

Rice Cultivation Project Protocol (RCPP)



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Workgroup Meeting # 4

October 4, 2011

10 AM - 12 PM PDT



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Welcome and Introductions



Purpose

- Update WG on V1.0 timeline and important decisions
- Discussion of Specific Topics
 - Defining Field Boundaries
 - Performance Standard Decisions
 - Aggregation Approach
 - Guidelines for Verification
- Discuss Next Steps

Protocol Development Timeline



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| | |
|---|-------------------------|
| WG Meeting 1 (conference call) | February 9 |
| WG Meeting 2 (conference call) | May 11 |
| Draft protocol to workgroup | June 02 |
| WG Meeting 3 (Los Angeles) | June 06 |
| WG Written Comments on Draft Protocol Due | June 28 |
| WG Meeting 4 (conference call) | October 4 |
| Start of 30-day public comment period | October 14 |
| Public workshop | October 24 (Sacramento) |
| WG Meeting 5 (if necessary) | Early November |
| Protocol adoption by Reserve Board | Early December |



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Defining the Field Boundaries

- The field is the minimum modeling unit
- All fields must meet eligibility criteria to participate in project aggregate
 - Need to define field ‘boundaries’
 - From first draft:
 - The defined field boundary must be under the direct management control of a single rice producer
 - The field management must be **homogeneous** across the entirety of the defined field boundary
 - What do we mean by ‘homogeneous management’ in relation to water mgmt and fertilizer application



Defining the Field Boundaries

- The field must be under the direct management control of a single rice producer.
- The field must be contiguous.
- Water Management within the field boundary must be relatively homogenous. This is defined having a flood up duration for all checks in the field of less than 96 hours from start to finish (4 acre-inches per acre or more). This can be documented using field sizes and pumping rates.



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New Field Boundary Definition

- Fertilizer management must be relatively homogenous.
 - This is defined as having application rates across the field not vary by more than 15% of the average application rate for the entire field. Fertilizer must be applied on the same day with the same type of fertilizer.
- The field must have at least 5 years of yield data for DNDC model calibration.



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Homogeneous water management

- The water management can vary due to the time it takes to get water on and off a given field.
- Differences in flood start can vary up to four days depending on the size of the field and the flow rate of the water pumps. Ninety six hours for flood up is generally considered acceptable according to the 2009 Rice Production Workshop Manual.

Homogeneous water management: Time to flood up fields



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Table 4. Approximate hours for initial flood for various field sizes with different flow rates. Shaded area represents acceptable time. Based on delivering 4 acre inches/a.

| Size of Field in Acres | | | | |
|------------------------|-----|-----|-----|-----|
| GPM | 50 | 100 | 150 | 200 |
| 500 | 181 | 361 | 542 | 722 |
| 1000 | 90 | 181 | 271 | 361 |
| 2000 | 45 | 90 | 135 | 181 |
| 3000 | 30 | 60 | 90 | 120 |
| 4000 | 23 | 45 | 68 | 90 |
| 5000 | 18 | 36 | 54 | 72 |
| 6000 | 15 | 30 | 45 | 60 |
| 7000 | 13 | 26 | 39 | 52 |
| 8000 | 11 | 23 | 34 | 45 |
| 9000 | 10 | 20 | 30 | 40 |
| 10000 | 9 | 18 | 27 | 36 |

Homogeneous water management: Context of DNDC Model Results



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- Examined the impact of differences of 4 days in flooding onset with DNDC model estimates of GHGs: 1500 simulations across random range of soils.
- Methane emissions ranged from 223.4 to 227.4 kg C-CH₄/ha (6.85 to 6.97 t CO₂eq/ha)
- Nitrous oxide emission varied from 0.779 to 0.784 kg N-N₂O/ha (0.362 to 0.364 t CO₂eq/ha)
- Given small differences in emissions, **flood up duration of 4 days or less** is considered homogenous water management



