Agricultural Modeling Team (AMT)
Meeting Minutes

March 10th, 2023
09:00 AM – 11:00 AM
Meeting Materials

Summary of Actions and Decisions

Decision: The AMT approved the February meeting minutes.

Action: Tom Butler will work with Jess Rigelman to develop scenarios for the AMT April meeting, including aspects such as moving around land uses, aggregating nutrient management multipliers, and revisiting the eligibility and/or timing components of nutrient management.

Meeting Minutes

Announcements

- Fertilizer Expert Group meeting was this past Monday, 3/6/2023
  - Sort through meeting minutes and proceed with short term fertilizer solutions
- **Decision:** The AMT approved the February meeting minutes.

Introduction – Tom Butler, EPA.

Tom provided a recap of previous CAST discussions.

Workplan: Topic prioritization poll results - Tom Butler, EPA.

Results of the reprioritization poll were collected and a formal group work plan was created. This work plan outlines the topics which the group will examine as well as the intended timeline in which to investigate these. This is a living document with the ability to revisit and alter topics as the group deems necessary.

Crop Nutrient Application Agriculture Land Use Categories - Tom Butler EPA.

Tom introduced our first decision item - the reevaluation of Crop Nutrient Application. Tom gave a brief informational presentation regarding the current crop nutrient application methodology used by CAST. The group then discussed whether to change how this application occurs.

Discussion

Ken Staver: When you have relative magnitude of manure and inorganic nutrients - the goal between nass data and animal counts and fertilizer sales data, the overall totals are as close as they can be to an absolute number?
Tom Butler: I think that's accurate to say, yes.
Ken Staver: So whatever we're doing all around the watershed is supposed to add up to a number that we think is somewhere close to the actual lbs of nutrients applied in the watershed total?

Tom Butler: Yes looking to reflect what's on the ground, but it's not the physical actual application. It's not exact. we're not necessarily there yet.
Ken Staver: When we sum it up it's bounded by actual numbers. Right?
Tom Butler: Yes. The fertilizer bucket is bound within the year we do it. We set that kind of proportion of fertilizer to the yield total and that stays the same. We don't have the exact data for recent years, so we base it on that proportion.
Dave Montali: How frequently do the yield goals change?
Jess Rigelman: Those change yearly for 11 of the crops (the biggest ones). They come from the ag census data every 5 years and subset of those supplemented from the annual NASS survey data.
Ken Staver: Difference between yield goal and yield, right? How is yield goal calculated based on survey data?
Jess Rigelman: We get acres and yield and then we do the math to put the yield per acre in the application.
Ken Staver: Yield goal at the production level can be higher in the long term. There are years when yields are bad, and you don't generally fertilize based on those years when yields are unusually low. Generally yield goal is higher than just a straight average because it drops out years when yields were damaged by unfavorable weather.
Alisha Mulkey (in chat): I thought we used a rolling average of best 3 of last 5 years?
Clint Gill (in chat): I was going to say the same
Gary Shenk: Excellent point. Does that still have too much variability? We should discuss that in the future.
Cassandra Davis (in chat): Is the yield goal by state or bay wide?
Gary Shenk: It's by crop region**.** Generally 1-3 regions per state.
Mark Dubin: States have diff algorithms for determining that. Variations between states.
Ken Staver: We don't calculate the crop acres, it comes from NASS right?
Tom Butler: There is a number that comes from NASS, but land use change plays a factor as well. We would split the information in relation to the land use change data. We can ask Peter for more details about how that happens.
Clint Gill (in chat): If I remember correctly, NASS and ag census used to be the number we used for ag acres. However now the available ag acres are constrained by the mapping tools, NASS and ag census are still used for the breakdowns between crop types.
Ruth Cassilly: Yes that's correct Clint.
Gary Shenk: For Phase 7 the total acres of crop will be constrained by the land use data and then we will use the ag census for the percentage of crops within that total acreage.
Dave Montali: So, the total acres of ag will be constrained by land use but census will be used to distinguish between crop, pasture and hay.
Gary Shenk: I think they will be able to distinguish between crop and pasture and then within the big categories we will divide up land uses based on ag census.
Mark Dubin: Still have limitations on remote sensing for pasture and hay right now so that will still be combined at this time.
Alex Soroka (in chat): When I compared the cast applied N with a home-made estimate of applied N (assuming 1lb of N was applied per 1bu of corn yield reported by ag survey data), I found that CAST's estimate of corn N need was close to reported yield. CAST's estimate of actual applied N was greater than need. That told me that CAST has a modified to increase the estimated yield goal beyond reported yield.
Mark Dubin: One of the reasons for that is because we're using a 1.3 multiplier for non nutrient management.

