Agricultural Modeling Team (AMT) Meeting

February 14th

09:00 AM – 11:00 AM

Meeting Materials

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This meeting will be recorded for internal use to assure the accuracy of meeting notes.

Summary of Actions and Decisions

Decision: The AMT approved the January 2025 meeting minutes.

Decision: We will alter the Land Uses in CAST to represent, Managed and Unmanaged Hay as well as Managed and Unmanaged Pasture.

Decision: We will modify the manure spread algorithm to create a fourth group and fill these groups as follows;

a. Group 1: Grain with manure, Silage with manure, managed Other hay, managed pasture,
b. Group 2: Small grains, double cropped, other crops, specialty high, specialty low,
c. Group 3: Other Hay, Pasture,
d. Group 4: Soybeans, Legume Hay.

Decision: The AMT approved the provided definitions for managed and unmanged hay and pasture for Phase 7.

Decision: The AMT approved the language that acres of managed hay and pasture will be reported by states by November 1st.

Decision: The AMT accepts the NM effects with a non nm multiplier of 1.2 for N and 1.5 for P for Phase 7.

Action: Please email Tom and Caroline if you would like to help with literature and science review for loading rate ratios.

Action: AMT members are encouraged to look at the reporting methodology for urban data and consider this methodology for our use.

Meeting Minutes

Statement of purpose:

Discuss details of the newly created Land Uses for managed hay and pasture as well as Inorganic fertilizer for Phase 7.

Decision items:

1. Approve the January minutes
2. Pasture and Hay Land Use details

Announcements:

- **Small Farm Micro-Irrigation Training - Friday, February 21, 202510:00AM - 2:00PM EST**

- Registration Deadline: February 19, 2025

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

Zach asked for approval of the January minutes and walked through today's topics.
Decision: The AMT approved the January 2025 meeting minutes.

Pasture and Hay Land Uses 09:15-10:30 [75 min (15 min presentation 60 min discussion) (Tom Butler, EPA)]

Last month the AMT voted to implement two new agricultural land uses, managed pasture, and managed hay. Although this decision is pending review by Delaware, we moved forward with several related questions to fully implement the changes. These questions were discussed, and feedback was elicited on the way to making more decisions. Decisional.

Discussion:

Chris Brosch: I had a brief conversation with James about this proposal, and apologies for missing last month. I did get a little hung up on the split between other hay and pasture. Prior to this suggestion, the group 3, where other hay and pasture are combined, was very purposeful because, in this version of the model, it was very difficult for us to separate those two land uses. That's a conversation that goes all the way back to two or three iterations ago of nutrient management expert panels and other conversations at the AgWG and other places. So, for me, it's very difficult to separate out. I agree with separating out managed versions of these land uses, but how they're collected and separated between other hay and pasture, I think is a bit too hard to replicate from state to state. So, I would suggest, as a friendly change, and I think James is on board with this, moving managed pasture to group one to keep it coupled with managed other hay. But, generally, I support separating out a managed version of those land uses because they do act very differently.

Dave Montali: Chris, this kind of goes to the conversation we need to have of how do you fill those managed hay and managed pasture classes? If it comes down to there's a linkage to the acres of those things that are for which nutrient management plans are developed, and that comes directly from the states, would you still have the concern about not being able to figure out what those acres are? In other words, if we made that decision, would that say ok well then you can have them in different groups?

Chris Brosch: Having worked in VA, MD, and DE, I would understand Virginia having a different percentage for other hay and managed other hay than they would a ratio between managed pasture and just pasture. In Delaware, and probably most of Maryland, I would not be able to parse that out. So, that's why I think they need to be coupled in a group. I think the reason that we have group one, or we have high managed manure heavy systems, that described managed other hay and managed other pasture. I wouldn't be able to separate those out the way we manage, especially on the Delmarva.

James Martin: I can see Chris' point here. I do think to some extent the hay and pasture land uses, certainly it's difficult to differentiate from the land use perspective, but also you could make a case that those land uses are somewhat transitional, if you will. They are areas of pasture that are cut for hay and does that make them hay? Does that make them pasture? Well, it may vary year to year. So, I wouldn't have any objections to sliding the managed pasture into Group 1 so that they remain coupled, as Chris said. We'll have our other hay and pasture in Group 3 and our managed versions in Group 1. I can't imagine it's going to make that big a