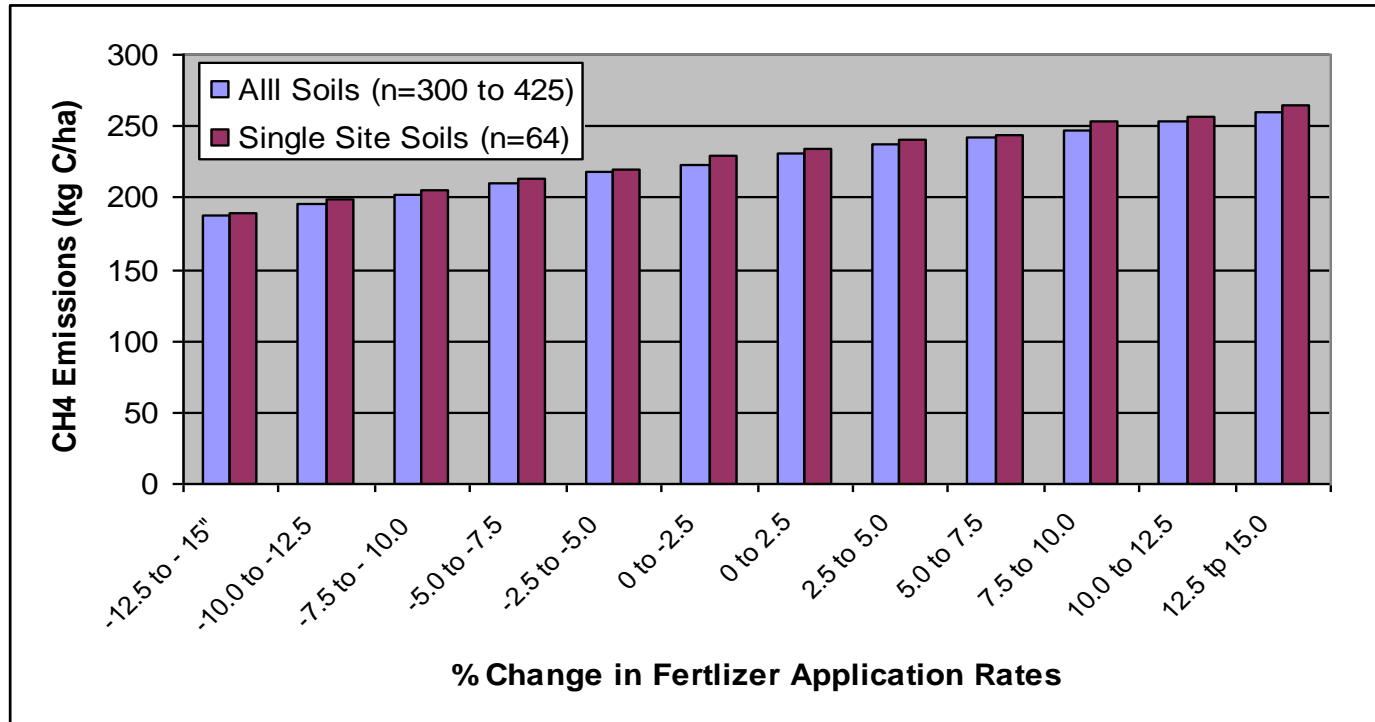
Homogeneous fertilizer management

- Background: Growers often apply slightly different amounts of fertilizer within the field based on different growing conditions.
- Question: do we need to break the field into separate “fields” due to differences in N application rates?
- Ran DNDC model with a range in fertilizer application rates (+/-15% of average rate). Over 4000 model runs.
- Examined impact on modeled CH_4 and N_2O emission rates. NB: changes in N application impact plant growth rates, which impact CH_4 emissions.

Variable fertilizer management: Impact on CH₄ Emissions



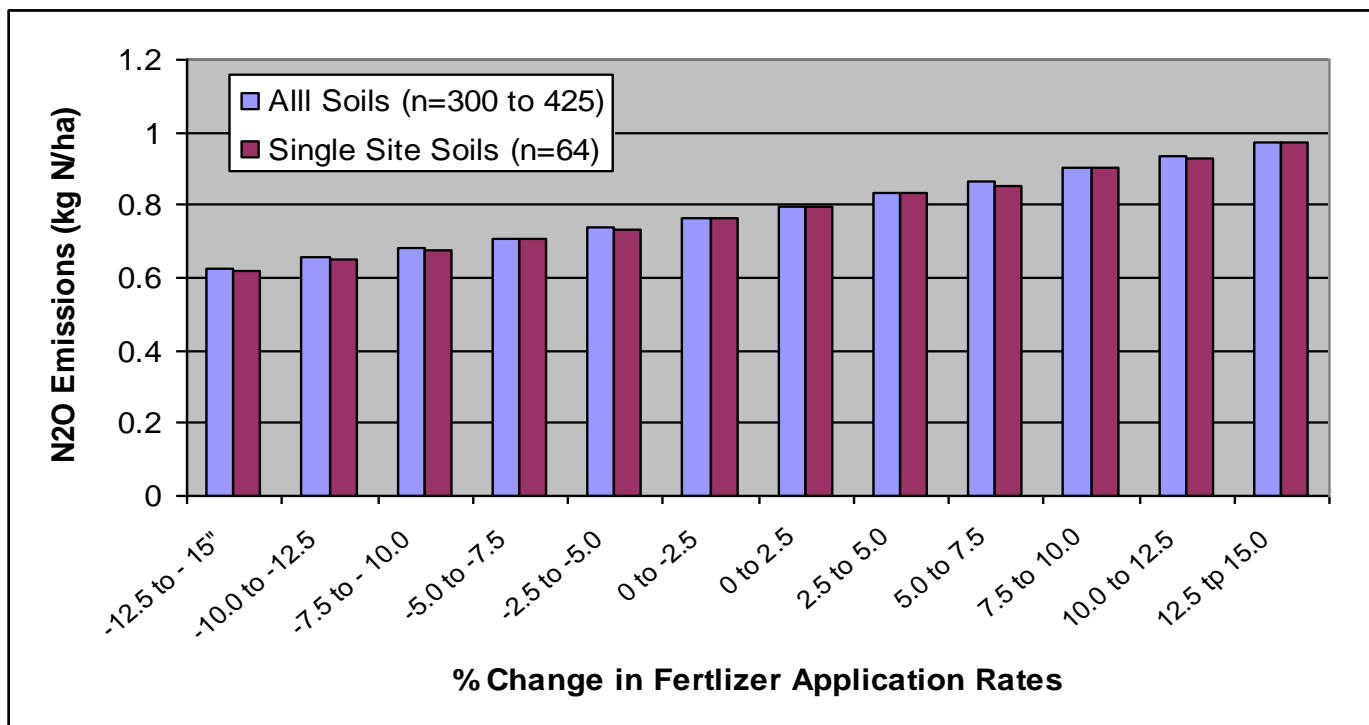
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Variable fertilizer management: Impact on N₂O Emissions



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Homogeneous fertilizer management

- The impact of increased (or decreased) fertilizer application rate on methane and nitrous oxide emission is linear.
- Given this it seems reasonable that the **average fertilizer rates** used within a field is sufficient to define the field as “**homogeneous**” as far as the DNDC modeling unit.
- NB: The linear nature between the increased fertilizer rate and DNDC modeled emissions was modeled across a narrow range of fertilizer application rate (+/- 15%).

Standardized Additionality: Performance Standard for Winter Flooding



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- Goal: Set a threshold representing common practice flooding intensity over a five year period
 - Preliminary analysis seemed to indicate that winter flooding is not consistent on a field basis in CA.
 - In any given 5 year period, hard to set a baseline number of times the field ‘would have winter flooded’ or not



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Update on PS Research on Winter Flooding

- Compiled aggregate data from irrigation districts
 - Glenn-Colusa provided field level data for 2007-2010.
- Used remote sensing to map winter flooding: MODIS and Landsat.
- Assessed the following:
 - Presence or absence of winter flooding from one year to the next
 - Mapping single versus maintenance flooding.

