Soil Carbon Protocols

Public Scoping Meeting

March 6, 2013

Sacramento, CA

CLIMATE ACTION RESERVE

Agenda

1. Introductions
2. Overview of the Climate Action Reserve
3. Protocol development process
4. Soil carbon scoping
   a) Grasslands
   b) Peatlands
5. Feedback & discussion

Introductions

- Climate Action Reserve
  - Max DuBuisson, Senior Policy Manager
  - Teresa Lang, Policy Manager
  - Sami Osman, Policy Manager
- Attendees

CLIMATE ACTION RESERVE OVERVIEW

What We Do

- Mission: to promote the reduction of greenhouse gas emissions by pioneering credible market-based policies and solutions
- Development of high-quality, stakeholder-driven, standardized project protocols
- Accredited offset project registry under the California cap-and-trade program
- Serve compliance and voluntary carbon markets
- Reputation for integrity and experience in providing best-in-class registry services for offset markets

Separation of Roles

- Independent from the State of California
- Reserve does not fund or develop projects
- Does not take ownership of offsets
- Is not an exchange
- Is a 501(c)3 not-for-profit organization
- Independent from third-party verification
  - Consistent with international standards
  - ANSI accreditation, training by Reserve or ARB

Serving Multiple Markets

- **Compliance market**:
  - Compliance buyers under California's cap-and-trade
  - Western Climate Initiative
  - CEQA compliance
- **Voluntary market**:
  - Voluntary corporate buyers
  - LEED certification (USGBC)
  - Retail and individual buyers

CA Compliance Offsets

- Early action: projects use Reserve protocols, and then move to compliance program through a desk verification
- Compliance offsets: credits issued against compliance protocols
- 4 Reserve protocols adopted for early action and adapted for compliance use
  - Forest, Urban Forest, Livestock, Ozone Depleting Substances
- Additional protocols will be developed by ARB staff, building upon existing methodologies
  - Strong interest in agricultural protocols
  - *Next up: Rice Cultivation, Coal Mine Methane – workshop in Sacramento March 28*

Compliance Offset Market

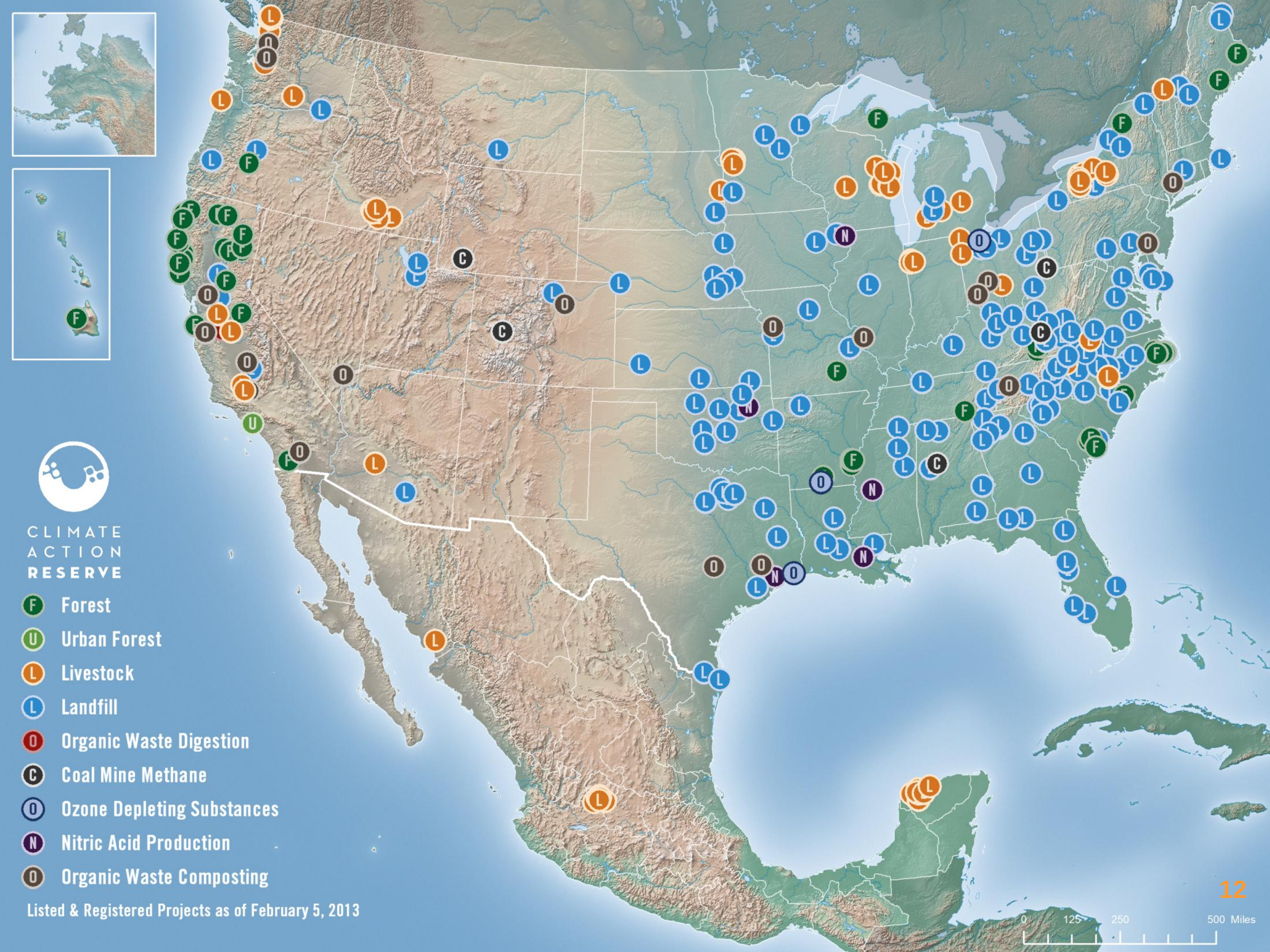
- Increasing demand as the program proceeds
  - 26.8M tCO_2e through 2014
  - 201.7M tCO_2e through 2020
- Allowance price floor of $10 (market currently ~$15)
  - Offsets usually not far behind (market currently ~$10)
- Additional market for CEQA compliance

Reserve by the Numbers

CRTs registered	**32.9 million**
ARB-Eligible CRTs registered	*12.1 million*
CRTs retired	*5.7 million (~ 17%)*
Account holders	**346**
Projects submitted	**496**
New & Listed	*303*
Registered & Completed	*193*
U.S. States with Projects	**45**
Mexican States	*4*

Adopted Protocols

- **Forest (Reforestation, Improved Forest Management, Avoided Conversion)**
- **Livestock Manure Management (US** & Mexico)
- **Ozone Depleting Substances (US** & Article 5)
- **Urban Forest**
- Coal Mine Methane
- Landfill Gas Capture (US & Mexico)
- Nitric Acid Production
- Nitrogen Management (currently corn in North Central Region only)
- Organic Waste Digestion
- Organic Waste Composting
- Rice Cultivation (currently CA only)


CLIMATE ACTION RESERVE
Forest
Urban Forest
Livestock
Landfill
Organic Waste Digestion
Coal Mine Methane
Ozone Depleting Substances
Nitric Acid Production
Organic Waste Composting
Listed & Registered Projects as of February 5, 2013
0 125 250 500 Miles

PROTOCOL DEVELOPMENT PROCESS

Offset Integrity

- **Real**
  - Can be measured to a high degree of accuracy
  - Is not an artifact of inaccurate or incomplete accounting
- **Additional**
  - Occurs outside of any regulatory requirement
  - Would not have occurred but for the incentive provided by a GHG market
- **Verifiable**
  - Can be (and has been) independently verified
- **Enforceable**
  - Ownership is undisputed and enforcement mechanisms exist to ensure all program rules are followed
- **Permanent**
  - Is removed from the atmosphere for a minimum of 100 years

Protocol Development

- Broad public input, sector-specific work groups
- Goal is to create a uniform standard that is widely recognized and builds on best practice
  - We incorporate the best elements of other protocols
  - We do not adopt methodologies from other sources (e.g. CDM, Gold Standard, VCS, project developers, etc.)
- Designed as step-by-step instructions on project implementation

