Agricultural Modeling Team (AMT) Meeting

April 11th, 2025
09:00 AM – 11:00 AM
Meeting Materials

Summary of Actions and Decisions

Decision: The AMT approved the March minutes.
Decision: Both crops; Other haylage; grass silage and greenchop AND Other Dry Hay should have no nitrogen fixation associated with them.*

*Note: The mixture of species composing these crops may contain leguminous species, but expert opinion determined that there is no accurate way to parse out the percentage of crops from the mixture as reported by NASS which fix Nitrogen. Furthermore, the percentage of leguminous crops is likely a small proportion. Therefore, the group suggested the Nitrogen fixation rate should be zero since it does not affect N losses from this land use or the application of any other N sources to this land use. Note: not including N fixation makes cropland mass balance calculations inappropriate for these land uses.

Action: Tom and Joseph will compile data on CAST runs for the 11 major crops using the new method to determine crop yield trends and distribute this data to the group. Data requested to visualize state and county data with these new yields can be found at the following link. Members are asked to review the requested data ahead of the May 9th meeting.
Action: Joseph will return at the May 9th meeting for decision on adopting the new statistical method for determining crop yield trends for the 11 major crops in Phase 7.
Action: Tom will follow up offline to continue discussions on the backfilling of fertilizer.

Meeting Minutes

Statement of purpose:

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

Decision items:

1. Approve the March minutes.
2. Other Hay crop composition and fixation

Announcements:

- Gary Shenk announced that he will be retiring effective 4/18. Thank you, Gary, for your contributions to the AMT!

Introduction/Recap: 09:00-09:15 [15 min (Zach Easton, VT)]

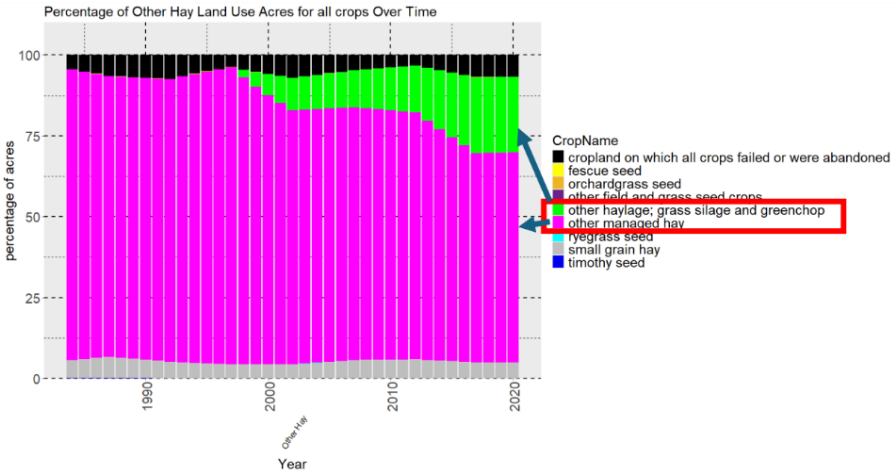
Zach went over the meeting materials and requested approval of the March minutes.

Decision: The AMT approved the March minutes.

Other Hay Crops 09:15-09:35 [20 min (5 min presentation 15 min discussion) (Tom Butler, EPA)]

Last month it was noted that several of the crops within the current Other Hay Land Use have the same definition in the Census of Agriculture. These crops are currently treated differently in CAST regarding the fixation of Nitrogen. After last month's discussion, the group continued conversations on the appropriate N fixation rate for these crops. Decisional.

Discussion:



Dave Montali: The shift that began around 2000, is that an artifact of ag census reporting?

Tom Butler: Yes.

Dave Montali: So, it's the same amount of stuff, but now we are calling it something different starting in 2000 and then increasing as we go in time?

Tom Butler: Yes. Great question. To get everyone else on the same page, they just reclassified something that they asked for as a question. Obviously that bar is pretty close, but the breakdown of it has just changed. It is overall kind of similar, and that artifact is just a different question in the census.

Bill Keeling (in chat): As I remember during p6 development the other hay was meant to represent hay without legumes vs leguminous hay.

Tom Butler: Bill, I think you are right that there are two categories.

Bill Keeling: That's how I remember it, Tom. That was the whole point of having the two hays. Not every hay field has legumes. Maybe a majority do, but we were trying to describe what hay would be like with legumes. If that was the case, then we really screwed up by having 30 pounds of leguminous fixation occuring in places where there are basically no legumes.

Tom Butler: I did reach out to Brian Combs from NASS and asked if there was a way to get more detailed information on what that breakdown could be. He said that unfortunately the Census of Ag is as detailed as we would get. We would be left to decide essentially what that percentage would be with whatever we had. Currently, you are right, these are in the non-leguminous hay category. That one does have a fixation value, so those in the lighter color green bar do have that value. That is where we want to go to today. Should that change?

Bill Keeling: There was a big debate because there was fixation going on and we had that change between one of the versions of CAST, so this should be simulated now like less than 5 pounds. Just plain fescue or orchard grass doesn't fix that much.

Tom Butler: I think you are referencing a change between 17 and 19 CAST versions where the fixation value for other haylage was 175 pounds per acre and it dropped to 30. That might be what you are referencing. I think the deal for today is we want to decide should that value exist? Should that value be on both of these bars? If so, should they move or not? We do have some proposals that I will walk through, but great questions on making sure the concept is solid. Does anyone else have questions?

