PEER REVIEW LOG FOR AVOIDED CONVERSION OF GRASSLANDS AND SHRUBLANDS TO CROPLAND (V 2.0)

OCTOBER 2019

The methodology entitled Methodology for the Quantification, Monitoring, Reporting and Verification of Greenhouse Gas Emissions Reductions and Removals from Avoided Conversion of Grasslands and Shrublands to Crop Production was first approved for use by ACR in 2013. With support from a USDA Conservation Innovation Grant awarded to Ducks Unlimited, The Nature Conservancy and ACR, the methodology has been updated.

All new methodologies and methodology modifications, whether developed internally or brought to ACR by external parties, undergo a process of public consultation and scientific peer review prior to approval per the ACR Standard. The updated methodology was posted for public comment from September 15, 2018 – November 18, 2018. Public comments and responses by the authors were finalized on March 1, 2019 and were provided to peer reviewers. Peer reviewer comments and responses by the authors are given below. ACR does not require all public and peer review comments be incorporated but does require that a response to each comment be provided.

On September 5, 2019 peer reviewers provided written confirmation that each of their comments had been addressed to their satisfaction and recommended adoption of the methodology update by ACR. Final and interim versions of the methodology during public comment and peer review as well as the public comment log can be found on ACR's website under Process Documentation.

	CHAPTER	REGARDING	PEER REVIEWER COMMENT R1	AUTHOR RESPONSE R1	PEER REVIEWERS COMMENT R2
1	General	General	Overall, I found that the proposed methodology was comprehensive and well documented. I think that it is accurate enough to estimate GHG benefits of avoided conversion, yet straightforward enough to be implementable. The weakest part of the report was the section on uncertainty. This is probably to be expected, given the limited resources that we have for estimating uncertainty propagation through complex models. Therefore, it may not be feasible to provide very detailed criteria for uncertainty estimation.	Thank you. Please see responses re: uncertainty estimation (38, 39, 40, 41).	Overall, I am satisfied with the responses from the reviewers and the changes that have been made to the report. I have looked through the revised documented and provided just a couple more editorial suggestions **below**. These are minor comments that the authors can respond to as they wish. I do not need to see the document again. In the legend of Figure 1, should it read "Participant Fields" instead of "Project Fields" to match the language used in the report? In Figure 2 (and Appendix A), it might be

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			However, there are some areas where additional clarification is needed as described in the subsequent comments.		helpful to include an overlay of the state boundaries using a slightly heavier line width than the county boundaries. I have found that when viewing a map like this one, seeing the state borders provides a useful reference. **ACR: Figure 1 Legend has been updated. Figure 2 has been updated.**
2	General	General	Please be aware that this review was purposefully overly critical. Overall kudos to the team for such a big effort. The biggest suggestion would be	Thank you. ACR is working on two companion documents that will be published with the methodology or soon after: 1) FAQ/Manual that will include examples and 2) Project planning excel tool.	Ok

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			to stick in a few examples using real data.		
3	General	General	Suggest cosmetically reducing the amount of material / text in the header. “No big deal but a bit cumbersome aesthetically.”	Unfortunately, this header style is standard template for all ACR methodologies and cannot be changed. https://americancarbonregistry.org/carbon-accounting/standards-methodologies	Ok
4	1. Background and Applicability	General	Suggest adding a very short intro on problem statement / context, goals, and objectives to quickly and simply introduce the issue for folks not deeply involved. Kind of starts at 3rd base. A nice figure or photo might be good here.	No change. Carbon offset methodologies are generally used as a manual for project development and consequently have dry, formulaic, “cookbook” style to facilitate use. General presentation of the problem (loss of U.S.	Perhaps state that someplace if this is the case. **ACR: Upon methodology posting, a summary paragraph framing the issue will be included on the methodology**

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			Encourages to show off the wonderful and valuable landscape a bit.	Grassland) and how the carbon market addresses this issue is often on ACR's website page for the methodology, in the public comment webinar, in presentations given by ACR or press releases.	**page within ACR's website.**
5	1.1 Summary description of methodology	The removal of project lands from the supply of potential Cropland is expected to create leakage effects, all in the form **of market leakage**. A default market leakage estimate is offered to account for these effects. Standardized values for leakage and baseline determination are specific to the United States.	It would help to provide a brief definition of "market leakage" in this paragraph.	The definition for leakage and market leakage can be found in the ACR Standard v 5.1 which applies to all ACR project types and will be used in conjunction with this methodology by all project developers. A footnote with this definition has been added and a reference to section 6.3.	Ok

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6	1.1.1 Field, Area, Region Boundary Terms	The Project Region may be an eco-region or geographic administrative unit of relatively homogenous economic conditions and governance at which baseline activities are occurring, e.g. a state, county, watershed, irrigation district, Major Land Resource Area, etc. The Project Region is the highest-level geographical boundary and is used in this methodology for demonstrating baseline conditions identification of baseline management practices and the quantification of greenhouse gas emission reductions and avoidance,	This paragraph can be confusing for a spatial scientist.	No change; consistent with version 1.0 of methodology. This language is mainly important for the counterfactual baseline scenario and selection of those management practices, as opposed to defining the physical boundaries of the project area.	Ok

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		i.e., to define the applicability of models and emission factors. The Project Region shall be further stratified to account for heterogeneity within the Project Region according to the procedures in Section 4 Stratification.			
7	1.1.1.2 Conversion Via an Identified Agent	The baseline land use scenario is Cropland for all Participant Fields not located in counties shown in the map below and listed in Appendix B but: 1) meet all criteria in Section 2.1 and 2) are unambiguously identified in written rental or purchase offers with Cropland named as the intended use or	Suggest for the methodology to have a figure description that explains this map. Something with source, colors, etc…	Caption added and legend removed.	Ok

