These represent SOCCR2 authors' responses on public comments submitted for the Fourth Order Draft of SOCCR2.

Starting Friday Nov 3, 2017 at 2 pm Eastern U.S. time, the fourth order DRAFT of the 2nd State of the Carbon Cycle Report (SOCCR-2) was available for download and for public comments via https://review.globalchange.gov.

The SOCCR-2 review site on review.globalchange.gov remained open for late comments submissions through midnight (Eastern U.S. time) Monday January 15, 2018.*

A simultaneous review of the SOCCR2 DRAFT was conducted by the U.S. National Academy of Sciences.

The authors' responses and revisions on the subsequent Fifth Order Draft were based on both public comments and U.S. National Academy of Sciences Review.

Multiple other reviews followed, including final interagency review and clearance on that draft. Additional revisions led to the Sixth Order Draft and then the final SOCCR2 report months later.

The final SOCCR2 report released in November 2018 is available via https://carbon2018.globalchange.gov.

Chapter	Comment Type	Figure / Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
							This is a very impressive effort and the many authors and contributors are commended for their tremendous input.	Thank you for acknowledging the effort by so many that went into this report. During review
							While at this late state the general comments likely cannot be fully integrated, they may serve for SOCCR-3 and beyond:	of comments and editing for the final draft, many chapters and the ES were made more
							-The main issue is that the document is much too long and as a result becomes repetitive --Several chapters (chapter 6, 7, 17 and 18)	concise. However, chapters are meant to stand alone, and so there is definitely some
							are largely descriptive and instructional and do not really fit in this report	repetitive text to reflect this and therefore the document is long. The descriptive parts
							- The approach of assessing confidence and uncertainty is sound but is not carried through consistently throughout the chapter. At	generally involved areas of less mature science such that a record of observations and
							time the distinction between Certainty, confidence level and likelihood is not clear	analysis is not as available as for other, more mature topic areas, and which will hopefully be
							- A major weakness is that there is not a clear distinction between the natural carbon cycle and the anthropogenic perturbation.	much more advanced for SOCCR-3.
							Along the same lines concepts of residence times and the longevity of the carbon sinks is not always clear.	
							- The uncertainty expression are not consistent between chapters (some use standard deviation, other 2 sigma, confidence intervals	We made considerable effort to improve standardization, consistency, and descriptions of
							etc.)	uncertainty in the final draft. We allowed chapters some flexibility depending on the state of
							- I think the changes between the first and 2nd report need to be better highlighted including:	science, disciplinary conventions, and available data, so some differences remain.
							A. Which fluxes and transports are now included in the carbon balance	
							B. Which fluxes and transports have greatly improved	Where possible, we tried to improve distinction between natural and anthropogenic drivers,
							C. and to me the biggest highlight that should catch the interest of the popular press is that the fossil fuel emission /energy	but because of data limitations and in some cases lack of clearly defined international
							consumption in the US has decreased appreciable in the last 10 years since SOCCR-1 (10-15 %). Other than economic downturns and	guidance about this issue, it is not always possible and remains a significant research need.
							wars this has not occurred since the start of the industrial revolution . This fact is downplayed in the report	
								Individual chapters and the ES, where possible, describe changes since SOCCR-1. However,
								because of different and more elaborate partitioning of ecosystems, it was not always
								possible to directly compare the two.
	Whole Document							We highlighted the decrease in fossil fuel emissions and the reasons, in the relevant chapters and especially the ES where it is highlighted several times, including main finding #1
							Please consider and incorporate pertinent findings and research needs from the following report:	Where appropriate we cited this report, especially with regards to monitoring and research
							NAS. 2018. Thriving on Our Changing Planet: A Decadal Strategy for Earth Observation	needs. Also the Preface explains the relationships between the different USGCRP reports,
	Whole Document							and Appendix C is a comprehensive listing of main observation systems, including current and proposed earth observations.
							GENERAL COMMENTS ON SOCCR-2 AS A WHOLE:	Please see responses to comments about individual chapters for chapter-level details.
							The North American carbon cycle is inherently large scale, and therefore potentially difficult to synthesize information on. However,	1. See response to general comment 1 pertaining to the length of the report and need for
							this document is (1) required by US federal law, (2) iterates only once every ten years, and (3) has already been through several rounds	repetition so as to have chapters be independently complete.
							of expert review. There has therefore been sufficient mandate, time, and previous review, to have created a cogent and informative	2. Cannot determine what changes the comment refers to. As a rule, each chapter covers the
							document. In reading carefully what I consider to be the most important chapters of the report (Preface, 1, 2, 8, Executive Summary,	important changes as determined by the expert authors.
							and Appendix A), I do not find this objective to have been met. Chapter 8 is an exception--it is much more well written and can serve	3. We have clearly documented, and where possible used, the preferred time period since
							as a model for the others, as discussed in more detail in the comments for that chapter. Chapter 1 is far too long and over-prioritized	the last SOCCR report (2004-2013). Where chapters had to deviate because of data
							in its position in the document, given that the report's mandated focus is North America. Chapter 2--arguably the single most import	availability or the need to include information outside of this timeframe, specific dates have
							chapter--is a very serious problem on several fronts.	been provided.
							In particular, and summarizing:	4. Cannot determine what assertions are questionable or wrong according to the comment.
							1. The report is counter-productively longer than necessary, relative to its useful information content. It is far overly heavy on verbage	5. GCP is global, so chapter 1 has incorporated and referenced GCP in its overview of the
							at the expense of truly useful data. It is not well-structured and has a haphazard feel to it.	global carbon cycle.
							2. The report fails to clearly identify and discuss some important and prominent changes in the North American and US carbon cycles.	6. The downturn in fossil fuel emissions is covered several times in the ES and also in several
							3. The focal time period is ill-specified, especially the end year. Some chapters compound this problem by ignoring the specified start	chapters (3,8) dealing with fossil fuel emissions. Given the uncertainties at the North
							date (2006) as well, using time periods whose justification is simply never given. One must assume that authors were free to focus on	American scale, and some changes in accounting elements, it we cannot definitively say that
							whatever period they so chose.	there is a trend in land and ocean sequestration. Chapter 1 addresses this globallyy based on
							4. Combined with some inexcusably poor statistical methods, the preceding point leads directly to questionable, or outright wrong,	GCP reports. Regarding organization, a very large contingent of agencies have had input into
							assertions regarding fundamental processes of the carbon cycle at the target scale.	the organization used in SOCCR-2. Also note that the glossary has been thoroughly updated
							5. The relationship of SOCCR-2 to other large-scale carbon cycle evaluations is unclear, that of the Global Carbon Project (GCP) in	and expanded for the final draft.
							particular. They range from poorly integrated, to outright at odds with, each other.	
							6. The report consistently tries to minimize, by its language, the clear evidence for a sharp downturn in NA fossil fuel emissions that	
							began around 2006, as well as that for an increasing land and ocean sequestration (i.e. sink) over the last few decades (globally and	
							continentally), especially in the Executive Summary and first two chapters.	
							The summary points above are expanded upon in items I and II below, using an example from Chapter 2 to illustrate.	
							I. Cogency	
							Given that this report has already undergone several rounds of expert review, and yet takes the length and structure that it does,	
							comments on the overall document structure seem very likely to be moot at this point, given the amount of re-working that would be	
							required for improvement: the entire document would essentially have to be re-written. As just one brief example, Chapters 2 and 8	
							are arguably two of the most important in the report, and I do not see the logic of Chapter 8 not following Chapter 2 directly, given	
							that it constitutes a fundamental accounting of CO2 and CH4 pools/fluxes. More generally, the arrangement (and topical breakdown)	
							of chapters seems rather random and not thematically cogent, sometimes based on vegetation type geography, other times on	
							population density, or who knows what exactly.	
							Given this condition, I note only that the report needs a thorough English language copy editing, which by itself could considerably	
							reduce length and improve readability. The report is quite loaded with ambivalent and/or poorly worded and/or confusing statements	
							that are ill-suited for a scientific assessment. As just one very brief illustrating example, page 74 line 5 begins "In the ca. 2003 time	
	Whole Document						frame...". Just how is the reader supposed to interpret exactly what years such a phrase refers to, other than guessing? Authors must work to state exactly what they mean, in all cases.	
							II. Focal time period(s) and quantitative analyses thereof	
	Whole Document						Check all numbers presented in chapters and executive summary for consistency. Make corrections as needed for final draft.	This has been done.
	Whole Document						Review the key findings in each chapter to ensure that the most important findings are labeled as "key". Be sure that the key findings listed at the beginning of each chapter are identical to the key findings listed in the "traceable accounts" at the end of each chapter.	This has been done.
	Whole Document						There are many publications coming out every day in this area, so please make sure these are considered so when this is eventually published, it will not be out of date.	This has been done where specific recommendations have been made by reviewers, or a particularly significant paper was published during the final review. But we had a cutoff date for incorporating new material that was generally followed so there was no document-wide attempt to update the literature.
							Overall, I agree with the scope and discussions of the Second State of Carbon Report. The treatment of certainty levels of knowledge	Thank you for the positive commrnts about the usefulness of the report and it was our hope
							is significant and important. Although I am not an expert on the carbon cycle, the findings have significance for my field of global air	that it would be used in educational settings. Please see Appendix C; nearly all observations
							quality and I feel are useful in advancing what my group does in fine carbonaceous particle research. The report provides a solid	have links. Further, all figures are linked to their metadata and original sources.
							synthesis about the carbon cycle, which is an important framework for understanding and developing strategies for global, regional	
							and local air quality management.	
							Where possible, it would be good to have links to data sources so that the report's findings can be linked with education and course	
							development. I could see using this in my new undergraduate course, "Energy, Carbon and the Environment." The BAMS State of the	
							Climate Reports give links to data sources from various agencies. This would be a good example to consider for the Second State of	
	Whole Document						Carbon Cycle.	
							Enjoyed reviewing the entire draft report	
							(1) Observed and future projected changes to the carbon cycle (e.g. changes in air temperature and ocean water pH resulting from	Consequences of changes in the carbon cycle are summarized in Chapter 17 to set the state
							fossil fuel emissions and carbon cycle imbalance) and (2) carbon cycle management (e.g. possibilities for mitigating or decreasing this	for why it is important to examine mitigation, but this topic is not treated in great detail since
							carbon cycle imbalance) are discussed throughout the report. However I could not find anywhere that stated a clear and complete	it is covered enhaustively by other USGCRP reports (see preface). Also regarding motivation
							motivation for the carbon management strategies discussed, i.e. the current or projected future impacts of the carbon cycle imbalance	for carbon management, we have tried to reference the scientific literature about why it is
							(e.g. p28) on North America and North Americans that would compel action to modify current carbon management. While the	necessary to limit temperature increase to 2 deg. C or less, but have not elaborated on
							companion reports (Mellilo et al., 2014 and USGCRP 2017) are referred to and provide detail outside the scope of this report, a full	specific programs to accomplish this besides acknowledging the existence of global efforts
							summary of these current and projected impacts should be provided within the report, for example in Chapter 17 and the Executive	such as the Paris Agreement, as well as regional and state efforts within North America.
							Summary and possibly chapters 1, 2, and/or 19. See for example https://health2016.globalchange.gov,	
							www.lung.org/assets/documents/healthy-air/state-of-the-air/state-of-the-..., Hansen et al. (2013 doi:10.1098/rsta.2012.0294),	
							http://www.worldbank.org/en/topic/climatechange/publication/turn-down-th..., Hauer (2017 doi:10.1038/NCLIMATE3271), NOAA	
							Technical Report NOS CO-OPS 083, Neumann et al. (2015 doi:10.1007/s10584-013-1037-4), Hansen et al. (2017 doi:10.5194/esd-8-577-	
	Whole Document						2017), IPCC (2014 Synthesis Report p13-16), DeConto and Pollard (2016 doi:10.1038/nature17145), USGRP (2017 p10-11), Melillo et al. (2014 p1)	
							Interestingly there is no assessment of interaction with SDGs and use of that framework which is infact a global agenda. It could have	Correct. This is a knowledge gap and should be acknowledged. We will do that where
							been evoked for multiple chapters or mention of this as knowledge gap will be useful.	appropriate, such as in the Preface. There is indeed a knowledge gap. We acknowledge SDG
								related carbon cycle science needs and growing opportunities and findings that could
								potentially be reflected in future assessments but not in SOCCR2.
	Whole Document							
							There is surprisingly no mention of consumption based approach. May be a clarification why is not that attempted at all would be	National emission inventories are based on a production-based emission allocation approach.
							useful. That can be a part of future report but one would have expected in this report.	The consumption-based approach states that a country should be responsible for the
								emissions created due to consumption as this is the driver of emissions generated elsewhere.
	Whole Document							A substantial discussion about the different accounting approaches was added as an appendix (see appendix D).

Whole Document	This comment pertains to the need for more robust, transparent, and timely information about carbon sources and sinks on the spatial scales needed for decision making. For example, the bottom-up inventory information available through the WRI CAIT system is updated only every several years. The CAIT system is arguably the most important source for international emissions policy dialogue. There is movement to reduce the latency of this system, but there are no plans to increase it to annually, which is a minimum needed for evaluation of national and local emissions in relation to commitments made by governmental entities at those scales. Moreover, the data available through bottom-up approaches are subject to inaccuracies, some of which is due to measurement error. However, some of the inaccuracies may be due to intentional under-reporting. It is difficult to know the extent to which inaccuracies -- whatever the source -- are being introduced, without an operational, independent verification system. The increasing availability of remote sensing, together with existing (and potentially new) sources of in situ data and inverse models, provides the potential to provide the needed low latency, spatial resolution, independence, and accuracy to support decision making in a way that is not possible with currently available data sets. Some of these points are made in various places in the report. It would be valuable for the report to directly address this set of needs in a single statement.	This topic is covered well in the revised chapter 18 regarding decision support, in the ES box E3, and in appendix D that describes accounting frameworks.Seems like a chapter 18 comment. Could also be mentioned in th ES.
Whole Document	A number of chapters should be shortened and made more concise. A goal of ~15 pages for each chapter (not counting appendices) seems appropriate. Some chapters seem to meet this goal, while others are far away from the goal.	During review of comments and editing for the final draft, many chapters and the ES were made more concise. Chapters are meant to stand alone, and so there is definitely some repetitive text to reflect this. Also, since the chapters need to stand alone, in some cases, more space is needed.
Whole Document	The document would benefit from a thorough review to bring ideas together and make it more cohesive. Each chapter seems to be very independent from each other. Taking the time to ensure consistency throughout the document will make it more valueable and more readable, and help to draw out and emphasize the most important points in the entire document.	We had an all-author workshop after the review comments were received, which was designed to improve cohesiveness of the document across chapters and the ES. Also the ES was thoroughly updated and revised to accommodate comments like this calling for better integration of findings.
Whole Document	Having found one spot, so far, where the text (page 16, line 21) referred to "95% certain"--a phrase that really makes no sense as one is really certain or uncertain (just try looking up the definition of "certainty" in a dictionary and then put the qualifier in front--it makes no sense). There can be degrees of "uncertainty", but not of "certainty". The appropriate phrase would be "95% confident" . I would urge a search of the document to make sure that this problem is fixed everywhere--an authoritative assessment should not take us down the road of there being degrees of certainty.	We agree with this comment and have made appropriate changes to uncertainty terminology as a result.
Whole Document	I have a problem with including in the sink the uptake of CO2 that was occurring in Preindustrial times--in particular counting the uptake of carbon into the coastal ocean areas of CO2 that was being emitted as part of the natural, preindustrial carbon cycle, most likely as CO2 coming out of the oceans in areas where upwelling of cold water is occurring. Were one to use the results of how this draft does the calculation in compiling an inventory of the human influence, the results would not balance properly because the emissions from the low latitude ocean are not counted in the global emissions inventory. What needs to be done, as best I understand what is done here, is to subtract off of the ocean uptake component what the preindustrial amount was and only include the amount resulting from the induced increase in the CO2 concentration and from whatever effects pollutants carried into the oceans by the rivers, etc. due to human influence are having an effect. I'm not completely clear if this criticism would also apply to the land fluxes--possibly not as presumably the lad vegetation was at near equilibrium before human habitation (figuring out the reference time needs to be done). In any case, it seems to me that this inventory should only be counting the fluxes being affected by US activities--not mixing in the natural components. Some sort of discussion of all of this would be helpful in the front of the report and first two chapters	Check with authors of Chapter 16. I don't think the land chapters get into anything pre-industrial. Otherwise, references to pre-industrial C refer to atmiospheric concentrations, I think mainlly in Chapter 1 and maybe one sentences in the ES.
Whole Document	I'm surprised there seems to be no mention of jet fuel and emissions from aviation, which seems a bit strange given that there are international discussions about regulations of emissions from aviation. In future, it would seem likely that there will need to be a conversion of aviation (and perhaps shipping) to biofuels, and this does not seem to come up at all. While cars, trucks and trains can go electric, it seems important to start building the base of information to evaluate if biofuels might be sufficient to replace jet fuels, etc.	Good point; refer comment to transportation chapter
Whole Document	There is a persistent problem regarding the showing of the sign of the result. When showing the carbon balance for the atmosphere, it is fine to say that uptake of carbon by forests, etc. is a negative number for the atmosphere. But the text and tables talk about the uptake of carbon by the forests or sequestration in the forests, etc., and these numbers need to be shown as positive numbers as the focus is on the balance of the particular ecosystem. Otherwise, the tables end up being very confusing. Table 10.2 is a good example, where uptake by the grasslands is shown as a negative number even though the whole focus is on the budget of the grasslands and not of the atmosphere. This seeming attempt at being consistent by always viewing the sign as determined by the atmosphere is just very confusing and I think not at all helpful to the reader. If one wants to have the title of the table be a focus on the effect on the atmospheric budget, well then change the title, but if the focus is on the particular ecosystem, uptake (gain) has to be shown as a positive number	Our consistent guidance to authors has been to use the convention of sinks being shown as negative and sources as positive, especially in tables where a net balance needs to be calculated from both sources and sinks. Consistency among chapters is critical for comparing values and patterns. However, we did modify the guidance so that, in specific instances where it does not make sense (such as example cited by this reviewer), authors could use appropriate language to infer sinks or sources without also using a positive or negative sign, which has caused confusion.
Whole Document	Overall, while I have a number of comments,chapters 1-18 provide an excellent compilation of information across a wide topical area with very extensive documentation and great care in expressing uncertainties and strengths and weaknesses in understanding. Regarding Chapter 19, I have serious problems with section 19.3.1 and finding number 2 for the chapter considers far too restricted a future scenario of what could happen with respect to fossil fuel carbon emissions, and does not even seem to admit to it (namely the emissions scenario seems to assume no futher policy actions after fall of 2016 to limit CO2 emissions--and this presumably means by not only the Federal Government but by states and cities (so I guess only changes in fossil fuel availability, or what). Fine if this is stated and this is one scenario for how the future could play out and there are a number of others, but this does not come across as the case in the findings or early framing of the chapter. I think that chapter needs major revision including much clearer indication of the assumptions being made/imposed on the scenario. There are technological developments alone that could take the emission s well outside of the overlly narrow range projected for 2040, what with cars going electric (partly a result of companies no longer even offering combustion engines), of wind and solar underpricing not only coal out of the market, but quite possibly oil and gas (when the natural gas bubble bursts). The possibilities are tremendous--and yet not in this chapter. This is totally inadequate. Perhaps fine as chapter on changes in terrestrial ecosystems, but not at all with respect to future emissions scenarios covering next 22 years.	We appreciate the positive comments recognizing the comopilation efforts. In terms of the cmments regarding Chapter 19, this comment has been addressed in the update of chapter 19.
Whole Document	I found Madeleine and real brothers!!! His false name is Raquel LudeÃ±a My name is Javier Lorenzo Galindo Ozuna and my brother Eric Garrido. We all live in Sant Andreu de la Barca	No response required.
Whole Document	Dear SOCCR-2 Team, I searched the draft SOCCR-2 for the word persistence as in atmospheric persistence of CO2. I have searched for online references to the concept with limited recent â€¨8th grade levelâ€™ communications examples. I think this aspect of climate change that CO2 not naturally absorbed is staying in the atmosphere for centuries (how long more specifically?) is not understood by the general public, media, and decision makers with the new concerns about fracking and CH4. Best wishes, Grant Millin, Innovation Strategist and Owner InnovoGraph - Strategic Innovation Services and Management Consulting Sustain NC Developer 615 Biltmore Avenue W-1 Asheville, NC 28803 Cell: 828.423.2266 Email: grant@innovograph.com URLs: www.innovograph.com / www.sustainnc.com / www.sgdeep.com / www.hydrogennc.com Biographical sketch: http://sustainnc.com/about/ InnovoGraph makes strategic innovation work.	We appreciate this comment and have addressed the isue of persistence of different GHGs in the atmosphere in the preface, Box P.1.
Whole Document	This message (including any attachments) contains confidential information intended for a specific individual and purpose, and is protected by law. If you are not the intended recipient, you should delete this message and are hereby notified that any disclosure,	

Chapter	Comment Type	Figure/ Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Preface	Figure	P.4	15				1. Consistency of terminology in "Likelihood" defns. column: top entry should be "Very Likely" 2. Greater consistency between the likelihood categories of Fig. P.4, and the "Quantitative Statistical Uncertainty Estimates" on p. 16, argues for the highest and lowest likelihood categories to be set to 2.5%, not 10%.	Yes. Logically that would make sense. We tried to use standard terminiogies in the used in this community of scientists.
Preface	Text Region		13	13	1	6	It seems very debatable to characterize ocean acidification as a disturbance to the carbon cycle rather than an effect. The increase in atmospheric CO2 increase is the underlying disturbance or perturbation.	We see your point. However, to be specific, this section lists examples of the role of disturbances on the carbon cycle.
Preface	Text Region		16	16	20	28	"Unless otherwise noted, values presented as â€œy A± x%â€ should be interpreted to mean that the authors are 95% certain the actual value is between y â€“ x% and y + x%...This characterization is not, however, a statistical property of the estimate and should not be confused with statistically defined 95% confidence intervals." I find this description of knowledge certainty very questionable. The authors' "confidence", is not really a quantifiable entity in any common sense of that term and by claiming that it is, you will very likely in fact confuse readers. Confidence intervals apply to statistical distributions. Any application of the term beyond that very immediately gets into the hornet's nest of subjective opinion that science specifically tries to avoid. The fact that the IPCC, or any other entity, uses these types of definitions also is not a warranted justification. Since these assignments apply to judgments based on expert opinion, and not statistical distributions, a better phrasing is "the authors' opinions of the 95% confidence interval that would contain the unknown true value, is [y â€“ x%, y + x%]".	For each Key Finding, authors characterize uncertainty quantitatively (when possible) and rank uncertainty qualitatively by reporting their level of confidence in the results. Measures of uncertainty expressed in SOCCR-2 are based on scientific evidence, statistical analysis of observations or model results, and expert judgment. The report follows NCA guidelines for transparent reporting of likelihood, confidence, and uncertainty of findings.
Preface	Whole Page		1				The numbering and organization of page one seems to be a bit of a mess, column placement relative to the numbering system. There is also no listing of the Review Editors anywhere in the pre-preface listings, or elsewhere in the document, that I could see. Since these people are apparently responsible for handling the public review comments (page 24 of https://www.carboncyclescience.us/sites/default/files/cciwg/Draft-SOCCR-2-slides-for-authors-Oct-2017-for-web-generic.pdf), there is no way to know who to contact if issues arise during or after that process.	Correct. When the draft was being prepared for review, the final roster of review editors had not yet been finalized. We have now included the complete list in the front matter as well as at the beginning of each chapter.
Preface	Text Region		6	6	12	12	Consider specifying that SOCCR-2 is a "sustained assessment product of USGCRP" - i.e., "... is designed as a special interagency SUSTAINED assessment PRODUCT OF USGCRP focused on advances in ..."	Done.
Preface	Text Region		7	7	11	12	It's unclear why only SOCCR-2 and CSSR are highlighted here. What about the Climate Change and Human Health Assessment (USGCRP, 2016) and the Climate Change, Global Food Security, and the U.S. Food System (USGCRP, 2015)? They are both sustained assessment reports, as well, and should be mentioned here.	The caption has been revised and mentions those two other reports: Figure P.1 'Geographic scope and examples of overlapping topics among 2017/2018 USGCRP interagency sustained assessment reports. Three concurrently developed USGCRP interagency assessments (SOCCR2 initiated in 2015, CSSR or NCA4 Vol.I in 2016 and NCA4 Vol. II in 2017) followed common Information Quality Act guidelines, report development processes, review mechanisms (public review via Federal Register Notices, National Academy of Sciences, multiple sequentially coordinated federal reviews by the Interagency Sub-Committee on the Global Change Research). While some topics are overlapping among the three assessments, the focii, scope and intended audiences differ, resulting in deliberate complementary or supplementary content cross-referencing across related chapters of SOCCR2 and NCA4. The USGCRP published NCA4 Volume 1 in Dec 2017, with planned release NCA4 vol. II in Dec 2018. Simultaneous Public and NAS reviews of drafts of both SOCCR2 and NCA4 Vol. II occurred during November 2017-March 2018. Both NCA4 Vol. 1 and SOCCR2 contribute to the robust scientific foundation of NCA4 Vol. II. NCA4 provides pertinent cross-references to both NCA4 Vol. 1 and SOCCR2, as well as earlier published USGCRP assessments (not shown in this figure) such as the Climate Change, Global Food Security, and the U.S. Food System Report (Brown et al. 2015) and the Climate and Health Assessment (USGCRP 2016).
Preface	Figure	P.1	7				Suggest deleting this figure. It omits two important USGCRP sustained assessment products (e.g., Climate & Health Assessment; Climate & Food Security) and is a fairly arbitrary assignment of topics, which could mislead the uninformed reader.	This figure represent three concurrently developed USGCRP assessments(SOCCR2 started in 2015, CSSR started in 2016 and NCA4 started in 2017) which followed similar reviews and informationa quality guidelines, and which were planned the released withing a few months of each other and how their common elements overlap in terms of scientific findings. So, it deliberately omits the reports you mention because those to reports were not developed at the same time as SOCCR2. To not mislead the uninformed reader, additional clarification has been added to the caption and the figure. See response above.
Preface	Table	P.1	8				This table should be deleted. It's not clear that any formal crosswalk has been done between the SOCCR-2 chapters and the listed NCA4 chapters. It would be more accurate and appropriate to leave the discussion to the text, noting that there are areas of commonality between the reports and that SOCCR-2 serves as an important technical input to the NCA4. As presented, the table leads the reader to believe that a careful and thorough crosswalk between reports has been conducted and it's not clear that has been achieved at this point. So, again, suggest deleting the table and keeping the discussion to text only.	See above response. During the report development process, both SOCCR2 and NCA4 authors were granted access to pre-public drafts of the each others' chappters and did go through overlapping topics for cross-referencing and cross-walking. This cross-walk table was prepared by both SOCCR2 and NCA4 staff, and presented over several meetings with USGCRP, CCIWG and SGCR meetings, at their request.
Preface	Figure	P.2	9				The USGCRP logo at the top of this figure is not the current logo that is used. Authors should obtain the most recent version and use that one.	We have deleted all logos in this figure to maintain consistency.
Preface	Text Region		10	10	3	3	Is there any citation that can be given for how USGCRP treats grey literature - perhaps an appendix from NCA3?	We have expanded this section and placed it in the appendix where we do describe adherance to the IQA . NOAA information quality act Guidelines: 55 http://www.cio.noaa.gov/services_programs/IQ_Guidelines_103014.html 56 and also decision tree that was also used by the NCA for making decisons about the use of grey literature.
Preface	Text Region		10	10	11	11	Shouldn't it be "Federal Register Notice" and not "public register notice"?	Correct. Amended.
Preface	Text Region		12	12	2	7	The text here refers to the 2011 U.S. Carbon Cycle Science Plan, but as a USGCRP sustained assessment product, it's worth mentioning how this report is aligned with the 2012-2021 USGCRP Decadal Strategic Plan as well as the 2017 USGCRP Update to the Strategic Plan (i.e., the "Conducting Sustained Assessments" goal contained therein). Authors should include that context here, as well.	Thanks. We added the triennial update but in the first paragraph of the first page where describe what the report alligns to.
Preface	Text Region		14	14	10	10	Technically, the relevant chapter from the 2014 NCA is the "Hawai'i and U.S.-Affiliated Pacific Islands", not just "Hawai'i". See this link: https://nca2014.globalchange.gov/highlights/regions/hawaii To ensure important aspects from non-Hawai'ian islands receive due recognition, authors should re-name to the formal chapter title.	Thanks. Corrected.
Preface	Text Region		16	16	18	18	There is no longer the need to caveat the CSSR with "the soon-to-be-released". Authors should delete this phrase as the CSSR was published in November 2017	corrected
Preface	Text Region		16	16	21	21	I would urge changing the word Ã‘certainÃ“ to Ã‘confidentÃ“. There really are not degrees to being certainÃ‘one is certain or not. There can be degrees of confidence. Imagine saying something like Ã‘the authors are 50% certainÃ“Ã‘qualifying the word Ã‘certainÃ“ is really not appropriate.	A standard terminology for this science community is used.
Preface	Text Region		16	16	26	26	The word "certainty" needs to be changed to "confidence" for reasons explained in a general comment and to be consistent with changing "certain" to "confident" in line 21. I'm encouraged that on line 28 the word "confidence is used.	corrected
Preface	Table	2	17				It is simply inappropriate to be talking about degrees of "certainty"--Having "very low certainty" makes no sense at all. The word "certainty" needs to be changed to "confidence" and "certain" to "confident". It is good to be defining one's terms, but this whole table needs to be talking about degrees of confidence.	This table uses standard definitions and terminologies but we do understand the logic of your statement.
Preface	Text Region		17	17	2	8	This paragraph reads well--it talks about degrees of uncertainty and confidence intervals, which makes sense. Table P.2 needs to be redone to be consistent with this paragraph.	See above response.
Preface	Text Region		18	18	16	17	It needs to be said that "CO2e" is calculated over a particular time period, and that the period chosen can make a big difference in what the value might be. It might be added that the COP negotiation process has tended to make the calculation over a 100-year period. Choosing a period this long tends to significantly diminish the relative importance of emission of short-lived species such as methane on near-term warming. Given that there is interest in taking near-term action to limit climate change in order to limit global warming, evaluating the relative importance of limiting emissions of methane and CO2 over the next few decades, it would be more important to be using the 20-year GWP to make the conversion to CO2e. In any case, the definition here needs to make clear that there is a time-period associated with the CO2e calculation.	Corrected. We have added more info on this. "Global Warming Potential and Carbon Dioxide Equivalent Natural and anthropogenically-mediated carbon cycling causes fluxes of the greenhouse gases (GHG) CO2 and CH4, and often of nitrous oxide (N2O) as well due to the tight coupling of the carbon and nitrogen cycles in ecosystems. Comparing the climate impact of these gases of differing radiative efficiencies and atmospheric residence times requires a metric to inter-compare the relative climate effects. Radiative effects are compared using various techniques, including instantaneous impacts, such as with the Global Temperature change Potential (GTP) metric, or integrated over time, such as with the Global Warming Potential (GWP) metric; the intricacies of the comparison techniques differ depending on metric. The GWP is the most widely used climate metric; it evaluates the cumulative forcing of a 1 kg pulse emission of a GHG over a specified analytical time horizon, and then normalizes against that of a 1 kg pulse emission of CO2 evaluated over the same time horizon. Multiplying this value (the GWP) by the emissions of the GHG gas yields the CO2-equivalent (CO2e)—the amount of CO2 that would have the same warming effect over that time period as the amount of the GHG emitted. The UN Intergovernmental Panel on Climate Change has evaluated GWP over 20- and/or 100-year analytical time horizons (denoted GWP20, and GWP100, respectively)(Myhre et al., 2013), which is a decent indicator of climate effects in the near- and long-term, respectively. It can be assumed that, wherever CO2e results are reported in Chapter 3 and elsewhere in the report, this refers to the IPCC GWP100 values (without consideration of indirect effects and feedbacks) except where noted otherwise. This semi-arbitrary but common choice of the 100-year analytical time horizon tends to de-emphasize the near-term climate impacts of CH4 and other short-lived climate forcers. While best practices call for reporting GWP20 and GWP100 values together as a pair (Ocko et al., 2017) or temporally-explicit climate impact accounting that avoids the issue of time horizon altogether (Alvarez et al., 2012), most of the previous studies available to inform this report evaluated climate impacts on a GWP100 basis only. Also note that while these CO2e estimates reflect several of the most important GHGs related to global carbon cycling (see Executive Summary footnote 4), they stop short of a full climate impact accounting. Aerosols and black carbon emissions are significant climate forcers important in some natural processes and energy use pathways (e.g., traditional biomass combustion), though translating them to CO2e terms is very difficult due to short atmospheric residence times on the order of a week, and therefore high regional variability that is complicated by local interactions with clouds and surface snow and ice; this results in GWP values with high uncertainty ranges (Myhre et al., 2013) and makes a global value inappropriate. Similarly, albedo changes and other biophysical changes are significant in certain land management settings (Caiazzo et al., 2014), but are also challenging to express simply in GWP terms for similar reasons. '
Preface	Text Region		19	19	16	44	This is a very long paragraph, and lines 31-38 a very long sentence. To aid the reader, it would be helpful to break this into a couple of paragraphs and break up that sentence.	OK. The quote is paraphrased as is.