Protocol Development Goals

- Develop a standardized approach for quantifying, monitoring, and verifying GHG reductions
  - Research industry trends in adoption of GHG reducing practices
  - Set criteria and reference points based on industry trends
  - Provide specific tools for quantifying emissions
  - Detailed and specific monitoring requirements
  - Train verifiers with a consistent set of protocol-specific standards
- Maintain consistency with or improve upon existing methodologies
- Balance accuracy, conservativeness, and practicality

The Standardized Approach

Benefits to a top-down approach:

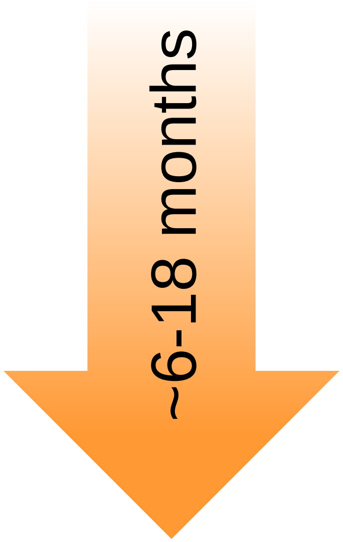
- Low up-front costs to project developers
- Efficient review and approval of projects
- Transparency and consistency
- Same approach applies across projects
- Prescriptive guidance to eliminate judgment calls

*But...*high initial resource investment to program

Protocol Development Timeline

1. Internal research and scoping
2. Issue paper
3. Scoping meetings
4. Workgroup formation
5. Draft development
6. Workgroup process
7. Public comment and workshop
8. Board adoption

- *Consideration by ARB*



Project Protocol Components

- Define the GHG project
- Define eligibility (including additionality)
- Establish GHG Assessment Boundary
- Quantify GHG reductions or removal enhancements
  - Baseline emissions
  - Project emissions
- Monitor eligibility and quantification parameters
- Verify project performance

Purpose of Scoping Meetings

- Share our plans with the stakeholder community
- Get input on initial findings
- Begin to fill gaps in our understanding
- Identify resources
- Discuss key issues

Minneapolis, MN (February 26th)

Sacramento, CA (March 6th)

Logistics

- Informal meeting
  - If you have questions or comments, please raise a hand
  - Please identify yourself and your organization
- We may take a short break in the middle, but if you need to get up, please go ahead
- The slides are available online

GRASSLANDS

Protocol Components

PROJECT DEFINITION	?	
LEGAL REQUIREMENT TEST	?	
PERFORMANCE STANDARD TEST	?	
GHG BOUNDARY & QUANTIFICATION	?	
MONITORING & VERIFICATION	?	
OVERALL ASSESSMENT	?	

Grasslands

- Typically considered as a subset of rangelands/grazing lands
- Dominated by grasses and forbs, may include shrubs, and trees at a low percent cover (no canopy)
- May include plantings, but managed through grazing and natural disturbance
- Protocols typically exclude histosol soils

Why Grasslands?

- Certain grassland ecosystems are highly-efficient at capturing and storing carbon
- Conversion to cropland or development releases much of the stored carbon
- Land use after conversion tends to have higher GHG emissions than grassland uses
- Conversion pressure is high and barriers are relatively low

= opportunity for GHG emission reductions

Why Grasslands?

- The emission reductions are quantifiable with a reasonable degree of scientific accuracy
- The potential abatement appears to be sufficient to provide feasible project financials
- We believe that the policy issues can be dealt with
  – Additionality
  – Permanence

Project Activities

Avoided Conversion of Grasslands (ACG)	Permanently conserving grasslands that would have otherwise been converted into alternative use
Conversion of Marginal Croplands to Grasslands (CCG)	Conversion of cropland of marginal quality to native grassland under permanent conservation

Overview of ACG

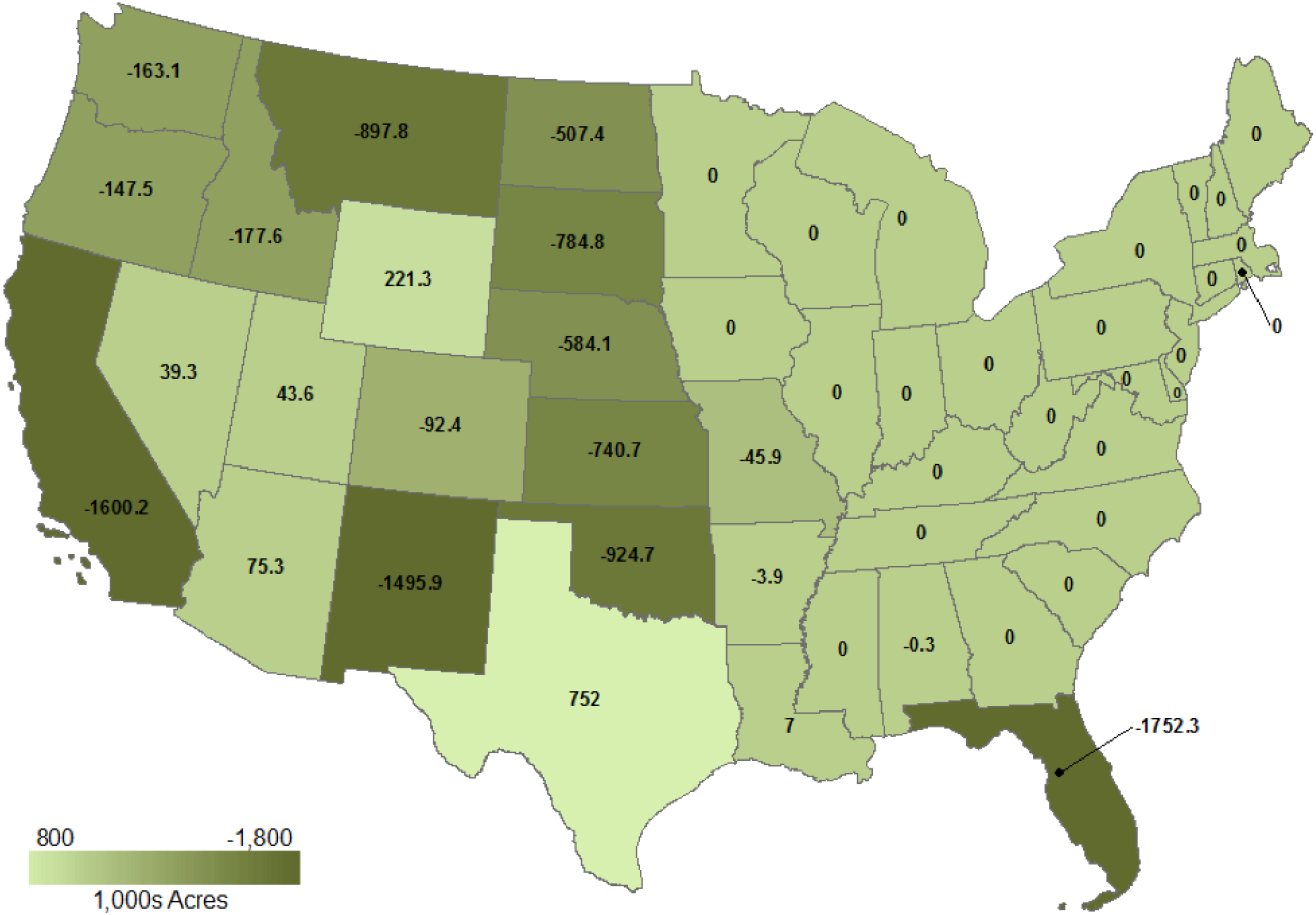
	AVOIDED BASELINE	PROJECT
Land Cover	• Cropland • Possibly development	• Existing grassland
Land Management	• Tilling • Addition of fertilizer • Biomass removal • Possibly irrigation	• Moderate grazing • Possibly biomass removal
GHG Sources	• CO_2 from tilling • N_2O from fertilizer • CO_2 from equipment	• CH_4 from livestock • Minimal CO_2 from equipment
GHG Sinks	• Assumed none • Possibly low-level soil sequestration	• Avoided loss of soil carbon