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		unambiguously identified in other documentation, subject to verifier and ACR review, including landowner affidavits, that can demonstrate a threat to conversion to cropland.			
8	1.2 Applicability Conditions	In the project scenario, **overgrazing, overstocking, or overuse of prescribed fires** leading to the progressive loss of vegetative cover shall not occur, allowing carbon pools to remain at a steady state.	How will overgrazing, overstocking, and overuse of fire be measured?	A conservation easement that meets the applicability criteria for this methodology will include language stating the purpose to "maintain and enhance conservation values", which are listed in the easement. Annual monitoring of the easement is conducted by someone with expertise in ecological assessments, either within the easement	Ok

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				holding agency (e.g. Accredited Land Trust) or contracted out to a firm with expertise. A Baseline Delineation (BDR) Report is completed at the time of the easement and it will include unique biological and physical characteristics of the property, species, boundaries, waterways, conservation values etc. Annual monitoring is conducted with the BDR as a reference. Any allowed grazing consistent with the conservation values of the easement would not meet any definition (subjective or no)	

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				of overgrazing, over-stocking or overuse of fire. For clarity, the word "detrimental" has been added to these terms in the text.	
9	1.2 Applicability Conditions	Project Areas do not include Grasslands or Shrublands on or-ganic soils or peat-lands, nor include wetland acres within Grassland/Shrubland tracts.	This sentence may be confusing to some readers. Does it mean that the wet-land acres must be subtracted from the total tract acres? or interpreted as mean-ing that if a grassland tract encompasses one or more wet-lands, then the entire tract is not eligible.	This sentence means that wetland acres are subtracted from total tract acres. This is described in sec-tion 2.1.2.	Ok
10	1.2 Applicability Conditions, first condition	All Participant Fields avoid the **complete**	Asks for 100% clarity, "Does "complete" suggest all-encom-passing practices / combinations in the	Footnote includes language "….. or combinations thereof". All treat-	Ok

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		conversion[1] of Grasslands or Shrublands to annual Cropland. Conversion of Grassland and Shrubland to uses other than annual Cropland is not an eligible activity under this methodology.	footnote or anyone particular technique (i.e., till)?"	ments are not required but listed as these are typical methods for initial preparation of the land prior to cultivation. The intended meaning is that 100% of original vegetation (grassland and shrubland) is removed within the project fields.	
11	1.2 Applicability Conditions, second condition	All Participant Fields in the Project Area are currently Grassland or **Shrubland**, have qualified as Grassland or Shrubland for at least **10 years prior** to the	Asks for clarification about how is this (Shrubland) defined? Offers the word Consecutive to be considered in the phrase "…Shrubland for at least **10 years prior** to the Start Date. ?	Grasslands and Shrublands are defined in the Definitions section and definitions based closely on those from the USDA NRCS National Resources Inventory Glossary.	Ok

[1] The complete removal of initial vegetation community through complete tillage, chemical treatment, fire, or combinations thereof which are followed by seeding of an annual crop.

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		Start Date[2], will remain as Grassland or Shrubland throughout the Project Term, and are legally able to be converted and would be converted to Cropland in the absence of the project activity.			
12	1.2 Applicability Conditions	In the baseline scenario, a strong justification must be made, ultimately subject to the verifier's professional judgement and shall include, at a minimum, an assessment of irrigation water access—both legal and physical—to the Project Field(s) at the Project Start Date	Suggest splitting this sentence into two or more sentences.	See revision. Sentence has been split into two.	Ok

[2] In the case of aggregated projects, Participant Fields must have qualified as Grassland or Shrubland for at least 10 years prior to the date the Project Participants agreed to enroll that field into the aggregate.

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		and evidence of on-going irrigation prac-tices on like parcels in the same county			
13	1.2 Applicability Conditions, last condition	The Project Area is located in the United States.	Asks whether there is a minimum size or GHG requirement? What if someone has ½ an acre in NH…?	There is no minimum size but as with all carbon offset pro-jects, there is a mini-mum size (project ac-tivity and carbon price dependent) where the administrative, verifi-cation and project de-velopment costs (e.g. the legal costs asso-ciated with conserva-tion easements) are recovered and the revenue to the land owner and/or project developer compelling.	Ok
14	2.1 Spatial Boundary	Referring to figure 1: Participant Fields are the discrete parcels	The figure might be confusing for non-ex-perts: What is the dif-ference between area	**See new figure**	Ok

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		where project activities are implemented, when referred to individually.	and field in this figure? Is the right-side call out the area? Maybe one is not needed? Make different color or label perhaps? Figure needs scale bars.		
15	2.1.1 Field, Area, Region Boundary Terms	The GHG project area, which is the aggregate of the Participant Field areas may be smaller than but must be completely within the qualified LCA boundary.	It would be more straightforward to talk about project area and participant field areas here, because they have just been defined in the preceding figure.	See revision	Ok
16	2.1.2 Recording the Project Area and Project Region	Spatially explicit data in ESRI shapefile format for the following units must be provided in the GHG Project Plan	“Shapefile” is one word when referring to this data type.	See revision	Ok

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17	2.1.2 Recording the Project Area and Project Region	Spatially explicit shape files recording the following boundaries must be provided in the GHG Project Plan	Mentions that Shapefiles are a brand as opposed to vector. Provides example: Kleenex and/or tissue.	See revision	Ok
18	2.1.2 Recording the Project Area and Project Region	Project Proponents must demonstrate to the satisfaction of the verifier that the project area is limited to the area that would reasonably be plowed under as part of conversion (i.e., roads, building envelopes, infrastructure or **wet areas** are excluded).	Asks whether this is different from the "wetlands" that were previously discussed.	Yes. This is potentially a broader definition of "wetlands" and includes anything that is infrequently wet or saturated enough such that it would not be plowed under in the counterfactual baseline scenario. The term "wetlands" implies areas protected as such and listed in the NWI and visually having the attributes of a wetland as defined by the ACR Standard (see	Ok