Ken Staver: Following corn silage, somebody plants a winter cereal and sometimes some people put vetch in it. Then they ensile it in the Spring. Sometimes they greenchop some of it. Sometimes they put in silage. Is that the light green color? I am not clear when you have the corn silage acre whether we are talking about double cropped acre or whether we are talking about something in this category. How is that counted?
Tom Butler: A state would have given us the input on what they'd see as their double cropped category or double cropped crops that are eligible. If they put a small grain hay or they put the other haylage, grass silage, and green chop on, then that could be considered in their double cropped acres. The actual cover crops themselves are eligible for application on any land use. I think they are limited in their total magnitude by double cropped acres, but I think they are applicable across the board. I'll lean on Jess because that is getting really in the weeds.
Ken Staver: Some of this goes to how the farmer reports it on the NASS survey. So, if they ensile the winter cereal in the spring before they plant silage again, it's two crops harvested. I guess I am just a little unclear about what's in this category relative to that crop. The hay part is fairly straight forward. It sort of turns into this secondary problem of cover crop reporting and getting kicked out because you don't have the acres. It's all kind of tied together somehow, I think.
James Martin: Tom, if you flip back to that graphic slide, I saw there's a category in light gray near the bottom called small grain hay. Logically, Ken, that seems like what you are describing. Does that make sense to you that that's where that rotation would fall?
Ken Staver: That would be one of the places. I only drive a certain part of the watershed, so I don't see everything that goes on. Most of the time I don't see that going into hay, because early in the year it's not an easy time to make hay and they're anxious to get the ground ready for silage. Generally, I don't see dairies fooling around with hay with their winter cereal. So, I'm surprised that category is as big as it is. But, that's not silage, so I don't know. Someone from the big dairy areas would be able to comment more on how that winter cereal or cover crop is typically handled in how it's reported.
James Martin: I didn't see that in any of the census questions. So, that raises the question in my mind of where are we getting that number from?
Tom Butler: I would have to dig through that and look at that. That might be another month of looking through it. I don't know offhand what that corresponds to exactly.
Joseph Delesantro: Which number?
Tom Butler: Small grain hay.
Joseph Delesantro: That was an old census category that I think was removed not too long ago and, since then, we've continued to estimate it as a ratio to other hay categories. Jess might be able to correct me if I am wrong.
Jess Rigelman: That one stopped reporting in 2017, and they combined 3 categories into one, so we had to categorize that. Remember that our crop names aren't exactly the ag census crop names. I can look it up, but I think Joseph is correct on that.
Cassie Davis (in chat): This is in the 2012 report form: Item 5 - Small grain dry hay - Report the acres, tons harvested, and any irrigated harvested acres of hay made from small grains or small grain mixtures. Include hay made from small grains and alfalfa mixtures where the quantity harvested was predominantly from small grains. Otherwise report these harvested acres as alfalfa mixtures for dry hay. Exclude straw acreage harvested and production. Report small grains cut for greenchop, haylage, or silage as "All other haylage, grass silage, and greenchop."

Cassie Davis: I already had the 2012 report form open, so I just searched for small grain and then I found the definition for small grain dry hay.
Tom Butler: I appreciate that. That was fast. Let's have people look at that if you wanted to look more in the small grains. Ken, your question was more about the silage component, and you are asking where winter cereals went within that?
Ken Staver: I think it's in the light green. It's going to be haylage, grass silage, and green chop. That's where your chopped winter cereal, whether you ensile it or feed it directly to the cattle, that's where that is. It's not other managed hay.
Tom Butler: You are right. You are saying it's usually too wet to get off the ground, so you are not going to mess with that. So, you would just ensile it rather than wait for it to dry out?
Ken Staver: That's what I see done in my dairy territory, which is southeastern Pennsylvania and Maryland, but I don't know how it looks in other parts of the watershed. If all this is about getting to the issue of N fixation, I don't see how it makes a difference anyway. It's not like we have an N fixation bucket we have to deal with. It doesn't really change the loads. The big N fixation in hay is leguminous hay; it's alfalfa. Most hay in the leguminous hay category would be alfalfa hay because how much red clover hay is there? My experience is you start off with red clover and some kind of grass mix, and it's not long before the red clover fades out. I think leguminous hay is mostly alfalfa. I am looking for folks from dairy county to weigh in.
Bill Keeling: I'm going to have to disagree with you, Ken. What I've seen in Virginia is different. In the Piedmont and western part, which is predominantly grass based ag, there are dedicated hay fields. The silage issue is really only with dairy. That's the only place I saw any ensiling of any type be it soybeans, small grain, or mostly corn. The only place I saw alfalfa being cut for hay or mixed with hay is with dairy, which is not a majority of the land area at least in Virginia.
Ken Staver: I don't think we disagree. Maybe I wasn't clear. So, you are saying you have leguminous hay that is not alfalfa?
Bill Keeling: Lots of hay that I've seen that has clover or vetch has nothing to do with alfalfa. The only places I saw alfalfa being grazed was around dairy.
Tom Butler: Bill, you are not saying that that's part of a mixture, though. Those are designated fields that are leguminous, not like this combination of things.
Bill Keeling: I'm thinking we are overthinking this in terms of other hay. I think these ensiled products should be more thought of as cropland and less of hayland. My experience is the other hay has nothing to do with dairy, and it's legume poor, but they're still cutting hay off of it.
Tom Butler: If I shifted a little north to dairy country, Kate, do you have any input on what any of those mixtures might be? For the other haylage; grass silage, green chop category we have here, the crops are a mixture of some leguminous with mostly non leguminous. Off the top of your head, you wouldn't happen to know if that was a big portion that was leguminous, would you?
Kate Bresaw: You want to know if most of it was leguminous or not leguminous?
Tom Butler: Yeah. Essentially, is there any big chunk that is leguminous or is it almost a negligible amount?
Kate Bresaw: The latter is my impression.
Tom Butler: Ok. Then I think that's good on the clarification. I do see Dave has a question. I'll let him go, and then we'll walk through where the group is going with this.