2007

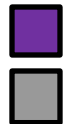
2008

2009

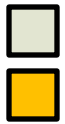
2010



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Habitat



Rice



Rice with flooding



Habitat with flooding



Non crop not irrigated

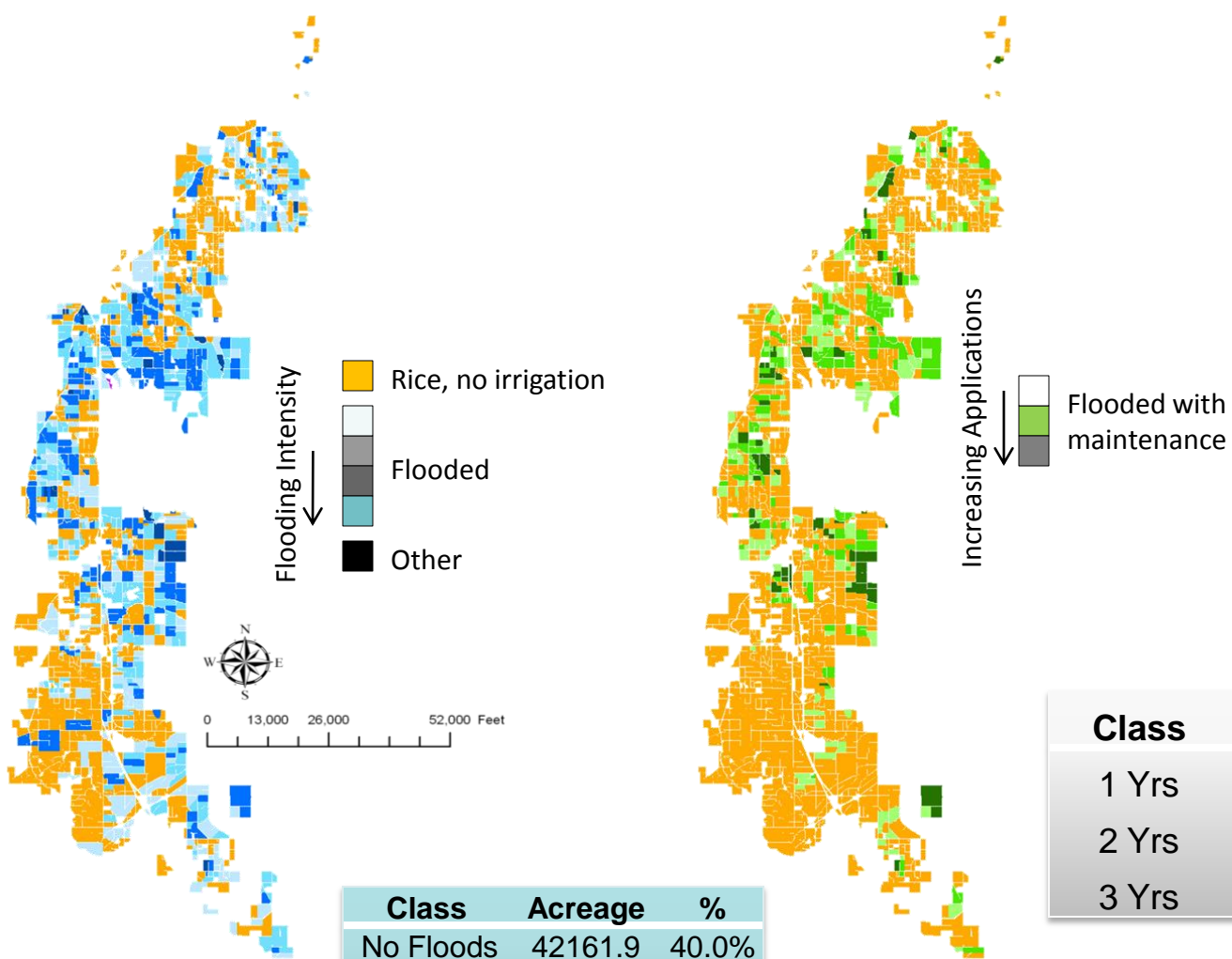


Rice with flooding maintenance





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| Class | Acreage | % |
|-----------|---------|-------|
| No Floods | 42161.9 | 40.0% |
| 1 Yrs | 20314.3 | 19.3% |
| 2 Yrs | 22346.9 | 21.2% |
| 3 Yrs | 17566.9 | 16.7% |
| 4 Yrs | 1912.6 | 1.8% |
| Other | 977.4 | 0.9% |

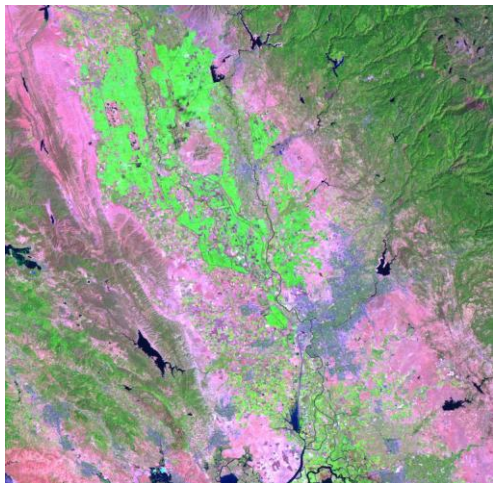
| Class | Acreage |
|-------|---------|
| 1 Yrs | 11786.5 |
| 2 Yrs | 11504.7 |
| 3 Yrs | 5233 |

