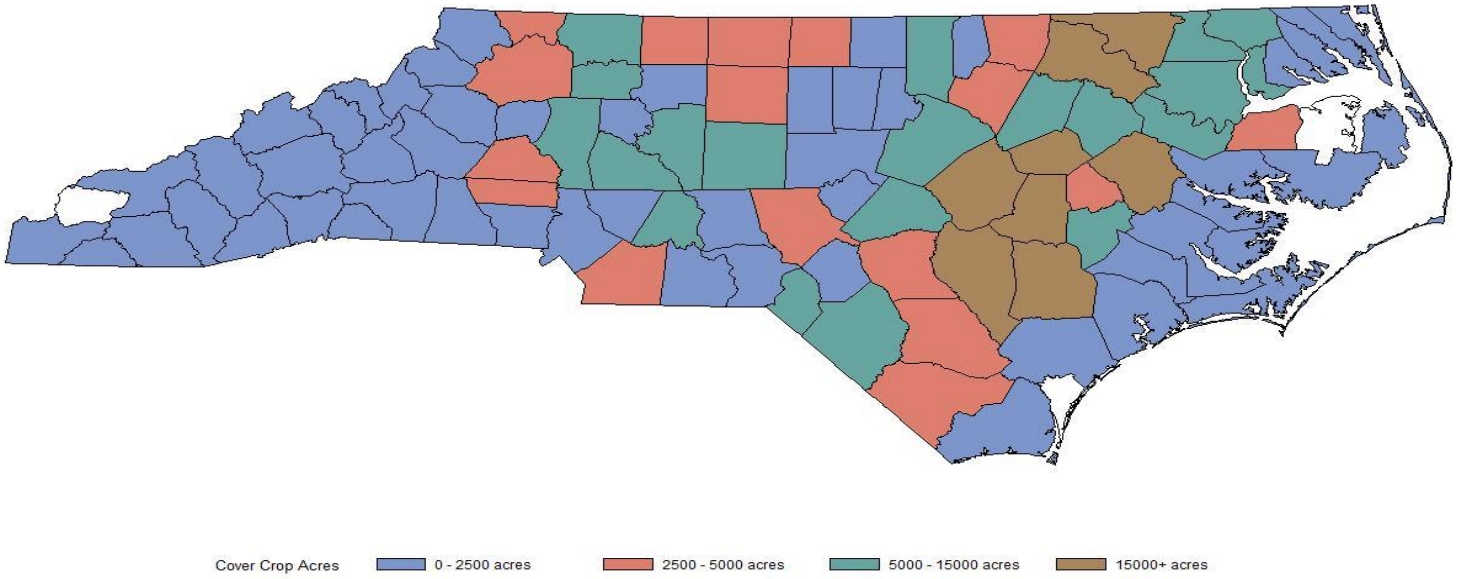
No-till Adoption

- No till adoption % in 2017 is ~37% of total cropland acreage

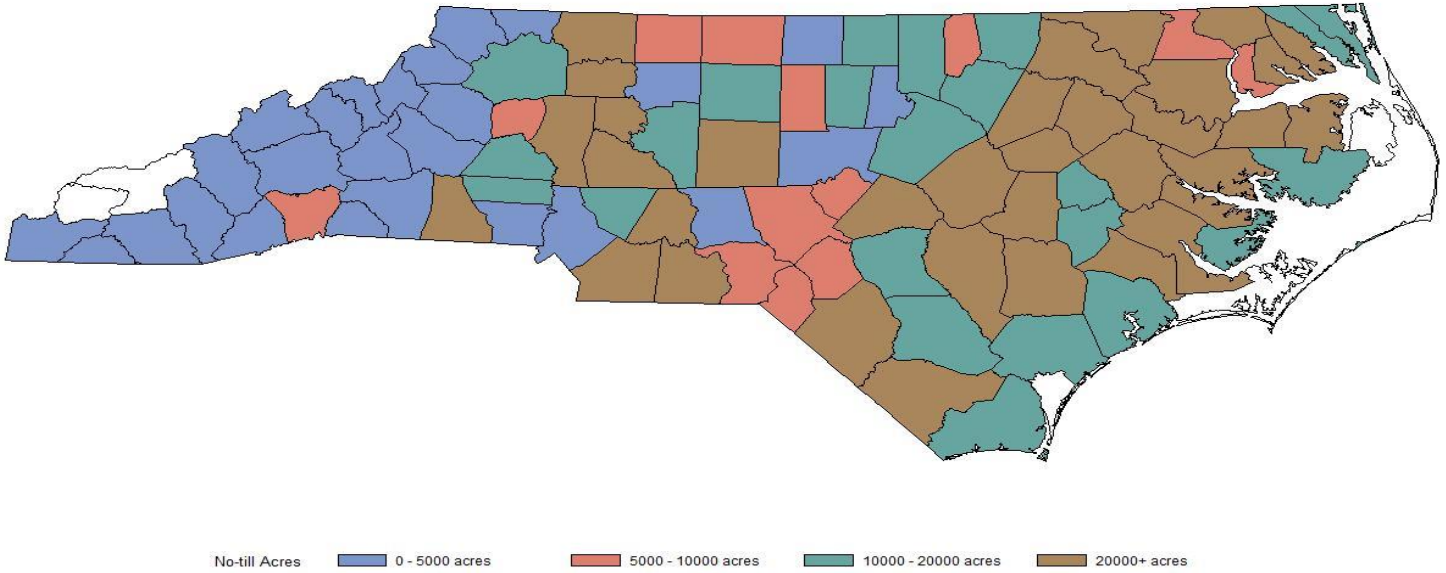


2017 NC cover crop acres



- Mean cover crop acres per county is ~4,966 acres
  - About 10% adoption rate (based on ~50k cropland acres per county)