Preface	Whole Chapter	While the report does seem to have some coverage relating to pulling CO2 out of the atmosphere, so negative emissions. There is nowhere in the index or the preface where this seems to get mentioned, so I think it would be helpful to be indicating somewhere how this report is treating CDR (and whether solar radiation management is or is not covered). It also appears that the substances that are emitted along with CO2 and CH4 are not being treated, so not SO2 or black carbon and apparently not ozone-producing substances; this should be explained. And what about albedo effects of changes in land It is really important to be clear on stating what is in and out and how important the items left out are.	We have corrected the omission in some chapters. SOCCR2 focuses on CO2 and CH4, and where negative emissions are included, albedo-related ones are not.
Preface	Whole Chapter	It seems rather strange to have a report that covers not only the US, but also Mexico and Canada without there being, apparently, anywhere in the overall structure, official participation in the project by scientific leaders in Mexico and Canada. While I do see a couple of authors from those nations, I think the Preface needs to explain how it is the US is doing this report apparently without official participation of research agencies in those nations. I would also note that in claiming that a good fraction of the carbon emitted in the US is taken up by the North American land and ocean area, I'd imagine that the fraction of emission to uptake within their boundaries is not perfectly equal for each. It seems to me the Preface needs to be offering some comment on this--why all of North America (it is a very interesting scientific question) but then why done by just one nation?	Good comment. While SOCCR2 is a U.S. Government-led interagecy assessment, its spatial focus is North America. About 1/10th of the authors are from Canada and/or Mexico and many of them have experience working with data from and/or conducting research in those countries. Inspired by SOCCR2, the Mexican Carbon Program is actually starting to organized its own SOCCR. Canada does not currently have a coordinated Carbon Program similar to the U.S. Carbon Cycle Science Program or the Carbon Cycle Interagency Working Group. While the Preface is the not the correct report section to comment on carbon uptakes in the three countries, pertinent SOCCR2 chapters do assess the science behind the uptake from various pools.
Preface	Whole Chapter	It needs to be made clear in the Preface that the calculations done here do not represent a carbon footprint for North America as they leave off the energy/emissions resulting from imports (and subtracting off emissions supporting exports). The Montreal Protocol actually called for this to be done for CFCs, other halocarbons, etc. at three levels (bulk amounts, in products, and used to make products). That is not what is being done here, although it is doing part of the calculation. This needs to be explained so US is not seen as taking undue credit or trying to underplay its role in global emissions.	We added a section on carbon accunting approaches, addressing this concern, with a broader description in the appendix.

Chapter	Comment Type	Figure/ Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Executive Summary	Whole Page		44				On the segment under "Reducing emissions from energy use," it is stated that the reduction methods should be encouraged. However, increasing shares if natural gas was one of the reduction methods. While natural gas does technically produce less emissions than coal when burned, it still releases carbon emissions, especially the methane that leaks from natural gas infrastructure. The reports have been stating that we need to hit zero emissions, so encouraging the use of natural gas is counterproductive to that goal. If possible, re-word the statement to not encourage natural gas. I thank you for your time and the opportunity to voice my concerns on this matter.	Statement has been significantly re-phrased, and neither encourages nor discourages implementing this or any other carbon management activity.
Executive Summary	Whole Page		45				Where it states that natural gas use can lower emissions, I recommend changing it to increases emissions. The fact that it is still a fossil fuel as well as having methane leaks shows that natural gas is not a substitute for renewable energy such as wind and solar power.	In ES, clarified table to be clear that using natural gas instead of another fossil fuel that has higher emissions would result in lower net emissions. We are not comparing natural gas to renewables.
Executive Summary	Whole Chapter						Page 21: line 18 define "tidal waters" and area they cover Page 22: For " tidal waters within the Exclusive Economic Zone, whose seaward boundary typically is 200 nautical 4 miles from a coast " are Hawaiian water included in the coastal flux estimated. I expect not and this must be clearly stated Page 23: All main findings are qualitative. This has less of an impact than actual values Page 26: The managed and unmanaged net ecosystem fluxes in this cartoon should be separated as these are separate chapters Page 31: figure ES3: Confusing- make separate panels for CH4 and CO2 Page 32: line 13: define "corrosive condition" Note it is not defined in entire document	Definiions of aquatic terms have been clarified throughout. Main findings -- added numbers and their uncertainties where appropriate. Managed/unmanaged -- actually, these do not align well with chapters. For example, forest C fluxes are influenced by both natural and management factors. Inability to completely separate these is one of the findings, so we can;t do it for this diagram either. Figure has been substantially revised. CORROSIVE CONDITIONS addressed in chapter 17
Executive Summary	Text Region		23	25	19	15	On behalf of Dwight Gledhill, NOAA: With regards to my comment pertaining to fossil fuel emissions, please see page 33 lines 16 - 18. The text reports that the averaged annual North American emissions from 2004 - 2013 were 1,765 Tg C (+/-2%) which is claimed to be slightly smaller than that of the prior decade. However, that amount is reported as 1,856 Tg C (+/- 10%). Given that the new number resides within the 10% error of the previous value, I think it is premature to conclude that there has been any statistically relevant change in the emission amount. "Main Findings of SOCCR-2" This is arguably the single most important list of items in the entire document. It makes no sense to interrupt it by inserting Box ES.1 into the middle of it. That can be better placed right after it's text reference (line 16). More generally, the insertion points of boxes ES.1 to ES.3 seems haphazard and disruptive.	Agreed -- this has been re-worded as in key finding #2 from chapter 2. Final published report will not have this interruption of flow. Box ES-3 moved to preface.
Executive Summary	Text Region		30	30	1	1	Box ES.3, "Likelihood level of key findings": It is no more space-consuming to actually list the five cutoff points, than it is to refer readers to the "front matter"--and is far more convenient. People should not have to flip to find that.	This introductory material has been re-written.
Executive Summary	Whole Page		29				The second paragraph is the much more relevant of the two, and is also known with much higher confidence. Most of the first paragraph is repetition of previous material, and the first sentence thereof: "Evidence strongly suggests changes in the carbon cycle are occurring at a pace that is much faster than observed at any time in geologic history" is very questionable, given for example the known large increases at the end of the Paleocene, Pleistocene deglaciations, and other times.	
Executive Summary	Whole Chapter						Check consistency of estimates with chapters, especially Chapter 2.	All estimates in the ES have been checked for consistency with chapters and particularly chapter 2.
Executive Summary	Whole Chapter						Review the list of main findings to be sure that they represent a reasonable and balanced selection of the key findings of the chapters.	Main findings have been reviewed and expanded from 8 to 10 to be more representative.
Executive Summary	Text Region		42		19		Carbon management section -- consider adding a table of quantitative estimates of the potential additional emissions reductions and CO2 removal increases that could be implemented in North America (coordinate with chapter 2).	We added a table with available quantitative estmates to chapter 18, but they are too sparse to include in the ES. Instead, we included a comprehensive list of mitigation options but without numbers.

Executive Summary	Text Region	33	1	Section on carbon stocks and fluxes -- consider adding a table showing area and carbon changes that result from various land-use changes (coordinate with chapter 2).	We decided that there is insufficient sufficient material to develop such a table, though we did include quantitative information in the text as available and in appropriate places.
Executive Summary	Whole Page	22		Page 22, line 21 reads: "Emissions from fossil fuels have declined slightly over the last decade, largely a result of decreasing 20 reliance on coal, increasing reliance on natural gas, the global recession, and increased vehicle fuel 21 efficiency standards." This statement is misleading and likely erroneous. Natural gas is a fossil fuel, although it is not a carbon based fossil fuel. The statement implies that shift from coal to natural gas reduces impacts of climate change. Methane is a more potent greenhouse gas than carbon.The statement should be corrected so the report does not imply, in the conclusion, that natural gas is not a fossil fuel or that use of natural gas (rather than nonrenewable fuel sources) will reduce climate change.	Coment actually refers to page 23 line 21. Edits made, as previously done, to clarify that substituting natural gas for other fossil fuels can reduce net emissions.
Executive Summary	Whole Chapter			Main Findings, line 21: â€œEmissions from fossil fuels have declined slightly over the last decade, largely a result of decreasing reliance on coalâ€¦â€ Specify the domain of this conclusion (i.e., North America?). It certainly isnâ€™t true globally. Figure ES2 and throughout the report: four significant digits seem unreasonable throughout and imply a certainty we do not have, even for industrial fossil fuel emissions. Page 29, line 2: Is this statement correct? â€œEvidence strongly suggests changes in the carbon cycle are occurring at a pace that is much faster than observed at any time in geologic history.â€ Any time in geologic history, as in billions of years? Page 30, Box ES.3 This short paragraph is important and somewhat ambiguous: â€œQuantitative estimates. Unless otherwise noted, values presented as â€œey Â± x%â€ should be interpreted to signify that the authors are 95% certain the actual value is between y â€“ x% and y + x%. These are informed categorizations. They reflect the expert judgment of chapter authors and science leads, using all known published descriptions of uncertainty surrounding the â€œbest availableâ€ or â€œmost likelyâ€ estimate.â€ What are â€œinformed categorizationsâ€? Are these based on statistics and quantitative metrics in some cases and expert opinion or judgment in others? Is so, I find that deeply unsatisfying (although I may be misinterpreting the box). Is there no way to distinguish the difference? Page 32, line 32: â€œThe effects of rising CO2 concentrations in the atmosphere interact with climate, sea level rise, and other global changes. For example, the frequency and intensity of disturbances such as fire, insect and pathogen outbreaks, storms, and heat waves change with increased temperatures.â€ This statement is literally true, but sounds benign. We donâ€™t want to say or imply that increasing temperatures will increase the likelihood of all disturbances, which isnâ€™t true. Nonetheless, doesnâ€™t the report want to acknowledge that it will, and likely already has, increased the occurrence of some? Page 34, Figure ES-4: Minor change, but add â€œe/yrâ€ to the Y-axis label (Pg C/yr) to make it obvious what the timescale is. Page 37: â€œAgricultural GHG emissions for 2015 totaled 522.3 Tg CO2 eq.â€ As above, surely we arenâ€™t implying we know this emission to four significant digits? Page 38, line 22: For the Executive Summary, itâ€™s especially important for the language to be accessible to a broad audience. Here and, in places, elsewhere, that is not the case: â€œThese issues include multiscale societal drivers of human-carbon-climate interactions, inertia or path dependency, the carbon gap, and the feasibility of reducing carbon gases in the atmosphere.â€ No normal human being would understand this sentence. Page 42, line 4: â€œGlobally, warming could cause the release of 55 Â± 50 Pg C from a soil pool of 1,400 Â± 150 Pg C.â€ Specify the depth for this estimate, likely 1 m. The total pool estimate seems a little low, but not wildly low. Page 43, line 11: â€œEstimates of the potential for removing carbon from the atmosphere and accumulating it in vegetation and soils are in the range of 1.6 to 4.4 Pg C per year globally or a cumulative total of 34 to 105 Pg C by 2100 (medium confidence); however, achieving such removals involves constraints regarding land area, water availability, and nutrients.â€ This statement is, in my opinion, insufficient if it is to be included in the executive summary. It implies such changes are relatively simple and makes no mention of economics. For example, what is the carbon price in 2100 associated with such changes? Presumably the numbers come from IAMs, which include carbon prices that result in the quantities removed that are listed above. Without additional information I donâ€™t think such a statement is wise or defensible.	Main Findings, line 21: â€œEmissions from fossil fuels have declined slightly over the last decade, largely a result of decreasing reliance on coalâ€¦â€ Specify the domain of this conclusion (i.e., North America?). It certainly isnâ€™t true globally. Clarified that this finding is for North America. Figure ES2 and throughout the report: four significant digits seem unreasonable throughout and imply a certainty we do not have, even for industrial fossil fuel emissions. see other responses to this same comment Page 29, line 2: Is this statement correct? â€œEvidence strongly suggests changes in the carbon cycle are occurring at a pace that is much faster than observed at any time in geologic history.â€ Any time in geologic history, as in billions of years? ????? Page 30, Box ES.3 This short paragraph is important and somewhat ambiguous: â€œQuantitative estimates. Unless otherwise noted, values presented as â€œey Â± x%â€ should be interpreted to signify that the authors are 95% certain the actual value is between y â€“ x% and y + x%. These are informed categorizations. They reflect the expert judgment of chapter authors and science leads, using all known published descriptions of uncertainty surrounding the â€œbest availableâ€ or â€œmost likelyâ€ estimate.â€ What are â€œinformed categorizationsâ€? Are these based on statistics and quantitative metrics in some cases and expert opinion or judgment in others? Is so, I find that deeply unsatisfying (although I may be misinterpreting the box). Is there no way to distinguish the difference? There are different approaches used, some quantitative and some “expert opinion” (which may be based on useful but incomplete quantitative information). Quantitative estimates are presented with a ± x% modifier; all others are based on expert opinion. We updated the guidance in this text box (moved to the preface) to make the process clearer. Page 32, line 32: â€œThe effects of rising CO2 concentrations in the atmosphere interact with climate, sea level rise, and other global changes. For example, the frequency and intensity of disturbances such as fire, insect and pathogen outbreaks, storms, and heat waves change with increased temperatures.â€ This statement is literally true, but sounds benign. We donâ€™t want to say or imply that increasing temperatures will increase the likelihood of all disturbances, which isnâ€™t true. Nonetheless, doesnâ€™t the report want to acknowledge that it will, and likely already has, increased the occurrence of some? ????? Page 34, Figure ES-4: Minor change, but add â€œe/yrâ€ to the Y-axis label (Pg C/yr) to make it obvious what the timescale is. Added word "annual" Page 37: â€œAgricultural GHG emissions for 2015 totaled 522.3 Tg CO2 eq.â€ As above, surely we arenâ€™t implying we know this emission to four significant digits? I agree, we should show 3 digits but not 4. Correction made.
Executive Summary	Whole Page	23		Consider including reference within the Main Findings to projected changes in the North American carbon cycle within the scope of this report (25-100 years as described on p15). As described elsewhere in the executive summary, a large body of research published since SOCCR-1 reports on observed trends since 2003 and increased certainty in observed changes in and projections of future changes to the carbon cycle, but these are absent from the main findings, with the exception of part of Finding 7.	Enhanced the main finding about projections.

Executive Summary	Text Region	24	24	1	2	Consider briefly summarizing the "feasible pathways" found, e.g. at the level of detail provided for Finding 1 on p. 23 and Finding 8 on p. 25.	Done
Executive Summary	Text Region	28	28	25	28	This sentence ("The carbon cycle imbalance....") seems incomplete and should include a larger list of well-established impacts. For example, there is no reference to human health, water quality and availability, species distribution, or sea level rise. See e.g. https://health2016.globalchange.gov and www.lung.org/assets/documents/healthy-air/state-of-the-air/state-of-the-.... In addition consider listing sea level as impacted by the carbon cycle imbalance. See e.g. Hansen et al. (2013 doi:10.1098/rsta.2012.0294), Hauer (2017 doi:10.1038/NCLIMATE3271) and NOAA Technical Report NOS CO-OPS 083.	Edits made.
Executive Summary	Text Region	31	31	2	4	This 0.85 temperature increase through 2012 is now 5 years out of date. Update with most current numbers prior to finalizing the report. For example see https://data.giss.nasa.gov/gistemp/graphs/.	Done
Executive Summary	Text Region	32	32	1	37	Understanding that this section is not a focus of this report, this summary does not reflect the range or extent of current impacts of changes in the carbon cycle on North Americans or projections from 25-100 years from today. For example, the occurrence and impacts of increased extreme weather events, average warmer temperatures and sea level rise on North Americans' health, safety, infrastructure and property should be mentioned. See e.g. https://health2016.globalchange.gov and www.lung.org/assets/documents/healthy-air/state-of-the-air/state-of-the-..., Hansen et al. (2013 doi:10.1098/rsta.2012.0294), Hauer (2017 doi:10.1038/NCLIMATE3271), NOAA Technical Report NOS CO-OPS 083, Neumann et al. (2015 doi:10.1007/s10584-013-1037-4), Hansen et al. (2017 doi:10.5194/esd-8-577-2017), http://www.worldbank.org/en/topic/climatechange/publication/turn-down-th...	This section has been edited but not lengthened since we also wanted to make the ES more concise.
Executive Summary	Text Region	32	32	34	35	The wording "...change with increased temperatures" suggests that the frequency and intensity of disturbances listed might increase or decrease with increased temperatures. However overall we expect the frequency and intensity to increase. Further, within North America overall we also expect the geographic area and portions of the year impacted by these disturbances to increase. See USGCRP (2017 doi:10.7930/J0J964J6).	Edits made.
Executive Summary	Text Region	43	43	3	5	Nuclear power should be listed here as a source of energy that could be increased to manage the carbon cycle to reduce the likelihood of rapid climate change in the future. E.g. in 2016 it was the largest source of non-fossil-fuel-based energy consumption/production in the US and currently supplies about 20% of electricity in the US (https://www.eia.gov/energyexplained, also see Ch3 of this draft report).	Edits made.
Executive Summary	Text Region	44	44	19	22	Why is nuclear power excluded from this set of options to explore, i.e. as a source of energy that could be increased to manage the carbon cycle to reduce the likelihood of rapid climate change in the future? E.g. in 2016 it was the largest source of non-fossil-fuel-based energy consumption/production in the US and currently supplies about 20% of electricity in the US (https://www.eia.gov/energyexplained, also see Ch3 of this draft report).	
Executive Summary	Whole Chapter					This is the chapter that will have the highest readership, especially by non-scientists, and therefore requires the greatest care in assembly. One would expect the ES to be a succinct summary of the report chapters but I find it instead to be a sprawling hodgepodge that wastes far too much space on background and ancillary information rather than the report's specific findings. That type of material belongs in the topical chapters (if even there), not the ES. Worse, the ES also presents a biased picture of the full understanding of the carbon cycle. In these two aspects, the ES is indeed a summary of the full document, unfortunately. Specifically: 1. Summary statements very often do not specify whether they refer to the USA, North America, or the planet, and are also frequently lacking regarding the exact time period referenced. This is inexcusably confusing in a report like this. 2. There are eight very short "Main Findings" starting on page 23 but a structured summary of chapters 2-19 does not begin until page 33, which is then interrupted by the section "A Systems Approach..." which is a mix of conceptual approach issues and exactly seven paragraphs of 2-3 sentences each attempting to summarize particular chapters. This is then followed by projections, and GHG mitigation option, sections...and that's it. So, in a total of 47.5 pages, wherein two pages or so could have been devoted to **actually summarizing** each chapter's main findings in decent detail, we instead have a sprawling mishmash of background and ancillary material, flow charts and blue boxes, random and generally useless statements about conceptual approaches, mitigation discussions, and biased, vague and/or incomplete statements regarding carbon cycle changes over the last couple of decades. That's pretty much it.	We appreciate the opinion of this reviewer about the ES and the whole document. However, these views are not widely shared, and given the advanced stage of this report, we can only review the ES (and chapters) to identify areas where the text can be made more succinct and unbiased. Regarding specific comments: 1. We reviewed summary statements for spatial and temporal clarity. NOTE that if not specified, the geographic domain is North America, and the temporal domain is 2004-2013 (or as close as data availability allows). This was made more specific in text box ES-2 (which was moved to the preface). 2. Note that chapters are summarized throughout the ES, not just the part beginning page 33. Regarding organization of the ES, we made several changes to improve the information flow.

Executive Summary	Text Region		23	23	26	27	Could point out that disturbances have already been causing increasing forest carbon losses in parts of the continent, including Canada and the western U.S. (as described in Chapter 9), and that human activities may be promoting such disturbances through climate change and in other ways.	Edits made.
Executive Summary	Text Region		23	23	33	34	Given that the confidence level is considered to be only medium for the statement about the stability of North American CH4 emissions (as indicated later in this Executive Summary on p. 36), its inclusion as part of a "Main Finding" in the ES is perhaps not warranted. At the least, the confidence level for the statement should be specified here as well. Furthermore, it's important not only to describe the overall North American trend but also to elucidate the causes (i.e. attribution). Readers need to understand that there could be compensating effects underlying a possible lack of a trend, e.g. increasing emissions from expansion of natural gas and oil production offset by decreasing emissions from other sources.	Even with high uncertainty, we highlighted the findings about the methane budget in the ES and hope that future reports will make significant improvements. We have added a statement about confidence. We do not have enough confidence in identifying causes.
Executive Summary	Whole Chapter						The descriptions of management opportunities, cost-benefit analyses of these kinds of options, is lacking. The summary adequately summarizes the document, but chapters such as Ch 18, Ch 5, Ch3, need to have more details of carbon management options such as biofuels, carbon capture and storage, etc.	Agree that management opportunities are sometime lacking in detail and cost-benefit analyses, but space is limited in the ES. Also see comment row 14.
Executive Summary	Figure	ES.3	31				This is a figure from chapter 8, which I have commented on there. It is a global scale figure. Since the focus of the report is on North America, the NA non-fossil-fuel trend shown in Figure 8.3 is the more relevant and at the very least, should be included here, if not replace it. The caption of ES.3 should re-phrased to indicate more clearly that the blue histogram represents the total of non-fossil fuel fluxes for the land and oceans. That's not entirely clear as is.	Edits made to Fig. ES-3
Executive Summary	Figure	ES.5	35				1. Lead sentence makes no sense: this *IS* the SOCCR-2 report. Please instead reference the chapter the figure is taken from. 2. The graph's values do not agree with various statements in the text, in particularly p 34 lines 7-14 and p. 35 lines 11-16. The latter refers to a bottom up sink estimate of -734 Tg/Yr--but the figure IS for bottom up estimates ("inventories")--and the relevant bars therein surely don't sum to -734, and even worse the graph includes coastal ocean whereas the text statement does not, so the discrepancy is even greater than what I've stated. 3. A simple data table would be better--it would give exact values and save space. The above points constitute an excellent example of why this report in general is a mess--differing or vague time periods, and geographic areas, contradictory statements, poor wording and etc.	This figure was deleted, and key information added to Fig. ES-2.
Executive Summary	Text Region		26	26	1	15	The figure and caption do not seem to match. The figure is showing fluxes yet the caption indicates that the numbers refer to the carbon in North American ecosystems (so not a flux, but content in the systems). Also, with regard to the number given for atmospheric content, this appears to be only the amount in the atmosphere over North America. This really needs to be made clearer in the caption as the way the figure might be read now, the US is emitting 1765 Tg/yr and the atmosphere only holds 1032 Tg, so North American emissions are roughly 70% larger than the atmospheric content (which if this is the case is really interesting--but, of course, the emitted CO2 mixes around the world). [After reading Chapter 2, I now understand that 1032 is actually the sum of the emissions and not the content in the atmosphere--this is not at all clear from a casual look at the figure and how it is designed--a clarification would help.] In any case, the caption needs to be fixed (content versus fluxes) and that the amount in the atmosphere is for only over the US and not for the world needs to be made clearer. I would also note that it would indeed be helpful to have a figure that is showing the carbon content of the various systems (perhaps separating the short- and long-term sequestered amounts), and actually doing so before showing a figure with fluxes.	Figure caption has been edited for clarity.
Executive Summary	Whole Page		27				The definition of CO2e is deficient in not discussing that the calculation involves consideration over a period of time (typically 20, 100, or 500 years). The choice of time period has an important effect and needs to be stated (there has been a tendency to slip into using the 100-year GWP and not explicitly state this, and that has a serious effect, namely understating the relative importance of emissions and other short-lived species in contributing to warming over the next few decades. This attempt to simplify the estimated significance of an emission is intended as way to avoid having to run large climate models every time one makes a small change in emissions--the assumptions in doing this, particularly the time period of the calculation, just have to always be stated.	Edit made.

Executive Summary	Text Region	28	28	2	3	The phrasing here needs adjustment. Yes, the GHGs contribute a warming influence, but to have "a climate suitable for life on the surface" we have to have the right amount of GHGs. Venus has GHGs, just too much for life; Mars has GHGs, just not enough of the right type. This sentence needs to be fixed to indicate that one has to have just the right amount of GHGs (or range of GHGs) to have a climate suitable for life on Earth. And actually, it is more complicated--there was life on Earth during the Cretaceous when the CO2 concentration was of order 1600 ppm, but there were no polar ice sheets, so sea level would be something like 70 m higher, and during the glacial maximums with CO2 at about 200 ppm, sea level was down over 100 m (sea level sensitivity based on paleoclimate changes is about 15-20 m of sea level change, at equilibrium, for every 1 C change in global average temperature). So, given our present international community of nations, we need CO2 to be within a very narrow bound--and we are already at a concentration that is likely to very seriously disrupt society. So, this sentence needs fixing or could be taken out of context very easily.	Edit made in ES.
Executive Summary	Text Region	28	28	5	6	I'd suggest that since the preindustrial period had a relatively stable CO2 concentration for the last several thousand years, what you want to be comparing to are rates of change caused by natural processes, orbital changes, etc. that have caused changes in the CO2 and other concentrations over Earth's history.	Edit made in ES.
Executive Summary	Text Region	28	28	9	10	The phrasing here is really a bit problematic, especially as Figure ES-2 is for North America and what really counts is the global system (at least for the ocean, where CO2 might be taken out in coastal waters and then given off when those waters move globally). And the word "significant" needs a bit of definition here--yes, they do in their current state take out C, but leaving any amount in the atmosphere contributes to climate change and inferring, as is done here, that, globally, the ocean and land taking out half of the emitted CO2 is near to adequate is a problem. It is because a lot is left in the atmosphere that is the basis of the problem that we have.	Edit made in ES.
Executive Summary	Text Region	28	28	20	21	Instead of "temperatures on the Earth's surface", I'd suggest saying "the long-term global average surface temperature". -given that the boundary layer CO2 concentration varies a bit and so does the Northern Hemisphere CO2 concentration, some skeptics have looked for the temperature response of seasonal CO2 changes and not found it, and they also look for CO2 in year-to-year (or even decade to decade) changes in temperature--what CO2 most clearly affects is the long-term average global temperature.	Edit made in ES.
Executive Summary	Text Region	29	29	10	10	This should say about 280 ppm rather than infer it is precisely that value, especially as there were variations through the Holocene. Also, on line 12, say about 800 ppb for methane.	Edit made in ES.
Executive Summary	Text Region	29	29	15	15	I'd suggest changing "was" to "averaged" as was it really the case that each year's increase was within the value and uncertainty given here?	Edit made.
Executive Summary	Whole Page	30				In "Quantitative estimates", line 2, the word "certain" needs to be changed to "confident"--the rest of the page explains confidence as is appropriate.	Edit made.
Executive Summary	Text Region	31	31	2	2	Need to delete "has"	Partially edited for clarity.
Executive Summary	Text Region	31	31	2	4	This sentence needs fixing. Strictly speaking, the change in temperature over this period was due to changes in all factors, not just the rise in the GHG concentrations. It takes model calculations to distinguish how much of the change was due to GHGs, or perhaps would have been were all other factors constant. Now, as it turns out, the range is probably valid for GHGs as most of the other forcings roughly cancel. But then, some of these other forcing terms are a result of the use of fossil fuels (sulfate, other aerosols, ozone changes, etc.). It would be useful to write a more rigorous statement.	Edits made to say "net".
Executive Summary	Text Region	31	31	5	5	It would really be appropriate here to say "Net uptake" here. There is a good bit of confusion out in the public (and especially denier community) who get confused by gross versus net fluxes. That this Executive Summary has yet to get into this issue, which I think is unfortunate. The net fluxes will depend a good bit on the gradient being maintained and so the emissions. The net values shown in the Figure ES.2 are for current emission levels--once we get to zero emissions, the net fluxes will move toward zero, so I really think the discussion here is over simplifying a number of issues by just discussing net fluxes and giving the impression that they will remain as they are over time.	

