Farm-specific modeling provides better value to sequestration offset buyers and producers

Karen Updegraff
Patrick R. Zimmerman
Patrick Kozak
PV Sundareshwar

_South Dakota School
of Mines & Technology_

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GHG Reduction opportunities in agriculture

- Agriculture produces 15% of global GHG emissions (not counting sinks) [EPA, 2006]

- 7-27 $MMTCO_2$/yr economic offset potential for soil C in US [Lewandrowski et al. 2004]

- Sequestration of CO_2 presents unique challenges in quantification & monitoring

Soil GHG offsets marketed to date

- GEMCo/TransAlta – IGF: 1.4m ac Iowa no-till, 12 yr @$1.50/MTCO$_2$.

- PNW Direct Seed Ass'n – Entergy: 5400 ac, 10 yr @2.50/MTCO$_2$

- Iowa Farm Bureau – CCX: No-till/CRP, 4-yr contracts @CCX price ($4/MTCO$_2$). 2m ac enrolled in IA, KS, MO, NE, ND.

  ALL ARE PRACTICE-BASED CONTRACTS.

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Requirements to qualify VERs

1. Establish BAU or baseline
2. Establish additionality
3. Quantify permanence
4. Quantify leakage
5. Prove ownership
6. Use accepted/appropriate verification and certification protocol

Accounting methodology *must* address 1,2 and 3.

Approaches to estimating soil C stocks

- Generic factor (IA Farm Bureau, CCX): *no site-specific information*

- Generalized modeling (Comet-VR): *limited site-specific parameterization, literature-based uncertainty estimate.*

- Site-specific modeling (C-Lock): *extensive site-specific parameterization + Monte Carlo uncertainty analysis + BAU.*

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C-Lock accounting model
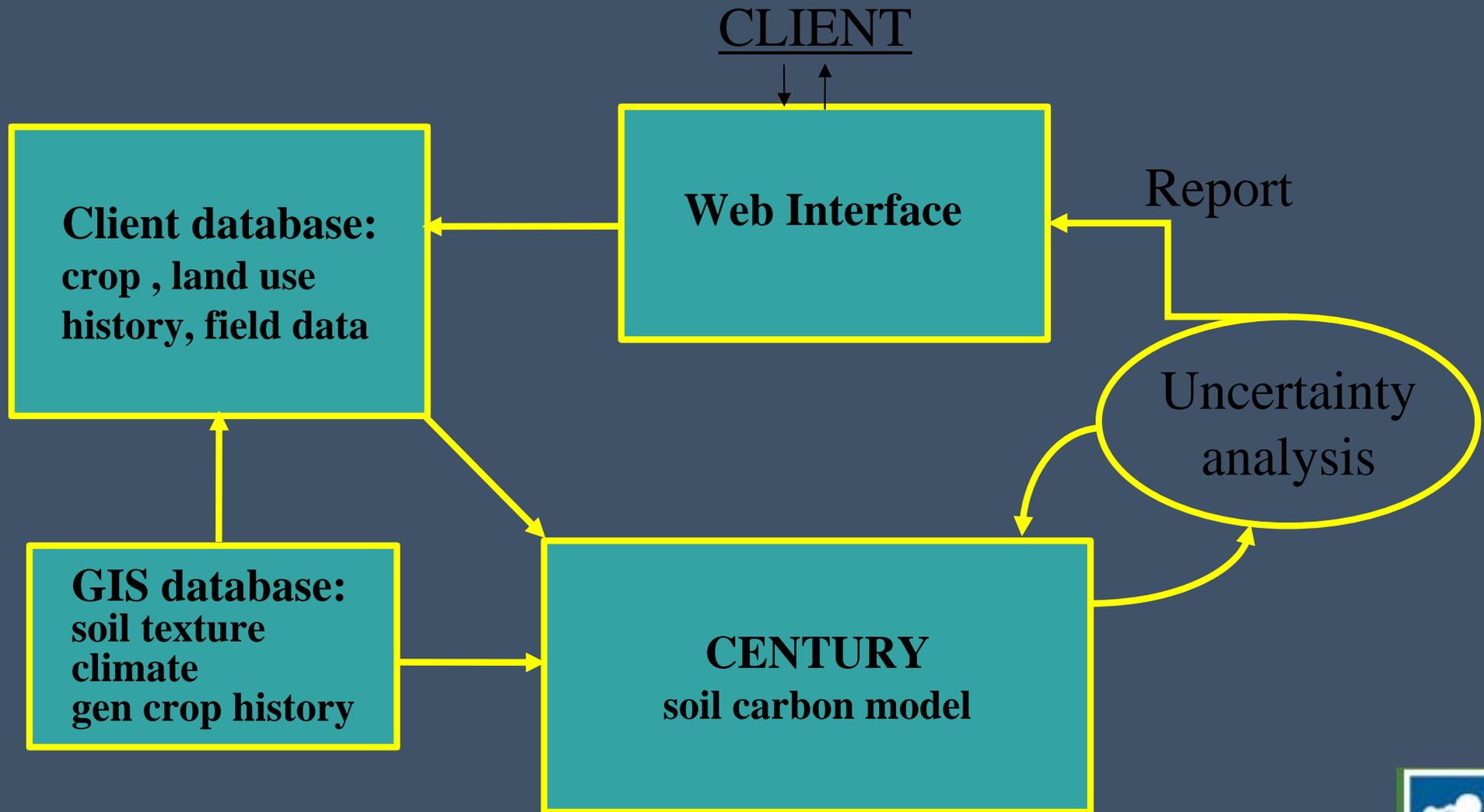
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- Sampling: *site specific but cannot account for BAU, very costly.*