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				Definitions). No change was made.	
19	2.1.2 Recording the Project Area and Project Region, fourth boundary	Wetlands, building envelopes, cultivated areas, streams, roads, gravel pits or other areas not covered by a sod-buster clause and/or excluded from but within the **Project boundary**	Asks whether these come from a source, such as NASS CDL? And suggest that one or two examples with real data would be very useful.	Wetlands that are excluded could come from the NWI but building envelopes and roads would need to be defined and provided by the project developer or land owner. Anything that would not reasonably be tilled in the event that the parcel was converted to agriculture should be excluded. ACR is creating a Manual/FAQ document to accompany the methodology when published. Examples will be included.	NWI are generally very outdated **ACR: Reference to NWI has been deleted. The text indicates that the accuracy of project boundaries is ultimately left to the verifier's discretion. A verifier may utilize NWI as well as any number of other sources as part of his/her due diligence on boundary establishment. NWI is not required as a resource. Proponents must demonstrate to the satisfaction of the verifier that the project area is limited to the**

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					area that would reasonably be plowed under as part of conversion.
20	2.1.2 Recording the Project Area and Project Region	All required shape files shall be made available in the **GHG Project Plan** at time of validation.	Is the GHG Project Plan is open or private?	GHG Project Plans are public via ACR's registry. However, anything the project developer considers meeting ACR's definition of "commercially sensitive material" (ACR Standard, Section 6G) can be redacted upon request.	Ok
21	2.2 GHG Assessment Boundary	Specific carbon pools and GHG sources, including carbon pools and GHG sources that cause project and leakage emissions, may be deemed **de minimis** and do not have to be	Referring to the terms *Di Minimis* and *ex ante,* Peer Reviewer suggests avoiding confusion for readers, not using Latin terms, and just write the meaning in English.	No change. The terms *de minimis* and *ex ante* are standard terms used in the carbon market, are specifically defined in the California Cap and Trade regulation, and thus have a well understood meaning in	Ok

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		accounted for if in aggregate the omitted decrease in carbon stocks (in carbon pools) or increase in GHG emissions (from GHG sources) amounts to less than three percent of the total **ex ante** estimate of GHG benefit generated by the project.		this context. All ACR program documents and methodologies use these terms and to maintain consistency with those, no change was made.	
22	Table 1: Carbon Pools	Below-ground biomass: Likely to be a significant source of carbon loss in baseline scenario. Below-ground **tree** biomass is conservatively excluded; projects may elect to account for below-ground non-tree biomass.	Suggest the word three to be changed for root	See revision. Deleted this sentence and added the word “non-tree” to column one to be consistent with nomenclature for above-ground biomass in previous rows. Biomass associated with any vegetation meeting the definition of a tree is excluded. Text revisions throughout	Ok

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				for clarity and new row in Table 1.	
23	2.2.2 GHG Sources and Sinks, table 2	Soil Management, CO_2, **Excluded**	Is this included since integrated within SOC carbon pool? In a sense?	Changed to Included.	Ok
24	2.2.2 GHG Sources and Sinks, table 2	Livestock emissions, CH_4, Included/ Optional	Included and optional seems conflicting	Changed to Optional.	Ok
25	2.3 Temporal Boundary	General	Can you make this a linear figure with the x-axis as time?	No revision. Items in the bulleted list are required to be included in the GHG Project Plan and not all of them easily fall into a timeline that would be relevant for ALL projects. Example timelines will be included in the Manual/FAQ document that will be published as a companion.	Ok

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26	2.3 Temporal Boundary	Project events defined in the GHG Project Plan	Maybe this can be a chronological timeline figure to mix it up.	See previous response. A chronological timeline figure can be added to the Manual/FAQ document.	Ok
27	3.1 Baseline Determination	The baseline land use scenario of conversion to cropland, once determined, is static and **made ex ante**, with no adjustments during the Project Term. The baseline management scenario must be updated every 5 years, as outlined below in 3.1.2.	Same as last comment, Peer Reviewer suggests being more straightforward, and just write the meaning in English.	See previous comment/response	Ok
	3.1.1.2 Conversion Via Identified Agent	Map	Suggests clarifying map level and adds that it would be helpful to include descriptive legends for this and other figures.	See new figure with caption	Ok

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28	3.1.2 Determine Baseline Cropland Management Scenario	Required projected baseline management practices are listed below. Management practices (including as inputs to approved **biogeochemical** models) shall be informed from producer surveys conducted by government agricultural agencies or university extension offices[3]; the expert opinion of university extension personnel working in the region and systems of interest; personnel of a governmental agriculture agency field office (e.g., United States Department of	Suggest changing wording: **biogeochemical** to **soils** for simplifying readability for some folks	No change. Maintain consistency with rest of document and other ACR methodologies. Biogeochemical models and their appropriate use within ACR's program are described in the ACR Standard (A.6), with which project developers will be familiar.	Ok

[3] The smallest geographic extent for such data shall be used. For example, if fertilizer rates are available at the county level and state level, the county-level estimate shall be used.