Acreage Winter Flooding by Irrigation District

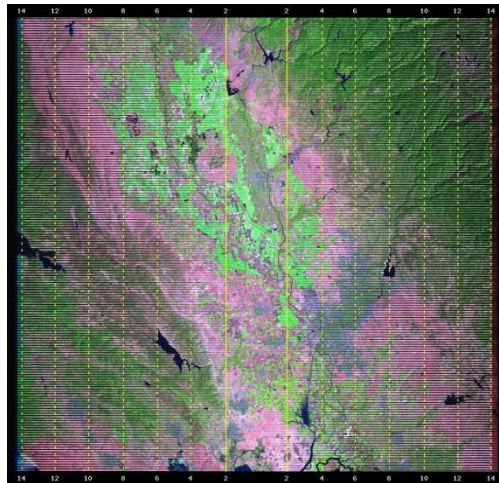


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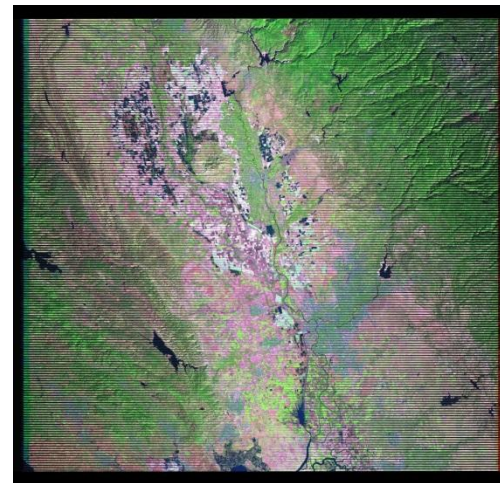
| | RD108 | Richvale | Western Canal |
|------|-------|----------|---------------|
| 2010 | 14381 | 18,981 | 44,910 |
| 2009 | 13478 | 21,638 | 47,413 |
| 2008 | 11130 | 18,792 | 43,509 |
| 2007 | 11953 | 22,993 | 44,253 |
| 2006 | 14588 | 22,066 | 41,610 |
| 2005 | 10480 | 20,616 | 38,784 |
| 2004 | 15117 | NA | 42,562 |
| 2003 | 10953 | NA | 37,715 |