Gary Shenk: Correct. We have additional factors that bring the application goal, but that goal is not what determines the application. It determines how applications are spread geographically.
Ken Staver: For a given county, states give the fraction of the county that is nutrient management versus non nutrient management?
Tom Butler: Yes, but usually submitted in acres not a percentage.
Dave Montali: NM is a BMP so there are nuances as the state reports. Some acres are on crop and there's a method to distribute those BMPs. The percentage is not set in stone.
Ken Staver: In these counties with excess manure, what percent of corn acres are manure eligible relative to what the county manure eligible need is?
Tom Butler: I can look into it and let you know.
Gary Shenk: Lets bring that back to next meeting.
Cassandra Davis (in chat): Are the nutrient spread slopes the same for the entire bay?
Gary Shenk: Yes, they are.
Lisa Duriancik (in chat): And would that be based on manure N or limited by a manure P application basis per LGU recommendations.
Gary Shenk: Yes, based on manure N.
Lisa Duriancik (in chat): Is it realistic to use an N basis?
Mark Dubin: Have to represent the time period all the way to 1985, and back then, N-based NM planning was mainstream before P-based NM was. And we also have to represent the non NM acres as well. Those are the two factors why the NM expert panel made that decision.
Ken Staver: As we move forward and the P factor becomes more of an issue, then manure will be spread across more acres. Dairy manure doesn't travel far but poultry is moving around quite a bit. Something that needs attention moving forward with efforts to redistribute phosphorus.
Tom Butler: This is all post-transport. We've accounted for losses with transport.
Alex Soroka (in chat): In reality, is manure tested on an individual basis before sale and spread to a field? Or, do we used published values for N content of manure and assume X lbs/ton?
Mark Dubin: We use a variety of sources in the model for nutrient generations, looking at population by nutrient excretion (nationally published values). We don't have regional values yet, only national ones. Laid out really well in the NM expert panel report for Phase 6.
Lisa.Duriancik (in chat): What is the basis/data source for transport and will that be reevaluated for the next phase given fertilizer prices?
Tom Butler: Dried manure comes from state data. I think that can be reevaluated if we chose to.
Dave Montali: What Tom mentioned is after the transport BMP, which is difficult to track. It's been difficult to capture transport because they can only report what they are cost sharing.

Scenario Brainstorm

Dave Montali: Maybe let's step back and say what is the simplest way we can do this? Can we pursue a path that is as simple as possible? Complexity about putting nutrients down on different crop types at different times of year - not sure it really does much for us. Or do we want to focus on tweaking the complex process that we have already got?
Alisha Mulkey: I support Dave and think we should consolidate crop land uses and manure eligible conversation is creating issues with distribution. So we'd be up for simplification.
Mark Dubin: When the AgWG approved the LU as they are here, we developed tiers to combine LUs into larger categories. Might give you some ideas for how to do that. Phase 6 land uses.
Clint Gill: Agree that we can simplify some things, but let's move carefully. When we simplify things the outputs don't always match the real world.