Dave Montali: When you are talking about other dry hay, not dairy, but the hay fields out there, do they have a substantive component in them of clover or lespedeza? Something that would say we shouldn't make our fixation zero? I think the group is saying no. It's negligible, and zero is a good approach for both of these land uses.
Ken Staver: I think fooling around with N fixation on these land uses is not worth the trouble. But, if you take the fixation out, does that mean we put more N fertilizer on because we are dealing with crop need and we take the N fixation away, so therefore we have to meet more of the crop need with fertilizer? That's the only reason I would see a problem with just getting rid of the fixation.
Alisha Mulkey (in chat): MDA agrees with Dave M.
Bill Keeling (in chat): If there are no legumes I could see 5 pounds or less of non-leguminous fixation.
Tom Butler: Great question. The fixation does not impact that crop need. That comes as a secondary thing after we apply the organic and inorganic. So, it's not like we have a bucket of fixation that needs to go somewhere. So, it shouldn't have any impact on that. It would obviously affect the fixation on nitrogen from that, but it's not going to hit that crop's expected application or the need.
Ken Staver: So, if we take fixation away, it will not impact how much N fertilizer we put on that?
Tom Butler: No. The fixation value is related to the manure and fertilizer that is applied. So, those two things are applied and then the fixation value would come as a product after that. It does not affect the overall need. The need is based on what we're applying from organic and inorganic.
Ken Staver: I thought the need was based on how much crop is grown?
Tom Butler: It's based on that and how much of the nutrient we have. So, when we have the crop yield, we know that that's grown. We have the manure from the county, and then we have the inorganic fertilizer. So, in the year we have the data, we have the yield, we apply the organic source and, from that, we're going to take from our watershed wide inorganic amount and we're going to apply all of those. That's our plant available need that is given to that crop. It's based off they yield. That's the last year we have data. Moving forward, when we don't have the fertilizer stock, we have the proportion of the need that was met. As the yield varies, so too does that amount.
Bill Keeling (in chat): But for soybeans we have very low crop needs because of the assumed fixation??
Ken Staver: I would think if we put in 30 pounds of N fixation, that's 30 pounds of the need that's met that we wouldn't need fertilizer for. Am I missing something here?
Tom Butler: The nitrogen fixation is not factoring into that need.
Ken Staver: I understand that, but we meet the need with N sources, right? Fixation is like some version of plant available N that's obtained through N fixation, so we wouldn't need fertilizer.
Tom Butler: Soybeans is a good clarifying example. Your need is 5 pounds of nitrogen because you assume the 100 pounds of nitrogen is going to be fixed by that, so that does factor in in that way. The need is a part of that, but the actual percentage of that is not in the same way as the fertilizer. The fixation is not going to affect the fertilizer amount outside of that.
Ken Staver: That's my bottom-line question. If we take fixation out, does it have any effect on fertilizer? If it doesn't, then I guess that's the bottom-line answer.

Jess Rigelman: The ag application rate should take fixation into account and, therefore, affect the yield. Then manure and fertilizer are applied, and fixation is calculated afterwards. It has a fixed amount, and that fixed amount would be reduced if any nitrogen was applied through manure or fertilizer. So, the application of nutrients affects fixation. Fixation does not affect the application of nutrients in the algorithm. Its effect is in the source data in that you would say that the application rate was lower because you're counting on fixation.
Tom Butler: This leads us to what has been proposed. The first thing is a proposal, not a change, it's just that we keep both crops where they are. Since that is the status quo, there is no need to look at that and change anything. The second part is related to the fixation values. What we've coalesced around has been that we should not have a fixation value on a crop that has a potentially negligible amount of fixation occuring in it. So, we should also not have fixation occuring in the non-leguminous hay category. By that reasoning, there should not be a nitrogen fixation value associated with the other haylage; grass silage and green chop and, for that matter, the other dry hay. Since they have the same compositions, they should behave the same way, and that way should be that neither of them have a fixation value associated with them. That is the proposal that we have in front of us now. We can work on the wording of that. We want to put this to a vote, obviously. Does item two make sense to people? Is this something we would like to pursue? If we have issue with this, then we will kind of go through one by one and look at that. Does anyone have heartburn with removing the nitrogen fixation value from other haylage; grass silage and greenchop?
Ken Staver: Can there be any comments here? It seems like something that's really popular now is to do these mass budgets/mass balances. People are running around with CAST data and doing other things with it, and this is really about doing loads and how we meet our goals in terms of reducing nutrient loads. That's what our overall charge is. This mass balance stuff, somebody's going to go back and say, "of course there are legumes in a lot of these hay fields; what are these people thinking?" So, is there a place where we can put a comment that this is from a practical standpoint? There needs to be an asterisk somewhere. We obviously understand that there are some legumes here and there. Some fields would be higher than others. Some would be zero. I just think there should be a comment with it. I think it's a good practical solution, just for a little cover down the road for us.
Tom Butler: We can absolutely wordsmith that. We can do it here, or I can take that offline and put that in the minutes.
James Martin: I agree with Ken. I think it's important that we document what we don't have is a basis for determining what the fixation value should be because the data we have available from the Ag Census does not provide us the clarity or the resolution that we would need to understand what percentage of this crop has legumes and at what percentage mixture those legumes exist. So, I think as long as we document that as part of this decision, I feel like it will be the cover that Ken suggests.
Bill Keeling: We also need to remember that we are talking a model that is, in effect, a crude instrument. So, we are representing leguminous or hay with legumes with one land use, and we are trying to represent the other situation with a different land use. They are different. One has fixation and one essentially does not.
Tom Butler: We will work on the wordsmithing. That will come out in the minutes and recap email, and we will be able to make some changes to that if people see that. I will also bounce that off a few of you guys on this call. Everyone will get a chance to look at it, and we will make