Executive Summary	Text Region	26	26	1	15	Showing three-figure, even four-figure precision seems to me to be over-stating our knowledge, especially when the text indicates that flux values are quite variable year-to-year. I'd suggest doing a bit of rounding or give an indication of the uncertainty/variability, etc.	We updated our guidance to chapters, recommending including not more than one “insignificant” digit in reported values. In some places in the text, it may make sense to round reported values if preceded by a word like “about”—for example, “the fluxes from these sources were about 100 Tg C per year over the last decade.” To the extent possible without causing confusion about consistency, we applied this logic to the ES.
Executive Summary	Text Region	31	31	6	8	It would be helpful here to be indicating whether you are here talking about the global or the North American budget. There really has not been a helpful discussion on this issue of attempting to separate North America from the global total, that CO2 molecules move around the world and get exchanged back and forth a lot--but what really matters is the duration of the perturbation in concentration from the failure of the atmosphere and ocean to remove all the CO2. So, on this sentence/paragraph, I am a bit confused about the discussion being about global or not (most ocean is not part of North America--so is the discussion about ocean uptake just for ocean areas that are part of US territory? I'd really suggest giving a good discussion of the global carbon cycle, of fluxes going both into and out of the land and ocean and then the net fluxes, etc.--and then fine to also give the North America values (though I would note that the US carbon footprint extends over the globe, and Americans live in a lot of countries, so this idea of separating out North America has to be done carefully rather than as some sort of claim that this means US-generated net CO2 emissions are small, etc.--in any case, saying the paragraph is about global conditions needs to be done in the first sentence of paragraph.	Clarified that statements are about global, and in places where necessary, specificed NA.
Executive Summary	Text Region	31	31	15	16	It needs to be made clear that the "nonfossil fuel Ã‰ annual emissions of CO2" are the "net" and that these are for human-caused emissions. Saying "net" is critical in that this is referring to "emissions" and there are very large amounts of gross uptake and release of carbon by the biosphere due to photosynthesis, natural decay and respiration, etc. So, a real clarification is needed here.	Bottom half of this figure was removed from the ES.
Executive Summary	Text Region	31	31	20	21	"ocean and land sinks" should be changed to "a combined ocean-land sink" or even "a combined ocean-land uptake of emissions"	Bottom half of this figure was removed from the ES.
Executive Summary	Text Region	33	33	11	11	To avoid the statement being misused, it needs to be made clear here that this is not a carbon footprint for North America as it takes no account of CO2 emissions elsewhere for the products made elsewhere but purchased in the US, etc.	We did not do a full accounting of imports and exports, and U.S. consumption, of carbon-based products. We also made clear that none of our estimates represent a "carbon footprint" analysis.
Executive Summary	Text Region	33	33	11	12	I don't understand what this sentence is trying to say. "Transfer" from where to where, and I assume this is with respect to "net" emissions.	Added a phrase to clarify what is meant by transfers.
Executive Summary	Text Region	33	33	16	17	Is four-figure precision really justified? Seems a bit overdone, especially when "approximately" is in the text.	We updated our guidance to chapters, recommending including not more than one “insignificant” digit in reported values. In some places in the text, it may make sense to round reported values if preceded by a word like “about”—for example, “the fluxes from these sources were about 100 Tg C per year over the last decade.” To the extent possible without causing confusion about consistency, we applied this logic to the ES.
Executive Summary	Text Region	35	35	2	2	This needs to say "net sources and sinks"--and maybe say "net human-caused sources and sinks"--the gross values are much larger.	Edit made
Executive Summary	Text Region	35	35	11	14	Giving three figure precision when the uncertainties are 45% or 50% just does not seem scientifically appropriate to me. The handling of the magnitude of numbers is much better handled in the next bullet.	We updated our guidance to chapters, recommending including not more than one “insignificant” digit in reported values. In some places in the text, it may make sense to round reported values if preceded by a word like “about”—for example, “the fluxes from these sources were about 100 Tg C per year over the last decade.” To the extent possible without causing confusion about consistency, we applied this logic to the ES.
Executive Summary	Text Region	35	35	24	25	I really wanted to also refer to page 36, line 1, but was not allowed to do by the spreadsheet. Again, it seems to me that using 3 and 4 figure precision might be overdoing it. And converting this to CO2e needs to indicate that this is presumably being done using the GWP-100 factor (which is itself uncertain, and should be listed here).	The definition of CO2e is clarified in the text box. See previous comments about significant digits.
Executive Summary	Text Region	36	36	2	3	It would be useful to be clear here if this statement applies to total CH4 emissions from human activities plus changes in the landscape and so natural emissions, or is just the former or is just from fossil fuel operations, etc. That is, it would be helpful to give an indication of the scope of sources being included.	Statement clarified.
Executive Summary	Text Region	36	36	5	10	It would be useful to make clear here that, I presume, you are omitting fossil fuel carbon pool (so coal, oil, natural gas)	

Executive Summary	Text Region	37	37	5	5	Again, when giving amounts of CO2e it is important to give the time-period used in this calculation	The definition of CO2e is clarified in the text box.
Executive Summary	Text Region	37	37	10	10	Given the effort put in to creating a lexicon for relative risk, the word "may" should not be used as it provides nowhere near as useful information as does the relative confidence lexicon. Actually, as was done for the first USGCRP national assessment, the document should be scrubbed for use of the word "may", replacing it with the appropriate word from the lexicon (especially in that this finding is "high confidence").	Removed the word "may"
Executive Summary	Text Region	37	37	33	33	Again, three-figure precision when the uncertainty is 100% seems inappropriate scientifically.	See previous comments about significant digits.
Executive Summary	Text Region	38	38	11	11	Given fossil fuel emissions are being discussed as part of the carbon cycle, it would have been helpful earlier to give the size of the fossil fuel reservoirs. I say this because it will give a sense of how large the fossil fuel reservoir is and so how large the other fluxes and reservoirs are and how large human-induced changes could be if not limited. [Reading further, I found these results presented in Chapter 3, which is helpful--and those results could at least be indicated here.]	Could add something here or elsewhere about the stock of fossil fuels, but seems low priority to me.
Executive Summary	Text Region	41	41	4	6	It should be pointed out that if these emissions are anywhere near to correct, global average temperature will be on a path to far exceed the temperature objectives of the Paris Accord. In my view, suggesting that emissions would be unlikely to be more than 9% less than at present when looking over two decades into the future suggests this must be a no-climate-change policy scenario given that wind and solar energy are providing such relatively low cost electricity and coal will be far too costly to still be a significant energy source.	This part has been re-wordsed for clarity.
Executive Summary	Text Region	41	41	8	8	The discussion in the Box, and apparently the pathways being analyzed seem not to even be considering the chance of policies that would seek to limit emissions over the next 20 years. If this is what the case is, this needs to be explicitly stated in the box--that is, that the scenario here is a no climate change policy scenario.	Pathways are meant to be long term.
Executive Summary	Text Region	42	42	13	13	Again, try to avoid using "may" instead of a confidence level from the defined lexicon because "may" could mean from 1 to 99%, etc.	Replaced "may be" with "are"
Executive Summary	Text Region	42	42	35	35	Having three-figure precision here is simply not justified--yes, a model simulation may have given this value, but it is only an approximation.	See previous comments about significant digits.
Executive Summary	Text Region	42	42	36	36	I don't understand the sentence--if this is value to supposedly have a 100% chance of staying below 2 C, then there needs to be a bit of elaboration here. And given uncertainty in climate sensitivity, there is again no basis for three-figure precision. I'd also note that by using the 100 year GWP for methane, this also leads to an underestimate of near-term warming, so the stated emissions really need to be CO2 and not CH4 or any other short-lived species. Basically, the discussion here is too definitively stated--plausible, but not exact. There also ought to be numbers given her for the Paris aspirational temperature goal of 1.5 C. And note that a 2 C warming might ultimately lead to sea level rise of 30 m or more.	Precision of estimates has been adjusted. References to the Paris Agreement have been clarified as appropriate.
Executive Summary	Text Region	44	44	10	13	I'm surprised that there does not seem to be any mention of limiting/capturing methane from waste disposal and sewage sites--and also from cattle feed lots. I wonder if the reason that this is the case because of the use of GWP-100 in compiling CO2e emissions. If one focused on reducing near-term warming (and this should be the case as it is suggested we could reach 2 C because of emissions between now and 2040), then GWP-20 should be used in the analysis of priorities for emissions reductions.	Throughout, the time period of methanne calculations has been made more explicit. Much additional meterial added about methane to better represent the availale literature.
Executive Summary	Text Region	47	47	2	2	Why only "may" lead to co-benefits. Again, use the lexicon--here, the appropriate choice is probably "very likely"	Changed "may" to "often".
Executive Summary	Text Region	39	39	13	20	It seems to me that this would be an appropriate place to discuss CH4 emissions as well, such as from natural gas and oil production and transmission. The issue of whether increased CH4 emissions could be offsetting some of the CO2-related climate benefit of switching from coal to natural gas could also be mentioned.	Discussion of CH4 emissions has been strengthened throughout.

Chapter	Comment Type	Figure/ Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Chapter 1: Overview of the Global Carbon Cycle	Whole Chapter						Should incorporate results of recent model intercomparison efforts focused on diagnosis recent historical changes in the terrestrial carbon cycle and the drivers of these changes (e.g., Huntzinger et al., 2017; https://www.nature.com/articles/s41598-017-03818-2)	Edited.
Chapter 1: Overview of the Global Carbon Cycle	Text Region		49	49	3	36	Key Finding #3 should be updated to include preliminary published estimates of increased global emissions in 2017. See Le Quere et al. (in review, doi:10.5194/essd-2017-123) and Peters et al. (2017, doi:10.1038/s41558-017-0013-9).	Updated per Le Quere et al. (2018).
Chapter 1: Overview of the Global Carbon Cycle	Text Region		50	50	10	10	Should "+" or "an increase of" or "warming of" be used to define the direction of the 0.7 to 2.4 C temperature response?	Edited.
Chapter 1: Overview of the Global Carbon Cycle	Whole Chapter						This chapter describes an overview of the global carbon cycle and possibilities for carbon cycle management, but I did not find a clear statement explaining motivation for the carbon management strategies discussed, i.e. the current or projected future impacts of the carbon cycle imbalance (e.g. p28) on North America and North Americans that would compel action to modify current carbon management. While a detailed discussion of climate change impacts is outside the scope of this report, a reference to these current and projected impacts should be provided within the report. See for example https://health2016.globalchange.gov, www.lung.org/assets/documents/healthy-air/state-of-the-air/state-of-the-..., Hansen et al. (2013 doi:10.1098/rsta.2012.0294),	There were several paragraphs that describe the motivation for carbon management later in the section. So we rearranged the section to put these up front. Also note that the report has a whole chapter devoted to "consequences" which elaborates much more about the need for managing the carbon cycle.
Chapter 1: Overview of the Global Carbon Cycle	Text Region		56	56	16	39	Consider adding more information about the current understanding of projected impact (and uncertainty) on the carbon cycle under a "business as usual"-type (or RCP8.5) scenario through the report period (100 years from today), for example as referred to in the last paragraph of this chapter.	Added a statement to the beginning of the referenced section, and also referred the reader to the "projections" chapter.

Chapter 1: Overview of the Global Carbon Cycle	Text Region	49	49	21	28	The 0.85 temperature increase referenced is now 5 years out of date. Update with most current numbers prior to finalizing the report. For example see Hansen et al. (2017, doi:10.5194/esd-8-577-2017) and https://data.giss.nasa.gov/gistemp/graphs/.	This one goes with line 8 and 10. Updated all instances using the Hansen et al. 2017 reference.
Chapter 1: Overview of the Global Carbon Cycle	Text Region	51	51	1	2	Be sure to include the start time from which the increse is calculated. Better to update to cite the final published (post-discussion) version of this paper, Hansen et al. (2017, doi:10.5194/esd-8-577-2017). The final version states "global temperature excluding short-term variability now exceeds +1 C relative to the 1880-1920 mean and annual 2016 global temperature was almost +1.3 C". Elsewhere this draft report cites 0.85 C warming from 1880 to 2012 from IPCC (2014 Syntheis Report, p3). For consistency update elsewhere for the final report or consider citing 0.85 and then refer to the more recent estimate (through 2016) of Hansen et al. Also see the GISTEMP data that Hansen uses at https://data.giss.nasa.gov/gistemp/graphs/. Here you can download CSV files of warming estimates	Updated all instances using the Hansen et al. 2017 reference.
Chapter 1: Overview of the Global Carbon Cycle	Text Region	51	51	1	15	Add more references to this section (beginning with "Other aspects of the climate system....") to support these statements. Consider separating or clarifying observed vs potential future changes. See e.g. the IPCC (2014) and USGCRP (2017) reports, https://health2016.globalchange.gov, Hansen et al. 2013 doi:10.1098/rsta.2012.0294.	We reworded the sentence about the impacts of climat change on agriculture and we added some references to this section.
Chapter 1: Overview of the Global Carbon Cycle	Text Region	51	51	35	36	Better to update to cite the final published (post-discussion) version of this paper, Hansen et al. (2017, doi:10.5194/esd-8-577-2017). The final version states "global temperature excluding short-term variability now exceeds +1 C relative to the 1880-1920 mean and annual 2016 global temperature was almost +1.3 C". Note that elsewhere this draft report cites 0.85 C warming from 1880 to 2012 from IPCC (2014 Syntheis Report, p3). Also see the GISTEMP data that Hansen uses at https://data.giss.nasa.gov/gistemp/graphs/. Here you can download CSV files of warming estimates over land and land+ocean through 2016; maybe 2017 will be added before this report is finalized.	The paragraph with this reference to temperature increase was deleted.
Chapter 1: Overview of the Global Carbon Cycle	Text Region	54	54	4	21	Update this paragraph to include preliminary published estimates of increased global emissions in 2017. See Le Quere et al. (in review, doi:10.5194/essd-2017-123) and Peters et al. (2017, doi:10.1038/s41558-017-0013-9).	These have been updated per Le Quere et al. (2018)

Chapter 1: Overview of the Global Carbon Cycle	Text	Region	56	56	16	39	Refer to Chapter 11 (Arctic and Boreal Carbon) and Key Finding 7 of this full draft report discussing possible permafrost changes.	Updated numbers and added specific referrence to chapters 11 and 19 (numbers now consistent with chapter 11).
Chapter 1: Overview of the Global Carbon Cycle	Text	Region	56	56	16	39	If I understand the scope of Section 1.4 (The Future Carbon Cycle: Emissions, Sinks, and Climate-Carbon Cycle Feedbacks) correctly, some significant global feedbacks are missing, such as ice-albedo feedbacks. For example see Velicogna et al. (2014 doi:10.1002/2014GL061052), Kashiwase et al. (2017 doi:10.1038/s41598-017-08467-z), Hansen et al. (2013 doi:10.1098/rsta.2012.0294) and discussion in Kopp et al. (2017 doi:10.7930/J0GB227J) and IPCC 2014 Synthesis Report p73-74.	We intended this section to focus on carbon cycle-climate feedbacks (including human impacts) since a discussion of all potential climate feedbacks would be beyond the scope of this study. The ice-climate feedback is interesting, and could certainly have implications for the global carbon budget, as shown by Parmentier et al (2015) - we added this reference.
Chapter 1: Overview of the Global Carbon Cycle	Text	Region	57	57	21	29	The description "scientifically accepted" is not supported by references in lines 25-29 to scientific assessments against the validity of 1.5-2 C warming as "safe" or "acceptable". It might be better to exclude "have led to the scientifically accepted conclusion" and replace with "publicly" or "politically" accepted and/or reference to the Paris Treaty: As of Nov 2017, all countries in the world have signed or ratified the UN Paris Treaty with the aim of "keeping a global temperature rise this century well below 2 degrees Celsius above pre-industrial levels and to pursue efforts to limit the temperature increase even further to 1.5 degrees Celsius." (http://unfccc.int/paris_agreement/items/9485.php).	This sentence has been edited to refer to "targets" rather than scientific conclusions
Chapter 1: Overview of the Global Carbon Cycle	Whole Page		57				Review uncited sentences/paragraphs in this section and add supporting references where needed. Also see Knutti et al. (2016 doi:10.1038/NGEO2595), Schnellnhuber et al. (2016 doi:10.1038/nclimate3013), Figueres et al. (2017 doi:10.1038/546593a). It might also be useful to frame this section with a statement that the carbon management activities discussed here require intentional government policies to begin necessary emissions reductions within the next several years (e.g. see RockstrÂšm et al. (2017 doi:10.1126/science.aah3443), IPCC 2014 Synthesis Report p28-3, DeAngelo et al. (2017 doi:10.7930/J0M32SZG)).	We added several references to support material in this section. We do not feel that we can get too deeply into policy, however.
Chapter 1: Overview of the Global Carbon Cycle	Text	Region	58	58	11	12	Nuclear power should be listed here as a source of energy that could replace the use of fossil fuels for energy. E.g. in 2016 it was the largest source of non-fossil-fuel-based energy consumption/production in the US and currently supplies about 20% of electricity in the US (https://www.eia.gov/energyexplained, also see Ch3 of this draft report).	This is true, but we don't specifically name other non-carbon energy sources.

Chapter 1: Overview of the Global Carbon Cycle	Whole Chapter	I find this chapter to be problematic on several fronts 1. The chapter is far too long, relative to its relevant content. It focuses temporally on changes since 1750, or 1880, and not on the last one to two decades, and spatially on the entire planet, not North America or the United States. It further does even remotely follow the chapter structure prescribed in the Preface. The global increase in atmospheric CO2 and CH4 over the industrial period is exhaustively detailed elsewhere, most prominently in the IPCC WG1 assessment reports. This is common knowledge; it is not necessary to more than reference that material and update it with the last few years of measurements not covered by IPCC AR5 (2013). Similarly, quite a fraction of the material is textbook type background information, which is common knowledge and/or covered in IPCC reports and similar. It's not necessary to repeat that material here and if deemed necessary, it should constitute an an appendix, not the leading material of this report. The text in several places, including in some "Key Findings", focuses on radiative forcing and temperature change (i.e. effects) at the expense of, and prioritization over, the carbon cycle itself. The carbon cycle is obviously supposed to be the primary focus of the report. Effects, no matter how	We appreciate the input, but that it runs contrary to other input received.

Chapter 1: Overview of the Global Carbon Cycle	Text	Region	51	51	16	36	"Tans (2009) demonstrated that accumulated carbon in the atmosphere and ocean reservoirs since preindustrial times is approximately equivalent to the total amount emitted by fossil fuel combustion If fossil fuel emissions were abruptly terminated, 20% to 60% of this carbon would remain airborne for millennia (Archer and Brovkin 2008; Solomon et al., 2009)." This type of assertion is commonly made, but examination of GCP data since 1959, and certain literature, indicate that this outcome is very unlikely, especially at the upper end. The problem originates in modeling work over the last two decades, in which unrealistically massive C pulses are added to the atmosphere at once and then the resulting fractionation tracked for thousands of years, for example in the Archer and Brovkin work cited above. The results of these model experiments have then been frequently mis-represented as being applicable to much smaller pulses tracked over much shorter time periods. I describe some issues with these estimates, relative to GCP observations, below. GCP data show that since 1959, at an annual scale, an average of about 44% of emissions have remained in the atmosphere, with little to no trend therein, over that time. If the land sink is excluded from this accounting, that value increases to about 5/8, or 62.5%, the remaining 3/8 going into the oceans. A commonly used (e.g IPCC) pre-industrial (i.e. assumed to be at equilibrium), inorganic C ratio between the atmosphere (CO_2) and oceans (CO_2, bicarbonate, carbonate), on a molar basis, is 590:38000, or 1.5% atmospheric C. In the absence of changes in ocean carbonate buffering, any pulse of CO_2 to the atmosphere would then, by first order kinetics, also be expected to fractionate at that rate, once equilibrium is reached by full ocean mixing, on the order of roughly 500-1000 years. Thus, e.g. a 600 Pg C pulse would end up with 9 Pg in the air and 591 in the oceans, after that time. But with changes in buffering capacity included (i.e. a "Revelle Effect", RE; Revelle and Suess (1957)) a higher C fraction will remain in the air: 10X according to Revelle and Suess, 11 to 12X per e.g. Sabine et al. (1994). On this ultra-simple basis alone, and taking no issue with accuracies of these RE estimates, no more than 15 to 18.5% of an emission pulse is expected to remain in the atmosphere, after 500-1000 years, and thus already below the lower range limit claimed by the chapter authors. [exclude land sink effects and any possible carbon cycle feedbacks here, as those factors are not considered when estimating Revelle Effect strength, which is strictly a function of partial pressures, diffusion rates, and carbonate chemistry. A land sink, especially an increasing sink as now exists, will reduce the AF even further.] Further clues are provided by GCP data and knowledge of the ocean mixed layer. The ocean mixed layer is commonly stated to be on the order of 40-100m deep; this represents roughly 5% of the total ocean volume. The layer equilibrates with the atmosphere in a year or less, and the mean of the observed, annual-scale air: ratio from GCP data since 1959 (5/8 to 3/8) must therefore result from the combined effects of all operating factors, mainly the partial pressure gradient and carbonate buffer capacity (Revelle Effect). This annual-scale AF value of 0.625 is just above the upper limit stated by the authors as resulting over "millennia", that is, at least 2000 years! It is wildly	This is a large number of comments. Will need to parse through them one at a time. I am assigning one of these big ones to each person.

							p49, l29. 4% increase; show the period during which the growth is 4%; it seems a very high rate unless you refer to just the 2000s. p50, l16. The remaining C quota refers to C from CO2, not C from CO2equivalent; that is even when non-CO2 is accounting. The budget is always related to C-CO2. The reason the previous sentence mentioning CO2 and non-CO2 is correct is because the C-CO2 carbon budget makes already assumptions of how non-CO2 gases and aerosols will change concurrently; part of the uncertainty comes precisely from different models having different non-CO2 trajectories. p51, l31-32. The reader could benefit from learning how the human CO2 emissions are partition among the various components. Total emissions (LUC+FF) = Atm + ocean + land. The partition provided, although correct might, can easily be misinterpreted as to no human emissions are been taken up by terrestrial ecosystems. See table 10 in Le Quere et al. 2016, ESDD. p52, l31. There is increasing evidence that the ocean inter-annual variability is larger than we thought, thanks to some of the data-based products which suggest a much larger variability. See Rodenbeck et al. 2003 and Chevallier et al. 2005 (in Figure 7 of Le Quere et al. Budget 2017, ESDD-D). p54, l6. The same as first comment on this page. p54, l12. It is the first time here that cement is mentioned. I assume that all other times before that fossil fuels emissions are discussed that they are fossil fuel + cement. I would suggest to mention this issue at the top of the chapter when ff are first mentioned, and mention you will use ff as a short for both.	
Chapter 1: Overview of the Global Carbon Cycle	Whole Chapter					p55, l11. Worth including recent work (a second world to be published shortly) showing that the decline in methane from fire over the last decade reconciles the isotopic 13C decline with increase emissions from biological sources and from fossil fuels, which have been previously presented as competing explanations. Worden et al. 2018. Nature Communications. p56, l16. Other feedbacks could be briefly mentioned, including negative feedbacks. Eg, positives: the savanization of the Amazon due to possible reduced rainfall in the future (Earth system models split	p49: This is from 2000 to 2012; p50: edited; p51: edited; p52: edited; p54: edited: p54: cement production is now mentioned earlier as well; p55: LORI -- PLEASE SEE COMMENT IN TEXT; p56: negative feedbacks now mentioned as well; p57: agreed and edited; p58: edited; p58: edited.
Chapter 1: Overview of the Global Carbon Cycle	Text Region	49	49	26	28	Actually, the temperature change was in response to all forcings, not just the GHG forcing. This could be fixed by saying "largely in response" or something similar.	Edited.
Chapter 1: Overview of the Global Carbon Cycle	Text Region	52	52	37	38	The last phrase needs to be qualified to indicate that this is likely unless large-scale carbon removal from the atmosphere is undertaken. There are those ready to do it--consider direct air capture proposals of Eisenberger, enhancement of ocean removal by fertilization, etc.--so it is possible, which needs to be indicated. Whether this is likely or not is a policy decision that this report should not be taking a position on.	This is correct, but rather than getting into carbon removal strategies here, we have simply edited the wording to reflect the fact that concentrations have remained above 400 ppm.

Chapter 1: Overview of the Global Carbon Cycle	Text Region	53	53	8	8	I don't understand this statement. Is this saying the last glacial period was the Younger Dryas? I would think that this would say from something like 110 kyr to about 11 kyr, peaking at about 22 kyr. The way the phrasing is now, the peak time is not within the interval of the glacial period.	sentence edited for clarity
Chapter 1: Overview of the Global Carbon Cycle	Text Region	53	53	12	12	I'd suggest saying "roughly 40%" or "an estimated 40%"--a number of the phrasings in this chapter seem to be stated a bit more firmly and precisely than is appropriate. Especially in that next sentence talks about big uncertainty in wetland emissions, saying "~40%" seems really important to do.	Edited.
Chapter 1: Overview of the Global Carbon Cycle	Text Region	54	54	15	15	The phrase "when it balanced at approximately zero" seems to imply emissions are at zero or are being balanced by sink, whereas this is not the case at all--I assume it means that emissions are not rising or falling. To convey that message, say that "emissions have leveled off at just under 10 PgC/year" or something similar and don't talk about "balance"--wrong word.	Wording in this paragraph has been adjusted to refer to "leveling off" of emissions.
Chapter 1: Overview of the Global Carbon Cycle	Text Region	54	54	35	35	To avoid the sentence being taken out of context, say "of all anthropogenic CH4 emissions"	Wording changed.
Chapter 1: Overview of the Global Carbon Cycle	Text Region	55	55	1	1	Need to say "at least the last 800,000 years" as the period is surely longer--it is just that the ice core only goes back that far.	Done

Chapter 1: Overview of the Global Carbon Cycle	Text Region	55	55	3	3	To be clear, say that this is the CH4 concentration so it is clear it is not about CH4 emissions.	I think the units and wording are clear here. I couldn't find where this would need to be clarified.
Chapter 1: Overview of the Global Carbon Cycle	Text Region	55	55	15	18	It would also be appropriate here to mention that over 20 years, despite its much smaller loading and emissions, on a per mass basis methane exerts about 100 (or whatever the number is for GWP-20) times the warming influence as CO2. This is critical to make clear that short-lived species are very important to control to create a slowing of the near-term warming rate.	We agree with the reviewer and added mention of the GWP of CH4 to the start of this paragraph.
Chapter 1: Overview of the Global Carbon Cycle	Text Region	55	55	21	21	It would help to start the sentence saying, "Since 1850, Ã‰" (whatever the year is)	This has been edited to "between 1850 and 2011"
Chapter 1: Overview of the Global Carbon Cycle	Text Region	55	55	29	31	Is this based on net emissions, or gross land cover and forest emissions? It would be useful to state. That China and Europe had their gross land cover emissions likely occur a couple of centuries occur, is this counted?	
Chapter 1: Overview of the Global Carbon Cycle	Text Region	56	56	18	27	It might be helpful to indicate that study of paleoclimatic changes shows a quite strong carbon cycle feedback (well, there are several--soil carbon in high latitudes, ocean solubility changes with temperature, etc.). So, it is not that a positive carbon feedback would be unexpected--just will take time to pin down. These processes are mentioned a bit further on, but somehow making mention in the first paragraph of the paleo occurrence of a positive feedback would be useful evidence to mention.	Since this section is about future changes, and the key processes are already discussed, it does not seem necessary to add text about feedback during the paleoclimatic periods.

Chapter 1: Overview of the Global Carbon Cycle	Text Region	57	57	22	22	REALLY IMPORTANT; There has been no scientific acceptance of a 2 C or 1.5 C as a long-term value. Negotiators have put forth these values and the IPCC FOD of the 1.5 C report had pathways that aimed to get back to these levels, but there has been no scientific acceptance of these values, and I'd argue that political leaders would not be accepting these levels if they know that this would lead to sea level rise of a few tens of meters of sea level rise (and perhaps a good bit faster than presently estimated). Hansen et al paper makes clear that going over 0.5 C would cause very significant societal disruption. So, this phrase needs to be stricken--I know of no scientific group that has accepted this other than as what the negotiators have agreed to (but actually aren't even near to being able to	This sentence has been edited to refer to "targets" rather than scientific conclusions
Chapter 1: Overview of the Global Carbon Cycle	Text Region	58	58	3	4	Really? The IPCC FOD of 1.5 C report envisions rather large overshoots of the Paris temperature objectives, and while one might eventually be able to get back to an equilibrium level such as that, it is the peak overshoot value that is likely to determine the major impacts--biodiversity loss, rate of loss of ice sheet mass, etc. And the notion that society will choose to get to zero emissions in just a few decades--it perhaps can, but certainly showing no indication that anything close to this will be done. This statement seems far too optimistic as a message for policymakers--it will lead to more and more procrastination, in my opinion. [The chapter gets to these points a bit later, but needs mention up here too]	This sentence has been edited to emphasize the difficulty in achieving the most conservative targets.
Chapter 1: Overview of the Global Carbon Cycle	Text Region	58	58	17	17	"Geoengineering" has generally included both Carbon Dioxide Removal and Solar Radiation Management. Instead of using the word geoengineering here, I'd suggest using "Climate intervention", which per the NAS is how to refer to SRM.	The term "geoengineering" has been removed to avoid confusion.
Chapter 1: Overview of the Global Carbon Cycle	Text Region	60	60	20	20	The phrase "highly certain" is really awkward--an unusual type of phrase for a scientific reader that is more used to the phrase "highly uncertain" (and what I mistakenly jumped to in my rapid reading of the sentence). We are either certain or not. I would suggest saying that there is very high confidence in the estimates of the increases in the concentrations of these species.	Edited.
Chapter 1: Overview of the Global Carbon Cycle	Text Region	63	63	4	4	The phrase "less certain" implies there are degrees of certainty--which is linguistically incorrect and this report should not be implying there are. This should be rephrased.	Edited to "more uncertain."

Chapter 1: Overview of the Global Carbon Cycle	Text Region		63	63	32	35	Again, "highly certain" is an inappropriate linguistic phrase, and so is the phrase "medium certainty"--one should be talking about degrees of confidence, not of certainty.	This wording has been edited.
Chapter 1: Overview of the Global Carbon Cycle	Figure	1	69				This is a much more correct representation of the carbon cycle than in Figure ES.2, which has presumably been derived from this figure but is fouled up in a number of ways. It would sure be nice if it were possible to make the widths of the arrows proportional to the amount of the flux.	We agree. However, we are using an existing figure and this change is therefore not easily feasible.
Chapter 1: Overview of the Global Carbon Cycle	Figure	2	70				It would be helpful if the width of the arrows was proportional to the magnitude of the flux--would make for easier understanding by the reader.	We agree. However, we are using an existing figure and this change is therefore not easily feasible.
Chapter 1: Overview of the Global Carbon Cycle	Whole Chapter						Overall, an excellently done chapter with a well-selected and phrased set of key findings	Thank you.

Chapter Comment Type Figure/ Table Number Start Page End Page Start Line End Line Comment

Chapter 2: North American Carbon Budget Whole Chapter Should incorporate results of recent model intercomparison efforts focused on diagnosis recent historical changes in the terrestrial carbon cycle and the drivers of these changes (e.g., Huntzinger et al., 2017; https://www.nature.com/articles/s41598-017-03818-2)

The findings from this study are cited in the "Synthesis, Knowledge Gaps and Outlook" section of this chapter, and discussed in more detail in other chapters of this report (see Chapter 19). We did not incorporate the results from this intercomparison, i.e. the ensemble estimates of the global C sink, because this paper does not report the quantitative estimates for the domain (North America) and time period (2004-2013) used in this report.

Chapter 2: North American Carbon Budget Whole Chapter "Page 82: line 17: define ""corrosive condition""

We have added / clarified the definition as "conditions that lead to lower water pH"

Page 81: line33: This is a huge finding:

Between 2000 and 2009 the per capita emissions in the United States were approximately 20 tons (t) CO2 per person, followed by Canada (approximately 18 t CO2 per person) and Mexico (approximately 4 t CO2 per person). This compares with a substantial decrease by 2015 for the United States and Canada (about 17 and 16 t CO2 per person, respectively). This should be discussed in chapter 6 and 19 as well, if this will carry forward

This is indeed expanded on and discussed elsewhere in the report, including Chapter 3 on energy systems – where report authors feel it is most appropriate to cover this particular issue in more detail. Drawing from Chapter 3, the Executive Summary in fact lists this as the first topic under the "Main Findings of SOCCR-2: 1. Emissions from fossil fuels have declined slightly over the last decade, largely a result of decreasing reliance on coal, increasing reliance on natural gas, the global recession, and increased vehicle fuel efficiency standards. Economic productivity has continued to increase, demonstrating that CO2 emissions can be decoupled

Whether this will carry forward is a more uncertain issue, particularly given the decoupling of emissions and economic activity, as stated above. Furthermore, there is a lack of analysis in the existing literature on the future trends of per-capita emissions for this report to draw from. Chapter 19 summarizes a range of projections of total emissions (see KF# 2 on p. 770 of the Public Review / 4 th-order draft) based on a synthesis of published modeling studies. However, these projections are not closely coupled to population changes and so are not readily translatable to per-capita emissions. In Chapter 6, it is discussed throughout the text tha

Page 90:

Key finding 1 : not quantitative add the # for top down and bottom up

Added, Key Finding 5 now reads: "The estimates of the magnitude of the continental carbon sink over the last decade are not significantly different between top-down (634 Tg C per year ± 45%) and bottom-up (577 Tg C per year ± 75%) approaches, given the uncertainty ranges around these two calculations"; The wording for Key Finding 5 was erroneously substituted in for the statement in Key Finding 1 under the "Supporting Evidence" section (this occurred in "Ch2-NAmericanCarbonBudget_4OD_09-21-17_ORNL-edits.docx" inserted by Wyrick on 9/20/2017 at 4:31pm)

Key finding 2: Aside from the finding that ff emission are the largest source of carbon the five fold decrease in uncertainty of this # is an huge finding/result that must be highlighted

This is an important comment that initiated a broader discussion of this issue among authors across various chapters of this report. We decided to look more closely at these uncertainty estimates and found that they were not as robust or well-sourced as they should be to be included here. As an alternative, we decided to re-analyze the FF emissions estimates and their uncertainties across other data sources beyond just the CDIAC inventory originally cited here. As a result, in the revised version of this Chapter (2) and others (3, 8) we are now using a mean estimate from an ensemble of inventory data sets (), and representing / reporting th

In Chapter 2, we have updated the new FF emissions estimates and uncertainty throughout the text and in the tables and figures where appropriate. The mean ensemble estimates are similar to those in the previous version and so do not change the discussion of magnitudes and trends in this sector relative to the other budget components. The new uncertainty estimate (5.5%) is now not substantially different enough from other reports as to warrant any further highlighting as a "huge finding" beyond that which is already discussed in the text.

Page 91:

Key finding 3: Keep same type of reporting ""Between one quarter and one half"" should be rephrased in line with the reporting key finding 2 to ""670 Tg C (Â± 12 %)""

Now reads "Between one-quarter and one-half of the total fossil fuel emissions from 2004 to 2013 (1,765 Tg C per year ± 2%) were offset by natural sinks on North American land (577 Tg C per year ± 75%) and adjacent coastal ocean (150 Tg C per year ± 50%)."

Page 93:

Key finding 5: include the actual values

Actual values added, Key Finding 5 now reads: "The estimates of the magnitude of the continental carbon sink over the last decade are not significantly different between top-down (634 Tg C per year ± 45%) and bottom-up (577 Tg C per year ± 75%) approaches, given the uncertainty ranges around these two calculations"

Page 104: I think that the change in continental proportion of ff fuel release from 26 % in 2000 to 17 % in 2013 should be a key finding

This has been added to Key Finding 2 about fossil fuel emissions: "Fossil fuel emissions were the largest carbon source from North America from 2004 to 2013, averaging 1774 Tg C per year (±5.5%). This estimate is less than – but overlaps the uncertainty range of – the 1,856 Tg C per year ±10% reported for the previous decade in the *First State of the Carbon Cycle Report* (SOCCR-1) in 2007. The continental proportion of the global total fossil fuel emissions decreased from 24% in 2004 to 17% in 2013."