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		Agriculture's Risk Management Agency, Farm Service Agency, Natural Resources Conservation Service) with jurisdiction in the Project Region; or Cropland management plans approved by a lending agency			
29	3.2.2.1 Unidentified Agent	Footnote 19 …. This calculation produced a county list of grassland conversion rates, **neutralized** by the unique number of grassland/shrubland acres available for conversion in each county in each time step…	Suggests the use of the term "normalized" rather than "neutralized".	See revision	Ok
30	4. Stratification	Soil texture has been mapped by SoilGrids	SoilGrids is a 250m global predictive dataset. Although it	See revision. SoilGrids has been removed. SSURGO	Ok

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		(Hengl et al. 2017)[4] and this dataset can be used for stratification purposes.	seems to be a good product, Peer Reviewer questions whether it will appropriate for these types of field-level assessments. Why not recommend SSURGO, which is derived from county-level soil surveys and has a higher level of spatial precision?	is recommended for stratification purposes.	
31	4. Stratification	Stratification must consider the biogeochemical and/or **empirical** models that will be applied for the methodology, where each stratum can be represented by a	Implies that this is too vague. Asks "Can someone do a regression with four samples?"	Requirements for both model types are described in Section 5. See revision in Section 4 referring reader to section 5.	If the answer is yes, the outcomes are meaningless, statistically. In this case, it might be a waste of time with no value and decreases the scientific robustness or credibility.

[4] Hengl T, Mendes de Jesús J, Heuvelink GBM, Ruiperez González M, Kilibarda M, et al. (2017) SoilGrids250m: Global gridded soil information based on machine learning. PLOS ONE 12(2): e0169748. https://doi.org/10.1371/journal.pone.0169748

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		unique model parameterization. It is not necessary to use the same strata for each pool.			**ACR: The cited methodology text does not specify sample numbers for regressions. One criterion for approval of empirical and biogeochemical models is publication in a peer reviewed scientific journal. This level of peer review combined with the incentive to minimize uncertainty deductions should ensure robust statistical approaches in the empirical models. Further these are subject to ACR approval. Finally, any stratification plan must be approved by both the verifier and ACR as part of**

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					the GHG Project Plan.
32	4. Stratification	For other pools or emission sources, stratification should be implemented when known sources of variation (e.g. soils, climate, land cover, crop management) are expected to alter estimates by more than 50% of expected average values within the Project Area.	I get the sense that this methodology gives requirements but tries to offer flexibility in this section i.e., Methodology gives qualitative guidelines for quantitative constraints which is kind of tricky. Is there a way to reduce the burdens to conduct all this process?	See revision in Section 4. Yes, the methodology gives requirements but tries to offer flexibility i.e., gives qualitative guidelines for quantitative constraints, which as the reviewer notes, is challenging. The goal is to allow flexibility in stratification in the scenario when several or many properties across a substantial geographic area join into a single project.	Ok
33	4. Stratification	The DAYCENT model is approved and validated for use with this methodology	Suggests adding some criteria here for empirical. Paint by numbers, Look Up Tables, regression,	See revisions in Section 5.	Ok

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		throughout the continental United States, excluding Alaska. For other biogeochemical and empirical models, model validation must be conducted as described below	samples, etc. Mentions that all gets a little noisy		
34	5. Use of models for quantification of GHG Emissions	**Be validated** for the Project Region to demonstrate that the model can accurately estimate each carbon pool and GHG source in the Project Region including the management systems identified in both the project and baseline scenario and regional weather and climate conditions (average annual precipitation and temperature) applicable to the Project Area.	This is a tricky requirement as there is no universally accepted criterion to determine whether a model is "validated", and it would be difficult to prescribe quantitative validation criteria for what is considered "accurate". Ask if It is possible to provide some additional guidance here. For example, it seems that at a minimum the model would need to be	See revision. This text now separates ACR's general criteria for approval of process based biogeochemical models and empirical models where soil carbon loss is measured or is a dependent variable. The ACR Standard includes overarching requirements for model approval by ACR for all project types (A.6). Climatological and other sources of variability	Ok

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			able to capture differences between cropland and grassland conditions and would also need to be able to capture physiographic and climatological differences among the major strata within the project area.	are captured in these criteria. Chapter 5 now lists suggested minimum criteria for empirical models – *were they to be proposed for inclusion in the methodology*. These would be approved on a case by case basis by ACR and included into the methodology where available. Currently, it's likely that most/all projects will use the DAYCENT model (already approved). The spin-up file and the weather input files for DAYCENT model capture physiographic and climatological differences at each site.	

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35	5. Use of models for quantification of GHG Emissions	Be based on a time series experimental design that includes cropped and grassland sites and t=0 is the conversion event (empirical models only)	There isn't enough information here to fully understand this criterion. Some further explanation is required, and a reference to an example of this approach would be very helpful.	See revision and response to comment 15. Empirical models would be approved for use on a case by case basis by ACR with suggested minimum criteria. This option is made available for project sites where long-term datasets of soil carbon loss are available.	Ok
36	5. Use of Models for Quantification of GHG	Be peer-reviewed	These days that can mean almost anything given the amount of #fakenews journals. Maybe a panel or appendix list of currently accepted models, not to pay favorites	See revision. Text now references the ACR Standard text regarding general requirements for process based biogeochemical models (A.6). Additional text added here regarding empirical models. The DAYCENT	Ok

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				model is the only model that is currently approved, per second sentence. Any subsequent model approvals for this methodology would be on a case by case basis. ACR relies heavily on expertise within our parent organization Winrock, the ACR Technical Advisory Committee, and external parties when considering the appropriate use of process based or other models for GHG quantification.	
37	5. Use of Models for Quantification of GHG	Be able to account for changes to soil organic matter and nutrient dynamics that occur following the	With some level of accuracy / quantify uncertainty?	Section 5 includes the following text: "Output from models should include estimates of uncertainties associated with	Ok

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		conversion of Grass-land or Shrubland to Cropland;		all pools and sources. In cases where vari-ances are not in-cluded in model out-puts, additional un-certainty analyses should be performed (e.g., Monte Carlo simulations). In cases where input variances can be calculated through Monte Carlo simulations, then these shall be per-formed and reported as well. See Section 6.5 Uncertainty As-sessment and Con-servativeness." ACR methodologies do not specify a minimum uncertainty as this is deducted from ERTs thus the economics of an individual project will determine the	