sure that there is some caveat or asterisk with this that says we don't know. Pending the implementation of that note, do we feel good on this one? In other words, this will be registered as a consensus decision that we will remove the nitrogen fixation value on other haylage; grass silage and greenchop, and that is for the reason that we simply don't know the proportion for fixation and the crops that would fix it. I will give a few more seconds for people to chew on that, and then we'll accept that one.
Tamie Veith (in chat): Thanks Tom. That sounds reasonable to me!

Decision: Both crops; Other haylage; grass silage and greenchop AND Other Dry Hay should have no nitrogen fixation associated with them.*

*Note: The mixture of species composing these crops may contain leguminous species, but expert opinion determined that there is no accurate way to parse out the percentage of crops from the mixture as reported by NASS which fix Nitrogen. Furthermore, the percentage of leguminous crops is likely a small proportion. Therefore, the group suggested the Nitrogen fixation rate should be zero since it does not affect N losses from this land use or the application of any other N sources to this land use. Note: not including N fixation makes cropland mass balance calculations inappropriate for these land uses.

Crop Yield trends 09:35-10:15 [40 min (10 min presentation 30 min discussion) (Joseph Delesantro, ORISE)]

We heard about the progress that has been made to improve the crop yield trends for Phase 7. Feedback was elicited to finalize this item in the coming months. Informational.

Discussion:
James Martin: Will you need to back cast this new yield data as well as forecast this new yield data as part of Phase 7? If so, how's that going to work exactly?
Joseph Delesantro: There won't be any need to back cast the data. We actually pulled data all the way back to 1950, and that's in order to give us more data to fit to and establish the trend. It ends up being really important for when I talked about why we are able to capture this deeper trend in the proposed method versus in the Phase 6 method. A lot of that has to do with pulling that data going all the way back to 1950. So, I don't see any need to back cast unless I am missing something. In terms of forecasting, this method provides a lot of flexibility. If we wanted to, we could take our projected weather and climate data and plug it in and estimate what the yields will be in the future. So that's an option. I will say that I was looking at that as being a separate issue. There is already currently a method that was used in Phase 6 for essentially extrapolating out the yields into the future. So, unless there's a specific desire to do something new, I was expecting that we would just continue to use that method from Phase 6.
Dave Montali: First off, a lot of good work here and it looks really good. In what is left to do, it's those eight crops and where we're projecting yield based on a per acre basis. You said some of these guys are not very important; there is no trend. Is there a way that we can take this list and make an assumption on a production rate per acre? It has no trend, we just put it in the

model flat all along, and we don't have to worry about it, versus which ones we really need to think about?
Joseph Delesantro: If there is a crop that essentially has no trend anywhere, I've not bothered to include it on this list. What's on this list has a trend somewhere in the watershed but not necessarily everywhere. So, there's more of a trend in hay yields, for instance, in Virginia. There are not really any trends in some of these smaller gay categories in New York state. It's a similar thing for tobacco. Where it's grown a lot, we are generally seeing some trends but where it's not grown so much, it's basically just flat. So basically, none of these are flat everywhere. I guess the question moving forward is maybe trying to break this out by growth region or break this out by acres. For example, here are the number of acres that have a trend that we might want to capture with an actual yield unit, and then maybe we can say that's not enough acres to be worth moving to a true yield unit from a per acre yield unit. How does that sound, Dave? Would that be a way to think about it?
Dave Montali: For now, that sounds good.
Hunter Landis (in chat): Do we need WS trends if a crop is isolated to a small region?
Joseph Delesantro: The way that CAST operates right now is it essentially needs a yield for each crop everywhere. If there are no acres of that crop, then it's inconsequential. It doesn't matter what the yield per acre is if the acres are zero. Maybe Jess can speak a little bit more to that. I would say we don't really have things set up to do things dramatically different and say we'll do this method for Virginia and this very different method for other states. Of course, there is a possibility where we might say, well, we only really care about cotton in Virginia.
Jess Rigelman: To speak to Joseph's point about CAST needing something everywhere, that's just kind of a fail-safe. As things have gotten warmer, some of the crops that were only in Virginia in 1985 have moved further North. If there are no acres, it is inconsequential, but we need data just in case it shows up in the future. We also do a lot of research things on the side where we may plug stuff in, so that's why we fill it in. How we fill it in is basically just based on a growth region substitution. But for 99.9% of all scenarios, there are no acres, so it really doesn't matter. The biggest example of this is we have all this data for DC in case we were to run a scenario where DC had data. It's happened before. It's happened once for research purposes, so that's the only reason we really have it.
James Martin (in chat): In discussions about P7 model development, we asked to see a comparison of the 2017 and 2022 data from the Ag Census that was used in P6 and will be used in P7. This presentation is a start, but seeing all of the AgCensus/survey proposed data for P7 as compared to P6 and how that data will be forecasted is still needed.
Tom Butler: Thanks. There's another comment in the chat here from James essentially asking for a comparison of the 2017 versus 2022 data from the Census of Agriculture. So basically Phase 6 versus what will be used in Phase 7 as well as any forecasting. So, just making a note that at some point, they'd like to see the end comparison for both those Censuses.
James Martin: I think the jurisdictions were promised that as we were working through the Phase 7 model development discussions. So, definitely still want to see that. Like I said, I think this is a strong improvement. We'll want to be careful, though. I think making sure if we're converting crops that historically Phase 6 have been acre-based yield units, and we're moving to a yield-based yield unit, we definitely want to make sure we don't accidentally leave the acre-based application rate when we've shifted to a yield unit based on its actual yield. I think this is obvious, but it just seems like an opportunity for error if we change one of these crops.