Chapter 2: North American Carbon Budget Traceable Account 90 90 1 36 There is a problem with the correspondence between the five Key Findings, and their corresponding "traceable account" information. It is unclear which of the information presented on page 90 actually corresponds to Key Finding #1 (KF1). The first item (lines 2-5) clearly does not, being instead a re-statement of Key Finding #5. The remainder (lines 6-36) appear to apply to KF1, but one cannot be certain. More generally, are there other pieces of text elsewhere in the chapter that haven't also been mis-copied? The authors need to insure that

The wording for Key Finding 5 was erroneously substituted in for the statement in Key Finding 1 under the "Supporting Evidence" section (this occurred in "Ch2-NAmericanCarbonBudget_4OD_09-21-17_ORNL-edits.docx" inserted by Wyrick on 9/20/2017 at 4:31pm). This has been corrected to now match the original wording for KF #1 (and exactly as stated on the first page of Chapter 2: "1. The North American continent—including its energy systems, land base, and coastal oceans—was a net source of carbon to the atmosphere from 2004 to 2013, having contributed on average approximately 1,032 teragrams of carbon (Tg C) (±50%) annua

Chapter 2: North American Carbon Budget Text Region 85 86 26 29 The summary of carbon management would be significantly enhanced by including estimates of the potential additional emissions reductions and CO2 removal increases that could be achieved by various sectors and activities.

Such a summary has been compiled across this report and included as a table and accompanying discussion in the Executive Summary (specifically, Table ES.2). We refer to this table in the revised text of this chapter (section 2.6) with an expanded discussion of the improvements to the methodological approaches needed to inform decision-making regarding emissions reductions.

Chapter 2: North American Carbon Budget Whole Chapter Consider adding a table and some text about land-use changes: area and carbon changes between major land classes (e.g., forest, cropland, rangeland, urban).

We appreciate this comment as it has been a point of discussion in developing this report. Although we were hopeful that such information could be included here, upon reviewing the existing literature we found that the available information is not comprehensive or consistent enough to make a continental-scale estimate of land use areas and changes in carbon. For example, Chapter 9 (Forests) does have good information on changes from forest to other land uses in its budget estimates, but similar data are not available for other land use transitions (e.g. grassland to cropland, etc.). A very recent article by Sleeter et al. (http://iopscience.

Chapter 2: North American Carbon Budget Whole Chapter The title of this chapter is "The North American Carbon Budget: Past, Present, and Future" but none of the Key Findings and little of the content refers to future projections. Given the title, there should be at least one key finding referring to the future carbon budget.

We agree with this comment and, as such, have changed the title to simply "Chapter 2. The North American Carbon Budget"

Chapter 2: North American Carbon Budget Text Region 73 73 21 23 This sentence ("In Mexico are….") is incomplete: What are these programs? Include links if relevant as done in the rest of the paragraphs.

Lines 22-27 have been re-worded for accuracy, clarity and language style: "Since the First State of the Carbon Cycle Report (SOCCR-1; CCSP 2007), multiple research efforts have aimed to synthesize and reconcile estimates across these key components of the continental-scale carbon cycle. A series of studies borne from the REgional Carbon Cycle Assessment and Processes (RECCAP) initiative has provided diagnosis and attribution of carbon cycle dynamics for global regions, including North America (King et al., 2015). Designed to advance research from SOCCR-1 toward SOCCR-2, several 'interim synthesis' studies organized by the North Ame

Chapter 2: North American Carbon Budget Whole Page 73 The emissions statistics in the first paragraph of Section 2.2 ("Historical Context"), which describe emissions though 2003, should be integrated with updated information about emissions since 2003. For example in the second paragraph, information from the SOCCR-1 is updated with more current information within the same paragraph (starting with "More recent analyses suggest….").

We added integrated statements on emissions since 2003: "More recent analyses suggest a 2.8% decline in total North American emissions from 2003 to 2010, with 3.4% and 7.2% decreases in the US and Canada, respectively, countered by a 13.6% increase in Mexico (King et al., 2012). Over the two decade period from 1990 to 2009, fossil fuel emissions from North America averaged an estimated 1700 Tg C per year (Boden et al., 2015), or 25% of the global total over that time period (King et al., 2015)."

Chapter 2: North American Carbon Budget Text Region 81 81 29 30 Change "Emissions" to "Annual emissions"

Changed.

Chapter 2: North American Carbon Budget Text Region 81 81 33 35 Change "per capita emissions" to "annual per capita emissions"

Changed.

Chapter 2: North American Carbon Budget Whole Page 85 Section 2.6 ("Societal Drivers, Impacts, and Carbon Management Decisions") should include a summary of the current understanding of what has potential to influence changes in the carbon budget. Three essential points to include here are that (1) currently the largest component of the carbon budget is fossil fuel emissions (See Fig 2.3, Table 2.2 p87 and Lines 7-8 ("…the fossil fuel source…") of this chapter) (2) as of Nov 2017 every country in the world has signed or ratified the UN Paris agreement which necessitates "a timeline to reach peak [GHG] emiss

Similar to the response to the comment above, this summary has been compiled across this report and included as a table and accompanying discussion in the Executive Summary (specifically, Table ES.2). We refer to this table in section 2.6 here, along with an expanded discussion of the improvements to the methodological approaches needed to inform decision-making regarding emissions reductions.

Carbon Cycle Science Report? Is this going to go to Ch. 18?

Chapter 2: North American Carbon Budget Whole Chapter "Chapter 2 is arguably the single most important chapter of the report, given that the commenting instructions warn specifically about cross-comment referencing. There are major issues in it that involve the combined effect of the chosen (1) focal time period and especially, (2) the statistical methods used.

1. We chose 2004 to 2013 as the decade since the time frame of the estimates in Chapter 3 of SOCCR-1, which are given as 'ca. 2003' so we used 2004-2013. This is clarified and explained with a new statement added to the end of the introduction section: "Specifically, this chapter follows the estimates of North American carbon stocks and fluxes synthesized and reported in Chapter 3 of SOCCR-1 (Pacala et al., 2007). That analysis defined the reported estimates as "ca. 2003", or approximately representing the time period at and around SOCCR-1. Here, we update these estimates for the time period of 2004 to 2013 as the decade since the

2. We have calculated, compared and reported the trends in the FF emissions estimates between the decades before and after the SOCCR-1 vs. SOCCR-2 break-point (i.e., 2003-2004), and have added this issue to the Key Findings, Historical Context (Section 2.2), Current Understanding (Section 2.3) and Synthesis (2.7) sections.

There are many discussions (throughout the report and not including historical discussions of the pre-SOCCR-1 time period), in which the focal time period varies--sometimes the start year, other times the end year, and sometimes both. Various scientific papers and technical documents will of course cover varying time periods, as described on p. 15 (section ""Time Frame""), but this point is largely moot given (1) that the GCP specifically summarizes carbon pools and fluxes at a yearly time step back to 1959, and (2) the SOCCR-2 instructions themselves. In a subject as complex and spatially extensive as the this, characterized l

As explained above, we chose 2004 to 2013 as the decade since the time frame of the estimates in Chapter 3 of SOCCR-1, which are given as 'ca. 2003'. The exact dates should not be considered too rigidly, however, when combining and reconciling the various data sets in the budget synthesis reported here. While some data sets have a temporal resolution allow precise time periods to be summarized, others do not. As such, we have attempted to synthesize the various budget components using reported estimates and data sets that are generally representative of the 2004–2013 time period.

However, there is in fact also confusion regarding starting year. The report states in the ""Time Frame"" section of the Preface (page 15, lines 6-8): ""The emphasis is on presenting the scientific understanding and developments that have emerged in the last decade since SOCCR-1 (CCSP 2007), which covered the science through 2005"". However, item number 4, page 13/14 (under ""Indicators, Trends, and Feedbacks"") states: ""…Particularly discussed is the understanding of the extent of agreement or disagreement between presumed trends, pre- and post-2007 (if applicable)"". These two statements are at odds with each c

Given these issues, the Key Findings (KF) of Chapter 2 are problems. Specifically, those KFs entirely fail to describe the pronounced changes that have occurred in both US and North American (fossil fuel + cement) emissions between the two reports, which are centered on a breakpoint year near 2005. Worse, they do in fact address the basic issue of trend change, but give an entirely misleading picture of it. Even worse still, the analysis follows directly along lines on which various aspects of climate science have been severly criticized by various people and groups in the past, i.e. for statistically weak, non-robust and/or biased

1. Key Finding 2

Key Finding 2 is the report's summary statement for changes in North American fossil fuel emissions. The comparison made there is between the average of the ten years from 2004-2013, with the single year of 2003. This comparison is entirely problematic on several levels, to wit:

(a) What is the statistical justification, rationale and/or precedent, for comparing a decadal mean value with any single year preceding that decade? What exactly does that comparison tell us?

The time frame of the estimates in SOCCR1 are given as 'ca. 2003', which was never supposed to suggest that these are exact estimates for a specific year, but rather a synthesis of various components with estimates approximately representative of the decade leading up to SOCCR-1.

(b) What is the justification for using 2004 to 2013 to define the decade, given that the stated SOCCR-2 mandate is to summarize the state of affairs post-SOCCR-1, that is, after 2005?

We chose the decade since the time frame of the estimates in SOCCR1, which are given as 'ca. 2003' so we used 2004-2013.

(c) What is the justfication for choosing 2003 as the single year to compare that decade against?

The time frame of the estimates in SOCCR1 are given as 'ca. 2003', which was chosen for that synthesis effort as approximately representative of the time period at and around SOCCR-1.

(d) What is the criterion for declaring that a 1765 Tg C/year mean, measured over ten years, is ""similar"" to 1856 Tg C/yr measured over one year? Similar compared to what? I might declare that 1809 Tg C/yr must be met before ""similarity"" is achieved...or no, maybe on second thought 1791 is good enough...

The comparison of annual emissions between the two decade averages has been removed as a statement in this key finding, replaced with suggested key findings on the change in trends between the two time periods. "Fossil fuel emissions were the largest carbon source from North America from 2004 to 2013, averaging 1774 Tg C per year (±5.5%). Emissions over this time period showed a significant decreasing trend of 23 Tg C per year, which represented a shift in direction from the increasing trend over the previous decade. The continental proportion of the global total fossil fuel emissions decreased from 24% in 2004 to 17% in 2013."

(e) Why is there no trend comparison, using fundamental and long-established statistical trend estimation methods, for the two decades breaking near the two SOCCR report periods' junction, made or discussed in any way? Exactly that analysis is a clearly stated mandate of the SOCCR process (as discussed more below). It is not there, neither where it should logically be, nor anywhere else in the report.

We have addressed this issue in a few different places in this chapter:

1. In the Historical Context Section 2.2, we have added text citing a published study that reports these trends for the three countries and the continental total: "More recent analyses suggest a 2.8% decline in total North American emissions from 2003 to 2010, with 3.4% and 7.2% decreases in the US and Canada, respectively, countered by a 13.6% increase in Mexico (King et al., 2012). Over the two decade period from 1990 to 2009, fossil fuel emissions from North America averaged an estimated 1700 Tg C per year (Boden et al., 2015), or 25% of the global total over that time period (King et al., 2015)."

2. In the Current Understanding Section 2.3, we report and compare the trends in the FF emissions estimates between the decades before and after the SOCCR-1 vs. SOCCR-2 break-point (i.e., 2003-2004): "The annual rate of total fossil fuel emissions from North America shows a significant change in trend during the decade since SOCCR-1. Emissions from 1994 to 2003 showed a significant (p<0.01) increasing trend of 24 Tg C per year that is mirrored by a significant decreasing trend of 23 Tg C per year between 2004 and 2013 (**Figure 2.2**)."

3. We have added a statement on this change in direction of the trend to Key Finding #2: "Emissions over this time period showed a significant decreasing trend of 23 Tg C per year, which represented a shift in direction from the increasing trend over the previous decade."

(f) What is the exact data source/provenance/authorship for the values used? This is never stated.

The data source/provenance/authorship for the values used is given in the "Supporting Evidence" section for KF #2 (p.91, lines 3 – 6): "Description of evidence base: Key Finding 2 is supported by fossil fuel inventories collected by the Carbon Dioxide Information and 4 Analysis Center and made available in the territorial fossil fuel carbon emissions dataset (Boden et al., 5 2015), as compared with those reported for ca. 2003 in SOCCR-1 (King et al., 2007)."

(g) Language and phrasing: the 1765 Tg/yr value is not a ""total""--it's an average...what exactly is a ""level of magnitude""...and so forth. This is imprecise language accompanying sloppy analysis.

This statement (KF #2) has been re-worded for clarity: "Fossil fuel emissions were the largest carbon source from North America from 2004 to 2013, averaging 1774 Tg C per year (±5.5%). This estimate is less than – but overlaps the uncertainty range of – the 1,856 Tg C per year ±10% reported for the previous decade in the *First State of the Carbon Cycle Report* (SOCCR-1). The continental proportion of the global total fossil fuel emissions decreased from 24% in 2004 to 17% in 2013."

Below I instead give the pertinent results from a simple, least-squares linear regression of decadal-scale fossil fuel emission trends, before and after the end of 2005, that is 1996-2005 versus 2006-2015, for North America and the USA, based on the ""national emissions"" data provided from the Global Carbon Project this year (GCP: http://www.globalcarbonproject.org/carbonbudget/17/data.htm). Central estimates, and standard errors, of linear regression slopes, are in units of Tg C/yr:

North America (= Canada, US, Mexico):

Decade,	slope,	S.E. slope,	p,	Adjusted R-sq
1996-2005,	+19.53,	1.73,	< 0.000003,	0.934
2006-2015,	-20.40,	5.15,	< 0.0042,	0.620

United States only:

Decade,	slope,	S.E. slope,	p,	Adjusted R-sq,
1996-2005,	+14.31,	1.56,	< 0.000016,	0.903
2006-2015,	-20.42,	4.79,	< 0.00280,	0.656

Based on the above data for mean and standard error of the estimated slopes for the two geographic areas and time periods, the probability of a linear regression slope of zero (i.e., no change in emissions between decades) can be directly computed, given a sample size of n = 10 years in each case, and assuming normally distributed residuals around the mean. The resulting probabilities that the observed emissions rate changes over the last decade exceed those of the previous decade (i.e. an increase in the rate of emissions changes), is p = 0.00002 for North America, and p = 0.00016 for the United States. The probabilities th

Instead, Chapter 2 authors phrase their conclusion to portray that there has been very little change in fossil fuel emissions rates between the time periods covered by SOCCR-1 versus SOCCR-2. There is nothing to call this conclusion except an inexcusable analytical failure leading to an entirely misleading conclusion. One could not reasonably make a more significant error in a report of this importance, and one can only wonder what the cause of this may have been.

In the Current Understanding Section 2.3, we report and compare the trends in the FF emissions estimates between the decades before and after the SOCCR-1 vs. SOCCR-2 break-point (i.e., 2003-2004): "The annual rate of total fossil fuel emissions from North America shows a significant change in trend during the decade since SOCCR-1. Emissions from 1994 to 2003 showed a significant (p<0.01) increasing trend of 24 Tg C per year that is mirrored by a significant decreasing trend of 23 Tg C per year between 2004 and 2013 (**Figure 2.2**)."

2. Key Findings 4 and 5

These findings are both directly contradicted by the analyses given in Chapter 8.

a) Key Finding 4.

Figure 8.3 shows that the North American terrestrial land sink has been getting steadily stronger since at least the year 2000, as evaluated by four atmospheric inverse models used in the TransCom model intercomparison project. The statement ""The strength of the natural terrestrial carbon sink in ca. 2003, as reported in SOCCR-1, persisted from 2004 to 2013 at a similar magnitude"" is thus at odds with that chapter's findings. I have made additional comments on the strength of the Chapter 8 evidence, in the Chapter 8 comments, that will not be repeated here.

This is an important comment pointing out that our wording needs to be more careful so that the findings are not misleading. In this case, trends in carbon uptake can be ascertained from the inverse models because of their annual precisions. However, this is not the case with the inventory-based estimates that really represent an "average" over a coarser time period such as a decade. Further, the estimates based on bottom-up synthesis of budget components between SOCCR-1 and SOCCR-2 are based on different components and methods. Therefore, while these different estimates can be compared for consistency, they cannot be used

b) Key Finding 5.

This finding is also at odds with the findings of Ch. 8 which compared four inverse models from TransCom with the US EPA's land sink estimates based on land use and land cover data. Furthermore, from a statistical point of view, it is well known that it is very easy to generate a non-significant difference between two estimates if each is of low precision--which land sink estimates generally are. Such a finding is not an indicator of real agreement between two means, but rather, of their mutual imprecision. This is basic statistics."

We have removed any suggestion of "significant" differences in the wording of Key Finding #5 so as not to suggest that the conclusion is based on a statistical test. Rather, this finding is based on the overlap of uncertainty ranges between these two very different, independent estimates of the continental carbon sink. It has been re-worded as: "There is an apparent agreement in the estimates of the magnitude of the continental carbon sink over the last decade between top-down (634 Tg C per year ± 45%) and bottom-up (577 Tg C per year ± 75%) approaches, considering the uncertainty ranges around these two calculations."

Chapter 2: North American Carbon Budget Figure 2.3 105 Please be sure in the text that it is clear that different timeframes are represented in the different inventories and fluxes from different environments; i.e., not all is equivalent. There is potentially more uncertainty in this figure than is readily apparent, because of this.

Where Figure 2.3 is first introduced, we have added a discussion of this issue where time periods are not always precisely lined up across the various estimates: "As explained above, we chose 2004 to 2013 as the time period for this analysis, which generally represents the decade since the time frame of the estimates in Chapter 3 of SOCCR-1, which are given as 'ca. 2003'. These exact dates are not considered rigidly, however, when combining and reconciling the various data sets in the budget synthesis reported here. While some data sets – such as the fossil fuel emissions estimates (e.g., Boden et al., 2015) – have a temporal resolution allo

Chapter 2: North American Carbon Budget Text Region 72 72 6 7 This is really the first time the 100-year period has been mentioned (it should have been done earlier when defining CO2e). The report also needs to explain that the 100-year usage can tend to minimize the climatic importance of CH4 because it has most of its effect over the first decade or two. This is nowhere explained and this needs to be done.

The definition for CO2e has been added to the front matter of this report (Preface) and explained in more detail in Chapter 8.

Chapter 2: North American Carbon Budget Text Region 73 73 21 23 Very awkwardly phrased sentence, if it even is a sentence.

This section of text has been significantly revised for clarity, language and phrasing: "Since the First State of the Carbon Cycle Report (SOCCR-1; CCSP 2007), multiple research efforts have aimed to synthesize and reconcile estimates across these key components of the continental-scale carbon cycle. A series of studies borne from the REgional Carbon Cycle Assessment and Processes (RECCAP) initiative has provided diagnosis and attribution of carbon cycle dynamics for global regions, including North America (King et al., 2015). Designed to advance research from SOCCR-1 toward SOCCR-2, several 'interim synthesis' studies organized by the N

Chapter 2: North American Carbon Budget Text Region 74 74 1 3 With respect to the per capita emissions calculation for the US, I've always wondered what the population number being used is. Does it include an estimate of the illegal immigrants? Does it account for the legal residents who are not citizens? Does it account for the several million students from other countries who are here in the US (and not count the number of US students abroad)? Same question for business leaders and workers? What exactly is the population that is counted? I ask this in that while Europe has had a relatively stable or even dec

While we agree that these are interesting and important aspects of the problem, these details are beyond the scope of the broader discussion offered in this chapter, which aims to reconcile the overall budget synthesis. Topics related to per-capita emissions and other societal aspects are covered in other parts of this report dealing with the human dimensions and social consequences of the carbon cycle, particularly Chapters 3, 4, and 6.

Chapter 2: North American Carbon Budget Text Region 74 74 6 7 Rather awkward phrasing

The two sentences starting this paragraph have been revised for clarity and language: "North American land and its adjacent oceans almost certainly represent a net sink for atmospheric CO_2 excluding anthropogenic emissions (King et al., 2015; Peters et al., 2007). In the ca. 2003 time frame, which includes SOCCR-1, North America's terrestrial carbon sink was estimated to be about 505 teragrams (Tg) C per year (±50%), which represented about 15% to 40% of continental fossil fuel emissions at that time (Pacala et al., 2007)."

Chapter 2: North American Carbon Budget Text Region 74 74 7 11 While the statement is the case, what is omitted is that the climate change problem is the result of not taking up 100% of the human-caused emissions, so this really would be better phrased by saying that North American sinks take up only about 15-40% of emissions, leaving a large amount to induce global climate change. The present phrasing seems too self-laudatory given the climate change challenge.

The two sentences starting this paragraph have been revised for clarity and language, as in the previous comment. We feel that this is now clear and concise, and stating the quantities (and their uncertainties) that can be given as facts. The implications of this are discussed in later sections of this chapter (particularly 2.6) as well as throughout the larger report.

Chapter 2: North American Carbon Budget Text Region 74 74 23 27 If one is really going to try to calculate a US carbon footprint, one has to include then the emissions caused by all of the nation's imports (offset of emissions supporting exports). That this aspect of the carbon footprint for North America needs to be mentioned for the statements here not to be quite misleading. At the very least, it needs to be mentioned that the compilation here is not a carbon footprint for North America and its population.

We appreciate this comment, as this is an important issue that requires not only careful analysis, but appropriate terminology and precise meanings. These issues as they pertain to the entire report are defined and described in the front matter (Preface and Executive Summary); here we are not aiming - nor claiming - to be calculating a "carbon footprint" or attempting a full life-cycle analysis. Rather, we have synthesized estimates of stock-change and flows from various sectors treated in this report into a broader synthesis of the continental carbon budget. As described in the chapter, we have used an approach that uses "bottom-up" estin

Chapter 2: North American Carbon Budget Text Region 74 74 32 33 The phrase "95% certain" is simply inappropriate--one is certain or not. One can have degrees of uncertainty and of confidence, but not of certain or certainty (just try looking up the definition of "certainty" in a dictionary and then put the qualifier in front--it makes no sense). Rephrasing is needed to refer to how confident the estimate is.

This statement now reads: "...considered with 95% confidence to be within ±10% of the estimates".

Chapter 2: North American Carbon Budget Text Region 75 75 3 4 Need to close the parenthesis

Removed the parenthesis around the "i.e., ..."

Chapter 2: North American Carbon Budget Text Region 76 76 9 9 It would be best to not use the word "may" as this can mean anything and use a word from the official lexicon regarding likelihood/confidence level.

Changed to "it has been suggested that..."

Chapter 2: North American Carbon Budget Text Region 76 76 19 19 Again, "95% certain" is not an appropriate term to be using--refer to degrees of confidence

Re-worded: "King et al., (2012) concluded that the "best estimate" of magnitude of the continental CO_2 sink early in this century was 635 ±26% Tg C per year, offsetting about 35% of fossil fuel emissions over that time period."

Chapter 2: North American Carbon Budget Text Region 76 76 32 38 For most of the northeastern US, the glaciers had scraped away most of the soils and it has had to build up gradually over time (at our summer home in NW CT, the soil cover over bedrock is quite thin). How does the build up rate of soil carbon being used compare to the average rate of soil carbon buildup over the Holocene? Is it within bounds of uncertainty? Is the rate accelerating? etc. It might be useful somewhere in this discussion to provide a sense of the rate from Holocene analyses to provide an indication to the reader that the very recent e

This idea is interesting but beyond the scope and time frame of this chapter. The historical context for North American soils is treated in Chapter 12 of this report.

Chapter 2: North American Carbon Budget Text Region 76 76 41 41 Given the focus here is on carbon stocks, it is really a bit strange that a negative sign is an indication that the stock is becoming larger--it might be worth making this point a bit more strongly to really be sure the reader gets this, indicating that the report is focused on the atmospheric contribution, but in looking from the perspective of the land/soil carbon reservoir, a negative flux means the stored carbon is being increased.

We agree with this comment and have made changes to the text throughout the chapter to avoid using signs by being explicit about what is being reported (i.e., uptake / emissions, source / sink, gain / loss, transfer / export, etc.) so that signs are not neede. However, signs (from the atmospheric perspective) have been retained in the tables and figures so that the source / sink calculations can be reconciled and compared across all stock changes, flows and transfers of the larger budget synthesis.

Chapter 2: North American Carbon Budget Text Region 77 77 27 27 Well done indicating the level of confidence (and not certainty).

Noted, and we have made changes throughout the text where applicable.

Chapter 2: North American Carbon Budget Text Region 78 78 17 19 In the front of the report (Figure ES.1) the scope of the report is shown to also encompass Pacific islands and surrounding ocean areas (basically their economic zones). Are these island nations and surrounding waters included in the compilations being discussed here? This needs to be stated. And it would be interesting to have a table indicating the areas of land and ocean/coastal waters so one can get a sense of per square meter averages, etc.

For the broader synthesis presented in this chapter, we are reconciling estimates across a variety of sectors (e.g. managed forests, agriculture), which do not necessarily have precise spatial boundaries that can be used for calculations as suggested. The details related to spatial boundaries of various studies and carbon densities for geographic regions are treated in the individual chapters written on these sectors.

Chapter 2: North American Carbon Budget Text Region 78 78 25 28 It would be useful to say then what the net change in land carbon has been since the start of the Industrial Revolution--is the US at this point a net source or sink due to changes in land carbon?

Some of this is generally treated in the 'Historical Context' sections of the various chapters in this report, but – especially without specific studies or inventory data to pull from - is beyond the scope and stated time-frame of this chapter.

Chapter 2: North American Carbon Budget Text Region 78 78 31 31 The phrase "sink in urban trees" is really a bit confusing. It might well normally mean that there has been a loss of urban trees but instead here it means, I think, that urban trees are actually taking up carbon--cities are becoming literally greener. I think it would be useful to more clearly make this point instead of relying on the reader to keep remembering that sink is referring to change with respect to the atmosphere. I think the text level needs to be set as being aimed at the general public or interested reader rather than an expert in the field, and

This statement has been revised for clarity: "The stock change estimate for urban trees is distinguished from that of the forest sector, and the transfers and fluxes associated with the wood products pool are separated as well."

Chapter 2: North American Carbon Budget Text Region 80 80 1 2 Regarding the phrase "climate cooling effect", this is really a bit misleading for the general reader. What this really does is to slightly moderate the rather strong warming effect of the overall total for North America. At the very least, say cooling influence as the sink does not actually do any cooling at all. And to then say may be offset by the non-CO2 GHG effect seems to ignore that it is already more than offset by the effects of the CO2 emissions, which is much larger. If you want to say the magnitude of the North American land/ocean system uptake

This statement has been revised and corrected to: "The potential benefits of the North American CO_2 sink (i.e., mitigating against the build-up of greenhouse gases in the atmosphere) may be wholly negated by emissions of non-CO_2 GHGs (e.g., CH_4 and N_2O; Tian et al., 2015; Tian et al., 2016)." The reader is referred to these two references for the details of these calculations.

Chapter 2: North American Carbon Budget Text Region 80 80 14 14 Change "Certainty" to "Confidence"

This change has been made.

Chapter 2: North American Carbon Budget Text Region 80 80 20 20 Should not leakage from pipelines and distribution systems also be indicated as a possibly significant contributor to uncertainty? I thought there was evidence from sensing along urban and suburban streets that there is a good deal of leakage.

This statement has been revised as suggested: "Uncertainties from energy-related activities derive from not knowing the actual extent and duration of gas flaring nor the magnitude of leakage from pipelines, distribution systems and other point sources."

Chapter 2: North American Carbon Budget Text Region 81 81 39 39 "have renewed their growth" makes it sound as if the concentrations are in on the decision. It would be better to say something like that concentrations are rising again due to some combination of increased sources and reduced sink strengths and chemical destruction

This statement has been revised as: "The trends in CH_4 emissions have been variable in recent decades, showing a renewed growth rate in global atmospheric concentrations since 2007 following a period of stabilization".

Chapter 2: North American Carbon Budget Text Region 82 82 12 14 IMPORTANT: I'm troubled by counting uptake in the oceans as part of the North American sink unless it is made clear that there are very large emissions of CO2 occurring out over the open ocean in lower latitudes as colder water upwells (so are the emissions from the California current off the North American coast being counted as ocean emissions) that are not the responsibility of any nation and so do not appear in any global inventory of emissions. And this is done because there is uptake of emissions in colder waters, a much larger fraction of

Generally-speaking, the authors and scientific leadership of this report do not feel that a clear distinction between the natural and anthropogenic carbon cycle can be made consistently across the sector budgets developed for this report. That said, in the text we do make every attempt to report on and discuss the attribution to causes when reasonably documented in the literature, such as the emissions of GHGs from anthropogenic sources or the impacts of harvesting on forest carbon. Furthermore, we have stated clearly in this chapter that clarification this synthesis is aimed at "net continental uptake" from the atmospheric perspect

To attempt to clarify this for the coastal ocean sink specifically, we have revised the wording of this section to now read: "Coastal monitoring networks suggest that coastal margins of North America currently act as a net CO2 sink, where the net uptake of CO2 from the atmosphere is driven by high-latitude regions but the net flux is not well constrained (see Figure 2.4 and Ch. 16: Coastal Oceans and Continental Shelves). Ocean acidification trends are difficult to identify in coastal waters because highly variable carbonate chemistry is influenced by seawater temperature and transport, primary production, respiration, and inputs from land, in

Chapter 2: North American Carbon Budget Text Region 83 83 17 29 It should be kg and not Kg in all cases here

This change has been made to all cases here.

Chapter 2: North American Carbon Budget Text Region 83 83 24 24 "high social pressure over use" is a really awkward phrase.

This statement has been revised to "and the high pressure on the use of natural resources that drives land-use change."

Chapter 2: North American Carbon Budget Text Region 84 84 6 9 How is the cutting of forests to make wood pellets to be burned in Europe counted? This is really a large source of CO2 to atmosphere in short-term and then takes time to regrow, so is really contributing to near-term warming even if later comes out neutral (or near neutral). Does this inventory count this as a wood export assuming it stays that way or as an emissions source in near-term?

The inventories account for this as a stock change, or loss of carbon from the forest sector. However, since the synthesis approach in this chapter is based on estimating exchange with the atmosphere to compare with the top-down estimates, it counts as an "apparent sink" of CO2 from the atmosphere over North America.

Chapter 2: North American Carbon Budget Text Region 84 84 24 26 So, here removing carbon from the land biosphere is said to be a loss--but in that the lost carbon is going into the atmosphere, by the sign convention that has been established, this needs to be called a source as it is adding carbon to the atmosphere. I realize this will sound strange, but then it also sounded strange earlier when adding carbon to the land inventory was called a sink (for the atmosphere). I don't mean to be a hobgoblin for consistency, but here one is making a sensible statement but it violates the convention, and doing this needs to b

This statement has been revised to clarify that "loss" is from the ecosystem - and thereby not necessarily just a source to the atmosphere but also in lateral transfers such as erosion and aquatic export. "Land use change, such as converting grasslands, shrublands, and forests to make way for agricultural lands, may lead to substantial loss of carbon stocks from ecosystems in this region."

Chapter 2: North American Carbon Budget Text Region 84 84 32 32 Change "came largely from" to something like "occurs largely because of" as this needs to not be in past tense.

This statement has been revised to: "The projected decline occurs mainly in ecosystems of the Northwest region in response to future climate warming and associated drought effects".

Chapter 2: North American Carbon Budget Text Region 86 86 5 5 One usually mitigates emissions in the jargon of our community--mitigating concentrations would be more the terminology of the disaster management community. In line 8, mitigation is referring to limiting emissions, and I would suggest keeping to that use of the word.

This statement has been revised to: "Regional carbon management decisions to mitigate CO_2 emissions could benefit from sector-specific accounting, focusing efforts on reducing atmospheric greenhouse gas concentrations and identifying options for carbon sinks."

Chapter 2: North American Carbon Budget Text Region 86 86 36 42 Per my remark regarding what I think is the inappropriate counting of the baseline uptake of CO2 in coastal waters, it seems to me that these numbers relating to the airborne fraction are mistaken--it is simply not appropriate to be counting the baseline (preindustrial uptake of CO2 by these waters--CO2 being released in ocean areas not counted in global emission inventories) in the inventory.