Cassie Davis: When we create planning scenarios in CAST, we are only given a small number of LU to choose from, the LU options we have to apply land BMPs to don't really get into different grain type. Are those the simplified LUs that Mark is referring to?
Mark Dubin: I'd have to check.
Cassie Davis: Will also be useful to look at what states are reporting to NEIEN, to see if we are reporting specific crop types or if we're just doing cropland.
Jessica Rigelman (in chat): Most states are using the default land use groups in NEIEN for most BMPs and not reporting their own land use group for the BMP.
Dave Montali: If a state reports NM on crop, then how we have the loading from silage, grain, whatever - it just goes away because when that BMP comes in, it gets distributed based on the ratio of land in the county, so if we just have an average number for all crop, and apply BMP to certain portion of the crop, you're getting that average result anyway. Also, we have other tenants in what we do that could be simplified, like determining loading for non nutrient management land could be taken from LGU recommendation and say non NM land is on average x % higher than the recommendations. Aggregate NM multiplier into a single average value. If we approach things on an average basis, a simplified basis, we could simplify the explanation of this. The real challenge is how to deal with change over time.
Mark Dubin: LGUs have specific recommendations for those crops. Typical way to represent that is to start off with those more specific categories and then combine them up and represent by percentage of total population represented. If we had one number for all acres, we lose our ability to represent a percentage within a total acreage population.
Dave Montali: Maybe we look at areas that are 1 crop type dominant and see how much our model and BMP applied vary at the county scale? Need to see what the effect would be if we represented one county with a priority crop as a generalized or average value.
Lisa Duriancik: Suggest whatever approach is taken reflects application of nutrients on the ground. LU more accurately captures that, but then we justify N basis for example, because thats the way it was done at one time. Struggling with how the model represents application of nutrients relative to what might be happening in the real world, particularly on options that are preparing and following an NM plan.
Ken Staver: That's approaching management at the field scale, and that's where we should be headed. It doesn't work very well otherwise. Simplification is great, but need to explain to farmers what they need to do on their farm specifically to meet these goals. In 2000, we tried simplification and the model said we met our goals when we didn't.
Mark Dubin: Have to represent change over time - 40 years ago, where we are today, as well as the future. It makes it really difficult. We have to think about pre-NM as well.
Gary Shenk: For P-based management - I remember it was really hard to represent this but can't remember what our difficulty was, so let's try this again. If we reduce the number of LU but still represent that they're made up of different crop mixes in different areas then we might be able to do that. The reason why our model said we met the 2000 goal is because we set the goal with a different type of model than we evaluated it with. Now we know that we have to set and evaluate the goal with the same type of model and we've been strict about that since then.
Ken Staver: Right, just making the point that a simplified model can cause issues.
Mark Dubin: Prior to Phase 6 we had a lack of soil P data so we couldn't implement a P based NM system.
Elizabeth Hoffman (in chat): I would be curious to evaluate the manure eligible fractions we assign to the land uses, and what impacts that has. Can we have the reference list of fractions by land source and county?
Tom Butler: We'll work offline to get you that.