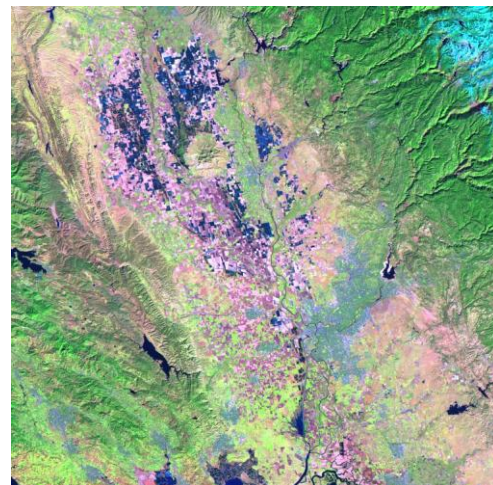
Aug 8, 2009



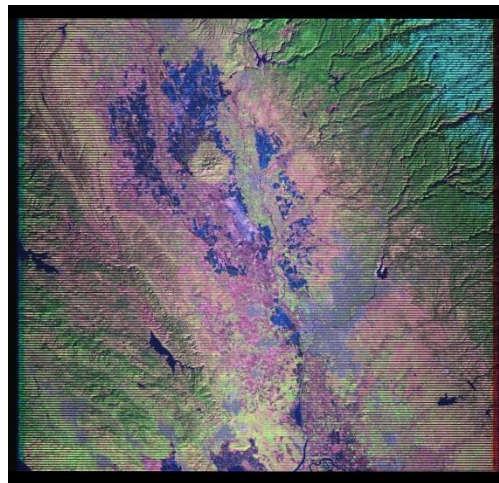
Sept 20, 2009



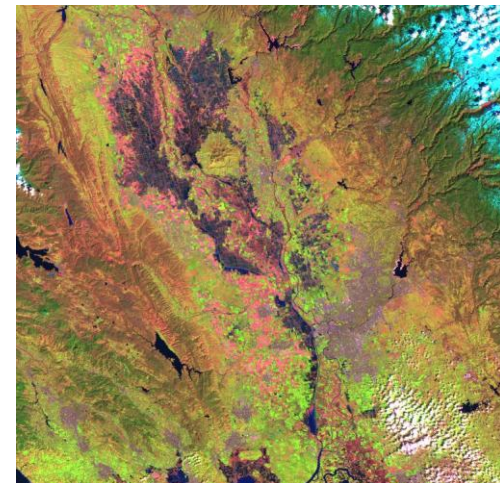
Oct 22, 2009



Nov 15, 2009



Dec 25, 2009

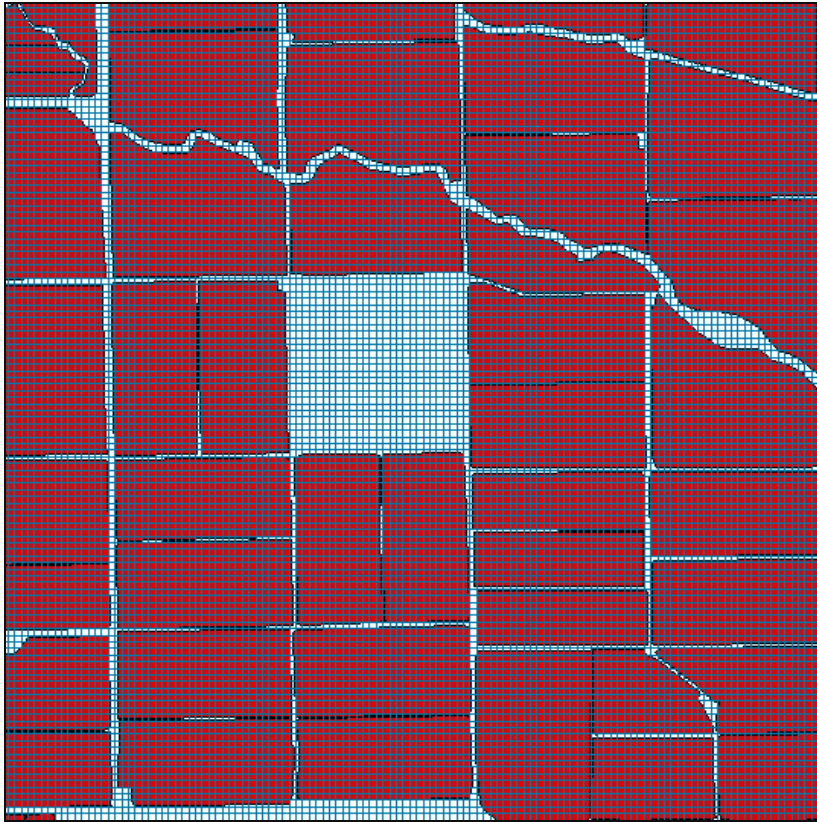


Mar 7, 2010

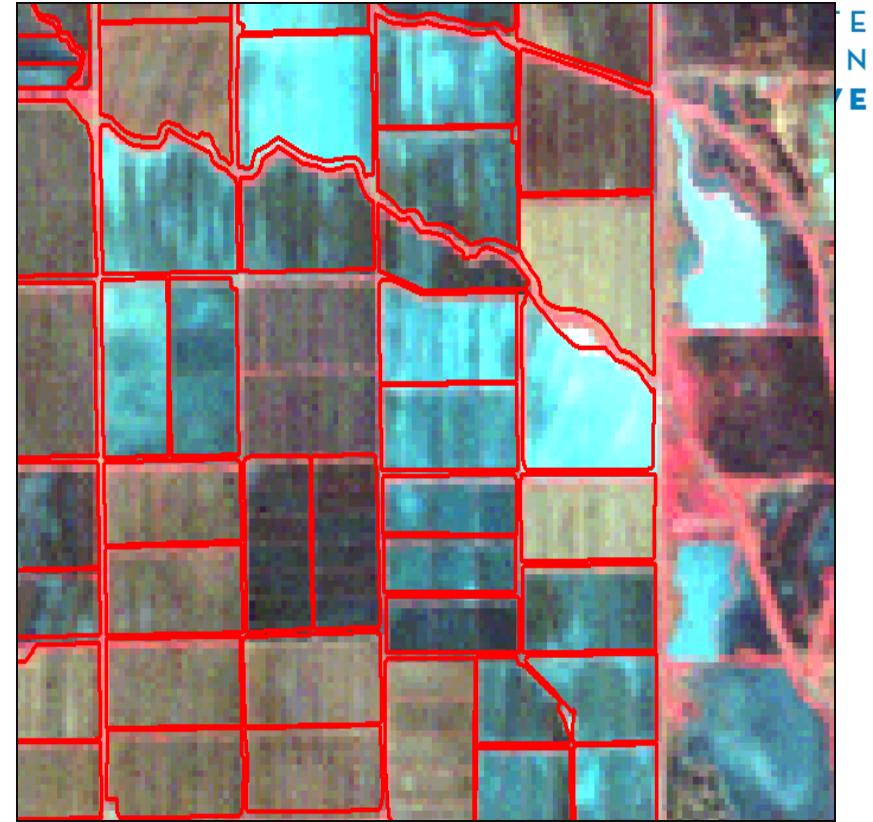


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Scale of Landsat TM & ETM+ 30m pixels relative to rice fields



Red: rice polygons / 30m grid overlaid



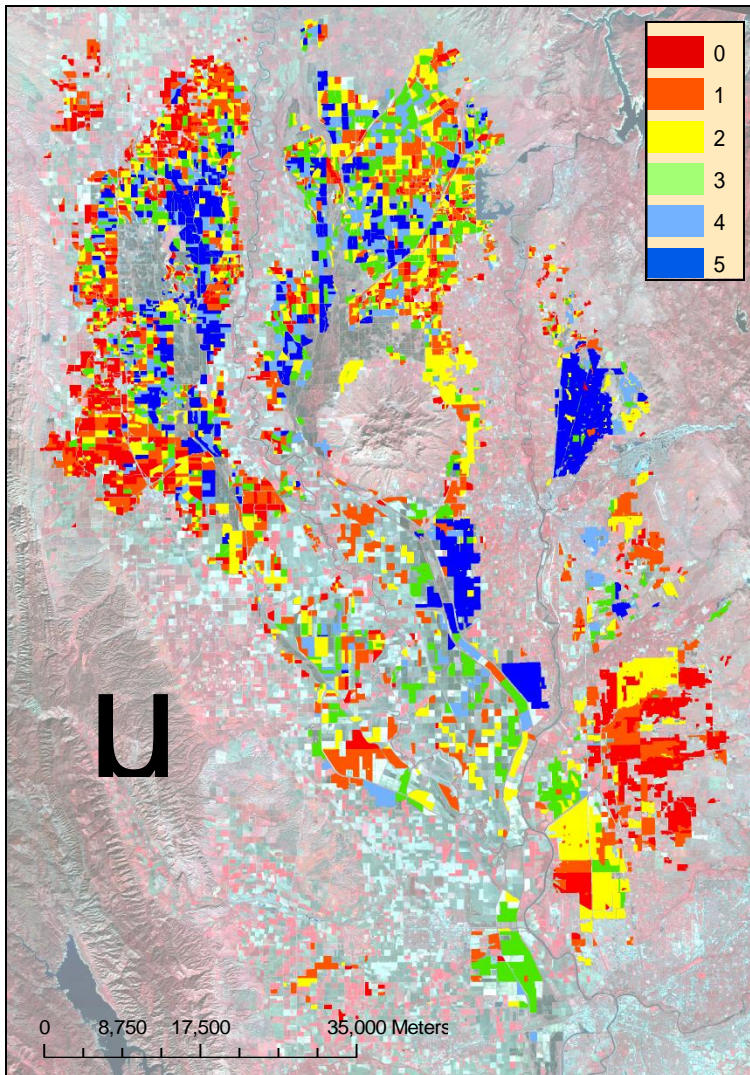
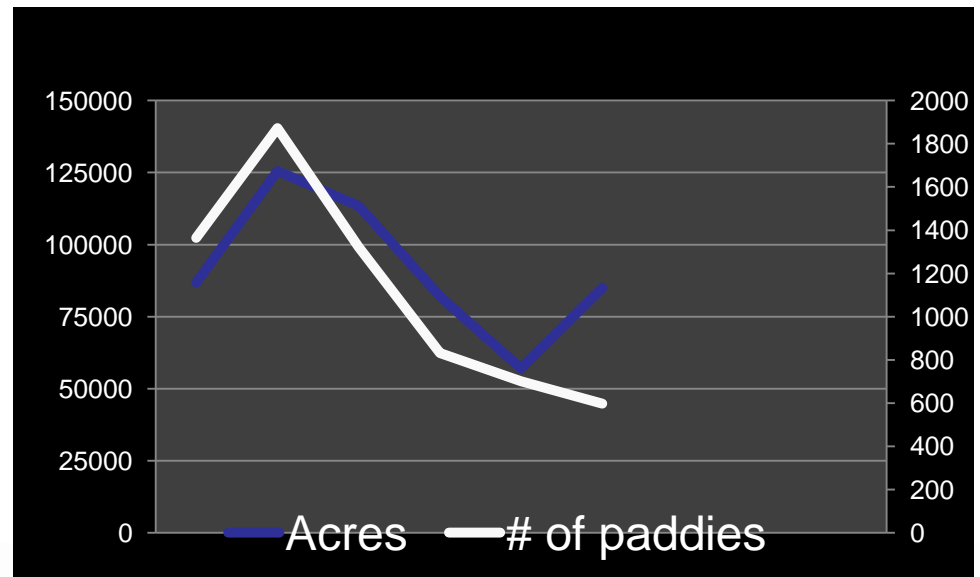
Rice outline: Rice polygons / Landsat TM (4:3:2) 1/5/2011