In the budget synthesis of this chapter, we have clearly stated that this is based on a scientific approach from an atmospheric perspective (as opposed to a production, consumption or other policy-based approach), so there is nothing 'inappropriate' about including land-atmosphere and ocean-atmosphere carbon fluxes that occur within the North American domain, regardless of their origin or source (natural or anthropogenic). We feel that the coastal ocean is a key component of the continental budget synthesis based on the major increase in the number of measurements and model results since SOCCR1, with the net effect that estimate

Chapter 2: North American Carbon Budget Text Region 109 109 6 6 This all needs to be rephrased in terms of "Confidence" and not "Certainty". There are not degrees of certainty--it just does not make sense and this report needs to avoid corrupting the word "certain".

The appropriate changes have been made in Table 2.2 as well as throughout the text to remove any use of 'degrees of certainty' and replace it with a confidence level.

l at least partly from economic activity."

t the social practices with embedded carbon are not well-understood (motivations, structural and cultural limitations, etc.; see, for example, paragraph starting at line 37 on p.259 of the Public Review / 4[th]-order draft). Chapter 3 discusses the broader socio-economic drivers of the energy sector.

e uncertainty as the range of these estimates.

t the entire chapter says what they intended it to say. The fact that this document has supposedly been through 3 or 4 rounds of "expert review" before the public review, with nobody apparently catching this issue, is not a good sign.

ely. (Very high confidence, Very likely)"). The remainder (lines 6-36) does indeed apply to Key Finding #1, so that this section of the supporting evidence is now complete and correct.

iop.org/article/10.1088/1748-9326/aab540) provides model estimates of carbon balance from land use change in the U.S. These data are not included here because the methods are not consistent with the other sources of land use information used for the other chapters in this report, and the estimates also do not include Canada or Mexico. In lieu of quantitative assessments, h

rican Carbon Program (NACP; nacarbon.org) compared observational, inventory-based and modeled estimates of carbon stocks and fluxes across sites e.g., Schwalm et al., 2010), within sub-regions (e.g., Schuh et al., 2013) and over the continent (e.g., Huntzinger et al., 2012). Currently, the Global Carbon Project (globalcarbonproject.org) develops global- and regional- scale estimate

ions and reverse emission trends" (see http://unfccc.int/paris_agreement/items/9485.php), and (3) significant reductions fossil fuel emissions would require government policies that reduce or prevent future emissions (e.g. see RockstrÃ¶m et al. (2017 doi:10.1126/science.aah3443), IPCC 2014 Synthesis Report p28-3, DeAngelo et al. (2017 doi:10.7930/J0M32SZG)). Management decisions

SOCCR-1 estimates."

by many different analytical methods and spatio-temporal scales, every effort must be made to reduce potential confusion, including temporal standardization. This interval's starting year is defined as 2006 (i.e., post SOCCR-1). An end year of 2015 will then define an exact decade, GCP data for which would have been available as of November 2016. The underlying point of this discussio

ther. Moreover, problems with the latter statement include the issue of which period 2007 itself falls into, why any discussed trends would be ""presumed"" rather than actually quantified, and exactly what defines ""applicability"". It seems clear that, since SOCCR-1 covered years through 2005, that 2006 should define the start year for SOCCR-2 analyses. It is entirely understood by this statem analyses and conclusions. This, without any question whatsoever, is a completely unacceptable outcome of the report, and must be remedied before final publication.

at these rates changed in the the opposite direction (i.e. a decrease in the rate of emissions changes) are thus p = 1 - 0.00002 and p = 1 - 0.00016, for NA and the USA, respectively. The corresponding odds ratios for these two possible outcomes are thus 53297:1 (NA) and 6131:1 (USA). These results show definitively that there is an extremely low likelihood that either the North American

to make conclusions about changes in or persistence of trends. As such, Key Finding # 4 has been revised to read: "Given the ranges of uncertainty around the two estimates, there is an apparent consistency in the bottom-up, inventory-based calculations of the average annual strength of the land-based carbon sink between that reported here (577 Tg C per year ± 75%) and in SOCCR-1 (505 Tg C p

owing precise time periods to be summarized, others – such as the periodically-sampled forest inventory (see **Chapter 9**) – do not. As such, we have attempted to synthesize the various budget components using reported estimates and data sets that are generally representative of the 2004–2013 time period. While this coarser-than-annual level of precision does add an additional (but unknown) amount of uncertainty to the overall budget, this synthesis approach represents a "best estimate" of carbon stock changes and flows for an average year during the decade since that reported in SOCCR-1."

North American Carbon Program (NACP; nacarbon.org) compared observational, inventory-based and modeled estimates of carbon stocks and fluxes across sites (e.g., Schwalm et al., 2010), within sub-regions (e.g., Schuh et al., 2013) and over the continent (e.g., Huntzinger et al., 2012). Currently, the Global Carbon Project (globalcarbonproject.org) develops global- and regional-
lining population and so can retire old facilities when new ones are built, this is much harder in the US with its growing population. This issue is simply not ever treated in discussions comparing the US and European situations in negotiations, etc. (nor really is that the US is much large than Europe and so, on a per capita basis, has a much large potential for storing carbon in t

nates of the vertical exchange of CO2 to compare with the "top-down", atmospheric estimates.

stimates are at least of a consistent order of magnitude with the past, etc.--that there are long-term studies that confirm the evidence from shorter periods is about right.

l recognize that extracted sentences need to be clear in themselves and so not be easily misinterpreted. Just a bit too jargony here.

is about the same and of opposite sign as the non-CO2 GHG effect, that is fine, but the word "offset" should not be used. And two related comments: I'm assuming this is based on the 100-year GWP, which needs to be stated, because a reduction in the non-CO2 GHG emissions would have its real temperature change impact early on and be substantially larger influence over the firs

which are within national economic zones as opposed to warm waters, that balance much of (even more than) the emissions from low latitude warm waters. I thus think that this consideration of uptake of CO2 in the coastal oceans of North America (except perhaps due to the higher CO2 concentration and so is leading to the PH decrease) is really inappropriate to be doing unless it is up
ive over North America. We are not attempting to differentiate between natural and anthropogenic sinks, nor formulate a policy-based budget based on producing vs. consuming regions.
addition to uptake of anthropogenic CO2 from the atmosphere."

e considered (here and elsewhere--do it here, perhaps do it elsewhere so the text actually sounds sensible to the non-specialist reader).

s of the coastal CO2 sink are converging. On the issue of how the coastal oceans contribute to the difference in airborne fraction, it is noted that some of this apparent change is due to better constraint on estimates rather than a truly changing airborne fraction.

Chapter	Comment Type	Figure/ Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Chapter 3: Energy Systems	Text Region		110	110	27	29	First, when making the conversion to CO2e, this needs to state the period of time for the conversion. The 100-year period is an arbitrary choice that is often used, but this choice really hides the importance of short-lived species in contributing to near-term warming (particularly by methane). Second, given uncertainties, five-figure precision seems overdone.	Defined CO2e and GWP issues in sidebar now located in the Preface of the volume. Changed the number of significant digits throughout the text (2-3).
Chapter 3: Energy Systems	Text Region		111	111	22	25	There has not been anywhere so far in this report an explanation of what CO2e is and the effect of choice of time periods and why this is important. This needs to be done--and when CO2e is presented, the period needs to be indicated. In that there is real concern about near-term warming leading to exceeding the Paris agreement temperature objectives, it is likely also important to present CO2e using GWP-20 to give a full indication of the relative importance of limiting methane and CO2 emissions, and what doing this could accomplish in slowing the rate of warming. It really needs to be stated that CO2e was created to give an approximation of how more detailed climate models would respond to a mix of GHGs--if one uses the GWP-100 CO2e, this will give an underestimate of near-term warming and this is particularly important given the imminence of approaching the Paris temperature accords and so provide less than optimal information for negotiators.	Included a definition of CO2e as sidebar in the Preface of the volume
Chapter 3: Energy Systems	Text Region		113	113	21	21	Missing a percentage sign after 40.7	Included % sign
Chapter 3: Energy Systems	Text Region		117	117	32	39	There is no discussion about deep decarbonisation in industrial sector.	We present the concept of "deep decarbonization" in the future outlook section
Chapter 3: Energy Systems	Text Region		120	120	15	27	At least until a few years ago, it was my understanding that EIA's data compilations considered only solar installations larger than 1 MW as contributing to electricity production (one has to check the footnotes of EIA tables to see this), and the distributed systems on rooftops were counted as reduced demand for electricity, and so were really interpreted as an increase in efficiency (so basically, the electricity generated by the distributed systems was not counted as part of the electricity that it takes to run the US economy, and making the estimated rate of efficiency improvement a bit larger than it really was). I am not sure how the accounting is presently done and if this would have an effect on the trends here, but just to note if a home, for example, goes off grid, there is still electricity being created to power a (small) part of the economy. It might be useful here to make the point that what is mainly being discussed here is grid-based electricity and not all electricity. I would think that some amounts of wind-based, geothermal and other distributed energy generation is treated in a similar way, but likely smaller.	We describe the limitations of the EIA data compilations in specific regards to renewable energy generation capacity.
Chapter 3: Energy Systems	Text Region		122	122	2	5	Regarding this sentence, the words on line 5 are particularly important--that is, the way IEA accounts for things, it is (or at least was) the renewable energy that goes on the grid and this total may well miss the amount of electricity being generated on distributed systems and used on site. So, these percentage estimates are really likely a bit low. IEA has kept track of the capacity of distributed systems being installed, but unless changed in recent years, was not counting the actual generation on distributed systems, and this is the reason, in my view, that the national picture of renewables being just a small share of US energy generation per IEA is so different from the very optimistic views of the companies installing distributed systems. It seems to me it might be appropriate to clarify this difference.	We describe the limitations of the EIA data compilations in specific regards to renewable energy generation capacity.
Chapter 3: Energy Systems	Text Region		124	124	10	14	And the consequences of all of this carry on to the next paragraph.	
Chapter 3: Energy Systems	Text Region		126	126	37	37	If nuclear power generation gets replaced by any kind of fossil or especially coal there will be huge implication for global carbon budget and also if that happens in next decade. So some discussion on what is the current research/progress on advanced nuclear installation might be useful.	We include a box on potential for nuclear power technologies and outlook
Chapter 3: Energy Systems	Text Region		126	126	20	25	Footnote 16, at the bottom of page 126, right side, is incorrect. Values for CH4 GWP vary from 28 to 34 as a function of whether or not feedbacks are included, not atmospheric variations. This is discussed on and before p. 714 of chapter 8 of the AR5 WG1 report: https://www.ipcc.ch/pdf/assessment-report/ar5/wg1/WG1AR5_Chapter08_FINAL.pdf	We have changed the footnote to include cc feedbacks
Chapter 3: Energy Systems	Text Region		128	128	17	27	If the trend toward microgrid systems continues and there is lots more distributed energy systems, it could well be that the grid would have a lot less energy being carried around--but then the transport system is going to go electric and so there would presumably be more. It seems to me it might be worth mentioning some of the reasons that the future electricity going over the grid could be very different instead of just suggesting that the trends over next 60-80 years is expected to be slow and relatively small. I'd suggest the composition of uses and generation are both likely to be quite different.	We have included a sentence directed to this point
Chapter 3: Energy Systems	Text Region		136	136	31	35	Given the uncertainties in population, it seems a bit overdone to be giving results with 5-figure precision. It might be mentioned that these are attempted to be consistently done calculations rather than really such accurate numbers.	Changed to between 2 - 3 significant digits
Chapter 3: Energy Systems	Text Region		137	137	1	18	I'm curious why there is not a reference here to the paper by MacDonald et al. (Nature, January 2016) which shows that, were it possible for energy to be transmitted around via a high-voltage, direct current network, renewables could provide up to about 80% of nation's energy, including allowance for the transportation system to go electric. It would thus seem worth mentioning that much greater reliance is technologically possible--it just takes doing it.	Reference included
Chapter 3: Energy Systems	Text Region		139	139	23	23	It would seem worth mentioning here that there will be very large co-benefits that would come from increasing CAFÅ¡ standards--emissions per mile would go way down and so would air pollution consequences, and other impacts as well.	We have an extended discussion of co-benefits of carbon reduction, using recent EPA 2018 report.
Chapter 3: Energy Systems	Text Region		140	140	11	11	Should IEA be EIA here, given reference at the start of the line?	Corrected
Chapter 3: Energy Systems	Text Region		140	140	10	18	Spelling is ExxonMobil	Corrected
Chapter 3: Energy Systems	Figure	1	143				So, why would there not be mention of other possibilities for emissions--so indicating what could be done? So, include citation of the Jacobson et al. possibilities, projections and possibilities mentioned by the Rocky Mountain Institute, etc. Just giving the fossil fuel company projections gives the impression that not much can be done. I think the chapter needs a sub-section on what technological experts are saying what might be possible (so not due to policies, but technologically possibilities).	We include a larger set of scenario approaches and results, demonstrating other plausible futures
Chapter 3: Energy Systems	Text Region		144	144	3	3	Very interesting figure, although the way it is shown it sort of looks as if future production will be coming mostly from the light blue area of resources that will remain in place. I would think that rather than the ellipses, another shape might give a better indication that current emissions are mainly coming from proved reserves. And perhaps add some sort of shape to indicate how large an area is being covered by each year's (or decade's) emissions. I'm also troubled that this figure is said not to be to scale--that seems a serious limitation.	This figure is included to demonstrate how the US DOE EIA calculate resources, not how they *should* be calculated.
Chapter 3: Energy Systems	Text Region		144	144	15	17	The phrase "precipitous increase" seems very strange, given that a precipice is usually a cliff headed downward.	Changed
Chapter 3: Energy Systems	Text Region		147	147	3	3	This is very helpful to include, but there is no association here of these findings and the tie to calculation of CO2e emissions. This association and its significance needs to be explained. There is also an aspirational goal of 1.5 C that might be mentioned. Also, it needs to be said somewhere here that continuing at a 1.5 or 2 C warming will be disastrous for society, at the very least in terms of ultimate sea level rise likely to be well over 20 meters.	A discussion is included in the beginning of the chapter The aspirational/backcasting scenario approaches are now included in the review.
Chapter 3: Energy Systems	Text Region		163	163	2	2	This is quite a strange table, the fossil fuel columns indicating the reserves (so what might be used over many decades) and the nonfossil column giving the installed capacity in 2015, as I understand it. This inappropriately makes the potential role of nonfossil look very small, especially as there is no way that all or even a small share of the reserves could be made available in a single year (and one would not want to do this). I just think these different aspects are very important and there needs to be a real separation of the two set of information.	This tables is now separated into two different tables: data for reserves from that of install capacity of renewables
Chapter 3: Energy Systems	Text Region		166	166	1	2	This title has to indicate that this is assuming no additional policies after something like September 2016 or whatever the date is. This table is looking forward 23 years or so. If one went back 23 years, so to 1995 or so and showed the projections from then with no policy assumptions, the reference case would be much higher and quite likely so would the other estimates. In any case, this chart simply has to say with no more policies. I'd also note that were there a case that involved adding in a high-voltage/direct current grid, that case would make renewable electricity a far less expensive energy source for transportation and for electricity supply and change this case greatly. So, basically, these cases assume only non-revolutionary introduction of energy technologies. Same comment applies to the tables for Canada and Mexico.	We provide further clarification of in the text for this table
Chapter 3: Energy Systems	Text Region		169	169	3	5	I think it needs to be explained that if this is really just the capacity of solar that is on the grid (and EIA only counts solar that is larger than 1 MW), that the EIA capacity of distributed systems that are not counted as on the net but are on people's homes and on other buildings have a capacity that is about equivalent to the grid solar capacity--so the values shown may well be low by a factor of 2.	These data are from IEA not EIA?! As mentioned, there will be a discussion of this issue of lack of inclusion of smaller generation plants
Chapter 3: Energy Systems	Text Region		170	170	2	4	It needs to be said that these are values for the grid-oriented systems and does not include the production from distributed systems smaller than 1 MW.	We mention the limitations of the EIA electricity data complication figures and provide further clarification and references
Chapter 3: Energy Systems	Text Region		172	172	2	4	The figure does not seem to support the statements that China is now the leading emitter of GHGs. Why is this?	The chapter does not make the statement that China is now the world's leader emitter in this chapter, as that statement is out of the scope of the review
Chapter 3: Energy Systems	Text Region		173	173	2	3	If these are no new policy cases, this needs to be indicated in the caption	Assumptions in the models are furthur clarified in the text
Chapter 3: Energy Systems	Whole Chapter						This chapter could benefit from adding more charts and graphs. For instance: 1) A chart demonstrating the decline in energy use and CO2e emissions 2) A chart demonstrating the increase in natural gas share of primary energy and electricity generation 3) A decomposition of the Kaya Identity components 4) a chart (and better table) for the projection of NA Co2 emissions scenarios	We now includes these charts
Chapter 3: Energy Systems	Whole Chapter						This chapter should contain more details of carbon management options in the energy systems, such as carbon capture and storage. Coverage of alternative fuels and their implications seems adequate.	We include a discussion of mitigation options for each sector along with costs that will include the presentation of 'deep decarbonization'. We also include a discussion of CCS in separate section
Chapter 3: Energy Systems	Whole Chapter						I am surprised that there is no mention in the key points for the chapter of other aspects of fossil fuel use that affect the climate, so nothing apparently on black carbon emissions (from diesel exhaust, fires, etc.), of hydrocarbon and related emissions that lead to tropospheric ozone and contribute to regional haze, and nothing on associated SO2 emissions that exert a cooling influence. The document--and this may need to be up front--needs to make clear that this report is not a complete examination of how fossil fuel affects North America and is not a carbon footprint for North America. Unfortunately, the way the report reads in some locations, it sounds as if this report is implying that it covers the influence of our energy system on the climate, and that this is not fully the case needs to be stated.	We include a discusssion of the calculations of CO2e, but it is in the Preface, as it relates to the entire volume
Chapter 3: Energy Systems	Whole Chapter						It seems to me the chapter needs to have a section on what various experts are projecting is possible to do--so, for example, Jacobson et al. argue that US could be 100% on renewables by 2055 while his critics say it might only be 80%. In either case such changes would be huge. So, fine to have main projection based on current policies, but indicating possibilities is important to show in that fear of future change seems to be a key issue. And in doing so, indicating that the set of possibilities seems to keep growing with innovation. So, energy efficiency could greatly improve (e.g., the consulting agency McKinsey saying could reduce emissions 30% at no net economic cost with existing technologies--to what Amory Lovins says that is possible); renewable energy technologies are on path of greatly improving performance, etc. Basically, I think a section is needed on this to really make this energy chapter as complete as is needed.	We include a wider discussion of potential plausible futures in the "Future Outlook" section.

Chapter	Comment Type	Figure/ Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Chapter 4: Urban	Whole Chapter						Chapter 4. Most of the quantification in this chapter is relative (%) rather than absolute in contrast to other chapters. Indeed the abbreviation Tg only shows up twice.	The unit, Tg, is not appropriate for the urban domain because of scale. There are some quantitative statements in smaller
Chapter 4: Urban	Whole Chapter						I wish there were better quantification of the carbon cycle of urban environments. This seems really important but answers seem lacking. This may be because that is the state of the science. So, pls make emphasis on this to clarify the lack of consensus so that future science and accounting efforts may be directed here.	Sentence added on page 174: "Nevertheless, more research is needed to quantify urban carbon fluxes using common star
Chapter 4: Urban	Text Region		175	175	11	14	It would also help to provide percentage of population living in such areas	This has been added to the text: "….but are estimate to contain 81.5% of the North American population."
Chapter 4: Urban	Text Region		175	175	19	25	It needs to be said somewhere that this report is not a carbon footprint for North America as it does not account for energy to make products coming into (or going out) of the US, etc. So, talking about carbon footprint here is a bit different than what this report is about.	This sentence has been changed to refer to "carbon flux studies"

units (e.g. tonnes of carbon) in the chapter. The use of % instead of absolute quantification is a limitation of the literature

ıdards and definitions."

Comment type	Chapter	Comment Type	Figure/ Table Number	Start Page	End Page	Start Line	End Line	Comment	Response	
Public	Chapter 5: Agriculture	Whole Chapter						Page 231. Key finding 1. Too many significant figures in values , also no uncertainty giving on values Page 232 Key finding 4: This is a run-on sentence and awkward-break up and rearrange Page 234: Include actual values (Tg) in addition to the % You state that Agricultural GHG emissions for 2015 total 522.3 Tgs CO2eq., which is taken from the EPA GHG Inventory produced in 2017. This estimate is from the Agriculture Chapter (Chapter 5) of the EPA GHG Inventory which is focused on non-CO2 emissions (CH4, N2O) but also includes some minor amount of CO2 emissions from liming and urea additions to soils. However, I don't think it's very clear from reading this that the "Agricultural" emissions you present here do not include the significant agricultural activities that are covered in the Land Use, Land-Use Change, and Forestry (LULUCF-Chapter 6) of the EPA GHG Inventory. Within Chapter 6 are all of the carbon stock changes (i.e., soils, above/belowground biomass, dead wood and litter) from croplands and grasslands and lands that convert to cropland/grassland (e.g., forest land conversion to grassland). Additionally, within the Chapter 6 are some additional non-CO2 emissions from agriculture such as grassland fires. The fluxes within Chapter 6 represent both emissions and sequestration, and are often presented as net values, thus making it difficult to reconcile with Chapter 5, which only presents some emissions from Agriculture and none of carbon stock changes. However I think it is important to explain this to the reader and potentially even provide the carbon stock change estimates from cropland and grassland that are presented in Chapter 6 so that the reader has a more complete picture of total agricultural emissions and removals.	We removed all decimal place components of values. Uncertainty is provided in a footnote to Key Finding 1 and under 5.8.1 Inventory Uncertainties. We altered Key Finding 4's wording.	
Public	Chapter 5: Agriculture	Text Region		213	213	22	23		Added clarification to a footnote for KF 1 and at several palces in chapter text.	
Public	Chapter 5: Agriculture	Whole Chapter						Agricultural intensification practices is most likely to have positive effect for carbon sequestration and reduce land take as well as GHG emissions.	a central issue is how we handle SOC responses to management and that we'll want to align ourselves with the soils chapter as well	This is what the chapter is implying saying, however it does caution and inform concerning the limitations of benefits
Public	Chapter 5: Agriculture	Whole Chapter						This chapter should contain some of the underlying science for carbon management options such as biofuels. There are basic science questions on the extent to which biofuels are carbon-neutral (or not), that should be addressed in this chapter.	This chapter did include biofuels because of its potential importance. The issue of C-footprint biofuels was not pulled out as a separate section rather it was addressed within the context of perennial systems (section 5.3.1; P 216 L 15- P 217 line 2, and annual systems within the context of management practices 5.5.1. The carbon footprint of a biofuel depends upon the feedstock and the associated management. (added to 5.2).	

Public	Chapter 5: Agriculture	Text Region	213	213	22	24	It needs to be stated in the text or the footnote that this is the CO2e defined using the 100-year GWP. Using this is an approximation from modeling for a specific period--and the choice of period matters. If one really wants to limit temperature change over the next few decades, it is really more appropriate to be using the 20-year GWP, which will better represent the relative effects of methane as compared to CO2 emissions. Also, four-figure precision seems overly precise estimate, especially given various uncertainties (if said was exact same technique as before and this is done to see difference, that might be a justification--otherwise, seems overdone in my view).	Addressed.
Public	Chapter 5: Agriculture	Text Region	221	221	6	13	Just to note it would be interesting to have these numbers also using 20-year GWP to see which are most important priority contributing to warming over next decade or two.	We now specify, eslwhere in the chapter, that these estimated are for the 100-yr GWP. Further calculations are not necessary.
Public	Chapter 5: Agriculture	Text Region	223	223	40	40	Does "This" refer to absolute amount or percentage. Note clear.	Text was slightly modified to address this.

Chapter	Comment Type	Figure/ Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Chapter 6: Social Science and Carbon	Whole Chapter						Page 252: Chapter 6. This chapter reads largely like a textbook and social commentary. Its interesting but this is not the way to entrain social science within the carbon cycle research. It does not realty fit in the SOCCR report. Make it an appendix Page 252: Try to be quantitative in these finding. E.g. line 24 Key finding 2 Opportunities to reduce emissions BY XX Pg C and 24 capture carbon BY XX Pg C can be identified"	The chapter attempts something different, i.e., to see the carbon cycle within social science research. In that way, chapter authors are trying to demonstrate that using this different framing, different insights can be obtained. Based on consultation with the report's Science Leads, it will stay in the report rather than being an appendix. In response to the second part of the comment: To date, very few attempts to quantitatively estimate the social potential for emissions reductions (as opposed to the technically feasible potential for emissions reductions) have been made. A new section of the chapter reports quantitative estimates for reductions in household emissions.

Chapter 6: Social Science and Carbon	Text Region	252	253	33	3	Key Findings 4: Which part of the message is low confidence? That these nations can transition? That stakeholder involvement will improve the tailoring? Also: the second and third sentences are so broad and inclusive as to be meaningless. Also: on what social science evidence is the stakeholder involvement sentence based?	The finding has been deleted.

Chapter 6: Social Science and Carbon	Whole Page	253	The first paragraphs give very broad brush overviews of 'what social science can do.' But its so broad brush and holistic not applied, delving immediately into issues of data issues and systems analysis, that it is not a great introduction. An improved introduction would be grounded more into the social dimensions of the carbon cycle. It may be that this current approach is necessary given the intended audience, but I don't think it quite gives non-social scientists enough to grab onto and be excited to read further.	The first paragraphs have been extensively revised to be more specific about the framing of the chapter.

Chapter 6: Social Science and Carbon	Whole Chapter	The chapter as a whole tends to be too inclusive in its systems approach, i.e. the idea that social systems and carbon have technical, economic, etc., dimensions. Which may be true, but it doesn't give readers an idea of an entry point to use to begin to analyze the system. There are too many sentences that have lists of all these factors, or list components of social science research.	Entry points to a social system with embedded carbon can be seen in any one factor or combination of factors, depending on the social conditions and restraints in a particular place. The authors have added text to make this point clearer.

Chapter 6: Social Science and Carbon	Whole Chapter	The chapter as a whole has a mix of very broad generalities and in-depth detail about social science. But it is still fuzzy about the actual social dimensions of the carbon cycle are. The chapter would be more powerful if it followed a structure that focuses on the topical dimensions of the carbon cycle & different social actors (e.g. production, consumption, industry, household) rather than a broad paragraph on social science methods, followed by really specific details on energy efficiency, then a broad paragraph on social practices. Right now, the chapter reads on a chapter on the social science of carbon cycle' not 'social/human	The intent of the chapter is—as the commenter says—to gain a different perspective—rather than the “social/human dimensions of the carbon cycle,” the chapter is framed as the “carbon cycle dimensions of human systems.” Different social actors with different abilities and motivations act differently within each broad area (production, consumption, industry, household). The strength of the social sciences is in researching these different abilities and motivations. The chapter revisions try to make this clearer.

Chapter 6: Social Science and Carbon	Text Region	260	260	29	41	In section 6.2.4 or elsewhere in the chapter consider discussing nuclear power as a source of energy that could reduce emissions from energy use. E.g. in 2016 it was the largest source of non-fossil-fuel-based energy consumption/production in the US and currently supplies about 20% of electricity in the US (https://www.eia.gov/energyexplained, also see Ch3 of this draft report).	A sentence has been added that recognize sources of non-fossil-fuel-based energy, including nuclear.

Chapter 6: Social Science and Carbon	Whole Chapter	The text of this chapter is well-written, however it is hard to extract major messages. Importantly, there is much greater emphasis on research gaps than on clearly outlining what research can tell us now and how this knowledge might be used. This is problematic as it risks conveying a sense of an arena of work that has produced little of use to public and private decision makers. Especially in the early pages, I had the sense that the purpose of this chapter is to comprehensively describe the scope of social science research approaches related to carbon, rather than is known about social dimensions of the carbon cycle . Relatedly, I encourage	The commenter is correct in that the purpose of the chapter is to describe social science research approaches related to carbon. Revisions have focused on what the research can tell us now and how such results can be used. Research needs have been prioritized.

Chapter 6: Social Science and Carbon	Text Region	253	253	17	22	Here or elsewhere, can you clarify which of these areas represent the greatest magnitude (in terms of impact on the carbon cycle) and which of these have a sufficient body of evidence on which to anchor findings / conclusions in this chapter. For example, will this chapter primarily deal with energy use or will it address other ways people engage with the carbon cycle?	Comparing the magnitude of impact on the carbon cycle of various lines of research is complicated in the same ways as measuring urban emissions is (see Chapter 3). The chapter deals more extensively with energy use because energy efficiency potentials have received more attention and funding than other areas, so more can be reported.

Chapter 6: Social Science and Carbon	Text Region	253	253	21	22	Here or elsewhere, perhaps include reference to how changes in the carbon cycle are associated with financial vulnerability. For example, the retirement savings of many North Americans are invested on their behalf by pension funds and other fund managers. There is growing awareness of the significant and poorly quantified climate-related risks embedded in these funds (and the associated risks to incomes in retirement).	Chapter authors agree that this is a relevant topic, but risk and financial vulnerability are outside the scope of the chapter.
Chapter 6: Social Science and Carbon	Text Region	256	256	20	22	What is the evidence for concluding people must change their living standards? This seems to suggest lowering quality of life, but many emerging low-carbon technologies could deliver equal or better quality of service; some may lead to reduced household costs.	The intent was not to indicate that people would be worse off by such changed living standards; the sentence has been revised.

Chapter 6: Social Science and Carbon	Whole Chapter					Early in the chapter, it would be helpful to have some frame of reference for what the reader will learn. For example, will the chapter focus on research related to individual decision makers, or will it also consider research related to public and private institutions as mediators of human choice?	The introduction has been revised to indicate that there will be discussions of both individuals and different kinds of groups as well as other clarifications.
Chapter 6: Social Science and Carbon	Text Region	257	257	38	39	Please note any existing examples of programs that have attempted this drawing together. In general, a reader could take the impression that social science research related to the carbon cycle lacks coherence. If this is the case, perhaps say so explicitly and make recommendations for how this could be improved.	Example programs can be found throughout Chapter 6; a sentence has been added to make that point. If by coherence, a standard set of methodologies applied widely is meant, then the comment is correct. However, the contention of chapter authors is that a multiplicity of methods that can be applied to different situations is actually a strength; a sentence has been added to that effect.
Chapter 6: Social Science and Carbon	Text Region	258	258	36	36	What existing situation?	The sentences following this first sentence in the paragraph describe the existing situation.

Chapter 6: Social Science and Carbon	Whole Chapter	The Chapter is well written and well organised but is somewhat incomplete. Economic system and institutions and it's role is conspicuous by absence except very marginally under 6.2.3. I think careful drafting of the chapter bye-passing the economic system and behaviour of individuals as an economic agent will only delay solutions in an integrated way. In a report so well written and for an economy reliant so much on market institution expectation was to see how other social science approach is integrating with economic science approach. It is somewhat disappointing.	Economic analysis in general has been well covered by the Intergovernmental Panel on Climate Change and by a National Academy of Sciences report on The Social Cost of Carbon. Economics has been the basis for a large literature; most studies assume that people will respond to scientific information and make decisions based on cost. This chapter's authors discuss research that demonstrates the importance of other factors such as what other people do, what cultural and social practices and preferences exist, leadership, existing infrastructure, convenience, etc. These latter factors have been neglected in the research, although the authors agree that market structures and institutions are important.

Chapter 6: Social Science and Carbon	Text Region	263	263	17	26	It is disturbing to see that future framework for research wants to shift from efficiency,carbon price. Infact what is needed is how with these main stream policies there can be more enabling conditions, action, policies, governance frameowrk....	Carbon pricing has a long theoretical history and a shorter history of experiments that have mixed results. The National Academy of Sciences report, The Social Cost of Carbon discusses the many factors involved in setting a value on the damage from carbon emissions. The emphasis on this chapter is on what the commenter calls enabling conditions—not just policies and governance frameworks, but a range of psychological and sociological factors that facilitate or inhibit change.
Chapter 6: Social Science and Carbon	Whole Chapter					Embedded carbon is very much associated with trade flows which is conspicuously absent in the chapter especially when the carbon cycle in north America is seen in global perspective.	This is an important topic but outside the scope of this chapter.