Overview of CCG

	BASELINE	PROJECT
Land Cover	• Existing cropland	• Restored grassland
Land Management	• Tilling • Addition of fertilizer • Biomass removal • Possibly irrigation	• Planting • Moderate grazing • Possibly biomass removal
GHG Sources	• CO_2 from tilling • N_2O from fertilizer • CO_2 from equipment	• CO_2 from equipment • CH_4 from livestock
GHG Sinks	• Assumed none • Possibly low-level soil sequestration	• Soil sequestration over time

Figure 8: Change in NRI rangeland (i.e., native grassland) acres by state, 1982-2007

Source: The Reserve issue paper prepared by The Climate Trust



Conversion Trends 2001-2006

Subset of National Land Cover Database (NLCD) conversions in acres

Converted to:

Converted from:		Cultivated Crops	Development
	Grass/Herb	598,000	373,000
	Shrub/Scrub	308,000	318,000

Source: The Reserve issue paper prepared by The Climate Trust

Figure 1: Gross conversion rates for grassland and shrub/scrub to cropland

Source: The Reserve issue paper prepared by The Climate Trust

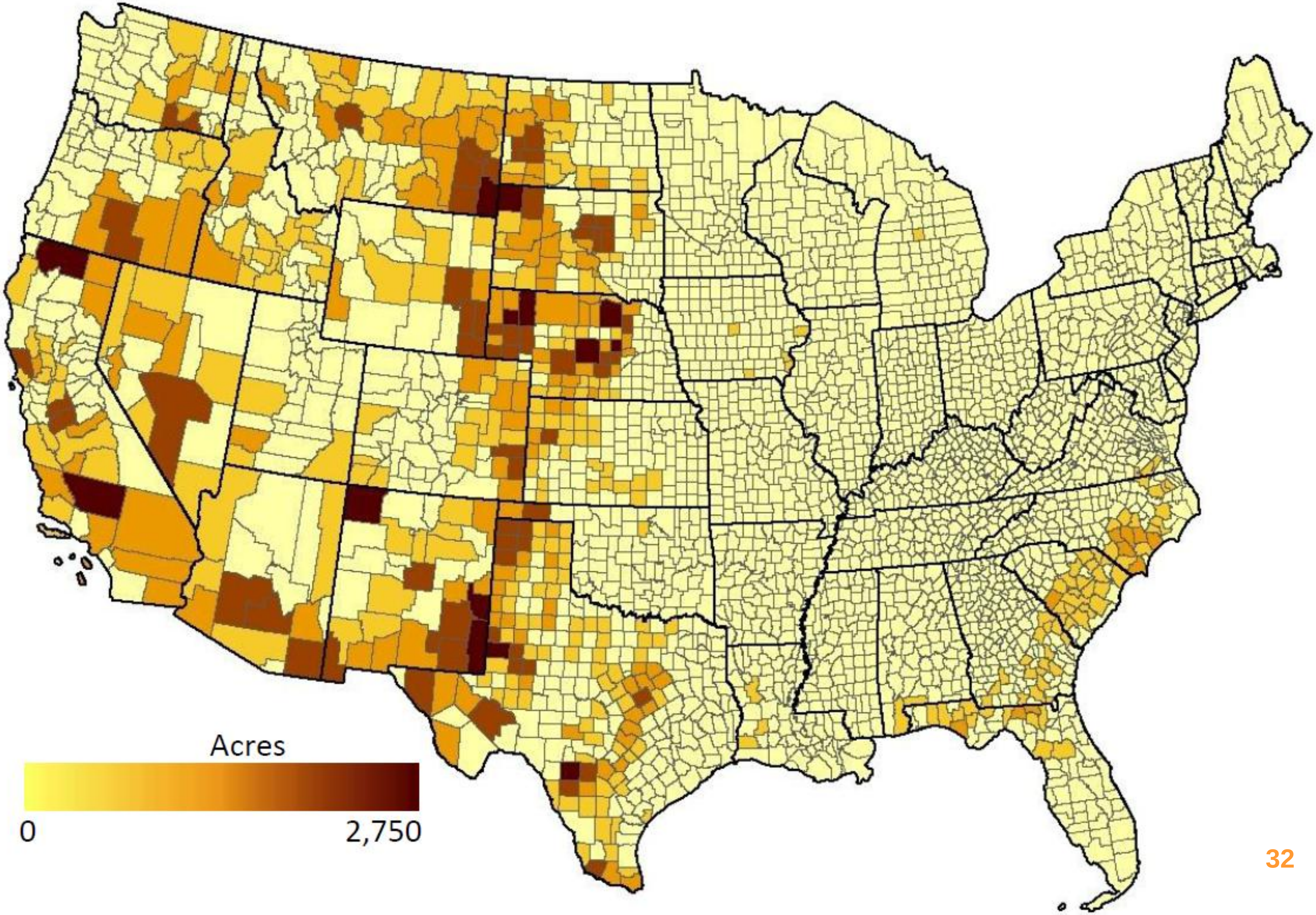
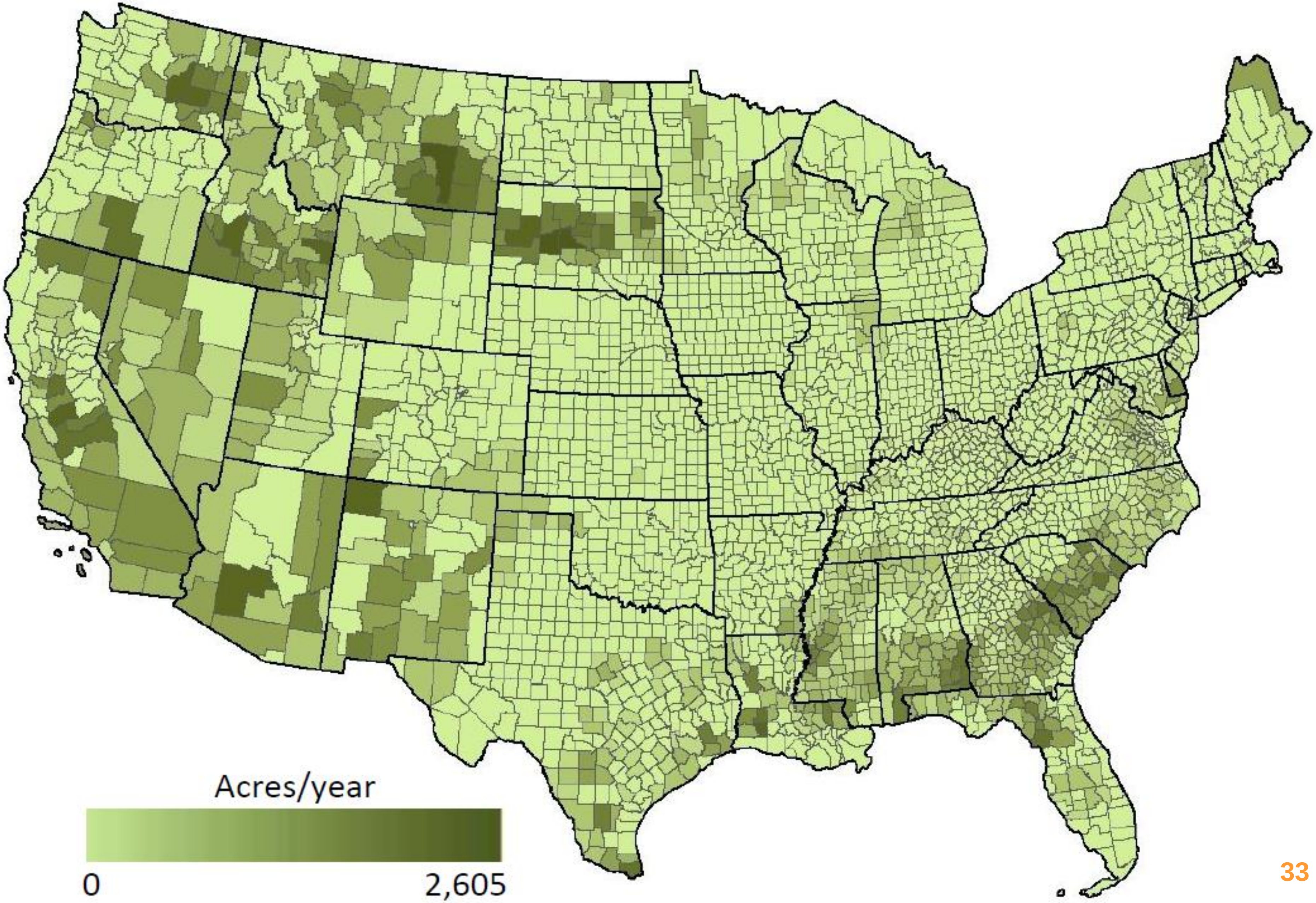


