Agricultural Modeling Team (AMT)
Meeting Minutes

February 9th, 2024
09:00 AM – 11:00 AM
Meeting Materials

Summary of Actions and Decisions

Decision: The AMT approved the January 2024 meeting minutes.

Decision: The AMT agreed to evaluate changing the land uses for Phase 7 CAST. The specific land uses and associated loading rates have not yet been determined and will be further investigated at future AMT meetings.

Action: Email Tom Butler and Jess Rigelman (butler.thomas01@epa.gov; jrigelman@j7llc.com) by Friday, Feb 16th if you are interested in reviewing the CAST results data from the loading ratio tests.

Minutes

Statement of purpose:

To evaluate the crop yield and loading rates/ratios in CAST and discuss potential alternatives for Phase 7.

Introduction and Announcements: 09:00-09:15 [15 min (Zach Easton, Virginia Tech)]

Zach presented a recap of the AMT work to date, as well as the following announcements.

- **Decision:** The AMT approved the January 2024 meeting minutes.
- Ag Modeling Team office hours
  - Optional time from 8 - 9 AM on the second Friday of EACH MONTH to walk through upcoming topics.
- Remote Sensing discussions
  - February 15th AgWG Meeting

Crop Yield trends 09:15- 09:35 [20 min (5 min presentation 15 min discussion) (Joseph Delesantro, ORISE)]

Joseph reviewed the importance of Crop Yield data in CAST as well as discussed progress being made to improve long term crop yields. This included multiple potential approaches for estimating yields from the Five-Year Census of Agriculture using correlations to crops with existing annual yield data.

Discussion

Bill Keeling: This is just cropland crops? or forage?
Joseph Delesantro: This is just crops. I'm excluding pasture land and types of crops that don't generate yields.
Bill Keeling: Hay or pasture does generate yields though.

Joseph Delesantro: Okay we'll look into how to characterize that.

Loading Rates/Ratios in CAST 09:35-10:25 [50 min (15 min presentation 35 min discussion) (Gary Shenk, USGS; Tom Butler, EPA)]

The group discussed the results of a CAST test scenario in which loading rates have been modified. The group was then asked to make a decision about how to represent land uses and their associated loading rates in Phase 7.

Discussion

Olivia Devereux (in chat): This is all spatially variable. Are you showing an average?
Tom Butler: Yes, the test results are showing an average.
Olivia Devereux (in chat): Please remind me how ag open space is different from open space in the natural sector?
Bill Keeling: Why is ag open space included? It's not grazed or fertilized. It's the BMP condition that we go to for land retirement for grass buffers, etc. so I'm not sure why it's included in pasture or hay.
Tom Butler: There was a desire to split it out in the report I mentioned.
Dave Montali: I think we should pull ag open space out of these groupings. The MWG or our team needs to look at how we are representing ag open space in relation to how we're representing mixed open in the natural sector. Need to ask ourselves what we're trying to represent here and if they should be the same or different. Also, when you do these groupings, can you segregate the leguminous from non-leguminous?
Tom Butler: The overall groupings are based on our current land uses of crop and pasture. Great feedback on potentially switching these.
Ken Staver: For ag open space in MD, almost all of that is converted into CREP as grass buffers or general CRP sign ups. Most of the time it's converted to grassland but it is still considered cropland. I think that land use should stay under agriculture. It's a reduction that should show up as an ag reduction.
Olivia Devereux: Forest buffers convert ag land to forest in the natural sector.
Ken Staver: We don't have many forest buffers going into retirement. Most of it is grass.
Bill Keeling: There is a difference between reality and simulation. We need a land use to convert to for the BMP condition.
Ken Staver: Are you okay with keeping it or do you want it out of the ag sector altogether?
Bill Keeling: To me, there's open land whether it's urban or agricultural - is it being managed, as in are we fertilizing it, applying manure, tilling it, etc., or is it just sitting there with atmospheric deposition? That situation whether it's in an urban or ag environment is analogous to each other. Can't we just have an open land category that is understood to be the bmp condition?
Ken Staver: The CRP grass buffers have an interception credit for intercepting loads from adjacent cropland, so I view them as part of the ag system.
Bill Keeling: Except buffers are not the upland cropland, it's the distribution of total ag land that it's applied to.
Elizabeth Hoffman (in chat): The forest buffer example is moving land between sectors, the grass buffer like Ken said, is switching from cropland to ag open space but keeping on our load ledger.
Elizabeth Hoffman: It's converting from that higher loading land use down to a lower loading land use, but it's still kept on our ledger of agricultural loads. I think we're adding a lot of layers