Joseph Delesantro: These applications for production unit, if we can get these values soon, then we can plug them into CAST and see what it looks like and make sure we don't have any problems. I'm wondering if these are values that are readily available from your land grants, if we can request these values ASAP. Is that a reasonable ask?
James Martin: I think the Bay Programs has collected those over the years. I don't know that it's a reasonable ask for all of the crops, though I do think we need to go back and look at the data. I really think the Bay Program has a lot of that data.
Joseph Delesantro: Ok. I haven't looked through that.
James Martin: I suppose land grant recommendations could have changed over time, so what was collected historically may not still be reflective of current land grant recommendations. So, are we going to have to look at this application per yield unit over time as opposed to a constant throughout the time series of the model, since land grant university recommendations do vary over the years?
Jess Rigelman: In general, the application rates have been provided by the state so I don't know if we have that, but we can look around for it. Application rates are by crop. They don't vary from year to year. I believe that was a proposal for Phase 6, data wasn't found, and it was quickly removed. So, a crop has one recommended or expected application rate. It doesn't vary by year.
Tamie Veith: This may be off base. I'm not sure. In the past, we've been concerned somewhat when making some of these changes to what was used initially, so that we could do the comparison with improving over time. You know, what was the initial condition set up of the modeling at the beginning? So, I'm just wondering, is that going to be a problem here or not? If we're changing these applications for crops now, will it matter?
Joseph Delesantro: Do you mean in terms of if we wanted to compare results from a past Phase 6 run versus Phase 7 with this change?
Tamie Veith: Yeah, I guess that's kind of the question I'm getting at. I think Gary's done a lot with keeping track of that before. Maybe it's not necessarily an issue here but if you are trying to do improvements over time, if you decide on an application now, it's probably not what was applied before. I'm not trying to cause a big problem here; I'm just wondering if that's a concern or maybe it's already been addressed.
Joseph Delesantro: I'm not sure to what extent that would be a concern. These crops are relatively minor. There's a reason I showed the corn, soy, and wheat. IF all we modeled was corn, soy, and wheat, we'd be 70% there. We've got another 11.
Tamie Veith: I don't want to open up a can of worms. I'm not suggesting you do something differently. I could see this getting into let's put tons of work into finding these new values to make those changes and yet it can't be compared to the past or it doesn't make a huge difference. Maybe they do need to be updated for the sake of the current public feeling like we are doing a good job of representing what's going on. How much time do we put into finding this information that you need? It does sound like maybe some of it is already available or CAST might have it. What's our charge?
Joseph Delesantro: I think those are good points. Maybe one way to think about this is to split this up a little bit and make sure we leave open the ability to work with these additional 8 crops if we would like to. Knowing that we need this additional piece of data, but that in the immediate term, we should move forward with the 11 crops which do have production yield units already in CAST and make sure to get that finalized and approved. Then maybe we can

talk about these additional crops. With that, happy to take any other questions, but I just wanted to hit this last question on my end one more time. What is needed for a final decision? Do you think we can bring this forward in May for a vote? I think if we're bringing this forward in May for a vote, we'd be doing it for the 11 crops that already have production units in CAST.
Scott Heidel: Great analysis. Great presentation. I guess my only concern is seeing that the slopes are pretty aggressively increasing over time, is there any forecasting that would show when they plateau off? Is there any method of tracking that? How would that be captured in the future?
Joseph Delesantro: Right now, the way that things are projected, I don't think it essentially would be projecting on this same trend. I'm sorry I forget exactly how that method works right now. I have done a sensitivity analysis with these weather and climate variables, and we do see all of these major crops starting to plateau or the growth in them slowing down with what we would expect in terms of changing environmental conditions. So, more heat stress, more large storm events, more growing degree days. That is not something we really have planned to capture in CAST. I'm not sure it's our charge to do that sort of climate projection, but it is an analysis that I've done. I've presented at a couple of conferences. I'd be happy to share here, but I would question whether or not that's something we would want to incorporate into Phase 7.
Jess Rigelman: There is no forecasting of the yield data. The last year we were given data, that yield is used for all future years. So if it's 2020, 2020 values will be used all the way through 2025/2030.
Alisha Mulkey (in chat): Tom, we would like this data request completed prior to decision in May. States need time to review.
James Martin: I have concerns that yields, while still growing through time in all probability, although there may be some plateaus, if we hold yields constant and we allow fertilizer to increase, we are artificially potentially increasing loads. If we forecast yields, we should also forecast fertilizer with a changing availability. If we're not going to do one, we shouldn't do the other. So, in my mind, those two things need to align.
Joseph Delesantro: Agreed. I think what Jess was saying is that, currently, the yield is flat. I don't mean flat to the trend line. I mean that we're taking that last year of data, in this case it would be 2022, and then that yield number, 160 bushels per acre, is the value that is used for 23/24/25 and on. The other way if there's a proposal to do so, we can discuss that, but I don't think that we had planned to change that as a part of this effort.
Jess Rigelman: James is correct, and that's what we do. We don't project a fertilizer bucket forward. We don't project yield forward. That fraction of crop need met from the last year aligns with the yield data, and that's how it's done which is part of the reason the decision was made to do it that way back in Phase 6.
Tom Butler: I wanted to address a comment in the chat. I think the initial reason we looked into this is because those blue lines, the lower ones for Phase 6, people just said were flat wrong. So, we've obviously had a lot of work been put in here to make those upper lines, the red lines, show what I understand to be a more accurate representation. So, I'd like to put the forecasting aside right now. For what we've got here, we would like to try and move forward on the decision because we went from the blue line to the red line, and I think that's really the goal is to get it better than what the blue line was. I think the real issue was the yields were too low, and now we've had the chance to improve those to be more realistic. So, if people had

concerns about that or what's kind of shown here, then I think that would be really useful because we would like to bring this up so that we can at least get some of these moving forward for those 11 major crops. Were there comments on if these red lines look better or look worse? That's where we would like to try and focus.