difference from a manure spread perspective. At least in Virginia, we're going to have more managed hay than managed pasture. It is accepted as a friendly change, and I can support that.
Ken Staver: I think you told me last time that is something we will deal with later. I am still looking at this Group 4 and thinking about where broiler litter goes. Soybeans are going to be very rare except in high counties that you're going to see manure on soybeans. Even legume hay in dairy country, my recollection is that legume and alfalfa hay are mostly in dairy country. You get in situations where you are going to spread manure sometimes it ends up on alfalfa fields. I'm ok with deferring it to later, I just feel like it ought to still be here that Group 4 is really way out there never getting manure, and I'm not sure that's quite right. Especially with soybeans where it's such a large acreage in the watershed. It doesn't have to be that higher percentage to actually take some nutrients. That's just a comment I would like to be in the record if we're not going to deal with it.
Tom Butler: Yeah, and thanks, Ken. I think we had some interesting insights about some of the dairy country, but that wasn't related to soybeans. So, in terms of the soybean question, I might lean on some people from those jurisdictions for how they feel soybeans might be better served in this group. If everyone's ok with what we've got and we're friendly, I'm not going to stop that.
James Martin: I think the hard part is that grain with manure, small grains, and soybeans are all the same place. It's the same field, just different times of the cycle in many cases. So, we have to remember that even though we are using a ten-year averaging model that in this case we're taking a snapshot of what's on the ground in any one time and making that distinction as to whether the field is a soybean field, a corn field, a small grain field, or a double crop field. So, yeah, I think it's a difficult question. I'm happy with the soybeans and legumes in general staying in Group 4 and, as we saw in the test, that doesn't mean they get no manure. They certainly do get some manure in almost all cases.
Ken Staver: We've been dealing with this fertilizer problem, and fertilizer is done on an annual basis. Basically, it's an annual budget. That's how loads end up coming out of the model is based on your annual N surplus at the acre level. The thing about legumes is, when you put manure on legumes, you're substituting manure in for fixed N, and then you make space in other places for fertilizer N. So, moving it around on all the grass land uses is not that big a deal. But, when you put it on legumes, all you're doing is displacing a category of N that causes us no problem. That is the fixed N, atmospheric N, but you do make space in other places for using fertilizer N. So, I'm just thinking about this in terms of this issue we are dealing with of these increasing N application rates per unit of harvest on all of our grass acres. I don't disagree with you about the fact that it's all the same land. But, it's an annual N budget that ends up giving us our loads in CAST. It's not all that, but that's a big part of it. I just wanted to say that this is not like saying they almost never get manure.
Tom Butler: That's a good insight, Ken. I will make sure that is in the minutes from this meeting so that it will be on record that has been brought up.
Ken Staver: Yep. I am good with that.
Tom Butler: With that being the case, the proposal now is to move managed pasture to Group 1 with managed other hay. So, Group 1 will read grain with manure, silage with manure, managed other hay, and then managed pasture. Group 2 will read all these top ones that are in a white color, and it will not read the managed pasture. Is that fine with everyone on this call?
Alisha Mulkey (in chat): MDA concurs
Candiss Williams (in chat): Group 2 is not managed hay?

Tom Butler: No, Candiss, Group 2 is not managed hay. Group 1 currently has managed hay. Group 2 has small grains, double cropped, other crops, and specialty. Group 1 would have grain with manure, silage with manure, other managed hay, and then managed pasture. So, we're just taking managed pasture from Group 2 and putting it in Group 1. The silence is being recorded as concurrence, so we are going to go ahead and do that.

Definitions

Dave Montali: Is that the way it is now for other hay?
Tom Butler: I'm going to lean on our CAST team here of Jess and Olivia to define better what the other hay is. I don't think it's changed, I think that is pretty consistent, but I want to be sure.
Jess Rigelman: It hasn't changed.
Dave Montali: Failed crops made me question, but that's probably a rabbit hole for today. I'm going to leave that alone. I'll figure it out.
Ken Staver: So, other hay is a category straight out of NASS, is that right?
Tom Butler: It's a combination of crops that are in NASS. So, it's not like a one to one.
Ken Staver: Maybe you are getting to this, but are we going to then split out yields for managed hay and unmanaged hay?
Tom Butler: Yes, we are going to have to split the acres in the same way we do for grain, with and without manure.
Ken Staver: But the corn yields with manure and without manure are the same. We don't change the yields.
Tom Butler: That's a good question.
James Martin: I think, right now, hay is not a yield-based need; we don't calculate the need based on the yield. It's just pounds per acre, I believe is how it currently is with hay, and how it is proposed with managed hay. We have yield data for some of our crops, and that influences what the expected application is, but I don't think that's the case for hay and pasture.
Ken Staver: That was when we were sort of taking the low N approach to pasture and other hay. I am just wondering how this is going to go into the model with the N surplus on an acre basis when we put on 120 pounds of N? You can't change inputs a lot and then keep everything else the same. You can't keep the load for those two land uses the same. I guess you can. You can do anything in the model. It seems a little counterintuitive to leave that part the same but change the inputs.
Tom Butler: Ken, your thought is that we should be looking at now putting a yield that is not like an application per acre, but like a tons per acre etc., to attach them with hay and pasture?
Ken Staver: I don't know. It just seems like if they are going to be differentiated in their inputs, they need to be differentiated in other ways as well, right? The producers putting on more N could get more productivity. If he's not, then he's not making a very good choice.
James Martin: We could make our nutrient applications yield based and, where we have reliable and good data, maybe that's the way to go. Ultimately, in terms of what's applied and what's lost, it's that loading rate ratio that drives it, isn't it?
Ken Staver: Not totally. We had that whole discussion with the grains and the manure and no manure was the big difference there.
Jess Rigelman: I didn't really have that much more to add. I think James said what I was going to say about it coming down to loading rate ratios. But, as far as yields are concerned, we've been stuck on trying to figure out whether or not Joseph's new method is good for the 13 crops. Then