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Convenience *vs* customization?

- Problem with sampling: expensive, no BAU
- Problem with generic Emission Factor: no sensitivity to site or management differences (BAU assumed?)
- Problem with generalized modeling: little sensitivity to site or management details, no BAU.
- Problem with site-specific modeling: time-consuming, data-intensive.

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Comparing estimation approaches

- 23 fields, 3042 ac in central SD: high-low productivity; no-till row crops/grains, pasture, CRP.
- Parameterized in C-Lock & Comet-VR.
- Estimated using IFB probable rate (0.5, 0.75).
- Compared estimated totals and rates in 2006.

Comparison results

Acres	Est Total MTCO2e/yr in 2006			Est MTCO2e/ac/yr 2006			Uncertainty %	
	Comet	CLock	IA FB	Comet	CLock	IA FB	Comet	CLock
3,042	464	3128	1521	0.14	0.95	0.5	7.08	23.24

C-Lock *uncertainty-corrected* estimate is:

2.1x Farm Bureau estimate;
6.7x *uncorrected* Comet estimate.

Financial implications

- Comet (NCOC), sold on CCX (20% reserve, 10% commission, $4/MTCO$_2$): $0.43/ac/yr.
- IFB method, sold on CCX (20% reserve, 10% commission, $4/MTCO$_2$) : $1.44/ac/yr
- C-Lock method, registered by ERT, sold on retail market or to industrial purchaser, (15% reserve, 30% commission, $5/MTCO$_2$) : $3.06/ac/yr

$223/hr of extra work!

Other advantages

- Simulates defined and BAU management in parallel to factor out natural variation (eg, weather), to ensure <u>additionality</u>

- Monte Carlo-based <u>uncertainty</u> estimation defines confidence intervals around estimate of marketable offset credits

- Built-in flags for uncertainty stemming from user error or lack of knowledge

- <u>Performance-based</u> contract provides flexibility for producer to meet obligations

- Third-party verification, rigorous registry standards

Contract issues

- C-Lock contract shifts delivery risk to the aggregator (us)

- This means that
  1. We must keep a large enough pool to indemnify against non-delivery
  2. Contracts must be designed to minimize the risk of

     a. Leakage

     b. Disputed ownership

     c. Permanence (defined-term contracts, reserve requirement, producer updates with verification)

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