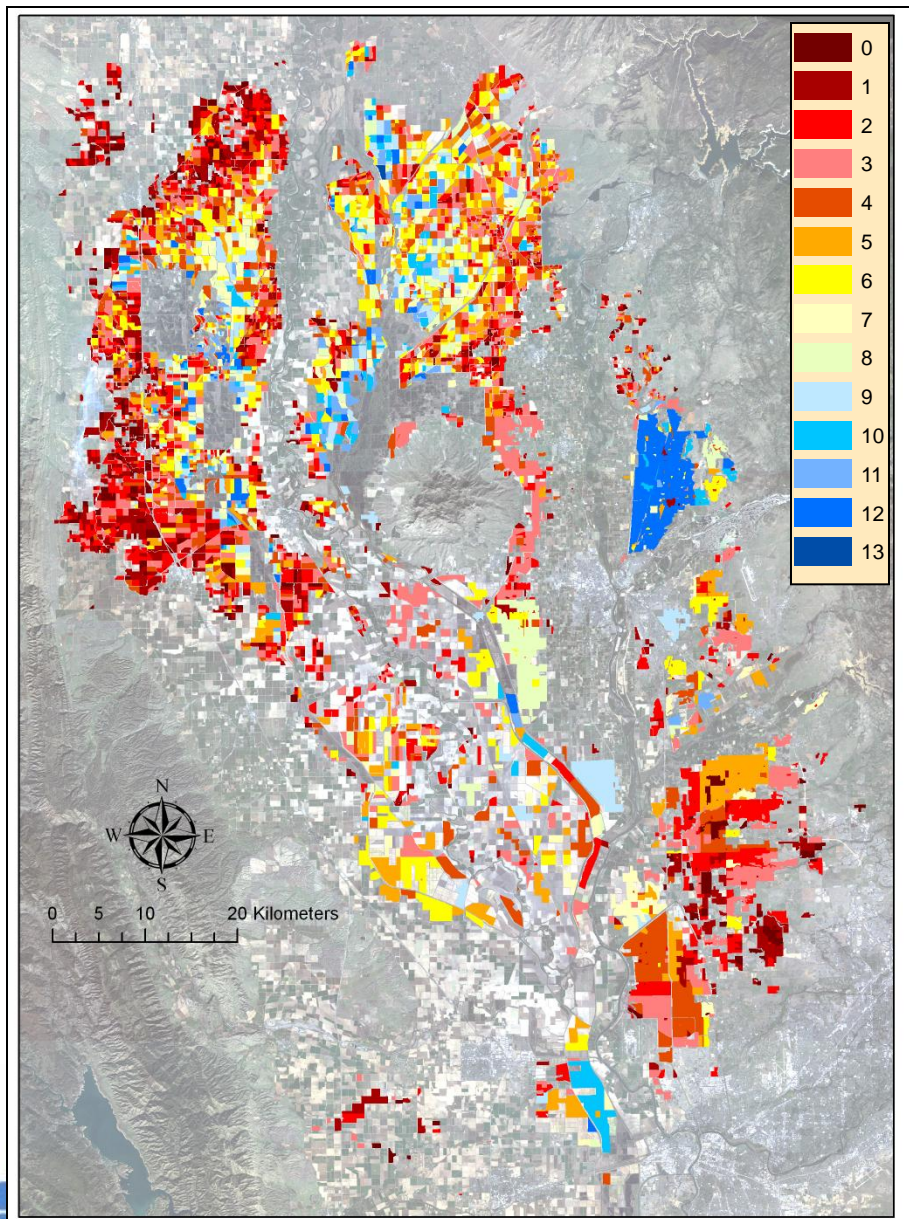
Landsat provides 3 decades of systematic observations
TM & ETM+ provides 30m observation ~once every 8 days