Ken Staver: We got into this jam with moving from the model applying nitrogen based on crop need versus moving to this fixed amount of fertilizer based on some version of sales data, and that's still in play. The thing that was jumping out at us was, since the model basically projects loads to some point based on the N balance per acre, we were seeing this big upturn because of fertilizer going up faster than yields. So, higher is good. My reaction is there is no perfect way to do it, but it certainly looks more realistic, and we know we have that problem with the ag census years. We had three in a row that were unusually low. That was a big problem. We've been talking about this so long that that problem is actually a little less now because we've gotten further away from those three bad years. So, if we keep doing it long enough, it'll trend back to something closer to average. Anyway, to me it's a positive step. You got two things since you're working with the difference between applied and used by the crop. This load thing comes from a difference in those two terms so if we're going to do one of them one way, we have to do them both that way. We've got to get them both right since we're working on the difference because it's two really big numbers that generate a smaller number that creates what we're dealing with. So, it's a little bit like a balance in your checkbook kind of deal. You can make a lot of money and spend a lot of money until you sit down and really go through the numbers, you really aren't sure whether you have a little surplus or a little deficit. So, that's kind of what we're dealing with. It's better. It's not necessarily going to totally solve our issue because what we are really interested in are loads. That's what we're interested in. If we're going to use this method, then we need to do the best we can on getting the distribution of crop removal and crop uptake right. It seems like a step in the right direction to me because we know what we were doing before was too low.

James Martin (in chat): I think we need to see more about the continuing % of crop need. It seems to me that approach does allow the fertilizer stock to change through the forecasted future.

Alisha Mulkey: I was going to go back to Tom's original question in the prior slide for the purposes of do these trends look more realistic in the method you put forward. Great work on your part. Thanks for the heavy lifting, Tom. I say generally, yes, but I do want to see Maryland data for these years at the county level for those eleven major crops. So that if you're asking us to make that decision in May, we have the best chance to review that sooner rather than later. I know we put that in the chat, but just iterating it again so that the states have a moment to really look at their own scenarios and then we reserve the right to make a different decision for forecasting and fertilizer. What's on your slides right now looks appropriate as I can tell from the watershed perspective.

Tom Butler: Thank you. That's great feedback. You'd be looking for state and county data for those 11 crops. From what we've got here, Joseph, I think that's something we can cook up, right?

Joseph Delesantro: Yes. No problem.

Dave Montali: I was trying to get it back to the simplified question like Alisha did. I think you did a good job of saying these are the problems and here's the solution when we're dealing with modeling Phase 6 to Phase 7 as good or better. It certainly looks better. I particularly like the

smoothing part of it, too, and increasing the magnitude. My reaction for what it's worth is, yes, this is good for this component and the other issues are the other issues. We've got to deal with them separately.

James Martin: I guess I am just trying to think ahead, and I don't know if we know the answers to this yet, but it seems to me our decisions about whether and how we forecast trends forward is in some ways related to the planned update frequency of Phase 7. If it's going to be 10 years before we have another bite at this apple, we maybe would make a different decision in terms of forecast. It certainly isn't going to be flat over the next 10 years. It may approach a plateau and then level out or, who knows, with the genetics that they may be able to continue right past those presumed plateaus. So, do we have a sense for how long these decisions in Phase 7 are going to have to hold before we have another chance to update the model?

Tom Butler: So, James, you are asking for a Phase 8 development timeline?

Dave Montali: No. I think he's asking every two years are we going to change CAST. I don't think Tom can answer that. I don't think anybody here can answer. I think that's a partnership decision.

James Martin: All I'm suggesting is that's a partnership decision that we should have an understanding of before we make decisions about how we're forecasting.

Tom Butler: That's a good point, James. I'm not sure the best group to take that to. I'm not sure if that's more of a management thing for GIT6 where we are talking about how we interact or at Water Quality GIT.

James Martin: I think it's either Dave at modeling or Water Quality GIT.

Dave Montali: No. I don't think it's Modeling Workgroup. Modeling Workgroup, as a principal, stays out of the policy. I think it's going to be GIT. I think people did not like the frequency that we did with Phase 6 and it's going to be longer than that. I don't disagree with your point, James. We may have said we're going to keep things flat because we knew that we're going to update CAST every two years, so that's safe enough. But, like you said, if it's going to be 5 or 10 years, then that ought to go into the thinking about what you do with forecasting.

Jess Rigelman: For Phase 5, it was much longer than two years. In fact, we weren't supposed to make any updates, but we made little changes here and there which very much frustrated people because it wasn't consistent. So, I think the proposal was every two years, and that was by the Water Quality GIT, but I don't think it was decided upon there. I think it got moved up to the Management Board if not even to the PSC. So, it is definitely beyond our pay grade. I do understand James' concern as to what that decision is, because he's right, if it's going to be that way for all of Phase 7, then we may want to change things. It's definitely not a decision that we're going to make in this group.