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				maximum uncertainty that can be tolerated.	
38	5. Use of Models for Quantification of GHG	Estimate size of relevant carbon pools on an annual basis	Asks “in what units for uniformity?”	Table 7 prescribes the units and frequency of measurement for terms in all equations. Ultimately carbon pools and loss are reported in units of $MTCO_2e$/year, converted from MT C, which could be converted from other units as well. See revision added “mass of carbon/year”).	Ok
39	5. Use of Models for Quantification of GHG	Output from models should include estimates of **uncertainties** associated with all pools and sources.	This part clarifies some questions regarding uncertainty	No response required.	
40	6. Quantification of Baseline GHG Emissions	BE_y	Suggest including this in the glossary.	BE = baseline emissions. This term is	Ok

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		Baseline emissions in year **y**, **y** = 0 at project start date; $MTCO_2$**e**	States that It's not immediately clear what the "e" means. Maybe "emissions"? If so, it's not clear why it's lowercase.	defined in the parameters table, Appendix A per ACR's standard methodology format. Authors double-checked that BE is always uppercase. $MTCO_2e$ – "e" refers to "carbon dioxide equivalents", in which case e is always lower case. No action.	
41	6. Quantification of Baseline GHG Emissions	General	For these sections can you illustrate a very simple example? That would help some folks I would guess	ACR methodologies generally do not include examples and follow a standardized style and format. The Manual/FAQ document will include examples.	Seems like the manual / FAQ will address many issues. Can you precanned this? **ACR: These should both be posted to ACR's website in October or November of 2019.**

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	6. Quantification of Baseline GHG Emissions	General	Mention that to avoid people's eyes glazing over with the equations, while at the same time offering transparency and showing underlying science, accuracy, and quantification, some kind of widget / calculator would be a huge lift.	Agreed. Carbon accounting methodologies are generally dry and employ a manual type writing style. ACR is preparing a companion Manual/FAQ document and Excel Tool to support project planning. The Excel Tool cannot be used for project quantification since the DAYCENT model needs to be run for each site.	Ok
42	6. Quantification of Baseline GHG Emissions	$C_{AGB,BL_{p,y}}$ Carbon stock of above-ground biomass for Participant Field **p** in the baseline scenario in year **y**; MT CO_2e (optional)	In the previous subsection, there was no space ($MTCO_2e$).	See revisions. No space between $MTCO_2e$.	Ok

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43	6.1.1.2 Carbon Stocks of Aboveground Crop Biomass	Footnote 25 Where process models require specific crops in a given year, crop selection and assignment to years shall not be done in a manner that would underestimate $C_{AGB_{crop},BL_{b,y}}$.	How assigning specific crops to years would result in underestimation. Can ACR provide an example?	Now footnote 29. Carbon stored in the above ground biomass in the baseline, i.e. crops planted in the counterfactual baseline scenario where the land is tilled and cultivated, is subtracted from the carbon "credited" in the project that is saved. To meet the principle of conservativeness, this value should not be underestimated. An extreme example would be if grassland is being converted to orchards (high above ground biomass), but a low carbon crop like wheat or barley is entered in the model.	Ok

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44	6.1.1.2 Carbon Stocks of Aboveground Crop Biomass	Average crop yields must be obtained from government or extension crop yield reports for the smallest available administrative unit containing the Participant Field (e.g., county).	Crop yields can vary considerably from year to year. Is there a minimum time frame over which these yields must be averaged?	See revision. Five-year average should be used and is consistent with the update interval for the baseline cropland management scenario.	Ok
45	6.1.1.2 Carbon Stocks of Aboveground Crop Biomass, equation 6	Formula	Ask to explain the basis for the 44/12 conversion factor.	44/12 is the ratio of molecular (and atomic) weights of CO_2 to C and allows for conversion of soil C units to MT CO_2e, the standard unit of accounting in the carbon market.	Ok
46	6.1.3 Accounting Baseline Emissions from Soil Organic Carbon	Direct measurement of changes in soil carbon in the baseline scenario is not possible as conversion of Grassland and	Asks for clarification: Isn't this the case for the other carbon pools as well? Why only mention this for soil organic carbon?	Yes. This sentence has been removed in section 6.1.3.	Ok

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		Shrublands is a counter-factual scenario.			
47	6.1.3 Accounting Baseline Emissions from Soil Organic Carbon	Direct measurement of SOC according to requirements in ISO 10381-2:2003 Soil quality – sampling – Part 2: Guidance on sampling techniques	Asks whether ACR expect folks to do this themselves?	Most project developers will use the DAYCENT model, but paired soil sampling time series is allowed to quantify the soil carbon loss. It is intended to allow for use of datasets where they exist.	Not sure how logical that becomes to scale. **ACR: Noted. No revision necessary.**
48	6.1.3 Accounting Baseline Emissions from Soil Organic Carbon	Direct measurement of SOC according to requirements in ISO 10381-2:2003 Soil quality – sampling – Part 2: Guidance on sampling techniques	This seems to contradict the previous statement that direct measurement of soil carbon in the baseline scenario is not possible. Perhaps some more explanation or context is needed.	See previous. Both modeling and direct measurement of soil carbon are allowed, although the DAYCENT model will likely be the predominant method for estimating SOC.	Ok