2017 NC no-till acres



- Mean no till acres per county is ~19,656 acres
  - About 39% adoption rate (based on ~50k cropland acres per county)

Economic Dimensions

- To promote further adoption of these soil health practices, these practices have to make "economic sense" to individual farmers
- Policy makers also need to understand the economics of adoption to better design policies to encourage further adoption if needed
- A framework that lays out the economic dimensions that affect adoption and impact of soil health practices is important

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Economic dimensions of soil health management practice decisions.

Type	Potential benefits (revenue increasing or cost decreasing)	Potential costs (revenue decreasing or cost increasing)
Private (e.g., individual)	Agronomic: • Increased yields (and revenues) • Reduced fertilizer expenses • Reduced fuel cost (in no-till) • Better resilience to extreme weather events • Yield stability over time • Grazing opportunities (from cover crops) Environmental: • Reduced soil erosion in farmer fields • Decreased soil compaction • Reduced nitrogen and phosphorus losses increasing nutrient use efficiency • Better moisture retention in-season	Agronomic: • Increased cover crop seed costs • Increased labor and machinery cost (e.g., for planting cover crops) • Increased herbicide costs (e.g., for cover crop termination and weeds in no-till systems) • Decreased yield (e.g., if delayed planting due to delayed cover crop termination, among other reasons) • Opportunity cost of labor for planting cover crops in the winter • Decreased moisture available for cash crop (after planting cover crops) • May recruit unwanted wildlife (for cover crops) Environmental: • None
External (e.g., societal)	Agronomic: • Reduced pest and disease outbreak incidence (e.g., due to beneficial insects) Environmental: • Reduced soil erosion on landscape • Carbon sequestration (e.g., cover crops or no-till remove carbon dioxide from the air and store it in the form of carbon in the plant and/or soil) • Improved water quality (e.g., from reduced nitrate leaching) • Increased biodiversity (e.g., better environment for beneficial insects and pollinators)	Agronomic: • Increased pest or disease incidence for neighbors due to cover crops being a possible host Environmental: • None

Economic Dimensions

- Without subsidies, farmers bear the cost of adopting cover crops, but benefits are received both by farmers and society
- This "mismatch" implies potential under-provision of soil health benefits
  - Farmers only adopt commensurate to their net private benefits (not considering the environmental benefits)
  - This "market failure" suggests likely role for public policy
    - Internalize the external soil benefits for optimal societal provision

Economic Dimensions

- Dynamic nature of economic outcomes
  - Adoption now affects current period but also future periods
  - Short-term versus Long-term outcomes
- Variability of economic outcomes
  - Some evidence that it reduces downside risk (insurance losses)
- Uncertainty in private and environmental benefits
  - Still lots of uncertainty on when yield benefits (if any) occur, as well as magnitudes
- Value of environmental benefits
  - E.g., hard to value reduction in N runoff and C sequestration

What does the econ literature say?

- Focus mostly on short-term private benefits and costs (especially for cover crops)
  - Long term cover crop studies still sparse
- Recent short-term cover crop studies indicate private benefits are less than private costs
  - See Plastina et al. 2018a, 2018b; Myers et al 2019
- Studies on long-term no-till systems generally show net profitability
  - Cusser et al 2020 says it may take several years

What does the econ literature say?

- Some conditions that may increase short-term net profitability of cover crops (Myers et al 2019):
  - When cover crops are grazed
  - When herbicide resistant weeds are a problem
  - When soil compaction is an issue
  - When transitioning to no-till
  - When there are soil moisture deficits
  - When fertilizer costs are high
  - When there are government incentive payments
    - Maryland state cost-share programs & EQIP/CSP

Policy Discussions & Issues

- USDA Climate Initiatives
  - EQIP and CSP programs through NRCS
    - Additional $10M to support EQIP in 2021 onwards
  - Crop insurance premium subsidy of $5 per acre
    - Pilot program in IL, IN, IA
    - Pandemic Cover Crop Payment
  - Proposed $28B investments in USDA conservation programs
    - In budget reconciliation
    - $25 per acre from FSA to grow cover crops
    - $5B to FSA for cover crop program, $9B for EQIP, $4B for CSP, $10B on others
- Carbon Markets
  - $15 per ton C sequestered (~$10/acre)

Take Home Messages

- Soil health practices (cover crops and no-till) seen as key practices for sustainable agricultural growth
  - Have important productivity and environmental impacts
- Adoption levels are still low (especially cover crops)
  - Need to consider different economic dimensions that affect long-term profitability
- Strong interest in developing policies to encourage adoption
  - Current administration on the record that they will provide more support
  - Carbon markets to play a role

Thank you!

- **Questions?**
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    - https://cals.ncsu.edu/are-extension/policy-and-regulation/agricultural-policy-and-farm-bill/

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