I think the next step would be, if you're ok with this, for the 13 crops coming, use this method to make some assumptions about more of the crops and actually use yield for more of them. But, we haven't really been able to discuss this in this group because we haven't been able to agree whether or not we're ok with the method for the 13 crops where we actually have solid data. James is right that we're going to talk about loading rate ratios but, also, we can talk about it when we talk about yields if we can get to a point where we can move beyond these 13 and then talk about whether or not we can use proxies for other crops, which may include the hay and pasture crops.

Joseph Delesantro: Nothing to add. That sounds right to me. That's also how I've been thinking about this. I've been focused on those 13 crops, but I can work in the background here to sort of pull up how the model is doing with the hay categories. I was curious about small grain hay, and maybe this is obvious, but are we excluding the separate category for small gray hay from other hay and managed hay as well?

Ken Staver: Is that haylage, too? What are we talking about when you say small grain hay?

Joseph Delesantro: I'm talking about a NASS category. I am talking about a CAST crop category. Part of my understanding is that some of these small grain hays are failed crops used for forage, but I don't really know the details on how that works on the field, just that that's a category we have in CAST.

Tom Butler: Earlier we had posted something about the categories and the crops in each land use. I don't offhand know if they're currently excluded from the other hay, or in small grains, or if they're in other hay, so I would need to double check where that exists now. But I would anticipate that, if it is in there, it stay. If it's not in there, it does not go in.

James Martin: I don't believe that was one of the crops in the hay group.

Tom Butler: I just don't offhand remember which ones are in hay. James, you may very well know better than me, so thanks. Good point, Joseph.

Ken Staver: I am still thinking about this. The way we handle N inputs on grain, nutrient management is not handled as like a checkbox or like a coefficient reduction in anything. It's handled as an N mass balance calculation in CAST. So, if you don't have nutrient management, more N is applied. The yield is the same as the average yield for that crop, so you get a higher load. It's a calculated increase in load based on the N surplus, which is higher when you don't have nutrient management, because you're putting on more N. I think we talked about that would be an option for this as well, without messing around with the load ratios, which are a little bit of a separate thing. So, we wouldn't necessarily have to do that.

Gary Shenk: We had talked about that but, I think what we were thinking is that the application difference is so big between these two land uses that if managed pasture is getting 120 pounds per year and regular pasture is getting 10 pounds per year as an average application, and we are just letting the difference in application drive the load, we're probably going to end up with most regular pasture having negative loads and managed pasture having really high loads. So, I think where we came down to in the conversation is that we wanted to have the loading rate ratio decide the central tendency of both of those new land uses. I guess the other hay and pasture, the standard ones, are just going to be the ones that they have been but, put new ones in for the managed classes.

Ken Staver: Right. I remember your negative load comment now. Now the only thing would be, if you adjusted yields, if you have that data, which I know that would be a tough thing to come up with, the yields do change an awful lot from unmanaged hay to managed hay. So, it might not be

quite as bad as what you are saying if you had a big yield differential because when we do that with grain, the yields are the same with or without nutrient management, right?
James Martin (in chat):

bromegrass seed	Other Hay
cropland on which all crops failed or were abandoned	Other Hay
fescue seed	Other Hay
orchardgrass seed	Other Hay
other field and grass seed crops	Other Hay
other haylage; grass silage and greenchop	Other Hay
other managed hay	Other Hay
ryegrass seed	Other Hay
small grain hay	Other Hay
timothy seed	Other Hay