to this. Are we talking about BMP reporting from a management standpoint or are we talking about how we should regroup land uses for the model?
Dave Montali: I wasn't suggesting that we should get rid of the ag open space land use. I was just commenting on the groupings of the test results. For these tests, maybe we just pull out ag open space since it doesn't receive manure like other ag land uses.
Lisa Duriancik (in chat): Land with a history of nutrient application (that came out of cultivated cropland and into CREP, e.g.), particularly manure application history, could have a different soil P level and different P loading rate as compared to N, in particular. I agree with Ken that it should stay in ag, but may be worth a look with current data?
Ken Staver: It's just strange that ag open space has a ridiculously high load for retired land for the "no ratio test".
Elizabeth Hoffman (in chat): I agree with ken. That IS odd.
Bill Keeling: I disagree. Historically we've separated pasture from hay. The open space was not considered "agriculture", it would have been pasture or cropland prior to conversion. but historically hay was separate because it was deemed to have higher inputs than pasture and higher exports. So I'm not sure that lumping hay and pasture and ag open space is the correct methodology.
Jessica Rigelman (in chat): A future test could separate out Ag open space, thus removing the jump.
Timothy Larson, VA DCR (in chat): How does the total net load change with no ratio?
Ken Staver: Loading rates for different types of crops are different. This gives us the option to focus our efforts. Something has to change if the high loading rates are no longer high. Loading rates allow us to target. If we get rid of them, I think it will be a huge mistake.
Bill Keeling: We're still managing manure inputs at the county scale, we're not modeling at the farm scale. A lot of the reporting is not that specific, it's just all cropland.
Ken Staver: But we're being more and more specific at the field and farm scale, so we should try to encourage and support that effort. As we are more precise in our management, we should capture that.
Tom Butler: This is just a test to see the "extreme". There is a middle ground we can explore.
Chris Brosch: We do want to target BMPs. The bars on the right help us justify allocation of resources towards crops that have higher inputs. But on the left we have the raw calculation of basically a mass balanced approach. The right includes a mass balance approach and then applies a forcing factor to elevate or depress the signal based on certain land uses, and supported by literature that shows that some land uses are higher loading than others. I don't think this would be a mistake. STAC told us we need a more mass balanced approach. It provides us the opportunity to get our inputs and outputs more aligned inside the modeling system. What I see this saying is that full season soybeans have way too many inputs because they are on par with several other higher intensity input land uses.
Ken Staver: It's just how the model handles fixation.
Chris Brosch: I don't think so. I think it has to do with how much fixation the model is simulating. Full season soybeans are simulating 360 lbs of N in the model and in the real world soybeans have a fixation that's directly correlated to their yield.
Bill Keeling: We're talking about rotation on cropland. What's in full season soybeans one year could be something else next year. We'll have issues if we try to model real world stuff and focus on the field scale.
Chris Brosch: How is the left different from the right from the perspective of the farmer?
Bill Keeling: If we're using these loading ratio values to target, then I don't think we're actually targeting what we need. We don't talk about the models with farmers.