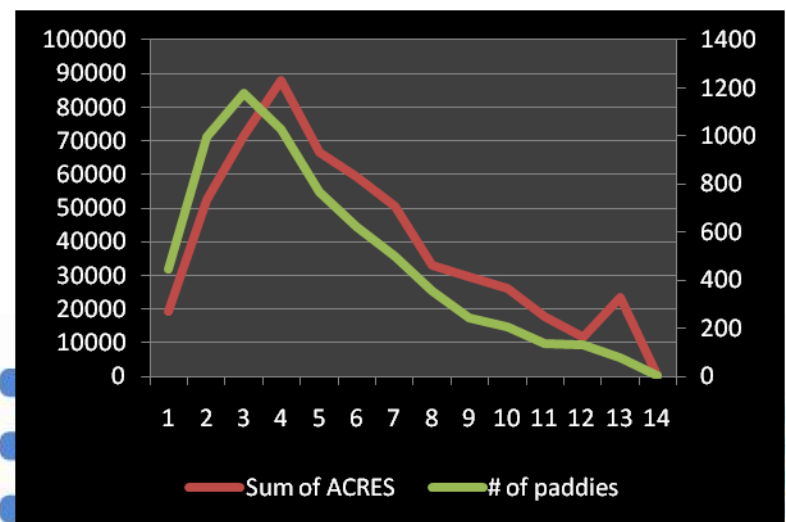
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| Flooded | Acres | # of paddies |
|---------|----------|--------------|
| 0 | 86815.26 | 1365 |
| 1 | 125603.3 | 1872 |
| 2 | 113410.4 | 1321 |
| 3 | 81976.08 | 832 |
| 4 | 57064.07 | 701 |
| 5 | 85003.65 | 598 |





| Years | Sum of ACRES | # of paddies |
|-------|--------------|--------------|
| 1 | 19342.133 | 444 |
| 2 | 52336.416 | 997 |
| 3 | 71599.151 | 1178 |
| 4 | 87865.274 | 1029 |
| 5 | 66429.303 | 769 |
| 6 | 59523.203 | 621 |
| 7 | 50419.065 | 500 |
| 8 | 33064.498 | 354 |
| 9 | 29708.742 | 243 |
| 10 | 26047.608 | 205 |
| 11 | 17880.331 | 138 |
| 12 | 11741.541 | 130 |
| 13 | 23551.332 | 78 |
| 14 | 364.179 | 3 |



(table and chart are not chronological)



Winter Flooding Dynamics

- Variability in the extent of winter flooding annually.
 - Role of Term 91
 - Impact of harvest dates: earlier harvest, less likely to have to winter flood for straw decomposition.
- Some fields have winter flooding most years, some are not flooded in winter at all, and large acreage have winter flooding some years.
- How to define the performance standard?
 - Factors: Term 91, harvest dates, hunting/habitat drivers, etc



Version 1.0 Protocol Decisions

- Will not include decreased intensity or duration of winter flooding as a creditable activity
 - Avoids many of the negative wildlife habitat impacts
- We will continue to assess data as it becomes available to determine if we can build this in to a subsequent version in the near future.
 - We will also continue to explore including 'Early Pre-Harvest Drainage' as a creditable activity
- Thoughts from Work group on this decision?



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Mitigation Scenario: Early Drain

- The timing of the draining the fields vary and can influence total yields.
 - UCCE recommends grower drain their fields when the panicles are “fully tipped and golden”.
 - This is done through visual inspection.
 - Typically 2-4 weeks prior to anticipated harvest date.
- Draining the fields earlier can reduce methane emissions.



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Issues with Early Drainage

- Issues related to selecting drain date:
- Drain too early
 - Impact on yield: impedes ripening of the grains resulting in light kernels.
 - Reduces milling quality: more kernels are broken or cracked during the harvesting.
- Drain too late
 - Field are too wet to get harvesters on the field
 - Harvesting on wet/damp soils can lead to ruts requiring more maintenance.
 - Uses more water.





Mitigation Scenario: Early Drain

- UCCE program: Set timing based on days after 50% heading.
- Cass research shows that draining a bit earlier (5-10days) than is typically done will not have negative impact on yield and quality of rice.
- DNDC Modeling: impact of drain date

| Drain date | CH4 Emissions (kg C-CH4) | Modeled GHG (kg CO2eq/ha) | Reduction(tons CO2eq/ha) | Reduction (tons CO2eq/acre) |
|---------------------|--------------------------|---------------------------|--------------------------|-----------------------------|
| 9/11 (Base) | 465 | 6276 | ----- | ----- |
| 9/6 (5 days early) | 442 | 5696 | 0.580 | 0.235 |
| 9/1(10 days early) | 412 | 4958 | 1.318 | 0.534 |
| 8/27(15 days early) | 383 | 4470 | 1.805 | 0.731 |

Early Drainage Slides: How to define performance standard



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- **Approach 1:** Set an industry performance standard on when rice fields are drained. For example, set the baseline date at 2/3rd tipped.
- **Approach 2:** If growers keep records on how they made the decision to drain (such as at 2/3rd tipped development/ripening stage), then that can form the baseline management. However, this is not a performance standard approach.
- UCCE program to define drainage data wrt to day after 50% heading.



Questions for WG

- Question to workgroup: should a requirement include drain time duration? Or we can set the official drain time when the first check is drained?.
 - Differences in drain time will impact CH₄ emissions
- Question: do growers keep records of when they drain and how they made the decision to drain?
- Question: How do we define baseline drain time?



Aggregation in the RCPP

- Aggregation will be necessary for projects to work
- Aggregators are important 3rd party actors enabling agricultural practice adoption
 - Provide technical assistance, trusted relationships, cost containment, and shared risk
- Reserve's goals for aggregation in the RCPP
 - Streamline requirements for participants w/out compromising integrity
 - Improve accuracy of GHG reduction estimates at scale
 - Make aggregation integral to methodology

Terminology



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■ Project Developer

- Has an active account on the Reserve
- Submits a project for listing and registration with the Reserve
- Is responsible for all project reporting and verification
- May represent a project or a project aggregate
- May be agricultural producers (including landowners or land tenants), GHG project developers, aggregators, or other entities
- Has exclusive ownership of CRTs

■ Aggregator

- A corporation or other legally constituted entity, city, county, state agency, or individual
- Must have an account on the Reserve (replaces Project Developer Account)
- Official agents to the Reserve on behalf of participants in a project aggregate
- Ultimately responsible for submitting all required forms and complying with the terms of the RCPP.
- Manage the flow of monitoring and verification reports to the Reserve and may engage in other project development activities such as developing monitoring plans, modeling emission reductions, managing data collection and retention etc..