Tom Butler: Thanks. I think that does give us some kind of direction to move forward for at least the specific element of updating the yields of 11 crops. We will work to get that data out in a way that people can use, and then we will get ready for that to bring to a vote next month.

Action: Tom and Joseph will compile data on CAST runs for the 11 major crops using the new method to determine crop yield trends and distribute this data to the group. Data requested to visualize state and county data with these new yields can be found at the following link. Members are asked to review the requested data ahead of the May 9th meeting.

Action: Joseph will return at the May 9th meeting for decision on adopting the new statistical method for determining crop yield trends for the 11 major crops in Phase 7.

Inorganic Fertilizer Update 10:15-10:55 [40 min (10 min presentation, 30 min discussion) (Tom Butler, EPA)]

We continued discussions on what improvements can be made to inorganic fertilizer application for Phase 7. This included updates on the current plans for raw data sets and the algorithm used for applications. Feedback will be used to improve the representation of fertilizer in Phase 7. Informational.

Discussion:

Bill Keeling (in chat): Does this apply to TP as well?

Dave Montali: I didn't want to say what Bill said, but I think that's true. I thought it was true that we don't backfill phosphorous with respect to what we remove by manure transport, but my first question was why don't we simply do what's shown in orange on your right-most bar?

Tom Butler: I probably poorly chose numbers, and you could cap it. The point is that we are looking at putting in a cap to this and you can set the cap to whatever.

Dave Montali: If you have effectively moved organics out to the point where they're not a surplus, why wouldn't you simply fill the void needed by the yellow bar as your backfill of inorganic?

Tom Butler: We can set that number to cap the backfilling and, Jess, maybe you had more on this, but that's the intent is to try and look at that.

Bill Keeling: The purpose behind manure transport in large part may be trying to control your excess phosphorous. Under your first set of bars, not the yellow, but the first to the right, if 120% is the nitrogen that is being supplied by organic sources, you're way overapplying your phosphorous. They're coupled when you are talking organic. So, I don't think you can just look at nitrogen.

Jess Rigelman: The rule for phosphorous is different, you're right. Obviously, the nitrogen and phosphorous is coupled in organic, but the way that phosphorous works is it basically says apply the manure and the biosolids and then figure out the difference of what was transported. Say we're in a future year and the last year we had data for the fertilizer was 2020 so we are basing our fraction of crop need met on the 2020 data. So, it says how much phosphorous manure was transported in 2020 and how much is transported now? It could be zero and now it's 100, and it would subtract 100 pounds of phosphorous off of what was applied for that historic crop need. But, it also has the factor of if you transported 100 pounds in 2020 and do zero now, then it's going to add 100 pounds of phosphorous. With nitrogen, I guess we are talking about a different method and basically saying if you applied four times the amount in organic, and you transport out three times the amount, it wouldn't backfill up to four times the amount. The proposal here is that it would only backfill up to 1.2 times the amount. Obviously, it could be a different number. So, it's the fact that you are going to backfill with fertilizer for nitrogen, and that is clear because you don't want your crop to die. But how much do you backfill? Do you do 100% of its projected need, or do you do 120% of its projected need? I think the idea was in Phase 6, that 120% is basically where you would apply before switching to a

different load source, under the assumption that you'd want to over apply for need just a little bit so you don't sacrifice yield.
Ken Staver: Are we clear on plant available N versus total N here in this graph? I'm not so sure it's clear to me.
Jess Rigelman: Plant available.
Ken Staver: I'm unclear why we would use inorganic to go over 100% of the crop need.
Tom Butler: Why it happens is probably different than why we would want to do it. I think it would only happen in some of these cases if you have a very large organic load in your county and you're in excess manure. As we've seen, that is not generally the case, but it can occur theoretically.
Ken Staver: If you haul it out, why would you bring inorganic N to go back up to the excess level?
Tom Butler: That's the kicker here. They're saying you won't sacrifice your crop yields. So, in the assumption here, it would be that you are removing organic N, and you still don't want to get below like 120%. 120% is what we had for Phase 6. If you have 100%, you might lose some, and your yield might not be what you want it to be. So, the 120% is kind of what they agreed to.
Ken Staver: Isn't that the non-nutrient management?
Tom Butler: This is regardless of the nutrient management. This example is not talking about nutrient management because that's going to obviously affect things overall. This is talking about filling the crop's need based on that proportion if you transported or treated the organic source.
Jess Rigelman: This is in response to the fact that we don't project a fertilizer bucket forward. So, this is when we don't have fertilizer data. We're basically saying you apply this much of crop need in 2020, so in this year 2025, let's apply to that percentage of need because that's what you did in the past. If we had a fertilizer bucket, this wouldn't be an issue. This has been an issue up through 2020 because we have a manure and fertilizer bucket, and we have to spread it all. But for years going forward, we're basically saying we are going to assume you're going to go forward with your need in 2020. It's not an absolute number because you could apply more nutrient management. Therefore, your total pounds are less, but the percentage of what you need is the same, and the rule was made that you would back off phosphorous, which is why that rule was made in Phase 6. You wouldn't back off nitrogen because you're going to backfill that. I don't think there was ever a thought that there's counties that have four times the excess of crop need. That's a rare case, but it does happen. Therefore, in the future, if you were to transport it out, you're going to backfill it with fertilizer. That's what we are saying. We would backfill it with fertilizer, but we're only going to backfill it up to 100 or 120%, whatever you guys want us to set the cap at, just to get rid of these few cases where there's an anomaly of we had too much manure in a year that we had all the data and in the future now we've solved it by transporting manure out. So, we need to think of this in the situation where we don't have a fertilizer bucket and, therefore, we're trying to estimate one based on historic application amounts.
Helen Golimowski (in chat): **Why did my nitrogen loads increase with Manure Treatment Technology or Manure Transport?** Removing manure without also controlling the amount of replacement inorganic fertilizer results in the same rate of inorganic fertilizer being applied as when manure was applied. While phosphorus will be reduced, nitrogen loads may increase. When using these manure BMPs, increase the amount of the Nutrient Management Rate BMP