Chapter 6: Social Science and Carbon	Whole Chapter	With the world headed toward overshooting the temperature objectives of the Paris Accord, much less returning the global average temperature to less than 0.5 C for reasons described in Hansen et al., there is increasing discussion of the requirement for negative emissions--indeed there is some mention of the possible need for this in the carbon cycle chapter (apologies if I missed seeing discussion of this in my quick read). Approaches include ones that return carbon to the soils, increasing transfer to the oceans, and directly removing it from the atmosphere. I would think that it would be useful in this chapter to start to build the base social science information	The points are well taken but outside the scope of this chapter, which does not cover specific prospective technologies.

Chapter	Comment Type	Figure/ Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Chapter 7: Tribal Lands	Whole Chapter						Chapter 7 Page 286: line 31:Wouldn't exporting renewable energy (from e.g. solar and wind farms) from tribal lands be a major opportunity Page 288: line 19: perhaps include total and per capacity CO2 emission from tribal lands Page 290: line 28: Be quantitative on land use fluxes and energy production on tribal lands Page 291 line 9: This is a SOCCR report and should report on carbon not on $$ values Page 293 line 7: This statement should be at the start of the chapter :"A quantitative assessment of the carbon stocks and fluxes for indigenous lands does not exist " Page 296: line 18: There are some relevant fact on online energy/ ff resources such: http://www.ncai.org/about-tribes/demographics	We thank the reviewer for these coments and address each in order: 1) We now address renewable energy much more specifically throughout the chapter; 2) unfortunately, the data don't exist that would allow us to cacluate total and per capcity CO2 emissions from tribal lands; 3) again, unfortunately ther are not sufficient data for quantitative flux on tribal lands; 4) we appreciate this perspective and have more consistently focused on C when at all possible, but economics are a part of the C story; 5) we have further emphasized this important point earlier in the chapter; and 6) thank you for this resource.

Chapter 7: Tribal Lands	Figure	7.2	309				This figure seems both anachronistic and stereotypical. Most NA communities are no longer agrarian or ranching in the way that this figure depicts. I am concerned that NA readers, and other readers, will misinterpret this figure as being too stereotypical and not representative of current NA societies.	This is an importat point to address.
Chapter 7: Tribal Lands	Text						Somewhat ironically, a number of the tribes were relegated to what were viewed as the worst lands, and now they are turning out to be some of the sunniest and windiest lands in the nation--so potentially excellent for development of renewable resources if good connections can be made to long-distance electric transmission lines (e.g., preferably high-voltage, direct current lines). So, in a good number of situations, the potential prospects for renewable energy development would seem to be strong.	We now address renewable energy much more specifically throughout the chapter.
Chapter 7: Tribal Lands	Text						Just a note that I think the law was just approved that added something like 5 additional tribes in the state of Virginia, so this number may need updating	This is an importat point to address.
Chapter 7: Tribal Lands	Text						It is a bit disconcerting having the area first given in acres (an English unit, I guess) and then for the biggest one to give its area in square kilometers. The same unit should be used--Chapter 9 on forests uses hectares, and that would actually be a good and uniform unit for the report. It would also be helpful to give an indication of the percentage of US area that are tribal lands and to perhaps pick out a state or two of similar size to the tribal area to further give an indication of why considering tribal lands separately is important.	Units have been kept as consisent as possible within and throughout all chapters.

Chapter	Comment Type	Figure/ Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Chapter 8: Atmosphere	Whole Chapter						Chapter 8 Page 311: line 31: unclear if [high confidence likely] refers to the top down estimates or to the comparison between bottom up (last sentence) and top down Page 395: line 7 be quantitative about increase in productivity I had nearly given up hope of finding much useful and reliable information from this report until reading Chapter 8. This important chapter should serve as a model for the report, and is far superior to Chapters 1 and 2 in terms of cogency, specificity and quality of scientific analysis. I was particularly glad to see a discussion of the degree of (dis)agreement between different estimation methods, e.g. the US EPA approach vs that from atmospherically constrained ("inverse") flux modeling. Whereas Chapter 2 comes to indefensible conclusions on fossil fuel emissions, understating the evidence for their reduction over the last decade based on extremely weak statistical methods, this chapter somewhat *understates* some quantitative evidence that would actually strengthen the stated conclusions. In particular, stronger statements could be made based on the data shown in Table 8.1, and especially, Figure 8.3. Specifically, the temporal trend in the strength of the North American land sink, as shown in Fig 8.3, can be estimated with a simple linear regression. This would almost certainly show that sink to be significantly different from zero at a high probability, and at an even higher probability if, instead of using the mean of the four inverse models, the data from each model is kept distinct. Similarly, stronger evidence regarding the apparent trend difference between temperate and boreal NA--an ecologically important result--can also be stated. Also, if the stated standard deviations in Table 8.1 truly are such (that is, obtained from statistical distributions), then all possible pairwise comparisons of the five estimates (four inverse models, plus US EPA's method) gives quantitative evidence on which of them is most anomalous--and the data provided indicates that this would almost certainly be the EPA estimate. Even the inter-annual flux *variances* can be evaluated probabilistically, albeit with very low power. Nevertheless, the authors' conclusion that the annual-scale variance for the United States land flux is almost certainly much higher than what the EPA claims, seems very likely, given the data presented. The first paragraph of the Introduction could be expanded upon for clarity. It should be made clear that the focus of the chapter is not actually the atmosphere itself, but rather on GHG measurements thereof that are used as constraints on land flux estimates, via inverse modeling. I don't agree with the assertion (p. 322, top) that the ongoing biomass rebound from past land clearing is necessarily "short-lived" relative to CO2 fertilization. Biomass accumulation is very context- (e.g. forest type and climate) dependent, and CO2 fert. has both taxonomic and temporal-scale uncertainties. In some NA forests, the very high potential biomass forests of Pacific North America in particular, biomass accumulates over many centuries, even over a millennium, before reaching equilibrium, and no North American forest type equilibrates in under roughly two centuries. The bottom line is that, even aside from land use change, a high potential for biomass accumulation still exists in the forests of North America, and this fact should not be minimized, because it is important both ecologically and atmospherically.	Removed "confidence level" text for KF 2 and 3. Second comment is not for chapter 8. (1) The uncertainties of the inverse model estimates we use are not well-characterized, which precludes standard statistical tests, nor are the inverse model estimates independent of one another since they use the same assimilation data. For these reasons, we prefer the simpler summary statistics presented in the text. (2) The first paragraph has been augmented, as suggested. (3) Point taken tha the land-use recovery sink may not be short-lived. However, this is why the text says "potentially short-lived". No change needed. (4) An extract of Figure 8.1 without fluxes has been created for the Executive Summary.
Chapter 8: Atmosphere	Whole Chapter						Figure 8.2 is very useful--the kind of graphic that should be present throughout the report, but isn't. Figure 8.1 on the other hand is a bit confusing (why the two different measurement scales, and shouldn't the histograms at the bottom be the actual focus?) and it also seems to belong in Chapter	

Chapter 8: Atmosphere	Whole Chapter					Impressive assimilation of information, and summary of how far research has come over the past couple of decades. I was surprised, however, that there was not a bit more discussion about other carbon-related impacts on climate that might be considered, including tropospheric ozone precursors, black carbon, non-black carbon (e.g., wildfire emissions), and even SO2 leading to sulfate. I would think it should be made very clear that this report is not nearly a full analysis of the climatic (and so also sea level) effects of fossil fuel use and land cover change.	These topics are beyond the scope of our chapter.
Chapter 8: Atmosphere	Text Region	311	311	32	33	Should specify the time period.	Fixed.
Chapter 8: Atmosphere	Text Region	312	313	40	5	Consider also citing papers by Turner et al. (2016), Rigby et al. (2017), Turner et al. (2017), and Worden et al. (2017), which present competing hypotheses. Turner, A. J., D. J. Jacob, J. Benmergui, S. C. Wofsy, J. D. Maasakkers, A. Butz, O. Hasekamp, and S. C. Biraud (2016), A large increase in U.S. methane emissions over the past decade inferred from satellite data and surface observations, Geophys. Res. Lett., 43, doi:10.1002/2016GL067987. Worden, J. R., A. A. Bloom, et al. (2017), Reduced biomass burning emissions reconcile conflicting estimates of the post-2006 atmospheric methane budget, Nature Communications, 8:2227, doi:10.1038/s41467-017-02246-0. (Full references for the other two studies are already included in this report chapter.)	Turner et al (2016) is indeed relevant, and that reference has been added. A discussion of the isotopic signature of biomass burning (cf Worden et al) has been added.
Chapter 8: Atmosphere	Text Region	316	316	1	9	I think this section on "Process Tracers" could be combined with the previous section on "Other Species." Also, the aircraft campaigns described here should actually be moved to the section above on "Vertical In Situ." And the info in the "Vertical In Situ" section on COS, 14C, etc. should be moved to this section.	Interesting suggestion, but a restructuring like this would be a pretty fundamental change, necessitating further review. The current structure organizes the important concepts in an efficient manner, and therefore we choose not to change the structure.
Chapter 8: Atmosphere	Text Region	320	320	15	22	Also cite Turner et al. (2016) (central U.S. oil and natural gas production as contributor to global CH4 increase), and Worden et al. (2017) (decreased fires together with increased fossil fuel emissions could explain both CH4 concentration and isotopic composition trends). In addition, Franco et al. (2016) use ethane data and Helmig et al. (2016) use both ethane and propane data to suggest that N. American oil and natural gas activities are likely the cause of observed atmospheric growth in ethane and propane concentrations over the past decade.	Turner et al (2016) is discussed elsewhere in the chapter and for reasons detailed in that section is considered too controversial to merit mention in this section on global CH4 abundance.
Chapter 8: Atmosphere	Text Region	320	320	23	24	Given that global CH4 emissions have been increasing, North America's absolute CH4 emissions may not actually be "holding steady." I suggest commenting on the absolute emissions here.	This has been reworded to indicate that inventories and inversions fail to reveal a trend in CH4 emissions.
Chapter 8: Atmosphere	Text Region	322	322	13	20	What may be even more important than the overall N. American trend is attribution to different sources. I recommend discussing attribution issues, e.g. contributions of fossil fuels vs. agricultural and other sources, noting the uncertainties and data limitations where appropriate. This could also be a place to discuss the attribution information provided by related tracers, such as ethane, propane, and CH4 isotopes. Also, this paragraph is lacking in references.	Section 8.6 has been substantially revised to address these points, among others. We agree. Text has been added to address this comment.
Chapter 8: Atmosphere	Text Region	327	327	7	8	Could also mention uncertainties associated with inverse models.	

Chapter	Comment Type	Figure/ Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Chapter 9: Forests	Whole Chapter						My report on the Amazon rain-forest devastation is done with extensive peer review and will be published soon. In my report I prove these things: The oceans are not a sink for carbon dioxide. The rain-forest burning the biomass waste from 2 billion acres since 1950 is responsible for 40 to 60 ppm of the carbon dioxide rise 1950. If we stop this and delay the burning for 10 years then the rain-forest will heal and the ppm level will go down. Also we need to plant 100 million native trees and shrubs in 2018 and this will help bring it down in 10 years. We have worked long enough to limit the production side of carbon dioxide and now we need to fix the consumption side.	Thank you for the comment. We have made every attempt to incorporate the latest peer-reviewed reports and literature on carbon cycle science and management in forests of the United States, Canada, and Mexico, with particular emphasis on the years 2004-2013.
Chapter 9: Forests	Text Region		342	342	25	25	Regarding the phrase "Net uptake of -217 Teragrams of carbon (Tg C) per year by forests" is a very confusing phrase as the forests are actually taking up the 217 Tg C and I am assuming the negative sign is put there to be indicating that it is being removed from the atmosphere, but given that the phrase uptake by forests is there I would argue that the minus sign needs to be dropped, or the wording literally would mean the flux is from the forests to the atmosphere.	We recognize the concern and struggled to make this intuitive and clear given the conventions that different communities and individuals adopt. The comment correctly interprets the negative sign - it indicates a removal of carbon from the atmosphere. By placing this in the context of "net uptake" the negative sign is confusing or ambiguous. The negative sign has been removed, in alignment with new, clearar guidance from the overall leads for SOCCR2.
Chapter 9: Forests	Text Region		342	342	32	32	It seems to me that this should be giving a comparison of amounts of land carbon now and preindustrial instead to talking about an increased rate of transfer. What I want to know is if we have restored the carbon that was emitted by land cover change (or even stored more), or if there is still a deficit compared to preindustrial.	The comment raises an interesting question but one that we have chosen not to highlight in a key finding. We see that the reviewer found this information later in the chapter as noted in a comment that follows.
Chapter 9: Forests	Text Region		343	343	13	14	In the tribal chapter they used acres and square kilometers to describe area (I urged use only one) and here the area is in hectares. It really seems to me that one unit is needed, probably hectares throughout the report.	Thank you for the comment. We agree that common units should be used throughout the report and we are working with Review Editors and the Science Leads to ensure consistency within and between chapters.

Chapter 9: Forests	Text Region	343	343	19	20	The implication of the phrasing here is that forest management could offset all of the fossil fuel emissions, and this is simply not the case given current fossil fuel emission levels. Fine to say offset some of the emissions or that this could be critical once fossil fuel emissions are way down and only remaining fossil fuel for aircraft and other special needs is going on, but no way that forest management could offset ongoing fossil fuel emissions and this should not be even implied--fossil fuel emissions simply have to be cut a very large amount.	Thank you for the comment. This sentence was not meant to suggest that all GHG emissions can be offset by forest management activities. Given the broad nature of the statement and unique country-specific circumstances the authors agree that the text, as written, is appropriate.
Chapter 9: Forests	Text Region	344	344	21	23	Given the controversy about it, the harvesting of forests to generate pellets that are mostly exported to Europe and simply burned needs to be mentioned--this harvesting involves essentially no storage and really takes the carbon stock down with recovery of the carbon taking many decades, so there can be warming due to this.	Thank you for the comment. Some carbon is transferred to harvested wood products following harvest. The carbon in fuelwood (including pellets) and mill residues is assumed to be lost to the atmosphere (burned) in the year of the harvest whereas sawnwood and panels used in buildings may be held for decades to over 100 years. This point has been clarified in the text.
Chapter 9: Forests	Text Region	345	345	2	2	How about converting this to mass per hectare, keeping units more consistent.	Thank you for the comment. We are working with the Review Editors and Science Leads to ensure unit consistency throughout the chapter and between chapters while also taking scale into consideration when reporting estimates and choosing units.
Chapter 9: Forests	Text Region	345	345	18	20	I would suggest that this should only really be counted if it is doing more than the forests were doing preindustrial--so really what should be counted is the recovery to the preindustrial/presettlement forest stock or something like that. Otherwise, this term is likely, in essence, including take up of emissions from natural sources and not human-induced activities. Given that forests may have been near equilibrium, this may be a moot point for forests--but the counting of uptake by coastal waters (in at least some areas) is likely including substantial uptake that results from the emission of CO2 in ocean upwelling areas as waters warm, and this should not be counted as part of the North American sink to the extent that one is trying to balance the human related sources and sinks.	The contemporary rate of carbon uptake/release is a central focus of the SOCCR2 activity, is of major relevance and importance to changes in today's atmospheric CO2 concentrations, and is featured here. The underlying causes of that net rate of uptake are also discussed throughout the chapter, including the legacy of carbon uptake from forest recovery after historical clearing. Reporting the carbon source/sink state of forests prior to human activity or in the preindustrial period (referred to as 'natural sources' in the comment) is beyond the scope of this chapter. Uptake and release in coastal waters and oceans are addressed in other chapters.

Chapter 9: Forests	Text Region	345	345	29	33	Interesting that a 25-year GWP is considered--I thought the convention was to use the 20-year GWP from IPCC. In any case, I've yet to be able to find in this report a clear discussion of the significance of using different periods for the analysis. That this discussion at least mentioned the period is an important step that has not been done in most other places where CO2e is being estimated, etc.	We agree that CO2e is an important advance relative to just consideration of CO2, but data on non-CO2 GhG contributions is not always available, hence its use in some but not all cases. There is not, we believe, a singular convention on the time frame for GWP, and in fact, this is a subject of much debate. For this chapter, we drew upon what was available in some of the national inventory reports in North American countries adopted a 25-year GWP in their reporting to the UNFCCC, and was included here.
Chapter 9: Forests	Text Region	346	346	7	8	Again, I think the use of minus signs here is confusing and not appropriate given that the text indicates what is happening. This is especially the case here where the "stock change" (so not a flux) is given a negative sign when what is happening is a build-up of carbon in forests, at least that is what I gather is happening.	As noted above, we agree and have removed the negative sign here.
Chapter 9: Forests	Text Region	346	346	13	13	To really clearly indicate what is meant, this should say "net atmospheric sink" (as was done on line 10) as that is where the carbon is coming from and the sign convention being used considers a sink. For the forests, the atmosphere is a source of carbon. This could actually better say "Most of the uptake of atmospheric carbon by US forests is in ..."	We agree. Now it reads: "Most of the net sink for atmospheric carbon in U.S. forests is in…"
Chapter 9: Forests	Text Region	346	346	14	18	Again, use of the minus sign while also saying sequester seems confusing and indeed inappropriate. The urban trees are taking up a positive amount of carbon from the atmosphere--if talking about the atmosphere, then the urban forest are removing carbon, but when one says sequester that puts the focus on the urban forests and not the atmosphere, and for the urban forests, the change in storage is positive. Same point applies to use of minus sign on line 15--the sequestration is positive for the forests. And same problem with minus sign on line 18--the sequestering is positive not negative--summarizing the atmospheric balance would show a negative, but not when sentence is addressing the forest carbon budget.	As noted above, we agree and have removed the negative signs where needed. This should, we believe, address the concerns raised here.

Chapter 9: Forests	Text Region	347	347	2	26	This section needs to discuss the wood pellet aspect of the issue--where forests are being harvested for immediate burning as pellets--just because the pellets are exported from the US as wood does not get away from the fact that they are immediately burned. This is not sequestration of wood products.	The numbers reported here rely on the production accounting approach that includes the emissions from pellets even if they are exported out of the US and emitted elsewhere. We would also note that much of the source material used in the pellet industry is what would have traditionally been scraps and residues that typically have a short residence time before decomposition and release as CO2.
Chapter 9: Forests	Text Region	348	348	10	18	It would be clearer if this said "atmospheric carbon sink" and then fine to keep the minus sign. Or say creates a carbon sink for the atmosphere of ...	We removed the negative sign on this term and state, "… contributres a sink of atmospheric carbon of X".
Chapter 9: Forests	Text Region	348	348	20	21	Just reading this as written, the minus sign looks to be on the wrong number. If one is talking about the amount of carbon held by the land, forget the sign convention for the atmosphere--so the forest is gaining mass and this should be a positive number, and the loss can be negative or explain the direction in the text without the minus sign. If you want to keep the minus sign then the focus of the sentence has to be what is happening in the atmosphere, not the forest reservoir.	Changed to read, "...with gains in forest land constituting a sink of atmospheric carbon of –23 Tg C per year and losses resulting in emissions of 23 Tg C per year."
Chapter 9: Forests	Text Region	351	351	41	41	Also continuing to 352, line 2, but file did not let me enter this. Note here that the values of the fluxes are listed as positive numbers as I argue is appropriate. What is here is actually inconsistent with the sign usage earlier, so chapter is inconsistent. I would argue that the convention here is correct as it is focused on what is happening to the amount in the forest reservoir and not what is happening in the atmosphere.	Thank you for the comment. For consistency, "sequestration" has been replaced with "carbon uptake" throughout the chpt and sign conventions have been checked for consistency.

Chapter 9: Forests	Text Region	352	352	14	14	I would note that a number of papers (generally relating to the integrated assessment modeling study project overseen by John Weyant) suggest the US estimate of the SOC is a factor of several too low. I do realize the present Administration is saying use a lower number. At the very least provide references citing the range of views about this value.	Thank you for the comment. I acrynomy here (SCC) is referring to the social cost of carbon. Regarding soil carbon, estimates in the US carbon budget are now based on empirical information from the US national forest inventory and the estimates in this chapter reflect the new methods and estimates. The new methods resulted in a 75 percent increase in soil carbon densities nationally and in increase in soil carbon stocks from 17 Pg to 28 Pg. This work is specifically cited in the Soils Chpt of this report - Domke, G.M., Perry, C.H., Walters, B.F., Nave, L.E., Woodall, C.W. and Swanston, C.W., 2017. Toward inventory-based estimates of soil organic carbon in forests of the United States. Ecological Applications, 27(4), pp.1223-1235.
Chapter 9: Forests	Text Region	352	352	40	40	There are some systems, however (chaparral being a key example), where building up the carbon stock really is just building up the tinder for wildfires.	We included this notion with the bold text in: "Important to note is that slowing deforestation and harvesting in one region may simply displace such activities (i.e., leakage) if unmatched by a change in the demand for associated land uses and forest products, **and also that increased carbon stocks in areas prone to severe disturbance may not act as a lasting sink for atmospheric carbon**"
Chapter 9: Forests	Text Region	353	353	5	5	Good, no negative signs on these numbers. Indeed, this part of the chapter seems to be doing well by not including the minus sign.	Right, we agree.
Chapter 9: Forests	Text Region	353	353	11	13	I do not understand how "fuel reduction treatments" have benefits for the carbon cycle--they may well have huge overall benefits by reducing wildfires--so sustaining a higher average loading, but the wording of this sentence does not seem to say that. What is the benefit being referred to?	This has been reworded as: "Fuel reduction treatments that aim to lower severe fire risk may constitute a limited sink for atmospheric carbon because any associated reduction in fire emissions is partially offset by substantial carbon emissions from prescribed burning, machinery, and …"

								Yes, this has been included in the chapter but was not featured as a key finding.
Chapter 9: Forests	Text Region		353	353	17	19	Finally, just the information that I had hoped to see earlier, including in the carbon cycle and other chapters. Very interesting.	
Chapter 9: Forests	Text Region		354	354	23	24	Just so this resolution does not sound like purely wishful thinking (that is, with thousands of foresters marching through every forest, etc.) and is realistically doable, it should be mentioned that this could be (even is starting to be) done using satellites. [I do agree, however, that going to such a fine resolution may start to freak out some groups who would view this as an invasion of the privacy--or maybe saying it would be done by satellites instead of aircraft would help to reassure the skittish.]	We agree, and this is discussed in the section, particularly three paragraphs after this line.
Chapter 9: Forests	Text Region		359	359	3	3	Ditch the minus sign--that applies when talking about the effect on the atmosphere. Here focus is on forests and the forests are gaining mass, and this needs to be a positive sign. If this is all confusing to an expert--imagine what a general reader might think of this.	This has been addressed as explained above (minus sign gone).
Chapter 9: Forests	Table	3	379				IMPORTANT HERE AND THROUGHOUT MUCH OF CHAPTER. The sign convention used in this table is very confusing--showing the forests gaining mass using a minus sign makes no sense at all. Were this referring to the effect forests on atmospheric loading, but that is not what this table is showing. It just has to be changed.	This has been corrected. We retain the convention as adopted throughout SOCCR-2 that treats carbon removal from the atmosphere as being negatively signed. However, when combined with language such as "Forests are a sink of atmospheric carbon amounting to ...", we drop the minus sign.

Chapter 9: Forests	Text Region	346	346	34	35	Could mention that these disturbances are anthropogenic to a certain extent, e.g. influenced by climate change and introduced pests.	While we agree that this is likely, the degree to which human-driven climate change has caused the growth in the severity, extent, or frequency of these disturbances remains somewhat ambiguous. Given this ambiguity, we chose to not include this mention.
Chapter 9: Forests	Text Region	347	347	35	37	Again, point out that these are actually anthropogenic to a certain extent.	Same as above

Chapter	Comment Type	Figure/ Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Chapter 10: Grasslands	Whole Chapter						Chapter 10 Page 395: line 7 be quantitative about increase in productivity	not intended to be quantitative but rather indicate the direction of change. Quantitative examples are provided in details
Chapter 10: Grasslands	Text Region		380	380	15	15	For consistency through the report, it would be good to have it be "Pg C" here and throughout the	Done.
Chapter 10: Grasslands	Text Region		380	380	17	27	drying and warming in the southern Great Plains (and perhaps elsewhere) tend to diminish grasslands; I'm surprised that is not the case and not mentioned. I also thought that wildfires would tend to burn out some of the debris and soil carbon. Given how soils are in regions that were once verdant in times coming out the last glacial when temperatures were cooler, it sure would seem that the extreme warming and	We point out that productivity in southern grasslands may decrease with climate change in section 10.4.3, but we lacked sufficient evidence to make this one of our key findings. Changes over glacial-interglacial time scales are beyond the scope of this report.

Chapter 10: Grasslands	Text Region		380	380	28	31	One really cannot indefinitely suppress fires in such regions--suppressing them tends to build up the stock and then it burns hotter and seems more likely to spread into inhabited regions, as this past fire season has shown. It seems to me that the limits of fire suppression need to be recognized--one cannot just keep	We are not advocating for fire suppression in grasslands. Many rely on regular fires to maintain the vegetation.
Chapter 10: Grasslands	Text Region		381	381	33	34	expanding and getting more Mediterranean like climates, and likely a decrease in average annual rainfall (but with many quite dry years and a few that are exceptionally wet due to the enhancing of extremes), the notion of expanding woody encroachment that will be sustained instead of subject to periodic fire might need to be reconsidered given the increasing variability being found in recent	If fires are allowed to burn, then woody vegetation will tend to be suppressed, unless it is already too well established to burn.

Chapter 10: Grasslands	Text Region		383	383	7	7	To better relate to other numbers used in chapters, I'd suggest giving such uptake rates on a per hectare basis (it would be helpful if chapters were consistent on things--and giving areas in hectares would be a useful choice). Here	We are instructed to use units for fluxes as per m2 per year.
Chapter 10: Grasslands	Text Region		383	383	38	38	Giving 3 Tg here is not really helpful to the reader--given that the earlier numbers are in mass per unit area of grassland, it would be helpful here to also be giving that number, so mass per hectare of grassland. Then I could compare	We calculated the amount to be 120 gC per m2 if averaged over the conterminous U.S. (Section 10.3.1, Conterminous U.S.)

Chapter 10: Grasslands	Text Region		384	384	38	38	reader, it would be useful here to give are in hectares as is done in some other chapters, and then later in this paragraph (inputting of comments did not allow comments extending over from one page to the next) to also give uptake rates in per hectare numbers. It really would help the reader not to have to do the various conversions. So,	We are instructed to use units for fluxes as per m2 per year.
Chapter 10: Grasslands	Text Region		385	385	39	40	What is not mentioned here is that the changing climate will be changing the various timings of weather events, etc.--and so be careful of tying	We added the statement "contingent on rainfall seasonality" to this sentence.

Chapter 10: Grasslands	Text Region		388	388	2	2	29 and the definition of CO2e, it is essential to say that the calculation is done over a certain period of time. Often, the 100-year value of GWP is used, but this is an arbitrary choice--if one wants to focus on what could moderate warming in the short-term, GWP-20 is more appropriate. I have yet to find in the whole report a good explanation of all of this. But here, if 100-	The standard 100-year value is used in this report, and is consistent with IPCC and many other publications.
Chapter 10: Grasslands	Figure	5	410				I'm surprised there is no indication showing fire, flooding rains and other disturbances	focuses on climate change effects for which experimental evidence exists.

Chapter 10: Grasslands	Table	1	411				convention here. Showing uptake by grasslands with a negative sign (which I think is what is being shown) is totally confusing. Yes, the grasslands are taking carbon out of the atmosphere, and if one is showing the atmospheric carbon budget, the grasslands would be a negative number, but when showing the numbers from the context of the grass ecosystem, these numbers have to be	The sign convention is clearly indicated in the table captions. We use negative to indicate uptake in Tables 1 and 2, as this is the standard convention for this report.

Chapter	Comment Type	Figure/ Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Chapter 11: Arctic and Boreal Carbon	Whole Chapter						This chapter is very well put together - it reads nicely, is well-cited, and is comprehensive. It does a good job of highlighting gaps in our current understanding based on poor (but growing) model descriptions and sparse datasets for this difficult region. The figures and tables are appropriate for this material - they are well-cited, clear, and well-organized.	No response needed
Chapter 11: Arctic and Boreal Carbon	Text Region		415	415	41	41	Replace "Canadian" with "Canada"	This typo was corrected
Chapter 11: Arctic and Boreal Carbon	Text Region		417	417	13	14	Alaska, Canada and Greenland are mentioned; then Russia Mongolia and Scandinavia. Is the Tibetan plateau part of the Eurasian part here? Since Tibet is mentioned elsewhere it would be helpful if these were consistent.	Text was added here to properly reference the Tibetan plateau area
Chapter 11: Arctic and Boreal Carbon	Text Region		417	417	21	28	The aim of this paragraph is a bit unclear and it is overly brief - what is the topic sentence? How to fit this information into other parts of the text? Are there citations available to, e.g., define which sites have been recording time-series measurements for a few decades?	Citations were added to reference the time-series; a detailed review of the cited literature is found within
Chapter 11: Arctic and Boreal Carbon	Text Region		426	426	1	13	Here and elsewhere there is heavy reliance on McGuire et al., 2009. Are there newer resources to bring into this or other sections?	A regional (Alaska) citation from 2016 was used here, but overall this section is short with material in the I
Chapter 11: Arctic and Boreal Carbon	Text Region		429		31		Please expand on the cite to Lee et al, 2014 - what kind of progress is made?	Text was added to detail the changes made by Lee et al. 2014
Chapter 11: Arctic and Boreal Carbon	Text Region		429		37		Explain a bit more, about the "fuller suite of processes" necessary for modeling CH4 dynamics.	This sentence was referring to the mechanisms described in the ~3 sentences that preceded. Text was cha
Chapter 11: Arctic and Boreal Carbon	Whole Chapter						This note is checking to see if the system is accepting comments on Sunday Jan 14, 2018. Thank you	No response needed
Chapter 11: Arctic and Boreal Carbon	Whole Page		418				Additional background citations for this section would be helpful even if they reference older work	Historical citations included for this background material
Chapter 11: Arctic and Boreal Carbon	Text Region		423	423	10	11	The text seems to say this already, but it might be good just to specify the flux of carbon in this case is gain in biomass (and soil?) carbon	Text was added to clarify that the carbon flux included biomass and soil carbon change together
Chapter 11: Arctic and Boreal Carbon	Text Region		424	424	21	24	There's a good new citation on this in Nature Climate Change by Crill and Thorton - the mismatch between bottom up and top down estimates, over time. Would be good to cite here.	Citation included
Chapter 11: Arctic and Boreal Carbon	Whole Page		424				Methane section as a whole (continues on 425). There are a couple of new methane papers that would be good to cite in the context of the information here. In particular, a paper about geologic methane by Sachs as one co-author may be helpful - although the temporal scale of that paper is very short. Check this section for other new methane citations that could be updated here.	Citations included
Chapter 11: Arctic and Boreal Carbon	Whole Page		423				Section on upscaling chamber carbon flux. There is a new paper summarizing chambers fluxes from a Finnish group. Check this citation to see if relevant to information presented here.	The proposed citation was a spatial analysis of flux infomration largely overlapping with what was present

Chapter 11: Arctic and Boreal Carbon	Text					There are a couple of new modeling citations that could be incorporated into this section. McGuire et al. 2018; (this is in press and so not sure how it relates to literature cutoff dates); also Burke et al.		
Chapter 11: Arctic and Boreal Carbon	Region	428	428	8	27	and another paper by MacDougall.	Citation included	
Chapter 11: Arctic and Boreal Carbon	Text					Check this section for appropriate citation updates, in particular the thermokarst region there is a paper by Steve Kokelj in Nature Geoscience.		
Chapter 11: Arctic and Boreal Carbon	Region	431	431	14	41	Also take a look at updating remote sensing/browning papers.	Citation included	
Chapter 11: Arctic and Boreal Carbon	Text							
Chapter 11: Arctic and Boreal Carbon	Region	415	415	30	30	What is a "press disturbance"?	Press and pulse disturbances are defined and described in the Introduction paragraph page 413 lines 1-16.	
Chapter 11: Arctic and Boreal Carbon	Text					Just a note that it would be good to try to avoid the word "may" as it conveys no really information--almost anything may happen. I did not read carefully enough to know if done elsewhere, but there		
Chapter 11: Arctic and Boreal Carbon	Region	427	427	20	23	should be effort to use the likelihood and confidence lexicon instead of the word "may"	Text in this section was revised to be consistent with rest of chapter	
Chapter 11: Arctic and Boreal Carbon	Text					Apologies if I missed it during a quick read, but I was a bit surprised not to see any mention in this section of impacts on sustainable harvesting and fishing, etc. Will climate change make it more or less difficult? With permafrost thawing, cold storage is being affected? And did I also miss what will happen as species food sources change and their life cycles change and affect people? What will be effects of less river freezing on salmon and migrating species? Perhaps this is all saved for the actual national assessment chapter on the Arctic, but I'm surprised there is not more in this section on the effects of		
Chapter 11: Arctic and Boreal Carbon	Region	430	430	32	32	all of these changes on humans (increased wildfires creating smoke that disrupts social activities, etc.)	These are all important impacts of a changing Arctic, but do not directly relate to carbon stocks and fluxes.	
Chapter 11: Arctic and Boreal Carbon	Whole Chapter					The chapter has a very helpful set of figures--and overall well done.	Thank you for comment - no revision needed	

Chapter 12: Soils	Whole Chapter						Please update first sentence in section 12.4.3 to reflect estimates of Tarnocai (2006) for peatland C (147.1 Pg C) Tarnocai, C. 2006. The effect of climate change on carbon in Canadian peatlands. Global and Planetary Change, 2006, 53 (4):222â€“232.	Thank you for this reference. The first sentence was updated, and this information was also incorporated into the Evidence Base section.
Chapter 12: Soils	Whole Chapter						Chapter 12 Page 460: line 2: include the time frame over which 55 Pg C would be released (or degree of warming to cause this release)	This is an expecellent point - the answer is 35 years, and this has been added.
Chapter 12: Soils	Text Region		465	465	14	14	Good to be calling the loss of material from soils "losses"--giving the sign. Elsewhere in this volume, using the sign convention for the atmosphere, these changes would have been called Gains (meaning to the atmosphere). The choice here of losses is, in my view, much more helpful to the reader.	It is indeed important to keep the signs consistent. Note that comment #6 also wants a consistent sign protocol. As both reviewers point out, talking about a "loss" of soil C in atmospheric terms would result in a positive sign and a gain in soil C would require a negative sign. This would be way too confusing for any reader, so we eliminated signs and clearly marked all numbers as "gains" or "losses."
Chapter 12: Soils	Text Region		465	465	32	32	Regarding footnote 1, it has to include the time horizon being meant here. I assume it is 100 years, so that should be said. Reference should then be made to the place in the report where there is a real explanation of the implications of choosing different time periods and what this means with respect to determining relative priorities for taking action to limit near-term warming, etc. (right now, near as I have found, there is no such section or box and one is needed).	The first sentence of the paragraph clearly stated over a 100 year time horizon, but we added this to the footnote as the reviewer requested. I agree that it would be nice if there were a discussion of priorities for taking action, but this is well outside the scope of our chapter. Further, such a discussion would likely be considered prescriptive, which is prohibited since SOCCR-2 is not a Federal Advisory Committee.
Chapter 12: Soils	Text Region		466	466	31	31	Properly, "predicted" should be "projected". And this comment also applies to other uses of the word "prediction" in the chapter (starting with several times in this paragraph).	This is a very good point. Throughout the chapter, "projection" now has replaced "prediction" unless "prediction" was directly taken from the title of a paper.
Chapter 12: Soils	Text Region		471	471	26	33	The sign convention used here applies to the atmosphere, which is not mentioned, not to the soil carbon. If the focus is on the soil carbon and its changes, use appropriate signs, with a + indicating a gain and a - a loss. Otherwise, very confusing to the reader. page 474, lines 37-38 deals with the sign issue very effectively by explaining the direction of the flux and leaving off the sign associated with the atmospheric budget--hooray.	This is a very good point. Because it would be confusing to talk about a net gain of C in soil and make it a negative number (because with respect to the atmosphere, it would be a negative flux), we have removed all plus and minus signs, and explained the direction of the flux and leaving off the sign, as suggested here. This has been done throughout the chapter for clarity.
Chapter 12: Soils	Table	2	499				Showing numbers to nine-figure precision is really a good bit overdone, given uncertainties. Same applies to the next table.	It indeed is important to have a consistent determination of significant figures. Because these numbers come from published reports, we did not want to change the numbers. However, we have changed values in the tables to be clearer. For example, "0.0009" has been changed to "<0.01" and no number is reported to greater than one decimal place.
Chapter 12: Soils	Figure	1	501				Very nice and informative figure	thank you!