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49	6.1.3 Accounting Baseline Emissions from Soil Organic Carbon, equation 10	Explanation of terms used in formula	Asks to list terms in the same order as in the equation.	See revision	Ok
50	6.1.3 Accounting Baseline Emissions from Soil Organic Carbon	Recent syntheses commonly find losses of soil carbon down to 1 meter (Sanderman et al. 2017).	Suggest adding a good figure here	No change. In general, carbon accounting methodologies are prescriptive, instructional ("cookbook" style) documents, and the underlying science is referenced but not explained in detail. The methodology is used as the list of requirements and rules against which the project is audited by the verifier. For consistency with other ACR methodologies that writing style is retained here. ACR will	Ok

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				consider adding a soil depth figure to the Manual/FAQ companion document that is in preparation.	
51	Equation 10: Total Soil Organic	An empirical result from field **measurements** at sites that have and have not been converted to Cropland but are otherwise materially similar to each other and to the Project Area (e.g. in soil type and climate), provided that soil samples are collected from the relevant soil layers that would be affected by the conversion process and baseline activity.	Asks: Who, what, how many, lab?	Most project developers will use the DAYCENT model, but paired soil sampling time series is allowed as a means to quantify the soil carbon loss. It is intended to allow for use of datasets where they exist. These would be approved on a case by case basis by ACR and the verifier at the time of project listing or validation. It is unlikely that project developers will be undertaking a carbon offset project and	Doubtful **ACR: We understand this comment to indicate the unlikeliness of soil sampling to be used as part of the project. Agreed. Most project developers will use the DAYCENT model.**

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				new soil carbon sampling effort at the project site simultaneously, but rather leveraging existing datasets. Best practices for soil sampling are available from ISO and referenced in section 6.1.3.	
52	6.1.4 Accounting Baseline Emissions from Soil N_2O	Accounting for this pool is **required**	This section reads a bit confusing. Is it required, not possible, not important? Please clarify.	The sentence is reiterating the information in table 1. Project developers may not read the methodology sequentially, so text regarding whether a pool is required in accounting or optional is stated in multiple locations.	Ok

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53	6.1.4 Accounting Baseline Emissions from Soil N_2O	GWP_{N2O} definition	Suggest for this term should be defined somewhere – perhaps in the footnote?	GWP_{N2O} is defined in the parameters table as the global warming potential of N_2O which is periodically updated according to the latest science. The footnote directs the reader to the ACR Standard where this is defined for all project types in the ACR Program: "A relative scale translating the global warming impact of any GHG into its CO_2e over the same timeframe. The IPCC periodically updates the list of GHGs and their GWP factors, based on the most recent science. ACR requires Project	Ok

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				Proponents to calculate GHG reductions and removals based on the 100-year GWPs in the IPCC Fourth Assessment Report, Working Group 1, Chapter 2, Table 2.14."	
54	6.1.4 Accounting Baseline Emissions from Soil N_2O, equation 14	**Number** of organic **N** amendments of type k	Suggest editing to total number instead of number, for consistency with previous equation.	See revision	Ok
55	6.1.5 Accounting Baseline Emissions from Enteric Fermentation (E_{ferm}, BL, p,y)	Estimates of enteric fermentation can also vary widely depending on the level of specificity of input data and use of defaults	Asks to be more specific. To be precise, default values of what?	This sentence is referring to default values of EF_l the emission factor for methane per head, per grazing day for a livestock type. These are typically used in state and national GHG inventories and values	Ok

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				available from the EPA and the IPCC. More specific (but still default) values can be available from more focused or regionally specific studies but project proponents will not measure this. Carbon offset project developers will be familiar with commonly used livestock methane emission factors.	
56	6.1.5 Accounting Baseline Emissions from Enteric Fermentation (E_{ferm}, BL, p,y)	Footnote 40	The footnote contains a long and complicated sentence that should be rewritten and possibly split in to multiple sentences.	Now footnote 45. See revision.	Ok
57	6.1.5 Accounting Baseline Emissions from En-	The effects of vegetation stimulation and soil nutrient amendments that grazing	Please revise and possibly split in to two sentences. Something seems to be	See revision	Ok

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	teric Fermentation (E_{ferm}, BL, p,y)	and natural manure management, as maintained from pre-project conditions, are assumed to be captured through estimates of soil and biomass carbon pools in the project scenario.	missing from this sentence.		
58	6.1.5 Accounting Baseline Emissions from Enteric Fermentation (E_{ferm}, BL, p,y), equation 15	Formula	Change to lower case "l" (not "i" at the bottom of the summation sign to be consistent with the rest of the equation.	See revision.	Ok
59	6.1.5 Accounting Baseline Emissions from Enteric Fermentation	It must be **shown** at time of validation that:1) winter grazing is common practice in the region as part of the baseline crop management scenario, per the requirements in section	Ask how this would be done	See section 3.1.2. "Management practices (including as inputs to approved biogeochemical models) shall be in-formed from producer surveys conducted by	Ok

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		3.1.2, and 2) winter grazing is feasible and likely at the specific project location because cattle are already present or have been present in the project area[5] or LCA area.		government agricultural agencies or university ex-tension offices ; the expert opinion of university extension personnel working in the region and systems of interest; personnel of a governmental agriculture agency field office (e.g., United States Department of Agriculture's Risk Management Agency, Farm Service Agency, Natural Resources Conservation Service) with jurisdiction in the Project Region; or Cropland management plans	

[5] These emissions are conservatively excluded in the baseline scenario if the project scenario does not also include grazing OR it cannot be demonstrated that grazing was already occurring within the project boundary or by the land manager and is thus can be considered both feasible and likely for the project area in addition to common practice in the region.