Dave Montali: Another nuance in the way we do things now with P is in areas of excess where states may be doing NM planning on pasture and hay because of disposal tending, things going on with chicken litter, there is no credit in application rate for NM planning. Now, they can claim core P on acres that are being NM planned for P but you have to have the manure transport out to get any credit and that process is difficult.
Robert Shoemaker: I looked at fertilizer data in VA for past 20 years from VDACS starting in 2000. The multiblend fertilizers from 2022 have gone down. The N rate fertilizer has gone up slightly but P commercial fertilizer dropped dramatically. So there are some larger macro environmental trends going on that tells an interesting story where N is staying where it is but P is dropping. Need to look at longer term trends to see what's going on (8 - 10 years).
Mark Dubin: Trends vary between states though. Virginia also has the most pasture acres in the watershed, which might be why you were seeing those trends. But definitely need to look into and represent that better.
Tom Butler: Is there a middle ground with how to simplify? e.g., effect of removing timing and eligibility/replacing them with an average value.
Alex Soroka: I would be interested in having an average value for timing and eligibility.
Ken Staver: Timing values need to be revisited, whether that be a simplification/average or an improvement of the way it's done now. I'm worried about simplifying for total inputs though. Agriculture will intensify and we're going to get more efficient but inputs will be going up. Also will be accruing N in soils as soil health and carbon storage grows. Nervous about too narrow of a definition of total inputs.
Tom Butler: So we want to simplify timing?
Ken Staver: I don't think we should remove timing because it's part of the 4Rs. We don't want to deemphasize the placement of nutrients at the management scale. But you made it seem like there were artificial constraints as to when these buckets were distributed in the model, which is what I think needs to be revisited.
Tom Butler: When we apply manure it's a 3:1 ratio for nutrients right now, and when we apply that with timing, it is possible when you're applying nitrogen you're getting excess P. We wouldn't remove the 4Rs, but if the states are providing us this data and giving us more than what we have then a solution might be to remove or simplify that.
Ken Staver: Following up about P-based management and redistributing animal manure comments - that will change the timing of when the majority of N is going to applied on an acre if you start using manure where you weren't previously. So we have to capture that better.
Tim Larson (in chat): Where acres have nutrient management plans, there are strict budgets for N, P, etc. in the plans .. so why wouldn't you use these net budget values where you have the data... and use simplified averages for acres where you don't have better data?
Tom Butler: My understanding is that we need to keep things consistent. Across the states, nutrient management is different and it's reported differently. More important to have that consistency than accuracy in some areas of the model.
Mark Dubin: We have some factors we use for nutrient management that are consistent across all states, mainly because of the limited data available to develop some of those, so we didn't have data for all areas of all states, but we did try to represent some variances by state. Tried to bridge the gaps where we were missing information.
Elizabeth Hoffman (in chat): To Tim's point, can we do a test scenario where crop N applied does not exceed crop need for NM acres?
Jess Rigelman: We don't have NM acres, we have NM rates for certain acres and they get lumped into a land use. So instead of putting them on NM acres we would put them on non-NM

acres, and the rate for that land use would be the exact same. So the end result would not result in any change.
Alisha Mulkey: Can you clarify what that means?
Jess Rigelman: We have a land use with manure which is made up of corn. We have acres with NM and acres with non-NM based on acres of NM reported. But we don't really have those in acres, instead we have (step 3) where we do a blended rate for NM and non-NM. If we wanted to, we can create NM version for every one of these land uses and not exceed crop need on those, but we still have the same amount of manure and fertilizer, so it might go down on corn with NM but it would go up the same amount for corn on non NM.
Tom Butler: So it would just change where things go, not the actual application?
Jess Rigelman: Right. It's possible but I don't think it will result in anything different.
Gary Shenk: When we're looking at the past when we have number of animals and fertilizer sales, when you assume more or less NM in one region that doesn't lessen the total amount of manure or fertilizer for the whole watershed, it just moves it around a little bit. But we can do a future scenario that has 100% of acres with NM, but it won't necessarily be applied at the recommended rate, it will be applied at the rate we calculated for NM given the last year of information we had. So we can do a scenario with 100% NM and look at the difference between that and a future scenario that doesn't have that. But assuming everything is actually applied at the NM rate is not in the rules at this point and may not be easy for Jess to do in a future scenario.
Tom Butler: I'll work with Jess to develop that scenario.
Scott Heidel (in chat): I have to hop off for another meeting but I am curious how the manure and fertilizer calculations are made in the first place since it seems it will be used regardless of nutrient management plan implementation.
Lisa Duriancik-NRCS (in chat): Tom- In your notes, I think the "P based NM bullet(s)" are captured under Simplify, but shouldn't they be under Can't simplify too much or we lose reality? Same regarding Ken's point about timing?

Action: Tom Butler will work with Jess Rigelman to develop scenarios for the AMT April meeting, including aspects such as moving around land uses, aggregating nutrient management multipliers, and revisiting the eligibility and/or timing components of nutrient management.

Adjourn – 11:00

Next Meeting: Friday, April 14th, 2023 from 09:00 - 11:00 AM.

Participants

Jackie Pickford, CRC
Tom Butler, EPA-CBPO
Zach Easton, VT
Gary Shenk, USGS-CBPO
Scott Heidel, PA DEP
Kristen Bisom, WVCA
Cassie Davis, NYSDEC
Jess Rigelman, J7 LLC
Dave Montali, Tetra Tech WV
Curt Dell, USDA-ARS
Elizabeth Hoffman, MD
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**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