Chris Brosch: I don't think we should talk about how we communicate the model. We should focus on how to improve the simulation to look more like the real world. I think the "no ratio" test better approximates the inputs that we've tried to reflect are happening in the real world through time, whereas the right throws a tinted lens over the outputs of the model based on a literature review. I think we could better reflect the actual inputs and outputs of farmers using the "no ratio" test.
Olivia Devereux (in chat): Conservation practices are reported on overall cropland, not on crop types. We must consider how programs are set up and the purpose of the model. The model does not drive farmer decisions. Technical assistance providers inform farmer decisions.
Alex Soroka (in chat): Soy and Corn are also rotated on the same land.
Lisa Duriancik-NRCS (in chat): With the Current Test, why is the same crop type so much higher for N lbs/ac EOS with manure vs. w/o manure?
Tom Butler: A lot of that is tied towards application. anything that gets manure will probably be higher in terms of loads.
Jess Rigelman: It goes back to the loading rates. Grain with manure loads 1.4 times higher than grain without manure.
Hunter Landis (in chat): Is "gets manure" the same as "eligible for manure"?
Tom Butler: Not exactly. If it's eligible, it *can* receive manure. It's based on crop need and how much manure is available in the county.
Lisa Duriancik-NRCS (in chat): If you are following a mass balance approach, it should not be higher for a different source. Perhaps I can speak with someone offline about it. I don't want to hold things up now.
Dave Montali (in chat): For what it's worth, could we think about if we just had row, hay, pasture, open and with some consideration of classing by leguminous/non-leg, would we be just as accurate but simpler. When you look at how BMPs are reported (ie., on "ag" or on row etc) it all averages out anyway.
Chris Brosch (in chat): Why do you not worry about the intensity of inputs of different row crops and huge differences in soil cover?
Olivia Devereux: People have been so concerned about excess and if we simplified these groupings, we'd have no issues of excess. The 1-meter land use data cannot tell between these different types of land uses. The ag census is only so precise and reports on a county scale. We're talking about addressing the accuracy and scale of the data we have.
Mark Dubin: In thinking about the subcommittee who determined these recommendations, essentially the left "no ratio" test is what they started off with and the right "current" test is reflecting their interest to incorporate the literature and research into that to reflect the different land use loadings. I'm not sure how useful this is in light of the concerns we have about the model representation of organic v inorganic nutrient applications of loadings. Am I correct in looking at this and saying well that's influencing the no ratio test? That would have a very different effect if you're directing a higher load towards an inorganic situation vs organic. Maybe that question should be addressed first before we get into this.
Tom Butler: Correct, application is driving a lot of these. We previously made a decision about timing and manure eligibility, but that's subject to change as we move forward. Also, this is just showing a test of no ratios vs how it's done currently, this is not the final decision we are voting on.
Chris Brosch: I like what you're saying Tom. If we go the path that Mark has suggested, influencing those factors will be masked if we continue to simulate with the loading rates shown in the "current" test. For example, we can get the fixation for soybeans right, but we'll never know if it's accurate if we test with the current loading rates because it will always be a certain

ratio below corn. I think we need to take that "mask" off to decide the inputs and then decide whether or not to put the mask back on.
Ken Staver: The right is trying to bring field research findings into the simulation process. If we take the mask off we are modeling our way to truth, which I don't think will work.
Chris Brosch: It's important for us to come up with a mass balanced model that reflects that research rather than force that research as a normalizing function over the mass balance we create.
Ken Staver: The mass balance works really well with P because there's not an atmospheric component. But with N, we have huge uncertainties in our mass balances. For example, half of the N excreted by broilers is volatilized by ammonia. If we're going to rely on the model for mass balance to tell us what our loads are without having controlled research results integrated, I think that will be a mistake.
Chris Brosch: STAC recommended that we do that. The factors that you mentioned, we've already tried to do that in other places in the model.
Timothy Larson, Virginia DCR (in chat): Can you link to the report where the ratios were studied and defined for the model?
Thomas Butler (in chat): https://cast-content.chesapeakebay.net/documents/P6ModelDocumentation%2F2A_AgLoadingRateDocumentation_Final_AgWG_approved_Jan2016.pdf
Mark Dubin: I don't think we can make a decision on this. We need to go back to the fundamentals.
Chris Brosch (in chat): How do we trust tests of the fundamentals with this forcing function from the literature as a permanent layer over the model nutrient spread?
Bill Keeling (in chat): How is manure actually handled as in is it applied to standing crops or pre-planting?
Tom Butler: There is a timing file and a curve for the application of manure. You can apply manure to eligible land uses at any point during the cropping cycle. That was a change we just made for Phase 6. We can revisit that later if needed for Phase 7.
Bill Keeling: There may be research on this stuff that we integrate for the current test, but it's impractical in terms of a planning tool. If we did an evaluation of the predictions of rotations for progress years vs actual rotations, I'm not sure whether we'd find it to be accurate. The idea that we're going to come up with a scenario ten years in advance and know the rotations is unlikely. This is not practical.
Olivia Devereux: When will we start making decisions in this group? Can you review the schedule and process? I'm concerned about having to make a ton of decisions in a very short period of time.
Scott Heidel: Instead of relying strictly on theoretical outputs, USGS is partnered with us to do small agricultural watershed in-depth modeling and monitoring. We're seeing the actual results of BMPs applied to specific croplands in a small watershed, where we can see the direct results of those BMPs. Can we use that for a test case scenario for certain areas within the watershed? Wondering if we can use those results to inform this model.
Tom Butler: I'll talk with you offline to see if we can do a comparison with that model.
Alex Soroka: Just a note that the small watershed model that Scott mentioned might not be ready by the time this group has to make decisions. It will take some time to translate the outputs.
Bill Keeling (in chat): VT did long term (10 yr) studies on Owl Run and Nomini Creeks in VA specifically looking at various NPS BMPs.