	Chapter 13 - Public Review Comments & Response							
Chapter	Comment Type	Figure/ Table Number	Start Page	End Page	Start Line	End	Comment	Response
Chapter 13: Terrestrial Wetlands	Text Region		513	513	23	#	I find this wording of this sentence perplexing. Wouldnâ€™t fluxes from peatlands be wetland fluxes?	Yes, peatlands are indeed wetlands. The sentence has been re-wroded to clarify.
Chapter 13: Terrestrial Wetlands	Text Region		514	514	11	#	Unless I'm missing something here, either the 18 Tg CH4 emissions should actually be CH4-C or the sum of -52.5 is incorrect.	Yes, the units re Tg CH4-C; the units have been clarified but we have also now added Tg CH4 to the Table 13.1 as well.

Chapter 13: Terrestrial Wetlands	Text Region		514	514	24	#	In section 13.3.4, you go through the interesting exercise of comparing the NEE - CH4 - DOC estimates to reasonable estimates for soil and plant sequestration. I think that this is great, especially given the paucity of NEE estimates, which you point out. However, one further potential reason for the much higher sequestration estimates is that in mineral soil wetlands there is often a large allochthonous C influx, which wouldn't be accounted for in NEE (except possibly by reducing it due to partial mineralization of the allochthonous C). So one might expect the NEE balance to be less than total sequestration in mineral soil wetlands but not peatlands. Also, it seems to me that soil C sequestration integrated over 100's to 1000's of years would include sequestration in wood (i.e., the trees die and make soil C), so is it more appropriate to compare just NEE-CH4 DOC to soil C sequestration? If you do this one gets the following values (in Tg C): Peat Mineral Soil Seques. -33.8 -20.1 Plant Seques. -38.1 -25.2	We define NEE=NEP = ΔC + export (loss from system) + Oxidation(e.g., fire, UV) - Import (C added from source outside system) [see Lovett et al. 2006. Is Net Ecosytem Production Equal to Ecosystem Carbon Accumulation? Ecosystems 9:152-155]. Accordingly, NEE does include accrual in the soils, but not sedimentation input if from other sources. The NEE will certainly vary temporally, depending on the condition of the vegetation community, climatic conditions, etc. Sustained accumulation within the soil (especially peats) is implicit. We prefer to convey the NEE as presented, as it better aligns with data from eddy covariance studies, while providing a framework for approximation from
Chapter 13: Terrestrial Wetlands	Text Region		553	553	20	#	Should the value of 70 g CH4-C per m2 per year be 7.6 g CH4 m-2 â€“yr-1 instead? Is the correct unit CH4-C and not CH4?	The correct units are g CH4 m-2 yr-1. And values was transcribed erroniously, the correct value is 7.6 g CH4 m-2 yr-

Chapter 13: Terrestrial Wetlands	Whole Chapter						The inventory analysis undertaken here is important. It seems appropriate, relying on publicly-available and cited information, as described in the appendix.	Acknowledged.
Chapter 13: Terrestrial Wetlands	Text Region		503	503	31	#	It would help here to say that terrestrial wetlands take up approximately 53 Tg C from the atmosphere or somehow indicate that the sink refers to being a sink for the atmosphere, which somehow is not really mentioned here. And on line 33, maybe say "atmospheric source" or add "to the atmosphere". I just think it is not as easy as volume assumes to keep thinking about these terms being with respect to the atmospheric budget instead of the budget of terrestrial wetland carbon.	The signage convention, and explicit description of the fluxes and sinks have been incorporated into this Chapter to clarify. We also think that this is a general comment for the volume, so it will also be addressed in introductory and synthesis sections.
Chapter 13: Terrestrial Wetlands	Text Region		507	507	5	5	6-figure precision seems a bit overdone; even 4 figure precision on line 15 seems a bit overdone.	Agreed. The presentation of figures has been constrained to the number of significant

Chapter 13: Terrestrial Wetlands	Text Region		510	510	34	#	I think it would make more sense here and elsewhere in volume to give such figures in mass per hectare of something larger than 1 square meter so easier to get a sense of significance of the change. Comment also applies elsewhere in chapter.	Agreed. The units on the figure have been changes to Mg ha-1, and Mg ha-1 yr-1.
Chapter 13: Terrestrial Wetlands	Text Region		518	518	34	#	Very strange sentence. Why does the model having more wetlands than observed suggest that the observations are incorrect rather than the model being incorrect (by a lot)? And is this difference a large or small fraction of the land area that could be considered wetlands. I'm guessing wetlands are a relatively small amount of total, so what seems like a small difference in allocation of land to various categories ends up with a large percentage variation in wetland area. I think this sentence needs rephrasing or elaboration of some kind.	This paragraph has been rewritten to better contrast the range in wetland area amongst the various reports.

Chapter 13: Terrestrial Wetlands	Text Region		520	520	13	#	I would have thought that Siberia was almost entirely classified as a wetland, and so would be much large than US wetlands. Similarly much of the Amazon and Congo would be wetlands. Do I have the definitions wrong? I think it might help to indicate why other areas such as Amazon and Siberia end up apparently classified as something different. And if North America has such a high percentage of the world's wetlands but is a quite limited fraction of global land area, the percentage of North America that is wetlands ust be much higher than for other continents. Is there a reason for this (e.g., others have drained their wetlands, etc.)? With climate change, will other areas add wetland area (like Siberia, etc.)? Not quite right place in chapter to raise the questions, but it really does seem strange for North America to have such a large fraction.	The proportion of global wetlands occuring in North America depends on the basis; the range in global wetland area varies from 6-29x106 km2 (Melton et al. 2013). Accordingly, we have revised the paragraph to better convey the context, thereby better reflecting variation in global wetland estimates.

Chapter 13: Terrestrial Wetlands	Text Region		524	524	17	#	There is a book by science historian James Fleming, as I recall, about Thomas Jefferson and early efforts to drain swamps and wetlands in the Atlantic coastal plain, sort of referred to as the Englandization of the coastal plain, so trying to make early US like England. And then also on how this may be affecting the sea breeze penetration into the coastal plain--so possibly the earliest mention of how human activities might be affecting the weather (and so the climate) of North America. Just an interesting factoid regarding point that the rate of wetland loss is now greatly reduced.	This is exactly how the "swamps" got the bad name originally, and laid the foundation for land development policies that weren't curtailed until the 1970's.

Chapter 13: Terrestrial Wetlands	Table	1	536				I am concerned about the sign convention in the table. While it is at least explained in the heading, in that one is talking about the carbon budget for the wetlands I think that the signs should relate to what is happening to wetland carbon, not the atmospheric pool (one can use negative sign when showing a table of atmospheric sources and sinks). This is a problem in many, but not all chapters. I am for using the sign appropriate to the reservoir being focused on and not trying to use the sign for atmospheric effect when talking about an ecosystem, etc. It is trying to overdo consistency to the point of confusion for the reader (especially if table gets used without the explanation in the heading). Same comment on Table 2.	We've used the convention adopted by the SOCCR which is to designate the flux direction relative to the atmospheric pool. Accordingly, fluxes into vegetation, soil, water from the atmosphere are negative. The narrative has been updated to try to make the convention clear.
Chapter 13: Terrestrial Wetlands	Text Region		537	537	4	4	Box needs to be changed. One is either certain or not--there are not degrees of certainty. What there are degrees of is confidence, so "certain" should be replaced by "confident"	Agreed. The convention has been changed to "confidence".

Chapter 13: Terrestrial Wetlands	Text Region		552	555	1	#	I'd suggest changing the numbers to be per hectare, which would also be consistent with the units used in Table 13B. I have suggested that per hectare might best be used for all chapters--but some overall decision needs to be made.	This change has been made. See response to commnet on line 9.

CHAPTER 14 SOCCR2 Response to Public Reviews

Individual Comments and responses:

Page 565: line 28: the per m2: is this the surface area of inland waters or the surface area of North America?

This comments was similar to the NAS review and the text has now been changed to "This estimate represents a weighted average of 24 grams of carbon (g C) per m^2 per year of continental area pe

Page 565: line 22: but is burial longer term sequestration and therefor, although small, critical as a carbon sink ?

As pointed out by this review, the burial term represents a potential long term sink for carbon, however as presented in the chapter this is outweighed by the estimate emissions from similar system

Page 570: line 38: different way of expressing uncertainty than other chapters, probably replace by Â± and std dev
In response to this review, we have adjusted the text to show that the percentiles are derived from the summation of data presented in (Butman et al 2016 and Stackpoole et al 2016).

Page 572: line 4 : Here st. dev. does not work as it spans negative concentrations [184.3 Â± 331.1 4 microatmospheres (Î¼atm]

The text has been changed to "with an average of 184

Page 576: line 6: This header "key finding" appears misplaced and paragraph

We must adhere to the established structure of the SOCCR2 document in its entirety, no change has been made.

Page 576. Line 13: Explain lentic and lotic systems

We have adjusted the text to reflect the definition of lentic and lotic systems to increase the accessibility of the writing to a broader audience.

Page 577: line 2: conclusion should be at end, call this summary or highlights
In response to this review we have change the subheading from Conclusions to Summary.

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573 – line 14-15: Seems like there should be some mention of the recent work (shown below) which estimated that from 1780 to 1980 wetland loss due to land-use alterations caused a ca.58% decrease in DOC

Duan, S, Y. He, S.S. Kaushal, T.S. Bianchi, N.D. Ward, and L. Guo. 2017. Impact of wetland distribution on decreasing dissolved organic carbon concentrations along the Mississippi River continuum. Front. M

In response to this comment we have added the statement "Tributaries to the Mississippi have been shown to have decreasing DOC as a function of wetland loss (Duan et al 2017). .

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565 – Line 15: Total flux from where to where--from inland waters to the atmosphere only? Or is this an amount that goes to ocean and/or sediments as well? Clarification on where the flux is going is needed.

In response to this review, we believe that the text in Key Finding 1 clearly states the flux in its parts in the following two sentences. We have made adjustments to clarify the types of fluxes in respo

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565 – Line 29: "processed"--is this word necessary? I'm not sure what it really means. Processed in the analysis, or carbon processed by the waters?

In response to this comment we have changed the word to 'exported'.

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571 – Line 16-17: I'd suggest expressing in mass per hectare as likely a bit easier for people to grasp.

In response to this review, we are required to adhere to the unit convention established for the SOCCR2 document in its entirety. No change has been made.

We are required to adhere to the unit convention established for the SOCCR2 document in its entirety. No change has been made.

This response doesn't really make sense. Here is the response I suggest: "The actual value and its standard deviation are not important to the point we would like to make, which is that surface waters are gr

rocessed and removed through inland waters across Arctic to tropical systems in North America."

s. Therefore we are unable to properly account for the long term role of burial in aquatic carbon cycling.

2 concentrations in the tributaries of the Mississippi River.

Mar. Sci. 3: 280.doi: 10.3389/fmars.2016.00280.

And this number intentionally leaves off Canada and Mexico? Same comment applies to parapgraph beginning on page 570, line 37--clearly state where the flux is going.

nse to the NAS review. We do not believe that additional clarification is necessary. In addition, and in reference to page 570 – line 37, we believe that there is adequate description both within the ta

Chapter	Comment Type	Figure/ Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Chapter 15: Tidal Wetlands and Estuaries	Whole Chapter						TIDAL WETLANDS - MEXICO Jorge A. Herrera-Silveira1 and Andrea Camacho Rico1. 1 Centro de InvestigaciÃ³n y de Estudios Avanzados del Instituto PolitÃ©cnico Nacional, Unidad MÃ©rida (CINVESTAV-IPN, Unidad MÃ©rida) jorge.herrera@cinvestav.mx; galata83@hotmail.com Tidal Wetlands Distribution and Changes In Mexico, the tidal wetlands with greater coverage and importance for the various environmental services offered to society are mangroves. More recently mangroves have been recognized for their importance in the role they play in mitigation and adaptation to the effects of climate change. In Mexico mangroves cover an area of 775,555 ha and have been grouped by the Mexican National Commission on Biodiversity (CONABIO) in five regions. The regions of mangrove in Mexico and their area changes are listed in Table 1. Mangroves are present on the coasts of each of Mexicoâ€™s coastal states. Within Mexico the three states of the YucatÃ¡n region hold the greatest area of mangrove, equivalent to about 53% of Mexicoâ€™s total. Of the seven mangrove species in North America, three are dominant and widespread: Avicennia germinans, Laguncularia racemosa and Rhizophora mangle. Table 1. Regional distribution and changes of mangrove area in hectares (percentage from this) in Mexico (1980-2015, Troche-Sousa et al., 2016). Region1970/19802015Net Change Area, (% of Region)Area Area impacted (% of Region) Gulf of Mexico89,650 (10.6)87,048 2,602 (2.9) Yucatan Peninsula453,635 (52.9)421,926 31,709 (6.9) Northern Pacific197,895 (23.1)187,383 10,512 (5.3) Central Pacific16,475 (1.9)7,011 9,464 (57.4)	THESE DATA WERE CHECKED AGAINST THE DATA REPORTED IN TABLE 1 AND WERE SIMILAR OR SLIGHTLY HIGHER (10%). We cite the datasets now in the text for rates of marsh loss.

Chapter 15: Tidal Wetlands and Estuaries	Whole Chapter						Chapter 15 Page 602: line 38-42: This is a recommendation and out of place here, rephrase Page 609: line 23: treatment of Mississippi-Atchafalaya fluxes is very confusing. While it is assumed that the Mississippi-Atchafalaya does not retain carbon in its estuary, what about retention in the extensive wetlands in the lower reaches ? Is this assume to be zero as well. Also, what is the effect of subsidence in this areas on C-fluxes?	We appreciate the comment and have rewritten these sections, both removing any reference to a recommendation as well as a rewrite of the discussion on the Mississippi-Atchafalaya basin, such that wetland interactions are more robustly described.
Chapter 15: Tidal Wetlands and Estuaries	Text Region		595	595	6	6	The reference for Bianchi (2006) should be Bianchi (2007)	We appreciate the comment and have updated the reference
Chapter 15: Tidal Wetlands and Estuaries	Text Region		600	600	12	12	Bianchi, T.S., M.A. Allison, J. Zhao, X. Li, R.S. Comeaux, R.A. Feagin, and R. Wasantha Kulawardhana. 2013. Historical reconstruction of mangrove expansion in the Gulf of Mexico: linking climate change with carbon sequestration in coastal wetlands. Estuar. Coast. Shelf Sci. 119: 7-16. should be added to the references cited in this sentence, this is a key reference for mangrove expansion and effects on C sequestration in GOM.	We have now included this reference.
Chapter 15: Tidal Wetlands and Estuaries	Text Region		596		26		"(i.e., produced off site; terrigenous" repeated	We appreciate the comment and have removed the repeated clause.
Chapter 15: Tidal Wetlands and Estuaries	Text Region		598	598	27	39	No mention of Gulf of Maine estuaries/estuarine dynamics in this paragraph, only MAB	We appreciate the comment and now include discussion of the GOM estuaries in this paragraph.
Chapter 15: Tidal Wetlands and Estuaries	Whole Chapter						This chapter is a really thorough and excellent summary of regional North American tidal wetland and estuarine carbon cycle dynamics that builds on previous synthesis efforts and includes the latest research projects and published literature. This chapter, which did not exist 10+ years ago (SOCCR-1), is a major victory for the carbon cycle research community!	We appreciate the comment.
Chapter 15: Tidal Wetlands and Estuaries	Text Region		606	606	39	39	In this paragraph and elsewhere, I would urge using rates of mass per hectare instead of per square meter--for consistency and to broaden thinking.	We appreciate the comment and have upscaled the units where possible.
Chapter 15: Tidal Wetlands and Estuaries	Table	2	637				Here, I am assuming that positive numbers mean accumulation, given the text above the table. I like it done this way but would note that in a number of other chapters the convention/instruction seems to have been (and I don't like it) that the signs of terms should relate to their effect on the atmospheric carbon budget. I agree with your approach--when focus is on the system instead of the atmosphere, and one says accumulation, then a gain to this system is a positive number.	The conventions we use are now in accordance with the other chapters, using an atmospheric focus. We appreciate the comment but stick with the atmospheric focus for consistency.

Chapter 15: Tidal Wetlands and Estuaries	Whole Chapter			Does anything need to be mentioned (and apologies if I missed it) about what is going to happen with sea level rise, not just the flooding of land and carbon implications, but the effects of contamination that is likely to occur as a result of pollution on the land?	Yes, we appreciate the comment and include more discussion of sea level rise implications (including a Key Research Area bullet), and only a small amont on pollution, namely as it affects eutrophication and thus productivity and pH shifts.
Chapter 15: Tidal Wetlands and Estuaries	Table	3	638	On the sign convention for this table, I'm not sure what is meant here. So, is a positive number a transfer from the wetlands and estuaries to the atmosphere as the table title is about outgassing? Then, what is a negative number--so a transfer from the atmosphere to the wetlands? I think what is meant needs to be defined in heading. And in row labeled 13, how can a segment number with no systems have a term here?	1) We stick to the SOCCR2 atmospheric convention of negative fluxes being removal from the atmosphere. 2) As we describe in the text, we rely on Chen et al 2013. Some MARCATS segments in North America have no measurements at all, and in this global synthesis, data from similar systems were used.

Responses to Reviewer Comments

(Reviews are pasted in black font; responses are in blue font.)

Page 652: Whole chapter there is quite a bit of switching of units between weight and mole **Response:** All numbers were converted to units of g C per m^2 per year or Tg C per year for CO_2 fluxes and g CH_4 per m^2 per year or Tg CH_4 per year for methane fluxes.

CO2: g C. The areas covered are not always clear. Sometimes its it the EEZ, other time the shelf, or the whole basin,.

Response: We consider coastal oceans, defined as nonestuarine waters within 200 nautical miles (370 km) of the coast (i.e. the EEZ) and continental shelves, which refer to the submerged margins of the continental plates, operationally defined as regions with water depths shallower than 200 m. Both are defined in section 16.1. Although the two definitions overlap, there are ir

Page 652:line 6. This is a recommendation, not a key finding

Response: This key finding addresses a research gap. We authors were encouraged, including by the NAS reviewers, to include such statements as key findings. The only modification we made was to remove "[very high confidence]".

Page 654:line 22: why is costal water denser? I thought it was less dense due to fresh water input

Response: Colder water is denser. We have made this more explicit by rephrasing the text as follows:

"In winter shelf water is cooled more strongly than surface water in the adjacent open ocean because the former is not subject to deep convection. The colder shelf water is denser and experiences a larger influx of atmospheric CO_2, because density and the solubility of CO_2 increase with decreasing temperature."

Page 656: line 28: "SAB is distinct from that in the MAB and has no trace of Labrador Current water" I do not think this is correct

Response: We changed the wording as follows:

"Shelf water in the SAB is distinct from that in the MAB and with almost no trace of Labrador Current water"

Page 656: line 32: add "C" : Tg C

Response: Done

Page 660; line 8: This is an ingassing flux not as stated outgassing " â``0.90 Â± 0.28 mol CO2 per m2 per year.

Response: Yes, this was corrected.

Page 665: line 13: (and throughout) I do not think "corrosive" is ever defined

Response: Corrosive is used here as defined in Webster's Dictionary in the sense of "damaging." We clarified this as follows:

"When the carbonate saturation state decreases below the equilibrium point for carbonate precipitation/dissolution conditions are said to be corrosive, or damaging, to marine calcifiers making it more difficult for these organisms to form shells, perform metabolic functions and survive."

Page 666: line 18: replace "higher CO2 fugacity " by "higher pCO2"

Response: Removed "and higher CO2 fugacity."

Page 668: line 2 This is not a key finding

Response: A key finding of our literature review is that efforts in quantifying coastal carbon fluxes have focused primarily on quantifying the net air-sea exchange of carbon dioxide. Only some studies have estimated other key fluxes, such as the exchange between shelves and the open ocean. The only change is that we have removed "[Very high confidence]."

Page 668; line 26: does this include the EEZ around the Hawaiian islands?

Response: Yes, we have now labeled the Hawaiian Islands in Figure 1 to make this more explicit.

Page 670: line 9: this is not a key finding

Response: Please see response to third comment above.

Page 685; figure 16.2: Including # to the arrows as in done in other figures in SOCC-2 would be very useful

Response: This schematic is meant to aid the reader's comprehension of terms and definitions. It is not meant to illustrate a coastal carbon budget. As we have summarized in our key finding 4, many of these numbers are not well known.

Page 654, line 4: It seems very odd that the paper by Bauer, J.E., W.J. Cai, P. Raymond, T.S. Bianchi, C.S. Hopkinson, and P. Regnier. 2013. The coastal ocean as a key dynamic interface in the global carbon cycle. Nature. 504 (7478): 61-70. is not cited in this senetence.

Response: Agree, we need to cite this paper. Now added.

Page 673, line 16-19: Reference incorrect - it's 2016, not 2014, correct reference as follows: Benway, H., Alin, S., Boyer, E., Cai, W.-J., Coble, P., Cross, J., Friedrichs, M., GoÃ±i, M., Griffith, P., Herrmann, M., Lohrenz, S., Mathis, J., McKinley, G., Najjar, R., Pilskaln, C., Siedlecki, S., Smith, R. (2016). A Science Plan for Carbon Cycle Research in North American Coastal

Response: Corrected.

Page 652, line 37: Benway et al. (2016) - not 2014

Response: Corrected.

This is a strong and comprehensive synthesis of coastal carbon fluxes that demonstrates the enormous progress this community has made with regard to observational and modeling capabilities over the past decade.

Response: We would like to thank the reviewer. This comment is greatly appreciated.

Page 651, line 31 to 36: I'm having a problem with including all of the uptake (and maybe at least some of the release of the release) as part of the North American Carbon Budget in the sense that a good bit of the uptake in cold waters was probably there in preindustrial times and a result of emissions of CO2 from outgassing in warm, low latitude ocean waters where upwellin

Response: This key finding explicitly addresses "carbon flux," not "anthropogenic carbon flux" as justified and explained in more detail in the last paragraph of Section 16.2. We agree that it would be desirable to quantify the anthropogenic components of coastal carbon fluxes. However, to the best of our knowledge, there is only one study, by Bourgeois et al. (2016), that has

Page 652, line 19: So, this may address my comment on page 651, lines 31-36, but how is "anthropogenic" defined--how do you know what is anthropogenic carbon and what is not? Are the analyses done so only considering the increment in the CO2 concentration above its preindustrial level?

Response: This statement was misleading and has been changed as follows:

"This chapter focuses on two particularly pressing issues within the much broader topic of carbon cycling along ocean margins: 1) the uptake of ~~anthropogenic carbon~~ atmospheric CO_2 and subsequent export to the deep ocean and 2) drivers of and trends in coastal ocean acidification."

In the last paragraph of Section 16.2 we now explicitly define "anthropogenic carbon flux" and state clearly why we consider total carbon fluxes throughout except when talking specifically about the anthropogenic flux estimates by Bourgeois et al. (2016).

Page 656, line 7 to 8: This set of units is quite different than in the other chapters--is there a good reason for this or might there be consistency that would allow easier comparison?

Response: Yes, we are reporting area-normalized fluxes so that these can be compared between regions and studies. Because different surface areas are used in different studies, reporting total fluxes would not allow us to compare fluxes to each other.

Page 659, line 36 to 37: Given the recent Supreme Court consideration of the adequacy of river flow from the Atchafalaya, one might want to be careful here. Also with climate change seeming to lead to a drying of the Southeast, river flow from this region may well end up decreasing even further than Florida is saying it has.

Response: This comment refers to the following sentence: "Riverine input is substantial in the northern Gulf of Mexico, where the Mississippi-Atchafalaya river system delivers large loads of freshwater, nutrients, and sediments."

Although we don't know which Supreme Court decision the Reviewer is referring to, we feel it is best to focus on the scientific peer-reviewed literature. With regard to the Reviewer's suggestion of a potential drying of the Southeast and decreasing river flow, we would like to point to the recent publication by Sinha et al. (2017), which projects significant increases in freshwat

Sinha et al. (2017) Eutrophication will increase during the 21st century as a result of precipitation changes, *Science* 357:405-408

Page 660, line 31: It seems a bit strange to say that the shelf waters originate some where as if new water is being created. It is the characteristics of the water that are presumably set there (after upwelling has occurred?).

Response: Modified as follows:

"Shelf waters ~~in~~ enter these regions ~~originate in~~ from the North Pacific"

Page 666, line 37: It seems a bit out of date to be citing a 2007 paper in describing the character of sea ice in the region given how much change has been occurring over the last several years. Is not the description a bit out of date? Should not there be mention of the rapid loss of ice that is occurring?

Response: This reference refers specifically to polynyas and was left as is, but we have added a more recent reference as follows:

"Areas of persistent multiyear sea ice at the northernmost extent of the CAA are rapidly declining (Stroeve et al., 2012)."

Page 664, line 33: I'd suggest changing "emissions" to "concdntrations"--we will have elevated CO2 concentration even if emissions now go to zero. Or maybe say "The increased atmospheric concentration"

Response: We mean to say increasing emissions. Yes, concentrations are increasing, but perhaps more importantly, even the annual emissions are still increasing. This is the statement we are making here.

Page 694, line 1 to 3: You have switched the sign convention here. I actually prefer this way, thinking that when talking about a domain, whether due to a process or for a region like the Gulf of Maine, a positive flux should be one into the system. If on the other hand talking about the atmosphere as the focus and doing its budget, then I understand that a flux from the atmosphe

Response: Yes, we have now adopted this throughout. When the direction of the flux is clear from the context, no minus sign is used. This avoids the awkward cases where one talks of a source but reports a negative number.

nportant reasons for considering both as described in Section 16.1 (3 rd paragraph). We clarified throughout the Chapter when we are talking about which. When describing observational studies we sometimes report results for just one station. Again, we made clear when this is the case.