Figure 2: Gross conversion rates for cropland to grassland and shrub/scrub

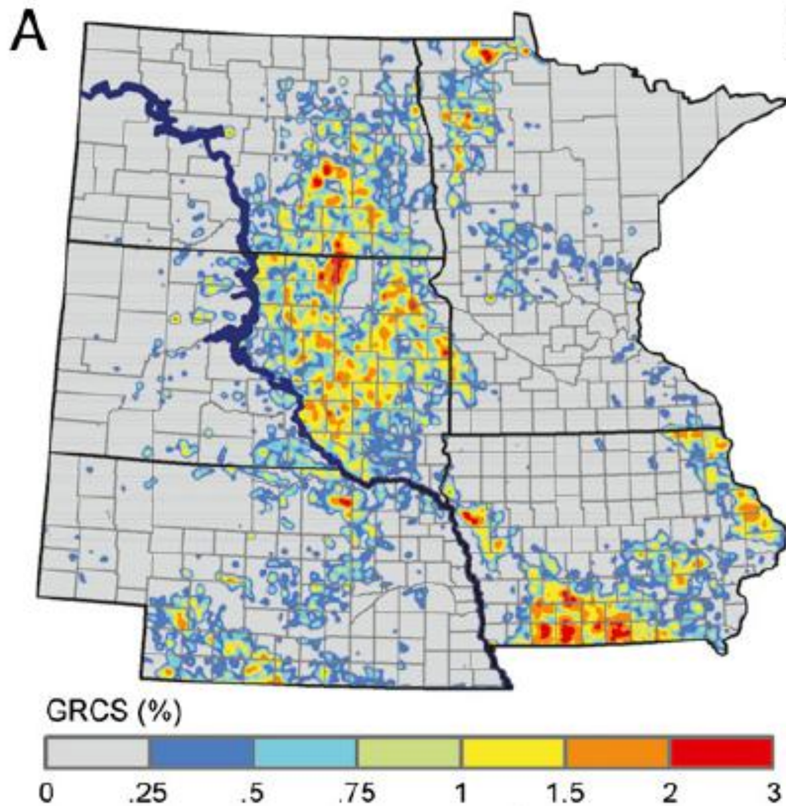
Source: The Reserve issue paper prepared by The Climate Trust



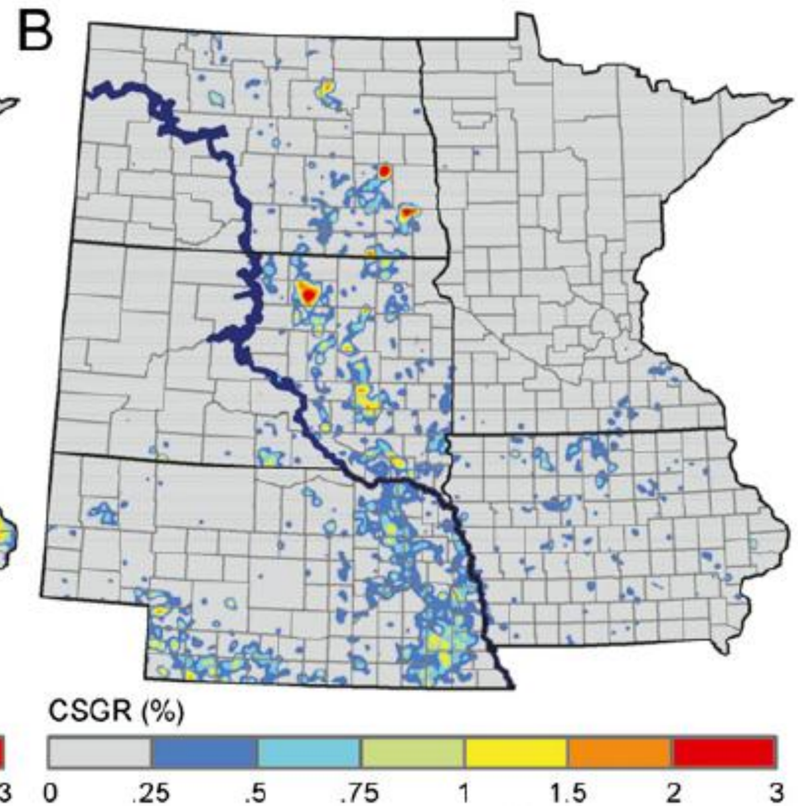
Conversion Trends 2006-2011

Comparing changes in the NASS Cropland Data Layer (CDL)

Christopher K. Wright and Michael C. Wimberly, "Recent land use change in the Western Corn Belt threatens grasslands and wetlands." PNAS 2013; published ahead of print February 19, 2013.



Absolute change from grassland to corn/soybean



Absolute change from corn/soybean to grassland

Drivers of Conversion

Converted to:

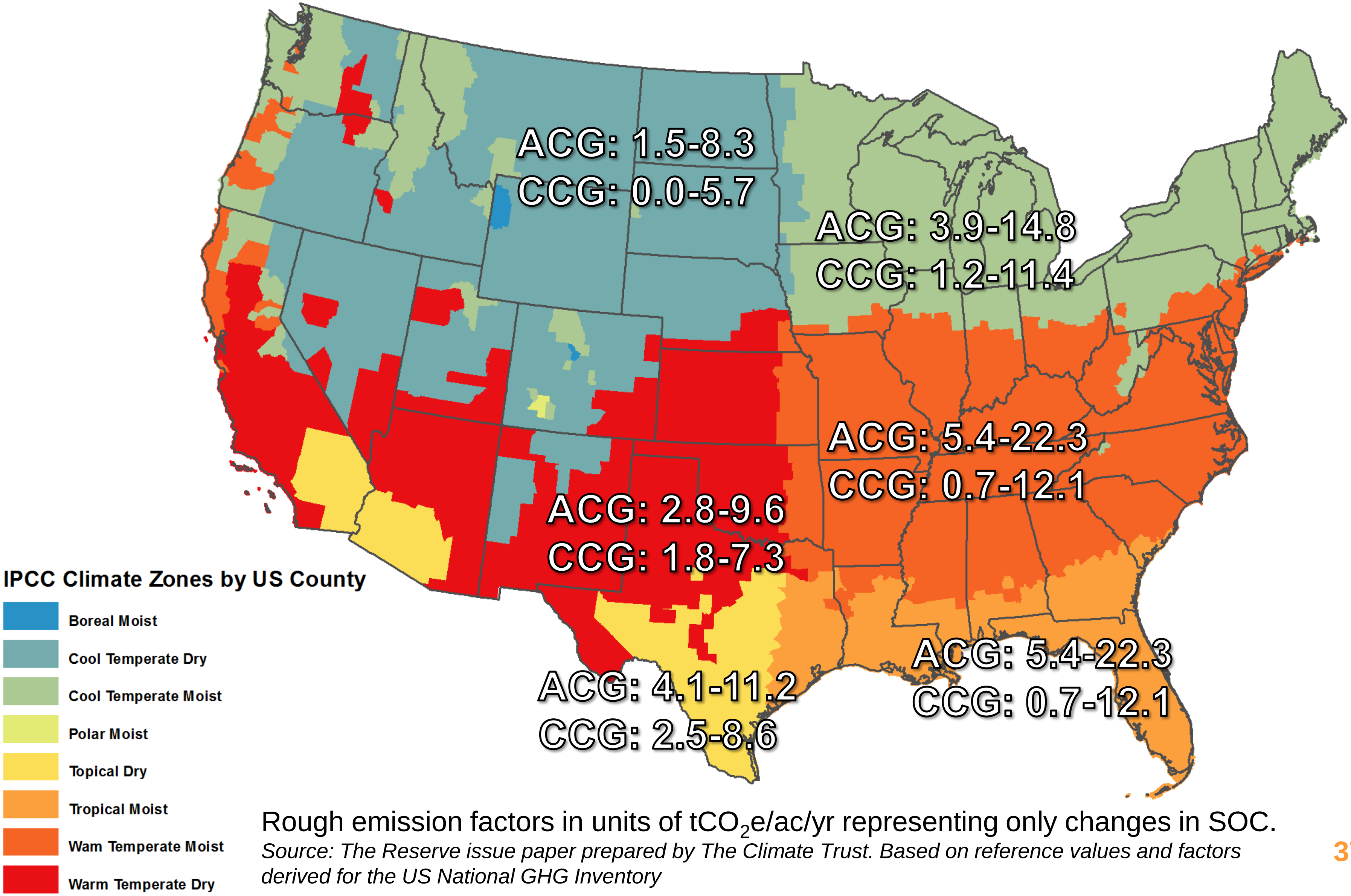
Converted from:

	Grassland	Cropland	Development
Grassland	*(no conversion)* • GRP payments • Grazing value	• High commodity prices • Reduced CRP payments	• Proximity to urban areas • Proximity to other development drivers (e.g. recreational areas)
Cropland	• CRP payments	*(no conversion)* • High commodity prices • Reduced CRP payments	*N/A*

Conversion Trends: Summary

- Grasslands are currently being converted into cropland of marginal quality
- In some areas cropland is being returned to grassland

Estimated Emission Factors



Rough emission factors in units of tCO_2e/ac/yr representing only changes in SOC.

Source: The Reserve issue paper prepared by The Climate Trust. Based on reference values and factors derived for the US National GHG Inventory

Technical Potential GHG Reductions

- **Avoided Conversion of Grasslands (ACG): 0.2 – 2.0 million tCO_2e/yr**
  - Based on annual rate of conversion from grassland to cropland (2001-2006) as 185,000 ac/yr
- **Conversion of Marginal Cropland to Grasslands (CCG): 130 – 1,160 million tCO_2e/yr**
  - Depends upon definition of “marginal” cropland
  - NRCS Land Capability Classes

Existing Methodologies

- **VCS VM0017** – Adoption of Sustainable Agricultural Land Management
- **VCS VM0021** – Agricultural Land Management, Soil Carbon Quantification Methodology
- **CCX** – Continuous Conservation Tillage and Conversion to Grassland Soil Carbon Sequestration Offset Project Protocol
- **CCX** – Sustainably Managed Rangeland Soil Carbon Sequestration Offset Project Protocol

- Additional quantification tools have been approved by CDM and VCS

Proposed Methodologies

- **VCS & ACR** – Methodology for Avoided Conversion of Grasslands and Shrublands from Planned Conversion
- Grassland management methodologies
  - **VCS** – Adoption of Sustainable Grassland Management through Adjustment of Fire and Grazing
  - **VCS** – Agricultural Land Management: Improved Grassland Management
  - **VCS** – Methodology for Sustainable Grassland Management (SGM)

GHG Assessment Boundary

- Upstream
  - Production, transportation, and use of livestock and crop inputs
  - Production, transportation, and use of labor and conversion inputs
- On-site
  - **Soil carbon dynamics**
  - Livestock direct emissions
  - Fertilizer direct emissions
  - Biomass dynamics
- Downstream
  - Leakage
  - Nitrogen leaching, volatilization and runoff (LVRO) emissions

Effects on Atmospheric GHGs

Soil Carbon
(increased or maintained)

Biomass

Livestock Grazing

Market Leakage

Crop Inputs (i.e. Fertilizer)
(reduced)

Replanting Activities & Inputs
(increased)

GHG Assessment Boundary

Questions for discussion:

- Where to set the upstream boundary?
- Where to set the downstream boundary?
- Are there any SSRs that could be optional?

Additionality

- What is an "additional" project?
  - A project that would not have happened without carbon incentive
- What is a "non-additional" project?
  - A project that would have happened regardless of carbon incentive (e.g. due to legal requirement or other market forces)
- Reserve's standardized approach
  - Is the project required by law?
  - If not, is it likely that it would be implemented for other reasons?
  - How long ago was the project implemented?

Performance Standard Test

- How to set threshold for additionality?
  - Conversion rates can vary substantially between datasets
  - Land use change drivers are diverse and evolve over time
  - Land rental rates vary considerably. In some places rangeland rental rates > cropland rental rates
  - Limit geographic scope to conversion hotspots?
- LUC trends are highly dynamic in some regions and not in others.

Performance Standard Test

- Reserve Forest Project Protocol V3.3 (FPP) test for avoided conversion projects:
  - Required real estate appraisal for project area (including minimum standards for an appraisal)
  - Project area must be suitable for conversion
  - Alternative land uses must have higher market value (at least 40% higher) than maintaining the project area as a sustainable forest
- This approach requires no national dataset on conversion

Incentive Stacking

Types of stacking:

- Payment stacking:
  - Payments for ecosystem service value of the project activities
  - Common among target areas and activities
- Credit stacking:
  - Tradable credits issued for ecosystem service value of the project activities
  - Uncommon among target areas and activities

Payment Stacking

- How to treat payment stacking and enrollment in existing conservation programs?
  - CRP (USDA Conservation Reserve Program)
    - Voluntary program supporting conversion of cropland to grassland
    - Increased exits of CRP land, payments currently decreasing
  - GRP (USDA Grassland Reserve Program)
    - Voluntary program supporting conservation of grazing land
  - EQIP (USDA Environmental Quality Incentives Program)
    - Cost-sharing for certain conservation practices
- RCPP disallows payment contracts for specific project activities that occurred prior to submittal

Payment Stacking

- Question for discussion:
  - What other programs should we be aware of?

Quantification

- Quantify primary effect:
  - ACG: Avoided loss of soil carbon due to baseline activities
  - CCG: Gain of soil carbon due to project activities
- Quantify secondary effects:
  - Avoided emissions from cultivation
  - Increased emissions due to grazing
  - Leakage emissions due to cultivation elsewhere

Quantification: Soil Carbon

- Field sampling can be expensive and uncertain
- Other options:
  - Biogeochemical process models
  - Emission factors
  - A combination of approaches
- Field sampling could be used to supplement the use of models

Quantification: Soil Carbon

- **VCS** VM0017– model baseline and project equilibrium SOC and calculate linear change over time
  - No direct field measurements
  - Model based on soil type and management
- **VCS** VM0021– model baseline and project equilibrium SOC with biogeochemical process model (DNDC or Century)
  - Direct field measurements as determined by stratification plan
  - Field measurements inform modeling.
- **CDM** – SOC moves from one reference value to another linearly over 20 years
  - Lookup value for each stratum defined by climate and soil
- **CCX** – default sequestration rates
  - No direct field measurements or modeling

Quantification

- Conversion hotspots display dynamic LUC, with some areas converting multiple times over multiyear periods
- Should ACG projects attempt to model this variability, rather than assume total conversion for the project crediting period?

Market Leakage

- Shifts in crop production or development outside of a project's physical boundaries due to project-related yield changes
  - Positive leakage impacts (none expected)
  - Negative leakage impacts (reduced grassland carbon storage and increased emissions outside of project boundaries)
- Both may involve indirect land-use change (ILUC)
  - ACG: conversion of grasslands elsewhere
  - CCG: shifting crop production to other areas

Determining ILUC

- Domestic leakage estimated as high as 20%
- International accounting could produce leakage ranging from 21% - 89% on a land area basis

- Questions:
  – Assess leakage on a per-yield or per-area basis?
  – Assess only domestic leakage or extend to international?
  – Different approach for ACG and CCG?