Tom Butler: Do folks agree that further investigation into the ag land uses is warranted? We are calling for a sandbox decision.
Jackie Pickford (in chat): Tom, can you explain what a sandbox decision is and if/how that's different from a regular vote or decision from the AMT?
Scott Heidel (in chat): Further investigation is needed.
Elizabeth Hoffman (in chat): Maryland is a yes then to further discuss potential changes to the land uses
Jeff Sweeney (in chat): Yes, investigate land uses further.
Dave Montali (in chat): Yes for WV
Zach Easton (in chat): Yes for me as well.
Tim Larson (in chat): Yes, further investigation is warranted.
Cassie Davis (in chat): Yes - NY.
Candiss Williams (in chat): NRCS is yes.
Chris Butler: To clarify my previous comments, I'm not trying to make the point that we should do away with loading rate ratios. I just think we should explore changes to the model without the loading rates so we can actually see the effect of it.
Elizabeth Hoffman, MDA (in chat): I agree with Chris that it's worth exploring pieces of the equation in isolation.
[post-meeting note] Alisha Mulkey: I still have questions but agree with Chris that we should turn loading ratios "off" temporarily to evaluate better between load sources. I also think consolidating load sources makes sense.
Dave Montali: A suggestion for simplifying the land uses could be looking at the cropland classification - pulling out soybeans to look at them differently, get rid of double cropped and get rid of with and without manure. But there are complications in making those changes, for example the with and without manure, with how we currently distribute manure, so how do we figure that out?
Tom Butler: Good point, Dave. We could run some scenarios with those changes to figure it out.
Ken Staver: The only problem we're going to run into is the only actual simulation the model does is based on annual loads. So all the timing stuff doesn't change the loads, it just changes the total annual mass balance. If we just use the model to do it, it won't capture the timing issues that we know have an effect. This model isn't capable of sorting all this out mechanistically because it's a process model. The loading ratios tell us a lot of information that is not otherwise captured in the model which is why I think it's important to keep them.
Chris Brosch: I don't think so. There are many variables built into these ratios. We could run these ratios without the inputs and outputs. It's in the states' best interest to try and synthesize a vast volume of data on consumption and application of nutrients and crops than it is to just use these coefficients to drive BMP implementation and cost share.
Bill Keeling: If Jess does some model runs, can we get the results at the smallest scale? So we can evaluate based on land river segment and by basin?
Jess Rigelman: Yes, I can get you guys what you need. Let's talk offline about what data you specifically need.
Bill Keeling: Can we see a no-BMP comparison? Can we pick a different year?
Chris Brosch: That's what I thought too, but if the BMPs are the same in the 1995 condition, I don't think it would be that big of an issue.
Jess Rigelman: Yeah we can do that. The reason we chose 1995 is because that's the TMDL condition. Part of the reason BMPs are used is because we're doing average inputs of the scenario versus average inputs from the calibration, which used the BMPs from 1985 - 2013. So the inputs for the calibration include the use of those BMPs, which sets up where the fertilizer is