Waters. Report of the Coastal CARbon Synthesis (CCARS) community workshop, August 19-21, 2014, Ocean Carbon and Biogeochemistry Program and North American Carbon Program, 84 pp., DOI 10.1575/1912/7777.

g is occurring. So is taking up emissions of CO2 that no country emitted. So, if one then were to use the North American uptake amount in trying to close the anthropogenic atmosopheric CO2 budget (and this is sort of being done as this number is used to offset North American fossil fuel emissions), the North American number would be bigger than is appropriate. It seems to a attempted to do so using a global model. We have produced estimates for the North American EEZ from the model of Bourgeois et al. (2016) and provide these in Section 16.3.5. All other estimates that we have compiled are total carbon fluxes. We have made several modifications in the text to clarify this. Also see response to next comment.

er flow for the Mississippi/Atchafalaya river system and resulting increases in nitrogen load.

re to the ocean would be negative--but nowhere yet has there realy been an attempt to do a summary budget for the atmosphere (well, only in Chapters 1 and 2), and I just think it counfusing to be having a positive flux some body of water to mean a release to the atmosphere.

me that the preindustrial uptake (and maybe some preindustrial release from the oceans--assuming the land to have been in equilibrium) should be subtracted off from the net uptake amount. Or, maybe I am wrong because these regions were in the past all covered by year-roun

Chapter	Comment Type	Figure / Table Number	Start Page	End Page	Start Line	End Line	Comment	Draft final response incorporating canned response text
Chapter 17: Consequences of Rising CO2	Whole Chapter						Chapter 17 Page 698; line 27: long term can be misconstrued perhaps "30-year time series" Page 694: table 16.5 Explain what "residual" is Page 713 line 28: Key finding "Ocean acidification resulting from rising CO2 has decreased commercial shellfish harvests in the 28 northwestern United States " There is no documentation of this fact, only that larvae were damaged by OA. Provide harvest results and clear link to OA Page 732: perhaps add ocean time series to this figure Page 733: figure 17.2 delete, it is not all that useful in this report Page 736: line 2: I'd state: "acidification model hindcasts and projections" Page 737: figure 17.5. This figure needs more explanation. I recommend deleting it as it is not that germane to the SOCCR-	P. 698, L. 27: The section identified has been reworded to incorporate your suggestion and now reads "thirty-year time series". P. 694, T 16.5: This comment does not appear to relate to the content of chapter 17. P. 713, L. 28: The text has been revised to incorporate this suggestion. It now reads "the supply of larvae that sustains commercial shellfish production," here and on p. 695 L. 33. P. 732: After consideration of this point, we did not make this change. Ocean TS sites (which are measurement sites, and not as comparable to terrestrial sites in terms of the work done) are shown in Fig. 17.3. Adding them to Fig. 17.1 would be repetitive. P. 733: After consideration of this point, we decided to retain figure 17.2, to show that today's CO2 rise is beyond compare. P. 737: After considering this point, we decided to retain Fig. 17.5 because it shows a number of expected direct impacts from OA on ecosystems and ecosystem services. **We have added substantially to the caption to clarify the intent and contents of the figure.**

Chapter 17: Consequences of Rising CO2	Whole Chapter						I can't find in this chapter a full summary of the current and projected future impacts of rising atmospheric CO2 on North America and North Americans. Most other chapters discuss carbon management strategies to impact the carbon cycle, but a clear motivation for such strategies is difficult to find in this chapter, the only one explicitly focused on "consequences" of anthropogenic changes to the carbon cycle. While a full description of direct and indirect effects might be left to the companion reports and many important details are included here, a more complete summary of these current and projected impacts should nonetheless be provided in this chapter. See for example https://health2016.globalchange.gov, www.lung.org/assets/documents/healthy-air/state-of-the-air/state-of-the-..., Hansen et al. (2013 doi:10.1098/rsta.2012.0294),	Thank you for your comment, but your suggestion is outside the scope of this report. We have clarified the scope of the chapter by making the title more specific: "**Biogeochemical Effects of Rising Atmospheric CO2.**" The scope of the chapter is stated in at least two places, e.g.,p. 696, l. 9-10; p. 702, L. 3-6. We mention the importance of thermal/climatic feedbacks on p. 702, L. 1-21, and offer the reader references to other publications that explain the effects of climate change on humans and terrestrial fauna. There is also discussion of drought and temperature caused feedbacks to the carbon cycle in the supporting evidence sections.
Chapter 17: Consequences of Rising CO2	Text Region		703	703	37	39	This sentence ("Under the current rate of CO2 emissions....") says that some marine organisms face a very high risk of impact by 2050; however the literature and Key Finding 1 of ch17 suggests that some marine organisms are currently significantly impacted. For example, coral reefs, see Hughes et al. (2017	The sections identified have been rearranged to incorporate your suggestion.
Chapter 17: Consequences of Rising CO2	Text Region		703	703	39	41	"early decades of next century", i.e. the early decades after 2100, appears to be a typo. As written the sentence says that ecosystem services are at very/high risk by 2100 but moderate risk for the subsequent decades after 2100.	Thank you for finding that. "The next" has been changed to "this."
Chapter 17: Consequences of Rising CO2	Whole Page		703				In section 17.4 (Consequences for Ecosystems and Human Communities) consider addressing the risks of continued CO2 emissions on air quality, vector-borne diseases, and sea levels. These are ecosystem services provided to North Americans through healthy air quality, stable sea levels, and constraints of a cooler climate on vector-borne diseases. See https://health2016.globalchange.gov, Hansen et al. 2013	Thank you for your comment, but your suggestion is outside the scope of this report. We have clarified the scope of the chapter by making the title more specific: **"Biogeochemical Effects of Rising Atmospheric CO2."** The scope of the chapter is stated in the introduction. We mention the importance of thermal/climatic feedbacks in the introduction and in other places, and offer the reader references to other publications that explain the effects of climate change on humans and terrestrial fauna.

Chapter 17: Consequences of Rising CO2	Text		704	704	1	24	The Biodiversity section makes no mention of terrestrial fauna. Consider including this, for example those directly impacting human health (disease vectors) and food supplies (pollinators).	Thank you for your comment, but your suggestion is outside the scope of this report. We have clarified the scope of the chapter by making the title more specific: **"Direct Consequences of Rising Atmospheric CO2 on Oceanic and Terrestrial Systems."** The scope of the chapter is stated in at least two places, e.g.,p. 696, l. 9-10; p. 702, L. 3-6. We mention the importance of
Chapter 17: Consequences of Rising CO2	Text		706	706	17	27	Consider referencing additional recent papers, in particular to support the phrase "hindering their ability to grow or recover from damage" (line 20): see Hughes et al. 2017 doi:10.1038/nature21707, Ainsworth et al. 2016 doi:10.1126/science.aac7125, Hughes et al. 2018	The suggested references have been added.
Chapter 17: Consequences of Rising CO2	Text		706	706	39	41	The scope of Section 17.4.2 (Feedbacks Within Human Communities) is unclear and the section seems incomplete. Potential economic impacts of communities/neighborhoods/property/infrastructure at risk due to sea level rise, changes in the size and distribution of species populations (e.g. fisheries), and increases in extreme weather events over the next 100 years extends far beyond the few examples included. See Neumann et al.	After consideration of this point, we have removed this paragraph. The chapter scope is not broad enough to allow a more comprehensive treatment of this topic, and as written it did seem not very helpful.
Chapter 17: Consequences of Rising CO2	Figure	5	737				This figure is quite difficult to read and interpret. For example the color scale for efficiency of Management Options: pink (medium efficiency) is intuitively but inaccurately read as "worse" than pale green (less efficient). Also there is no explanation of the meaning of differences in	We appreciate this suggestion, but our ability to revise this figure is limited because it is a reprint from another paper. The source paper used an expert input process to generate its conclusions, so rebuilding the figure using a different set of scenarios would require an activity outside the scope of this report. The author team has deliberated and agreed on the most important information and
Chapter 17: Consequences of Rising CO2	Figure	5	737				The emissions scenarios shown in this image appear out of date and thus misleading, with 1.2 C warming appearing increasingly unrealistic according to more recent literature. For example see Knutti et al. (2016 doi:10.1038/NGEO2595) (e.g. section "Timescales and reversibility"), Raftery et al. (2017 doi:10.1038/nclimate3352), Schnellnhuber et al. (2016 doi:10.1038/nclimate3013),	We appreciate this suggestion, but our ability to revise this figure is limited because it is a reprint from another paper. The source paper used an expert input process to generate its conclusions, so rebuilding the figure using a different set of scenarios would require an activity outside the scope of this report. Comparison of the different CO2 emissions scenarios is found in Ch. 19.

Chapter 17: Consequences of Rising CO2	Text Region	697	697	29	29	Suggest replacing "methods" with biochemical pathways and anatomy	We appreciate this suggestion, we do not wish to include additional technical terms that might be unfamiliar to the reader so we have changed the term to "mechanisms and anatomies"
Chapter 17: Consequences of Rising CO2	Text Region	698	698	4	4	The reader would benefit from a brief explanation of why 13C/14C ratios changes	We agree that a brief discription would be helpful, and have added the following sentence "Fossil fuels have less of the Carbon 13 isotope because they are composed of dead plants and animals, burning them changes the isotope ratio in the atmosphere."
Chapter 17: Consequences of Rising CO2	Text Region	700	700	29	29	CO2 concentration is not "changing" it is increasing. It would be could to state "CO2 concentration" rather than just "CO2". Needs modifying throughout.	Thank you for your comment. After considering the comment we feel that the wording as written is sufficently clear. Regarding the use of concentration we have used the style decided for the entire report
Chapter 17: Consequences of Rising CO2	Text Region	701	701	18	18	The Gray et al (2016) paper (already cited in the chapter) shows that this assumption is not always true and the CO2 x soil moisture content story is complex	The text has been revised to incorporate this suggestion. "Crop carbon accumulation and water use efficiency can be enhanced under drought conditions (Blum 2009; Morison et al., 2008) but extreme droughts may reduce or eliminate these enhancements (Gray et al 2016)."
Chapter 17: Consequences of Rising CO2	Text Region	701	701	20	20	Potential confusion. Elevated CO2 will always stimulate C3 photosynthesis it is the magnitude of the stimulation that may be reduced. [see also p712 line 21]	The text has been revised to incorporate this suggestion: "If another environmental factor limits growth, then experimentally increasing CO2 causes diminished enhancement photosynthesis and plant production (Ainsworth and Long 2005, Ainsworth and Rogers 2007). "
Chapter 17: Consequences of Rising CO2	Text Region	701	701	19	28	Clarify whether you are discussing instantaneous response of acclimation to growth at elevated CO2 concentration	thank you for the comment. We have clarified that we are refering to effects over years "Plant growth over years is not limited by CO2 alone (Körner 2015)"

Chapter 17: Consequences of Rising CO2	Text Region	702	702	10	10	Potential confusion. CO2 and CH4 are not "stored" in the permafrost. It is frozen organic material that is subsequently metabolized by microbes that leads to release of CO2 or CH4 (depending largely on aerobic or anaerobic conditions). [see also p715-11]	Thank you for the suggestion. In both locations we have made sure the text is clear on this point. For instance, the passage now reads "releases CO2 and CH4 from microbial respiration back into the atmosphere."
Chapter 17: Consequences of Rising CO2	Whole Chapter					One missing element I see here is discussion of rising vapor pressure deficit. This has important consequences for crop yield (see Lobell et al. 2014 and Ort & Long 2014) and tree mortality (see extensive work of Nate McDowell). Perhaps this is just the required format but	Thank you for the suggestion. The effects of climate on the carbon cycle as a result of rising CO2 and other greenhouse gases is the subject of other reports. We have added a section at the start of the chapter that refers readers to other reports and other sections of this report. We have also added information on how warming and rising VPD may be tied in to the uncertainties in the limits
Chapter 17: Consequences of Rising CO2	Text Region	695	695	35	35	Might it be better to say "difficult to anticipate" than "difficult to predict"? The problem is we don't know what the influences might be rather than thatw e know what they are and can't then project what they might mean.	Thank you for your comment. After considering the comment we feel that the wording as written is clear.
Chapter 17: Consequences of Rising CO2	Text Region	696	696	23	23	I'd urge just saying "rising CO2" and always saying either "rising CO2 concentration" or "rising CO2 emissions" as appropriate. Literally, CO2 itself does not rise. (comment applies generally to chapter--even to findings). I would also urge the authors to be more careful on talking about a CO2	Thank you for your comment. We have consulted with the report leadership team and we have used the style recommended by the overal report.
Chapter 17: Consequences of Rising CO2	Text Region	697	697	19	19	The deglaciation did not occur about 20,000 years ago--that is when it started, so this needs to have a range of time for the deglaciation period, perhaps from 22,000 to 10,000 or something similar.	Thank you for the correction. We have clarified that the deglaciation occurred over a range of time. We used the midpoint of the last glacial maximum and the onset of the Holocene as noted in the Shakun et al cited here. "Recent analyses show that during the last deglaciation (from ~21,500 to ~11,500 years ago), observed increases in global temperature lagged behind observed increases in
Chapter 17: Consequences of Rising CO2	Text Region	697	697	19	22	This is a pretty controversial statement to have only one reference here and so little explanation. Also, it may be that the orbital parameters warmed just the appropriate region to get the CO2 released early on. In any case, some mention of orbital effects needs to be mentioned as major forcing (or	Thank you for the correction. We have removed this portion of text and highlighted the role of orbital effects on the ice age cycle "The glacial-interglacial cycle in Earth's climate during the Quarternery period is caused by a combination of changes in Earth's orbit, atmospheric greenhouse gases and ocean circulation (Rohling et al., 2018)."

Chapter 17: Consequences of Rising CO2	Text Region	695	695	1	1	I think the title of this chapter is too general, making me think I would also be getting details about climate change itself, changes in the energy budget and more--all material that is covered in the CSSR that was recently issued. So, perhaps add to the title "for Ocean and Terrestrial	Thank you for the very specific suggestion. In response to this and other comments leading us to see the chapter scope needed to be more clearly defined, we have changed the chapter title to : **Biogeochemical Effects of Rising Atmospheric CO2.**

Chapter	Comment Type	Figure/ Table Num	Start Page	End Page	Start Line	End Line	Comment	Response
Chapter 18: Decision Support	Whole Chapter						Chapter 18 Page 739: Chapter 18- This reads a bit as an esoteric discussion and lacks hard facts and concrete examples	This chapter attempts to address how science-based observations and analyses can be used most productively and efficiently in decision-making. Examples and support, where available, are cited throughout the chapter.
Chapter 18: Decision Support	Text Region		742	742	22	22	Please define 'attitudinal inoculation'	The process of attidudinal inoculation was defined, but also moved to chapter 6.
Chapter 18: Decision Support	Text Region		746	746	8	8	I believe 'use-inspired' is a more common and appropriate term than 'user inspired'	We agree that the traditional term is "use-inspired" and it is typically used in conjuction with terms "basic" and "applied" research. We have therefore changed the 3 occurences of this term in the text to "use-inspired" as opposed to "user-inspired". However, Figure 18.2 was authored by another and copywriten with the term "user-inspired" so this term will remain in the figure.

Chapter 18: Decision Support	Text Region		750	750	2	3	This sentence is unclear. What are the data and models developed for then?	They were developed for completely different purposes. For example, the forest inventory analysis system of measurements was developed to estimate and ensure an adequate supply of timber. Similarly, agricultural statistics were initially developed to estimate food
Chapter 18: Decision Support	Table	1	766				Nuclear power should be listed here or in an additional table row as a non-fossil-fuel-based source of energy. E.g. in 2016 it was the largest source of non-fossil-fuel-based energy consumption/production in the US and currently supplies about 20% of electricity in the US (https://www.eia.gov/energyexplained, also see Ch3 of this draft report).	We added a row in the table regarding energy production and use. We also collaborated with the energy chapter on this topic and moved additional information and analyses for use in that chapter. We did not make a row in the table just for nuclear, because we then would have needed a row for all other individual energy sources.

Chapter 18: Decision Support	Whole Chapter	This chapter would be much improved, and would serve the three stated goals of SOCCR2 by providing more concrete examples of carbon management strategies: biofuels, carbon capture and storage, etc. Descriptions of how effective, including summaries of life cycle analyses, cost-benefits, would greatly enhance the applicability and meaningfulness of this chapter and the entire report.	We appreciate this good suggestion. There are numerous reports that document robust analyses of carbon management strategies, including a summary of current and potential national strategies in the 2016 US Biennial Report. The intent of this chapter was to look at how management strategies are communicated and used within decision-making. Other chapters within this report have sections on management of respective systems (i.e., forest, agriculture, energy, etc.). If there is interest in a compendium of management strategies across sectors, we might suggest a separate chapter on carbon management in the next version of this report.
Chapter 18: Decision Support	Whole Chapter	Chapter 18 Great chapter with specific examples of what has been achieved and science-policy interface has advanced. I think that it is also	We fully agree that the research enterprise plays a very important role in checking what we think we know about the physical and policy environment by continually developing and

Chapter 18: Decision Support	Text Region	743	743	13	15	Repeated references.	We apologize for this error that we assume occurred sometime during the editing process. It has been addressed.
Chapter 18: Decision Support	Text Region	741	741	40	41	I wonder here if it would help to replace the word "science" by something like "observations and theoretical analyses"--	Sentence was edited to refer to more specific, and less ambiguous, processes of research.
Chapter 18: Decision Support	Text Region	742	742	3	4	Is there research indicating if there has been a trend in this direction or if this has always been the case, or So, is it the case that there is a preference for Biblical creation rather than evicence of climate change? Is that what this really means? I'm curious why this paragraph does not specifically mention religious belief--are not there surveys of	We know of no studies that indicate long-term trends for this phenomenon. We cannot answer this question without speculating. The Kahan et al. (2012) study that is cited does address this issue or subject matter.
Chapter 18: Decision Support	Text Region	742	742	22	22	What is "attitudinal inoculation"? This needs to be defined/explained.	This was pointed out by another reviewer and is now defined. (Note that we have moved this section for inclusion in Chapter 6)

Chapter	Comment Type	Figure/ Table Number	Start Page	End Page	Start Line	End Line	Comment	Response
Chapter 19: Future of the North American Carbon Cycle	Whole Chapter						Chapter 19 Page 782: section 19.6. confidence level and likely must be included in these statements. In particular, "shifted the global coastal ocean from being a net source to a net sink of	Page 792; section 19.6: The statement being referred to is citing reported (by Bauer et al., 2013) average annual net carbon uptake by the global oceans over the past 50 to 100 years. Therefore, a statement of confidence level or likelihood is not appropriate here since we are not presented projected future changes. The statement has been revised slightly to improve
Chapter 19: Future of the North American Carbon Cycle	Text Region			816	820	1	4	1. It is not clear why Table 19.1 exists in a chapter devoted to CC projections. It belongs near the front of the report. 2. Table 19.3 appears to me to be	We were instructed to provide a historical context for each chapter. We have substantially reduced Section 19.2., but retained some text in order to provide a basic introduction to the carbon cycle and its historical changes. We have removed Tables
Chapter 19: Future of the North American Carbon Cycle	Text Region			773	773	5	17	Consider providing an estimate of the North American share of the transfer of carbon to the atmosphere (lines 5-11), as is similarly provided for the North American share of global carbon	As reported in Chapter 2 (Section 2.3), according to recent data (Boden et al., 2015), the United States emitted approximately 1,400 Tg C from fossil fuel burning, cement production, and gas flaring during 2013-accounting for 15% of the global total that year. The United States still contributes 85% of the combined
Chapter 19: Future of the North American Carbon Cycle	Text Region			774	774	27	28	The phrase "...several countries including Mexico and China" is inaccurate and should be replaced by something similar to "...nearly all of the world's governments". As of Nov 2017,	This phrase has been removed.
Chapter 19: Future of the North American Carbon Cycle	Text Region			777	777	1	25	The likely effects on the North American climate of the projected 5.8-11.9 F temperature increase stated in lines 1-3 are inadequately described in lines 4-25. This section should emphasize that such warming creates a	We thank the reviewer for the comment. The scope of this chapter is to provide projections of future changes in the North American land, ocean, coastal and freshwater Carbon Cycle in response to key drivers, such as fossil fuel, land use change and climate. It is beyond the scope of this chapter to cover socioeconomic and environmental impacts of climate change.
Chapter 19: Future of the North American Carbon Cycle	Figure		1	819				This figure is out of date and should be replaced or updated. The last 7-17 years of data (different for each section	We thank the reviewer for the comment. During the revision of this chapter and in response to other comments, this figure has been removed.
Chapter 19: Future of the North American Carbon Cycle	Text Region			774	774	10	31	Please add reference to fossil fuel emissions in relation to the emissions scenarios (RCPs) referred to throughout the rest of this report. How	The RCPs represent potential future scenarios out to 2100, globally. The emission projections reported in Table 19.2 (now Table 19.1) are based on forecasts from three different sources based on likely trends. They do not necessarily map on to the
Chapter 19: Future of the North American Carbon Cycle	Text Region			774	774	10	31	Please add a description of potential mitigation (i.e. reduction) strategies similar to what is described in section 19.3.2 for land use/cover (p 776 lines 20-17) as well as known factors currently in flux that will impact the stated projections, for example national emissions targets and carbon pricing being implemented in Canada. See e.g.	Chapter 19 focuses on projected future changes in the land, ocean, coastal and freshwater carbon cycle in response to key drivers, one of which is fossil fuel emissions. It is beyond the scope of this chapter to describe or evaluate potential mitigation (i.e. reduction) strategies, which has been covered in more detail in Chapter 3. However we do acknowledge the reviewer's comment (both this one and several following ones). We have made two modifications to the chapter: (a) based on details provided in Chapter 3 (evaluation of all potential trends/pathways of future FF emissions), we have acknowledged

Chapter 19: Future of the North American Carbon Cycle	Text Region	770	770	26	31	At least so far, I have seen no indication at all that this assessment has done an analysis about future energy technologies and so CO2 emissions out to 2040 that would justify the statement that the future fossil fuel emissions will be between -9% and +6%, much less to say this with high confidence. This might be what some sort of studies show for no future policy action (and if so this needs to be	Kindly see response to comment #9.
Chapter 19: Future of the North American Carbon Cycle	Text Region	771	771	1	2	So, there can be changes in forest and land management policies, but not in policies limiting CO2 emissions--is that the assumption being made?	This is not an assumption, but rather a reflection of the fact that this is an assessment report - hence it is based on published literature and can not be based on hypothetical scenarios. Specifically in this case, published literature discuss that management activities may change due to different factors,
Chapter 19: Future of the North American Carbon Cycle	Text Region	770	770	1	1	The title needs to make clear that this chapter is based on the assumption (I am assuming, based on what was said in an earlier chapter) that there will be no more policy steps on limiting fossil fuel CO2 emissions after the fall of	Kindly see response to comment #9.
Chapter 19: Future of the North American Carbon Cycle	Text Region	770	770	33	35	How is it that there are no projections considered that envision a reversal of the terrestrial system contribution	Kindly see response to comment #9.
Chapter 19: Future of the North American Carbon Cycle	Text Region	772	772	26	26	If you are going to say this, then all the fossil fuel stores are presumably included as part of the system. Is this really what you want to say--or is it that fossil fuel CO2 actually is added to	We have revised the text to avoid confusion. The revised text now reads: "The global carbon cycle can be viewed as a system of reservoirs (e.g., atmosphere, ocean, and land). A reservoir's size (or pool) depends on the balance of carbon flowing into and out of it (i.e., the net flux; see Ch. 1: Overview of the Global Carbon
Chapter 19: Future of the North American Carbon Cycle	Text Region	772	772	33	36	This is actually incorrect. What the orbital changes do is almost exactly simply shift around the amount of incoming solar by time of year and latitude--the global integral of	Based on other reviewer(s) comments, this section has been rewritten to provide a simple overview of the carbon cycle. We now point the reader to Chapter 1 that provide a more detailed synopsis of carbon cycle dynamics and long-term changes due to anthropogenic and natural perturbations.
Chapter 19: Future of the North American Carbon Cycle	Text Region	772	772	38	39	Change "rotational orbit" which makes no sense to "changing orbital parameters" or something similar.	We thank the reviewer for this comment. This section has been revised to provide a basic introduction to the carbon cycle.
Chapter 19: Future of the North American Carbon Cycle	Text Region	773	773	1	1	There are no degrees of certainty--there is certainty and then degrees of uncertainty. You can say "high	We have changed the word "certainty" to "confidence".
Chapter 19: Future of the North American Carbon Cycle	Text Region	773	773	3	3	Change "carbon" to "carbon dioxide"--don't go introducing some new term.	This error has been corrected. Thank you for pointing this out.
Chapter 19: Future of the North American Carbon Cycle	Text Region	773	773	6	9	I'd suggest making the statement about fossil fuel addition the second part of the first sentence, and then	We thank the reviewer for this comment. We have modified this entire section to address multiple comments from reviewers.
Chapter 19: Future of the North American Carbon Cycle	Text Region	773	773	10	12	This makes it sound as if half of the particular CO2 molecules emitted have stayed in the atmosphere, which is not the case. What needs to be said is that	Based on other reviewer(s) comments, this section has been rewritten to provide a simple overview of the carbon cycle. We now point the reader to Chapter 1 that provide a more detailed synopsis of carbon cycle dynamics and long-term changes due to
Chapter 19: Future of the North American Carbon Cycle	Text Region	773	773	16	17	I'm sorry but I think it is stretching things to say that North America's 0.3 is a "rather substantial share" of 2.3 or	This section has been modified. We now refer the reader to Chapter 2 where a robust assessment of the contemporary carbon budget is provided.

Chapter 19: Future of the North American Carbon Cycle	Text Region	773	773	21	21	I'd suggest changing "air-sea exchange" to "air to sea transfer" as we are interested in the net effect.	We agree with the reviewer's comment and made the change for all relevant text.
Chapter 19: Future of the North American Carbon Cycle	Text Region	773	773	29	30	So, is this statement going to totally ignore the commitment of international leaders to phase out fossil fuel CO2 emissions in the second half of the 21st century? It may be that that does not happen, but how can this	Kindly see response to comment #9.
Chapter 19: Future of the North American Carbon Cycle	Text Region	773	773	36	40	This is simply wrong. The RCPs were not developed bottom-up the way the SRES scenarios were--the were scenarios of forcings developed mainly by climate modelers for convenience	We thank the reviewer for this comment. First, the information about the RCPs discussed in this chapter were taken from peer-reviewed publications. We cannot speak to the criticisms the reveiwer states here. Second, this is an assessment report and not for prescribing policy or an aspirtational study. We can only
Chapter 19: Future of the North American Carbon Cycle	Text Region	774	774	7	8	I don't understand here--the climate change will depend mainly on how global emissions change--not US emissions. This needs to be made clear.	We have modified this line to address the reviewer's comment. The line(s) now read - We also describe how climate is projected to change in North America according to different projections of future global emissions (see Section 19.3.3). Even though the
Chapter 19: Future of the North American Carbon Cycle	Text Region	774	774	12	14	The EIA projection does not allow for policy changes in the future (so after late 2016)--that may be imposed on them for the US, but are they really suggesting the rest of the world won't be taking any actions. That is equivalent to saying all the rest of the leaders of the world are liars and no country will live do anything and that the many mayors of cities in the US and	While we appreciate the reviewer's comment, this is all hypothetical. This is an assessment report and not for prescribing policy or an aspirational study.
Chapter 19: Future of the North American Carbon Cycle	Text Region	774	774	16	16	This is far too small a range for a scientific paper to put forward without there being a lot of qualification--like	Kindly see response to comment #9. This is not a scientific paper, hence not conducting original research per se. Rather it is an assessment report that is based on published literature.
Chapter 19: Future of the North American Carbon Cycle	Text Region	774	774	21	21	Not only subject to uncertainty, but to very large uncertainty--just take a look at the IPCC range of projections.	We have revised the text to address the reviewer's comment.
Chapter 19: Future of the North American Carbon Cycle	Text Region	774	774	28	28	"several countries"--the leaders of the world's nations in Paris agreed to phase out all CO2 emissions by some	We thank the reviewer for the comment. We have now added projections from the RCP 2.6 scenario, which assumes that emissions will decrease after 2020.
Chapter 19: Future of the North American Carbon Cycle	Text Region	774	774	10	31	This section is totally inadequate looking at only one possible future situation rather than the much wider range of possibilities being considered	The scope of this chapter is on projected future changes in the land, ocean, coastal and freshwater carbon cycle in response to key drivers, one of which is fossil fuel emissions. We summarize likely fossil fuel emissions for North America based on published
Chapter 19: Future of the North American Carbon Cycle	Text Region	775	775	5	5	Regarding the footnote on CO2e, it has to be revised to indicate that this calculation is made over a time period and that the choice of the time period (i.e., the GWP to use) can affect the	The definition of carbon dioxide equivalent (CO2e) is the amount of CO2 emission that would cause the same radiative forcing as an emitted amount of a well mixed greenhouse gas or a mixture of well mixed greenhouse gases, all multiplied with their respective GWPs to take into account the differing times they
Chapter 19: Future of the North American Carbon Cycle	Text Region	776	776	7	8	So, for land use change the chapter proposes a very wide range of conditions. Was this done in the same way as the EIA scenario or did it allow	For the land use management and land cover change section, we are able to reference published reports from the US Department of State (2016 US 2nd Biennial Report land use projections) and Governments of Canada and Mexico. Since this is an assessment
Chapter 19: Future of the North American Carbon Cycle	Text Region	775	775	21	21	With respect to the US Department of State reference, somehow there needs to be an indication that this report is	This has been changed to: in the 2016 US 2nd Biennial Report land use projections.

Chapter 19: Future of the North American Carbon Cycle	Text Region	776	776	24	24	It is late in evening, so I am a bit groggy, but having a reference from a person named "Van Winkle" when	Thank you for the comment.
Chapter 19: Future of the North American Carbon Cycle	Text Region	777	777	5	5	The subtropics are not only projected to become drier, but to expand in area poleward, which is likely to be quite	The text has been modified to acknowledge the reviewer's comment.
Chapter 19: Future of the North American Carbon Cycle	Text Region	777	777	16	16	It might be noted tha thte RCP8.5 scenario is sort of like the EIA scenario, assuming no action to limit cliamte	We appreciate the reviewer's comment. However, to avoid confusion, we chose not to draw comparisons between the RCPs and EIA projections. See our response to comment #8 above for
Chapter 19: Future of the North American Carbon Cycle	Text Region	778	778	31	31	Spelling should be Arctic	The spelling error has been corrected.
Chapter 19: Future of the North American Carbon Cycle	Text Region	780	780	33	33	The period is in the footnote--needs to be on main line (just something that might not ever get caught)	This has been fixed.
Chapter 19: Future of the North American Carbon Cycle	Text Region	782	782	2	3	It might be noted that the oceans taking oup the heat is because of the heat capaicty difference--just the way the system is.	We have added reference to Gleckler, P.J., Durack, P.J., Stouffer, R.J., Johnson, G.C. and Forest, C.E., 2016. Industrial-era global ocean heat uptake doubles in recent decades. Nature Climate Change, 6(4), pp.394-398. and Frölicher, T.L., Sarmiento, J.L.,
Chapter 19: Future of the North American Carbon Cycle	Text Region	782	782	23	24	As I indicate in comments elsewhere, it seems in appropriate to me for the total uptake to be including net ocean uptake that may have been occurring in preindustrial times as this is part of the natural ocean emissions that are not charged to any nation. What	In the chapter, we mention historical uptake since 1870 in the North American EEZ, as well as projected increased uptake out to 2050 and from 2050 to 2100. Therefore, the information presented addresses the comment from the reviewer. However to be absolutely clear, we have added "of anthropogenic CO2" to more clearly distinguish its impact from the natural carbon cycle. As the section already states that only US EEZ is being included in
Chapter 19: Future of the North American Carbon Cycle	Text Region	784	784	15	16	That is a very interesting comparison--thank you for including it, and I'd urge additional efforts to make various	Thank you for the comment.
Chapter 19: Future of the North American Carbon Cycle	Text Region	789	789	2	4	What about the issue of melting clathrates on ocean shelves? There are some observations suggesting that these are starting to release carbon? Doesn't this need to be mentioned as	We have added "Considerable methane is also stored in the ocean as clathrates that may be susceptible to release into the ocean and subsequently into the atmosphere. While there is no conclusive proof that hydrate-derived methane is reaching the atmosphere now, but more observational data and improved
Chapter 19: Future of the North American Carbon Cycle	Text Region	790	790	37	37	Change "than" to "that"	Text has been revised as suggested.
Chapter 19: Future of the North American Carbon Cycle	Text Region	790	790	2	2	I was surprised not to see any mention of possible methane/CO2 release from methane clathrates in the coastal ocean sediments	We have added "Considerable methane is also stored in the ocean as clathrates that may be susceptible to release into the ocean and subsequently into the atmosphere. While there is no conclusive proof that hydrate-derived methane is reaching the atmosphere now, but more observational data and improved
Chapter 19: Future of the North American Carbon Cycle	Text Region	794	794	38	40	Good that there is finally an indication and explanation of the EIA scenario. I must say, their set of side scenarios is totally inadequate for developing a range of possible emissions ranges for the US--where is there anything about This is a totally inadequate explanation of the limitations of this CO2 emissions scenario process (see other comments). It is just far too limiting on what is likely and possible. Basically,	We thank the reviewer for their comment. However, it is inconsistent with the author team's thorough assessment of the science and the overall scope of the chapter. We have clearly established that the chapter is part of an assessment report and policy issues are beyond the defined scope of SOCCR-2. Hence we have not made any further changes. We thank the reviewer for their suggestion. As we have established the scope of the chapter and its framework (it is part of an assessment report), we have not made any further changes. The assessment does not include evaluation of mitigation or adaptation policies or detailed discussions of climate change
Chapter 19: Future of the North American Carbon Cycle	Text Region	817	817	1	5	these scenarios are based on neither	interventions, adaptation, or economic valuation. The entire

Appendix A: Carbon Observations	Whole Chapter	Line 5 states: "Note: This is a partial listing; some important observations may not be presented" When combined with the lack of clear data reference and provenance for the various quantitative statements made	Thank you for your comment, but it is not realistic for the actual observations to be presented anywhere in this document. It is important to realize that SOCCR-2 is an assessment – and as such, it is a summary of the available publications on a given topic, and an assessment of the data and the interpretations of the data found in those publications – by our chapter authors. The individual chapters each have a "Supporting Evidence" section that describes the publications and data on which their assessment is based.