to control the amount of replacement inorganic fertilizer. Additionally, the runoff of inorganic fertilizer is higher than manure, which also contributes to the potential increase in nitrogen loads. These runoff rates are based on multiple peer-reviewed research articles. More documentation may be found in the CAST Model Documentation page found under the About header in the top navigation bar.
https://cast.chesapeakebay.net/Documentation/Faqs#UnderstandingResultsFaq
Ken Staver: With all the nutrient management efforts and everything, I am trying to wrap my head around this 120%. So, if we had an inorganic acre in this county, would it get 120% inorganic? Would our application rate be 120% relative to crop need?
Jess Rigelman: No. Only if the application rate in the last year was over 120%. If in 2020 you only applied 60% of crop need, then it would only get 60% of crop need in 2025. We're talking in cases where you had excess manure and now you don't have excess manure. So, we're talking in very few cases here, but that's the situation.
Ken Staver: I don't want to put too much time into what is a very limited case, but it doesn't strike me that it makes any sense to backfill to an excessive level with a purchased fertilizer. But, again, it's a really small case. I don't want to get very deep into it, but that seems self-defeating to manure transport. If you're following a nutrient management plan, you shouldn't be sacrificing yield. Lord knows if you had the history of putting on 120% organic, you got to have a lot of residual soil N. So, you will not likely be in an N limited situation. I'm thinking too practically about this, I guess.
James Martin: I think this is going to be, hopefully, if we change the scale which I think is the next section of where we have our fertilizer supply, it will help with this issue. I do agree with Ken. I think it's difficult because we're looking at it on a specific crop and really on a specific acre of a crop is how I look at this graphic, but when we report manure transport or manure treatment technologies, we're talking about tons moved from this place to this place, right? It's not a crop specific thing. You'd have to reduce your overall supply of organic to this 80% level that's demonstrated in this example which is, if you were previously at enough organic material to apply 120% to not just crop A but every crop that receives manure, it's a lot of manure to transport and it could happen. In any event, in my view, whatever manure you transport out should not be backfilled unless you fall below the crop need, the actual crop need, not the forecasted crop need from the last year of fertilizer data, or the percent applied. That's what Jess was getting at is carrying forward that percent applied is how we end up in this situation. So, I think it should be whatever you transport out, you shouldn't backfill with inorganic fertilizer unless a particular crop is dropping below that crop's crop need, and then you should backfill only to meet the crop need. In my mind, that's the logical way to give appropriate credit for manure treatment or manure transport. If you're really moving enough or disposing alternatively of enough manure that you've dropped one or more crops below their actual need, yes, you'd want to backfill with N organic fertilizer. Absent that, we shouldn't be backfilling to meet some ongoing percentage based on the last year of fertilizer data. That's my opinion.
Tom Butler: Thanks, James. I know we're at time here, so this one obviously is going to need more work. So, I will be reaching out to people offline to talk more about this one because there's a lot of good feedback, and I definitely think we need to keep talking about what that means and that crop need versus the percentage need that we have going forward.

Scott Heidel (in chat): MTT is increasing in PA. Load allocations are jurisdiction specific. Fertilizer should be jurisdictional as well so that we can dial in our operations at the jurisdictional level to attain our allocations/load reduction goals.
Helen Golimowski (in chat): There is also this FAQ doc about manure BMPs: https://cast-content.chesapeakebay.net/documents/CASTManureQA_20200521.pdf
Ruth Cassilly (in chat): @James- Does that mean that crop need would need to be calculated annually in CAST? Is that possible logistically?
James Martin (in chat): I agree. Jurisdictional stocks at a minimum (could be county stocks even).

Action: Tom will follow up offline to continue discussions on the backfilling of fertilizer.

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

Adjourn – 11:00

Up Next:

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

AMT Meeting: Friday, May 9th, 2024, from 09:00 - 11:00 am.

Participants

Zach Easton, VT
Tom Butler, EPA
Caroline Kleis, CRC
Alex Soroka, USGS
Joseph Delesantro, ORISE/CBPO
Anne Coates, TJSWCD
Scott Heidel, PA DEP
Tim Larson, VA DCR
Cassie Davis, NYSDEC
Alisha Mulkey, MDA
Emily Dekar, USC
Arianna Johns, VA DEQ
Ashley Hullinger, PA DEP
Tyler Trostle, PA DEP
Helen Golimowski, Devereux Consulting
Jess Shippen-Hansen, TJSWCD
Nathan Radabaugh, PA DEP
Jeff Sweeney, EPA
Nick Moody, VA DCR
Jess Rigelman, CBPO Contractor
Dave Montali, TetraTech/WV
Curt Dell, USDA-ARS
Hunter Landis, VA DCR
Karl Blankenship, Bay Journal
Bill Keeling, VA DEQ
Ken Staver, UMD/Wye
Olivia Devereux, Devereux Consulting
Tamie Veith, USDA-ARS
Seth Mullins, VA DCR
Tad Williams, VA DCR
Candiss Williams, NRCS
Tim Talley, Thomas Jefferson SWCD
James Martin, VA DCR
Ruth Cassilly, UMD/CBPO

**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