Reversals

- Reversals occur when carbon stored to offset CO_2 is released back to the atmosphere
  - Relevant to SOC sequestration
  - Reversals are a function of soil and biomass disturbance
  - Can result from natural causes, management decisions, tillage, grazing, project termination
  - Not every disturbance leads to a reversal

Managing Reversals

- Reducing reversal risk
  - Long-term monitoring and enforcement
  - Permanent conservation easements
  - Transfer to public ownership
- Mitigating reversal effects
  - Liability provisions (intentional reversals)
  - Buffer pools (unintentional reversals)

Project Duration

- Forest projects = 100 year crediting period plus 100 year permanence requirement
- Agricultural land management follows shorter timeframes
- SOC stock achieve equilibrium over shorter timeframes
- Grassland projects:
  - Crediting period 20-30 yrs? Less for ACG?
  - 100 year permanence requirement

Project Aggregation

- Individual project participants would be managed by a single project aggregator
- Benefits of project aggregation
  - Improved sampling efficiencies and accuracy of models
  - Potential reduced costs and administrative burden
  - Distributed liability and risk

Reserve Approaches to Aggregation

- Forest Project Protocol:
  - Limited to 5,000 acres per project developer
    - Acreage share for single project acreage share up to 50%
    - Acreage share for two project aggregates up to 70%;
  - 50% of projects get site visit verifications within 6 years, 100% within 12 years
- Rice Cultivation:
  - Declining limit of 70% - 25% share of individual fields as number of fields increases
  - Verification on all data, site visits on risk-based sample of fields

General Questions

- What type of landowner will be interested in participation?
- Who will typically serve as the project developer or aggregator?
- Thoughts on the project duration?
- Data sources for predictions of future trends in the drivers of conversion?

Protocol Components

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PROJECT DEFINITION	☺	Possible to develop specific definition of the project activities and eligible lands.
LEGAL REQUIREMENT TEST	😐	Complex legal landscape, but appears that it could be navigated.
PERFORMANCE STANDARD TEST	😐	Many complex drivers of conversion, but appears that specific thresholds could be identified. May limit scope.
GHG BOUNDARY & QUANTIFICATION	😐	Numerous options for quantification have been developed by other methodologies.
MONITORING & VERIFICATION	☺	It is possible to monitor and verify complex, land-based carbon reduction projects.
OVERALL ASSESSMENT	☺	Additional work is required to overcome obstacles, but the Reserve believes it is possible.

Permanence

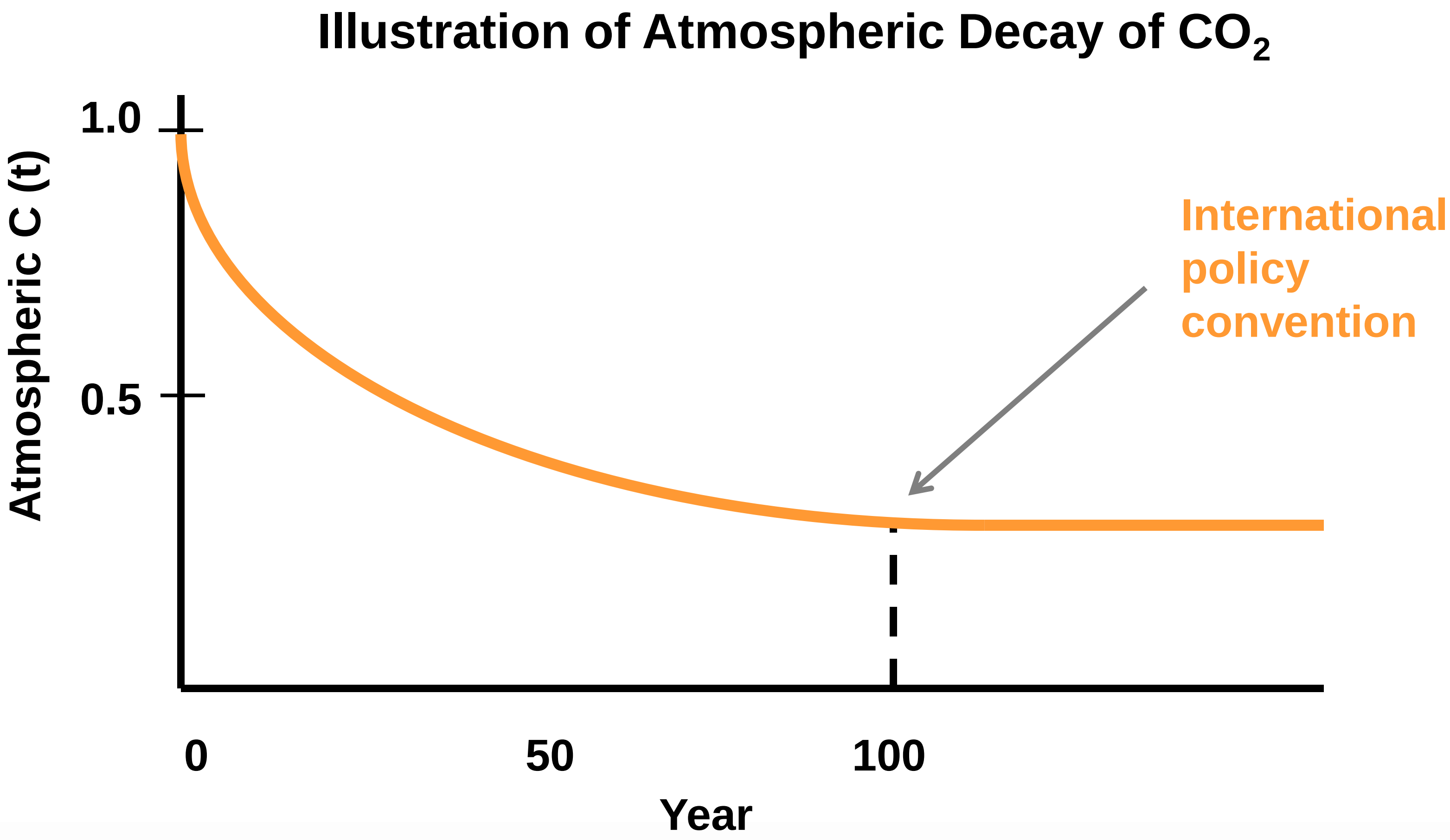

Illustration of Atmospheric Decay of CO_2
1.0
0.5
Atmospheric C (t)
International policy convention
0
50
100
Year

PEATLANDS

Protocol Components

CLIMATE ACTION RESERVE

PROJECT DEFINITION	?	
LEGAL REQUIREMENT TEST	?	
PERFORMANCE STANDARD TEST	?	
GHG BOUNDARY & QUANTIFICATION	?	
MONITORING & VERIFICATION	?	
OVERALL ASSESSMENT	?	

What Are Peatlands?

- Subset of wetlands – inconsistencies in definition
- Partly decomposed biomass with high organic content
  - Histosols: dominated by organic soil material
  - Marshes, swamps, bogs, mires
- Flooded, anaerobic systems
- Water level appears to be most important factor on ability to serve as GHG source or sink

GHG Source or Sink?

- Wetted peatlands are anaerobic
  - CO_2 sequestration + CH_4 emissions = net SINK
  - Sequestration via peat accumulation is > CH_4 emissions
- Drained peatlands are aerobic
  - CO_2 emissions + potential N_2O emissions = net SOURCE
  - Natural decomposition speeds up under aerobic conditions
  - There are exceptions: forested drained peatlands in US may act as sink

Why a Peatlands Protocol?

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- Peatlands are the most carbon-dense ecosystems of the terrestrial biosphere
- Cover only 3% (4,000,000 km^2) of world's land area, but store 550 Gton of carbon
- Conversion or draining of peatlands creates large releases of CO_2
- Potential opportunity in many regions of the U.S.
- A subset of wetlands, a project type of interest
- Unique ecosystems with strong co-benefits

Co-Benefits

- Projects ideally result in benefits beyond climate change mitigation
- Benefits include:
  - Water quality improvements
  - Aquatic habitat protection
  - Terrestrial habitat protection
  - Fire management and avoided wildfire response costs

Countries with Largest Peat Occurrence and Emissions [1]