distributed. So it was meant to keep that the same. I do understand your point though and we can run it as a no-BMP condition as well.
Dave Montali: The bmp and no BMP condition might have an effect on the ag open space issue because its a BMP land use. When we look at the groupings, I suggest looking at other agronomic crops since it's a composite of a bunch of things. Some ag census land uses that go into other agronomic crops are like BMP land uses, similar to ag open space, and some that are not. There are nuances there, but we should keep an eye out for that.
Bill Keeling: All 3 WIPs were created using a no-BMP condition, which is why I want to see that since I'm sure we will be using that to create a Phase IV WIP for Phase 7.
Jess Rigelman: Just a reminder that this test was run on CAST-17. We can only do progress through 2018. And this should not be compared to what you're seeing online right now for CAST-19 or soon to be CAST-23.
Chris Brosch: So are big issues like the fertilizer issue included? A no ratio test in 2018 - is that projected fertilizer from 2012?
Jess Rigelman: No, it's not the latest data for fertilizer. For C17 we only had fertilizer from 2012 and projecting based on those ratios.

Decision: The AMT agreed to evaluate changing the land uses for Phase 7 CAST. The specific land uses and associated loading rates have not yet been determined and will be further investigated at future AMT meetings.

Action: Email Tom Butler and Jess Rigelman (butler.thomas01@epa.gov; jrigelman@j7llc.com) if you are interested in data on the CAST results from the loading ratio test by Friday, Feb 16th.

Manure Generation and Acres in CAST 10:25-10:55 [30 min (10 min presentation 20 min discussion) (Tom Butler, EPA)]

The group did not have time to review this topic. At a future meeting, the AMT will review CAST data demonstrating how CAST calculates manure. These example data will help inform members on the current state of manure related information in CAST.

Recap/Closing 10:55-11:00 [5 min (Zach Easton, VT)]

Adjourn – 11:00

Upcoming Meetings

Office Hours: Friday, March 8th, 2024 from 8:00 - 9:00 am.

AMT Meeting: Friday, March 8th, 2024, from 09:00 - 11:00 am.

Participants

Jackie Pickford, CRC
Tom Butler, EPA
Zach Easton, VT
Kristen Bisom, WVCA
Cassandra Davis, NYS DEC
Arianna Johns, VaDEQ
Zachary Easton, VT
Jessica Rigelman, J7 Consulting
Chris Brosch DDA
Scott Heidel, PA DEP
Olivia Devereux, Devereux Consulting
Mark Dubin, UME-CBPO
Jeff Sweeney, EPA-CBPO
Elizabeth Hoffman, MDA

Ashley Hullinger, PA DEP
Chris Brosch, DDA
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Ken Staver, UMD
Dave Montali, WV Tetra Tech/MWG
Karl Blankenship, Bay Journal
Tyler Trostle PA DEP
Lisa.Duriancik-NRCS
Dylan Burgevin, MDE
Hunter Landis, VA
Alisha Mulkey, MDA
Tad Williams, USDA
Timothy Larson Virginia DCR
Nick Moody
Alex Soroka, USGS
Kate Bresaw - PA DEP
Bill Keeling, VA DEQ
Ruth Cassilly, UMD-CBPO
Emily Dekar, Upper Susquehanna Coalition
Suzanne Trevena, EPA R3
Victor Clark, Farm Freezers DE
Doug Austin, EPA
Candiss Williams, USDA
Curt Dell -USDA ARS
Helen Golimowski, Devereux Consulting

**Common Acronyms
AgWG- Agriculture Workgroup
AMT- Agricultural Modeling Team (Phase 7)
BMP- Best Management Practice
CAST- Chesapeake Assessment Scenario Tool (user interface for the CBP Watershed Model)
CBP- Chesapeake Bay Program
CBPO- Chesapeake Bay Program Office (houses EPA, federal partners, and various contractors and grantees working towards CBP goals)
CBW-Chesapeake Bay Watershed
CRC- Chesapeake Research Consortium
EPA- [United States] Environmental Protection Agency
PSC – Principals' Advisory Committee (CBP)
STAC- Scientific & Technical Advisory Committee
TMDL- Total Maximum Daily Load
WQGIT- Water Quality Goal Implementation Team