Terminology



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- Project Participants
 - Agricultural producers who elect to enroll fields in a project aggregate
 - Must be responsible for making management decisions for crop production on their fields enrolled in the project
 - Are **not** required to hold an account on the Reserve
- Project Aggregate
 - Made up of X number of fields (minimum of 5 fields)
 - Represented by a project Aggregator
 - No upper limit on the total number of fields or acres enrolled in a project aggregate
 - Sliding scale for maximum size of a single field in relation to total combined acreage in the aggregate

| Aggregate Size (in acres) | Maximum Proportion of a Single Field (% of Aggregate) | Actual Size Limit of Fields (acres) | |
|------------------------------|---|--|-----------------------|
| | | Lower End of Range | Upper End of Range |
| Up to 100 | 20% | | 20 |
| 101 - 250 | 15% | 15.15 | 37.5 |
| 251-500 | 10% | 25.1 | 50 |
| 501-1000 | 7.5% | 38.6 | 75 |
| 1,001 acres or more | 5% | 50 | |



Mechanics of Aggregation

- Each field has unique start date
 - Start date = start of the “cultivation cycle” in which approved project activities are implemented for the first time
 - “Cultivation cycle” begins immediately post-harvest, runs through the end of the next harvest, can be > one year (def. in development)
- Fields may join aggregate at any time provided they meet requirements of most current RCPP version at entry
 - Eligibility Criteria applied at the ‘field’ level
- Each field is eligible for 5 continuous cultivation cycles (“crediting period”)
- Possibility for a second, third, fourth crediting period, but we would have to ensure that any new performance standards are met
- Fields cannot change aggregates, except
 - When re-enrolling in subsequent eligibility period (if this is an option)
 - In special circumstances, such as when an aggregator goes out of business, or when a field’s management control changes and the new manager has fields enrolled in another aggregate
- No crediting period limit on an aggregate

Aggregation and Emission Reduction Ownership



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- For proposed aggregation model, the Aggregator must have legal ownership of GHG emission reductions that occur at each field
- Ownership of GHG rights can be tricky issue, given the multiple parties involved (Aggregators, tenant farmers, land owners)
- Proposal:
 - Require Aggregator to attest that they have legal claim the title to all GHG reductions from all fields in the aggregate (similar to other Reserve projects)
 - Puts burden on Aggregator to ensure appropriate contracts in place with Project Participants (producers) and land owners to transfer GHG rights to the Aggregator
 - Require Aggregator to inform land owner of each field that a GHG reduction project is occurring on that particular plot.
 - Verifier reviews contracts and notification to land owner as part of verification



Aggregation Questions for WG

- Thoughts on ownership issues?
- Thoughts on aggregation scheme:
 - Too restrictive? Not restrictive enough? Verifiability of aggregates?
- Thoughts on sizes of aggregates and number of project participants:
 - For average producer, how many fields are under their management control? How homogeneous is mgmt across fields?
 - What is a estimated size range (number of fields and number of project participants) you would expect for rice aggregates?





Monitoring and Verification

- Annual monitoring report required for every field
 - Must include DNDC input files and monitored data
- Verification Schedule:
 - Option 1: Each field required to have site visit at some interval
 - Site visit during first cultivation cycle, with 2 desk audits over the 5 year crediting period
 - Option 2: Randomized site visits and desk audits with no minimum requirement at field level
 - Verifier audits sample of monitoring reports each year
 - Site visits required for \sqrt{n} (n = number of fields), Desk Audit required for twice that number
 - Non-linear, % of fields audited declines as aggregate size increases
 - With large “populations” get good representation even with smaller % sampled
 - Assigned randomly, but fields undergoing site visits that year cannot also have monitoring reports audited
 - Will require stricter “enforcement mechanism” for aggregates with unsuccessful verifications



Verifying Field-Level Data

- Potential resources for verifier:
 - Remote Sensing Data (can see if a field had standing water on a given date – useful for Dry Seeding)
 - Require Pictures be taken while seeding, flooding, draining, baling (thoughts on usefulness)
 - Physical evidence on site (rice field layout, rice straw bales, equipment etc.)
 - Farm staff interviews,
 - Records for services, equipment rental, fertilizer purchases, rice baling services and/or rice bale purchases



Verifying Field-Level Data: Role of RS

- Map historical rice production: verify that the field has been in rice production
- Map the historical winter flooding patterns
- Map general planting and harvest dates
- Map use of dry (drill) seeding: crop green up prior to flooding.



Reporting and Verification Schedules

Questions for WG:

- Do we need to impose minimum number of site visits and/or desk audits for each field, or keep it random?
- If site visits/audits are random, would have to have relatively harsh penalties for entire aggregate for failed verifications or mis-representations (the aggregate would therefore be incentivized to 'self-police' to some extent)
 - Thoughts on this approach?



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Verification Questions for WG

- How can site visits be more productive ? (Should they have to occur during the growing season, after the growing season, etc.)
- What other evidence must a verifier gather (on-site or off-site) that could help substantiate claims regarding dry seeding and/or baling
- Verifying baling practices: it is our understanding that rice growers typically only bale if they have already sold the straw for a specific end-use – therefore there should be records indicating straw end-use.
 - Are these assumptions correct?



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Next Steps

- Continued development of Aggregation / Verification Guidelines
- Finalizing Public Draft V1.0
- Release for Public Comment October 14
- Public Workshop October 24
- May have one more WG meeting (conference call) TBD
- Submit revised protocol to CAR Board week of December 11

Thank You



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