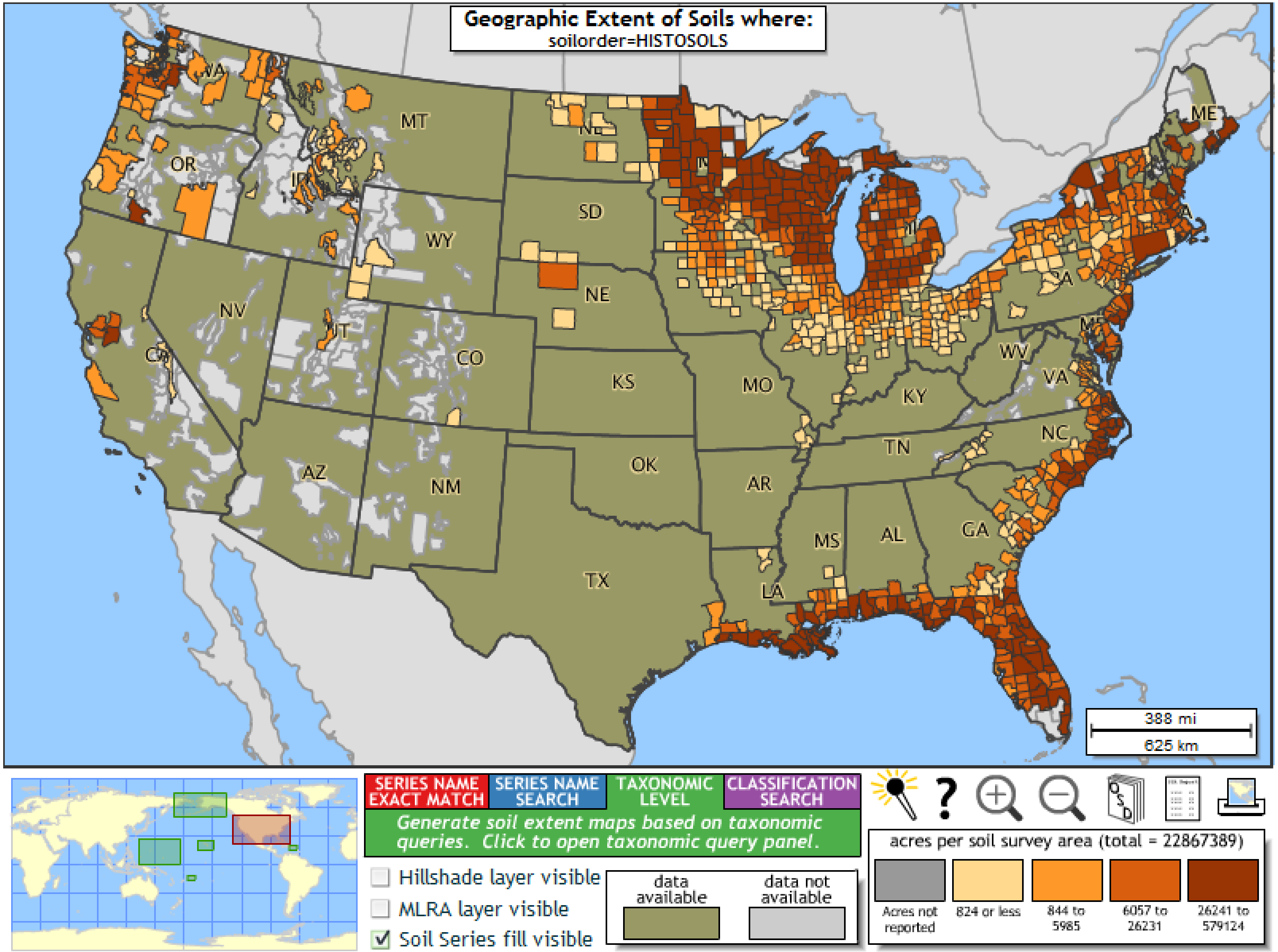
Country/Area	Peat Area (km^2)
1. Russia – Asian part	1,176,280
2. Canada	1,133,926
3. Indonesia	265,500
4. Russia – European part	199,410
5. USA – Alaska	131,990
6. USA – lower 48	91,819

Country/Area	Emissions from Degrading Peat (Mtons CO_2e/year)
1. Indonesia	500
2. Russia – European part	139
3. USA – lower 48	67
4. China	66

U.S. Peatlands 2

- Differences in how peatlands are classified make analysis of data on existing peatlands and loss of peatland over time difficult
- Using wetlands as a proxy, extensive losses have occurred, particularly since 1950s
  – 22 states have lost 50% of wetlands
  – California has lost nearly 99% of wetlands
  – In recent years, pressure from conversion to ag has decreased; development pressure has increased

Histosols Distribution in the US [3]



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Peat in California – Sacramento – San Joaquin Delta

- Tidal freshwater marsh – blanketed by peat;
- From 1800s levees built – land protected from flooding was drained / cleared / planted;
  - Very high $ value agricultural productivity;
  - Centre of Nth-Sth water-delivery system;
- Subsidence!! Islands of agricultural fields sinking – as peat oxidizes
- Water threatened by increased salinity and other contaminants;
- Multiple complex efforts underway to halt subsidence – do so in way that promotes GHG benefits;
  - USGS project has documented carbon accumulation – approx. 14.8tCO_2-e / ac / yr

Project Types

1. ***Avoided conversion of peatland***:
   Permanently protecting peatlands that would have been converted into alternative use

2. ***Restoration/rewetting of degraded peatland***:
   Restoring water level to degraded peatlands to allow peat accumulation and CO_2 sequestration

Existing Methodologies

Available:

- VCS *Rewetting of Drained Tropical Peatlands in Southeast Asia*
- ACR *Restoration of Degraded Deltaic Wetlands of the Mississippi Delta*

Under development:

- VCS *Baseline and Monitoring Methodology for Avoiding Planned Deforestation of Undrained Peat Swamp Forests*
- VCS *Baseline and Monitoring Methodology for the Rewetting of Drained Peatlands Used for Peat Extraction, Forestry or Agriculture*

GHG Assessment Boundary

- Focus on CO_2 and CH_4 fluxes
  - Decrease CO_2 emissions from oxidation
  - Increase CO_2 sequestration in accumulating peat and other woody biomass
  - Increase CH_4 emissions from anaerobic activities
  - Avoid CO_2 from reduced risk of fire?
- Conservative to exclude N_2O

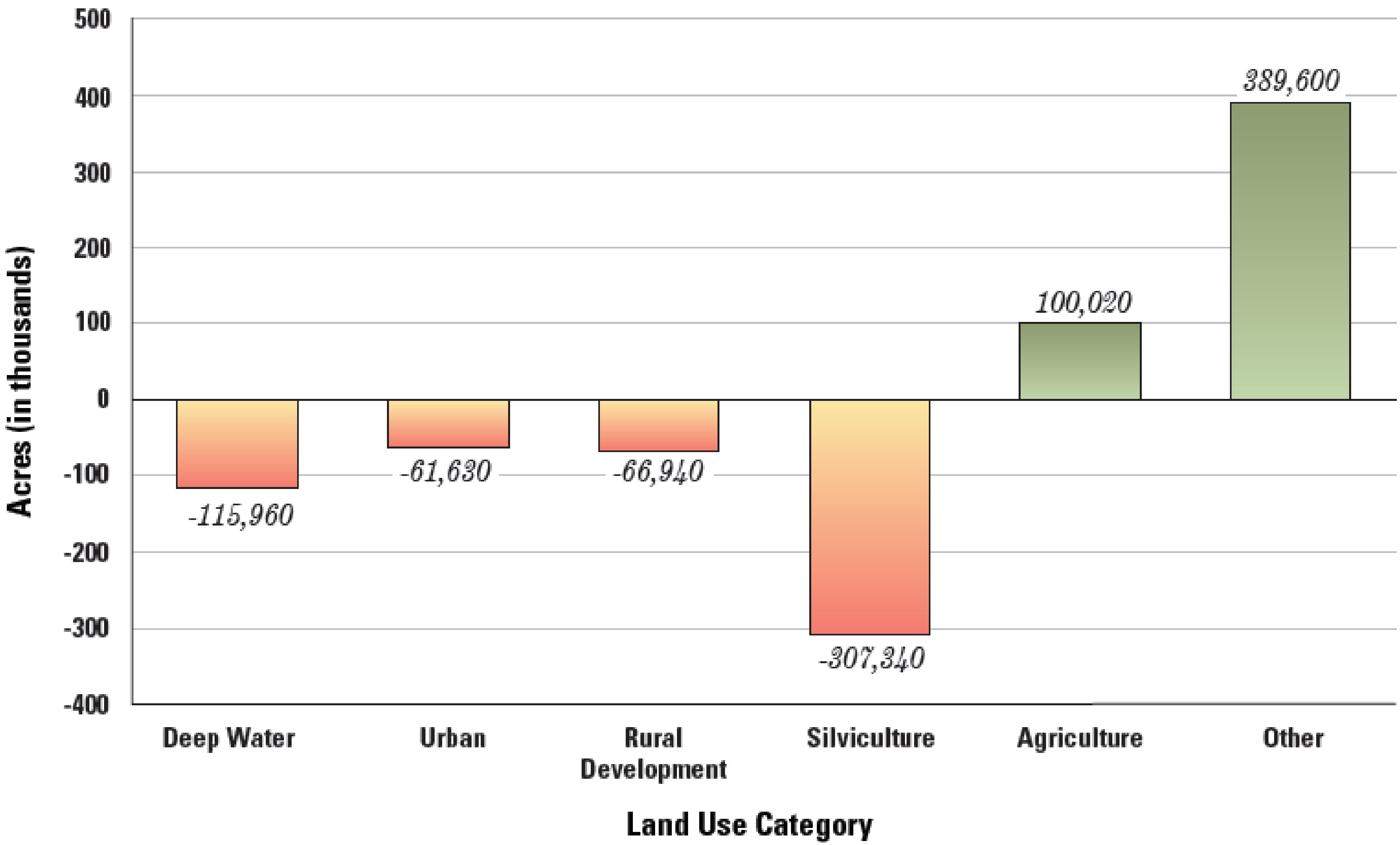
Avoided Conversion [2,4]