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				approved by a lending agency. Alternatively, a survey conducted by the Project Proponent may be used where the above sources are unavailable, unreliable or outdated, or aggregated at a scale larger than the Project Region.”	
60	6.1.6 Accounting Baseline Emissions from Fossil Fuels, equation 17	Formula description (v)	For some equations, these index variables (lowercase) are left out of the description and only the total number variables (uppercase) are defined. In other equations, such as this one, both types of variables are defined. For clarity, Peer Reviewer recommends using a consistent approach	Revised in all equation boxes.	Ok

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			across all the equations.		
61	6.2.1 Accounting Project Emissions from Above-ground Biomass (Woody and Non-woody)	Formula	For consistency, asks to provide a table describing the terms for this equation.	See revision. Table added.	Ok
62	6.2.4 Accounting Project Emissions from Soil N_2O, equation 26	$Nex_{l,p,y}$	Points out that subscripts for this term do not match what is in the equation.	See revision.	Ok
63	6.3.1.2 Market Leakage	Therefore, methods based only on price elasticities will tend to overestimate leakage, making them conservative from the standpoint of calculating offsets generated by a project.	Asks for clarification – is this the method that is being implemented in the subsequent equations?	Yes. The method here is based on price elasticities which as noted in text is very likely an overestimate, but which results in a conservative estimate of carbon offsets.	Ok

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64	6.4 Net GHG Emissions, equation 35	Non-permanence	Since “non-permanence” is not explicitly discussed or defined in this methodology, suggests providing some additional explanation.	Permanen(t)ce is defined in the ACR Standard, California Cap and Trade regulation and other carbon offset registry programs and applies to all project types where carbon is stored, and that storage can potentially be reversed.	
65	6.5 Uncertainty	Where **uncertainties exceed 10%** at the 90% confidence interval, an appropriate confidence deduction shall be applied, calculated as the lower bound of the 90% confidence interval.	Asks for clarification of this statement. Does the methodology say that the difference between the estimate and the upper bound of the 90% confidence interval should be no greater than 10% of the estimate? Or that the range of the confidence interval should	Yes, to the former. The boundary of the confidence limit must be less than +/- 10% of the mean value. Otherwise the CL is used. This is a common threshold used in carbon accounting methodologies. See revision for clarity. Only relevant for sampling or default	Ok

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			be no greater than 10% of the estimate?	values where provided.	
66	6.5 Uncertainty	Where uncertainties exceed 10% at the 90% confidence interval, an appropriate **confidence deduction** shall be applied, calculated as the lower bound of the 90% confidence interval.	Asks for clarification of what a confidence deduction is.	See previous comment/response	Ok
67	6.5 Uncertainty	Uncertainty estimates, or **lower bounds** are required for default values (such as those by the IPCC), estimates from peer-reviewed literature, and direct measurements or empirical relationships based on measurements.	Asks for clarification regarding lower bounds of what? States that it would help to have some more specific guidance on how uncertainty should be measured and reported.	See previous comment/response In practice, the verifier will ensure that values used for project ERT reporting (whether from DAYCENT, sampling or another approved empirical model) are conservative. In many instances this will de-	Ok

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				pend on how quantification was set up for each individual project in the GHG Project Plan. This language is intended to be general enough to capture many likely project scenarios.	
68	6.5 Uncertainty	Footnote 56	Asks for some clarification is needed in the footnote – is the most conservative uncertainty value the one that has the widest confidence interval?	Now footnote 61. The most conservative uncertainty estimate is the one that results in the lowest number of ERTs.	Ok
69	6.5 Uncertainty	Estimation of **uncertainty** is required for each baseline and project carbon pool and GHG sources.	Can ACR/authors make a tool in this case for ease of execution?	Unfortunately, ACR cannot make a generic tool for uncertainty. The methodology allows project developers a lot of flexibility to optimize pro-	

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				ject logistics and accuracy (i.e. site-specific characteristics and ERT estimation) and use of models and available datasets. Because so much flexibility is allowed to the project developer, each project will have a unique uncertainty estimate. A standardized uncertainty deduction would likely overestimate uncertainty for some and underestimate for others. ACR will build a project developing support tool (DAYCENT must be used for quantification) that includes a very conservative uncertainty	

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				estimate to help estimate worst-case scenarios.	
70	6.5 Uncertainty	They should be directly estimated with **appropriate statistical techniques**. Where process models are used to estimate pools and sources, model outputs must incorporate all sources of model uncertainty.	Asks whether there is any specificity for the appropriate statistical techniques	See revision. The ACR Standard contains the general guidance below on model uncertainty. Reference to this language has been added. "The use of biogeochemical or process models must also include an estimate of structural uncertainty related to the inadequacy of the model, model bias, and model discrepancy. This should be quantified using the best available science, and can include Monte Carlo anal-	Ok

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				yses, uncertainty estimates from peer reviewed literature, and/or consulting model experts who have either developed or worked directly with the model in an academic setting." P 19	
71	6.6.2 Mitigation of Risk	Project Proponents shall ensure that **participants follow any county or local requirements** for prescribed burns on participating parcels to reduce the risk of reversal due to fire and any associated negative impacts.	While this is certainly a good idea, most county or local regulations will focus primarily on safety and less on the impacts that prescribed fire have on carbon storage. However, there are quite a lot of resources available these days to help managers develop burning strategies. So perhaps the requirement should be that	See revision. The reviewer's recommendation was the intent of the statement. By following the best management practices for prescribed burns in the region, it is more likely that the fire will not burn out of control or into areas not intended or cause negative environmental impacts.	Ok

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			participants know and follow the applicable best management practices for the use of fire in their particular vegetation type and region.		
72	7.2.1 Description of the Monitoring Plan	Conversion Agents	Asks for more details regarding what is being asked here	Conversion agent is either an unidentified agent or an identified agent, both of which are defined in the Definitions section and in section 3.1.1.	Ok
73	7.2.1 Description of the Monitoring Plan	Any effects of disturbance, especially of burning (wildfire or prescribed), on aboveground shrub biomass.	Asks whether this should be a bullet in the previous list	Yes. See revision.	Ok
74	7.2.1 Description of the Monitoring Plan	Biogeochemical model parameter definitions	Suggest writing out the meaning of “ex post” in English in the footnote	No change. See comment/response 9.	Ok

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75	7.2.2 Sampling Design	Where uncertainty exceeds 10%, estimated GHG benefits or values must be discounted	Mentions that this seems like a somewhat arbitrary criterion – why 10%. Also, what does it mean to say that benefits or values "must be discounted"?	See revision. Additional language added for clarity. This is a standard approach across all carbon accounting methodologies for carbon offsets, across all programs (not only ACR) where sampling is employed. When the 90% confidence interval (high or low bound) is larger than 10% of the mean value, the bound of the interval must be used instead of the mean value to yield a conservative result of ERTs.	Ok
76	7.3 Data Archiving	All reports, measurements and other project related documents, including documentation of LU/LC	Asks whether this is kept locally or a centralized and standardized database?	See revision. Text is clear now that these requirements are specific to the VVB. The ACR Standard	Ok

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		conversion, shall be **kept** per requirements in the ACR Standard.		states the following, (P 57) "The VVB shall keep all documents and records in a secure and retrievable manner for at least 2 years after the end of the relevant project Crediting Period, even if it does not carry out verification throughout the project Crediting Period." The project developer is responsible for maintaining soil samples when used.	
77	Definitions: Forests Lands	Land with at least 10 percent **cover** (or equivalent stocking) by live Trees of any size, including land that formerly had such Tree cover and that will be naturally	Wonders whether this is low, 10%?	See ACR Standard, section A.3.1 "Forest projects shall use a nationally approved "forest" definition for the country where the activity occurs. For projects in the United States,	Ok

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		or artificially regener-ated.		Project Proponents shall use the U.S. definition below, which is based on the U.S. Forest Service Forest Inventory & Analysis Program definition. For pro-jects outside of the United States, Project Proponents may use the Kyoto Protocol definition below, with the relevant Desig-nated National Au-thority (DNA) selec-tions for minimum land area, crown cover, and tree height. If the project is in a country that no longer has a desig-nated DNA or whose DNA has not made these selections, the Project Proponent may propose another	

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				nationally approved forest definition. Forest (for projects in U.S.; based on U.S. Forest Service Forest Inventory & Analysis Program definition) Land with at least 10% cover (or equivalent stocking) by live trees of any size, including land that formerly had such tree cover and that will be naturally or artificially regenerated. To qualify, the area must be at least 1 acre in size. Forest land includes transition zones, such as areas between forest and non-forest lands that have at least 10% cover (or equivalent stocking) with live trees and forest areas adjacent	

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				to urban and built-up lands". This definition from the USFS FIA that includes the 10% cover threshold is consistent with that used in the California Cap & Trade Program and other carbon registries.	
78	A.3 Parameters Monitored	Table	Points out that with respect to layout and readability, long and narrow table entries are very difficult to read.	Changed to layout format	Ok
79	Appendix B: Eligible U.S. Counties	Map legend label	Mentions that legend label in the map in uninterpretable.	See new map and caption	Ok
80	Appendix B: Eligible U.S. Counties	The top 50% of counties experiencing the most grassland conversion during this	Asks about counties in map: "if not orange is the not eligible?"	Project fields/parcels located in the counties highlighted in orange have a baseline	Ok

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		period were considered to be at-risk and meet the protocol's additionality threshold in full.		scenario of cropland for unidentified agents of conversion and surpass the practice-based performance standard for demonstrating additionality. Project fields/parcels in white counties must determine the baseline land-use scenario and demonstrate additionality according to sections 3.1.1.2 and 3.2.2.2 respectively. Projects in white counties can still be eligible but need to follow the requirements for "Identified Agents of Conversion" per Section 3.2.2.2	

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81	Appendix B: Eligible U.S. Counties	**The top 50% of counties experiencing the most grassland conversion** during this period were considered to be at-risk and meet the protocol's additionality threshold in full.	With respect to the underlying science and accuracy of the county-level eligibility maps, Peer Reviewer wonders: 1. What is meant by "most grassland conversion"? Based on the information presented earlier in the document, this text should be clarified to state that these are the counties with the highest conversion rates. 2. Clarify – is the map based only on conversion of grassland? Or of combined grassland/ shrubland?	The map includes conversion of grassland and shrubland. The analysis follows the approach described by Lark et al. 2015 and first identifies new areas of cropland using CDL and NLCD at intervals over the period 2008-2016. After locations of conversion were identified for all areas of change (classes 3 and 4) and for the year of conversion, the specific land cover preceding and following a conversion was characterized. The NLCD has distinct categories for herbaceous grassland and shrub/scrub.	Ok

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			3. The 50% cutoff is not necessarily unreasonable, but the criterion is clearly arbitrary. Some additional rationale should be provided for this cutoff.	The 50% threshold is arbitrary as the reviewer suggests. Indeed, any absolute value selected would be arbitrary as noted as absolute acres of grasslands and shrubland lost to cropland vary annually due to short term and long-term drivers. The analysis underlying map in Appendix B looked at ACTUAL conversion over a 9-year period which should capture response to various drivers. The 50% cutoff selects counties that have a better chance than not (i.e. the likelihood of conversion is positive) of being converted	

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				given the trend of actual conversions in that county relative to the county in the U.S. that is the maximum for that period (highest acres lost relative to grassland/shrubland available for the period). Project fields/parcels located in the counties highlighted in orange have a baseline scenario of cropland for unidentified agents of conversion and surpass the practice-based performance standard for demonstrating additionality. Project fields/parcels in white counties must determine the baseline land-use scenario and demon-	

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				strate additionality according to sections 3.1.1.2 and 3.2.2.2 respectively.	