- Nationally, marked reduction in the rate of wetland losses
- Rates have slowed significantly and trend has reversed at times
- Regionally, significant losses are still occurring
- Losses appear to be concentrated in area where peat soils are prevalent
- *But*, only 0.1% (60,000 acres) being lost annually
- Conclusion: attractive project type in credits per project, but less opportunity overall

Restoration/Rewetting [2,4]

- Nationally, rates of wetland re-establishment/ creation are increasing
- Overall net gains are slowing
- Regionally, increased drainage and acres leaving conservation programs (e.g. Midwest)
- Reclassification of wetlands makes data assessment over time difficult

Gains and Losses of Wetlands, 2004-2009 [4]



Projected Benefits for Peatland Restoration Project in NC [5]

1. Amount retained that would otherwise be lost without restoration
2. Amount retained in peat as soil genesis is re-established
3. Amount retained in above ground biomass

Project Year	Carbon Sequestration Potential (mt CO_2e/acre)
0	10.8
10	108
50	540
70	756
100	1080

Relevant Regulations

- Section 404 of the Clean Water Act ensures no net loss of wetlands occur
  - Reports of inconsistent enforcement across states/regions
  - Exemption for “normal farming activities”
- Endangered Species Act
- State and local rules provide wetland protection but do not mandate restoration

Conservation Payments/ Stacking

- "Swampbuster" provisions under the Farm Bill to protect wetlands from agricultural conversion
- NRCS Wetlands Reserve program to protect and restore privately-owned wetlands
- EPA Wetland Program Development Grants
- Wetland mitigation credits/banks (CWA) – generally thought of as "bundled credit"
- Would need to consider "stacking" these payments with carbon credits – may affect eligibility or CRT issuance

Discussion of Key Issues

Source or Sink?

- CH_4 emissions depend on water level and peatland type
- Combined effect of CO_2 and CH_4 fluxes on 100 year timescale could be positive or negative…longer time scales, $CO_2 > CH_4$
- *Risk of restoration projects not having climate benefit because of increased CH_4?*
- *In cases where restoration floods abundant fresh biomass, could CH_4 emissions outweigh CO_2/N_2O benefits?*

Additionality – Data Availability

- Using wetland data as proxy for peatland, but need peatland data *over time* to set appropriate performance standard
- USGS Land Carbon project underway and some data to be released in 2013
  - Potential for collaboration to model C storage and emissions in peatlands
- *Other data sources? Can peatlands be "mapped" to other classifications used in available datasets?*

Baseline – Avoided Conversion

Options for assessing/proving threat of conversion:

- Real estate appraisal used to identify higher value alternative land uses in other protocols
- Regional data could be used to set default conversion rates, if available
- *Data sources? Other ideas?*

Quantification Methods

- Direct measurement
- 3 proxy measures for GHG fluxes:
  1. Vegetation – high grade GIS mapping and known GHG fluxes from land and vegetation types
  2. Water level – digital terrain modeling (e.g. LiDAR) + modeled water levels (e.g. SIMGRO)
  3. Subsidence (level of ground) – direct measurements
- Not all proxies handle CH_4 as well as CO_2
- *What quantification approaches are practical and cost-effective for CO_2? For CH_4?*
- *How do rates change over time?*

Quantification Summary

SSR	Quantification Method	Tools Used	U.S. Applicability?
CO_2 from peat	Subsidence	Direct measurement and existing literature	Sufficient data likely for some areas
CO_2 from peat	Water level modeling	GIS 20 modeling – LiDAR, SRT data; SIMGRO-DRAINMOD	SIMGRO not validated in U.S.; DRAINMOD may have been adapted by Duke
CO_2 from peat	Vegetation modeling	GIS data + data on project area vegetation GHG fluxes	Sufficient data likely for some areas/vegetation and land strat types
CO_2 from peat	Direct sampling	NRCS Soil Survey online tool	Sufficient data likely for some areas
CH_4 from peat	Soil GHG modeling	DNDC, others?	Sufficient data likely for some areas

Project Duration & Permanence

- Forest projects = 100 year crediting period + addl 100 year permanence requirement
- Current ag protocols have shorter crediting periods, but reductions are not sequestration-based
- *How do subsidence rates change over time?*
- *How does rate of peat accumulation change over time?*

Project Implementation Costs

- Avoided conversion – crediting, not costs, would be front-loaded
- Restoration – majority of costs would be early, but credits would accrue over time
- *What affects the cost of peatland restoration? Can we target more cost-effective regions/ types/restoration activities?*

Pilot Project Underway

- Carbon Balance Verification Project - Pocosin Lakes National Wildlife Refuge, NC
  - US FWS + Duke University Wetlands Center
  1. Quantifying change in soil level, soil carbon flux, and nitrogen dynamics in response to restoration
  2. Completing site-specific C and N budgets to determine storage and losses from the natural state, drained state, and restored state
  3. Quantifying carbon and nitrogen sequestration benefits of restoration work
- *Other efforts on peatlands to watch/engage?*

References

1. Wetlands International, *The Global Peatlands CO_2 Picture: Peatland Status and Emissions in all Countries of the World* (2009)

2. U.S. EPA, *Threats to Wetlands: What is the Status of Our Nation's Wetlands*, 2001.

3. Soil Extent Mapping Tool, a product of the National Cooperative Soil Survey partnership of Pennsylvania State University, West Virginia University and USDA NRCS

4. U.S. FWS, *Status and Trends of Wetlands in the Conterminous United States 2004 to 2009.*

5. U.S. FWS, *Benefits of Wetland Hydrology Restoration in Historically Ditched and Drained Peatlands: Carbon Sequestration Implications of the Pocosin Lakes National Wildlife Refuge Cooperative Restoration Project*, pg. 18. http://www.fws.gov/raleigh/pdfs/PeatlandRestoration_CSeqBenefits_Jan2010.pdf

Protocol Components

CLIMATE ACTION RESERVE

PROJECT DEFINITION

LEGAL REQUIREMENT TEST

PERFORMANCE STANDARD TEST

GHG BOUNDARY & QUANTIFICATION

MONITORING & VERIFICATION

OVERALL ASSESSMENT

FEEDBACK & DISCUSSION

NEXT STEPS

Next Steps

- Workgroup formation
  - Statement of Interest (SOI) to be posted online soon
  - Limited space, strive for diversity of experience
- Observers
  - Workgroup process is public but with limited dissemination
- Workgroup process and protocol drafting
- Public comment

Online Resources

www.climateactionreserve.org

www.climateactionreserve.org/how/protocols/soil-carbon/

Contact Information

- General questions:
  - policy@climateactionreserve.org
  - (213) 891-1444
- Staff
  - Max: max@climateactionreserve.org
  - Teresa: tlang@climateactionreserve.org
  - Sami: sosman@climateactionreserve.org