Gary Shenk: I think theoretically you are right. But, when it comes down to actually implementing this in the 200 counties, it's going to come up with a squirrely calculation in a few of those counties, and we are going to be back here in a couple of years talking about those again.
Ken Staver: Dealing with those load ratios isn't fun either, but that's ok. I was just sort of thinking out loud.
James Martin: I dropped in the chat the crops that are currently part of other hay, which would continue to be part of other hay, and all except for failed crop would be part of managed hay as these definitions stand. I think all of this is good discussion and we are going to have to have it eventually today, but I'm not sure any of that really resulted in proposed changes to these definitions. Can we see if there's agreement on these definitions?
Tom Butler: Yeah, let me run through pasture as well just so that people see it. It is essentially saying similar things to hay. It's just land use for pasture grazing animals. You may put on manure and/or fertilizer in addition to the direct deposit. For managed, pretty much the same thing, but there's a regular application as well as having that core enhanced nutrient management on it. So, it's very similar to the hay, and other hay, and managed hay. So, given these two, as James said, are we alright with these definitions? Ken and others, your points are going to come up later. But, for the definitions, are we good?
Ken Staver: Yeah, I wasn't really picking at the definitions. I am fine with them.
Tom Butler: Are there any issues? If there are, drop them in the chat or raise your hand. Ok, then we are good on these definitions.

<u>Acres: Hay Lands</u>
Dave Montali: The analogy to construction or forest, there's a basis for the states to report. For construction, it's the area of land regulated by a construction stormwater permit and, for harvested forest, it's the amount of land, at least in West Virginia, that's subject to regulations relative to forest harvesting. So, when you say that they're going to be reported by the states, will you also say based on the nutrient management planning for those land uses? Or any other recommendation about how a state would do that?
Tom Butler: I'll open that up and see what we have here because I understand that we don't necessarily have consistent nutrient management across the watershed, so I want to see what

everyone has to say on that. Do other people feel that nutrient management reporting could give us some way to split this?
Scott Heidel (in chat): PA DEP disagrees with the default values. PA does not regularly apply manure and/or fertilizer to hay or pastures. Please remove the default values.
James Martin: I think in Virginia, nutrient management records are likely what will be the driver of how these acres are determined. But, I'm not personally inclined to constrain a state as to how they set these acres. Nutrient management is certainly one line of evidence. I'm not sure what other lines of evidence a state may use, but I wouldn't be inclined to rule any out necessarily.
Tom Butler: Thank you, James, that's good insight. Scott, can you elaborate on your comment here?
Scott Heidel: Just because we are adding these in on the request of another jurisdiction should not force a default upon a different jurisdiction because we were trying to help someone else out. I feel like this is a penalty and does not apply correctly to Pennsylvania.
James Martin: I disagree with the penalty part, Scott. Honestly, I think this will help all jurisdictions because it is going to draw excess fertilizer and manure that is currently being overapplied on cropland acres onto other acres where it is more likely to be taken up rather than lost. But, all speculation, because we haven't seen it run through the model. So, I don't have any concerns and don't disagree with your concern about the default. But, I will say, if we are not going to have a default and we are not going to have a minimum, Virginia is going to be hard over on making sure that, when we make fertilizer decisions, that we are doing away with the bay wide stockpile of fertilizer and that we are constraining that to at least a state scale.
Cassie Davis: I have a question on where the 10% came from. I just wanted to note, too, that when we do our value for construction stormwater, it's based on what we're supplying to the model because all construction stormwater projects have to have erosion sediment control projects. 100% of them. So, what we're reporting to the model is all of our construction stormwater that's required to have erosion sediment control. So, there's that one to one where there isn't something saying so many percent have to applied to nutrient management. So, it's going to be difficult to come up with that estimate of what's managed hay and what's not managed hay, because there's nothing that says you have to manage your hay. Does that make sense?
Tom Butler: Yeah, you don't have the same restrictions that would be for construction.
Cassie Davis: Yeah, and I'm just curious where that 10% came from.
Tom Butler: That was just a proposed value. I think there was a foundation in the extension discussions that happened in one of the states. I'm not sure exactly. So, it sounds like this may be something that needs a little bit more discussion here. How about we circle back to this, because I don't think we're there right now.
James Martin: I think the concerns we have heard are more about Scott's concern about the 10% as a default and less about the concept of states will report their acres of these managed land uses. So, I wonder if we could get the top half of these slides? Scott, that gives you the ability to report zero acres everywhere if that's what you want and, Cassie, if you don't have data from nutrient management or another source, that would give you a solid basis for splitting it out. You could report zero.
Cassie Davis: I think what I am hung up on is we do report nutrient management plans on pasture and legume hay in New York and, so, if it were construction stormwater, we would just get those numbers ahead of time and then report that number of acreage as our managed

hay/managed pasture. I'm just hung up on if we are saying zero and then we actually are applying it.
Tom Butler: Is there maybe a different way states would be willing to report this? I am not an expert on forest or construction acres reporting. Is there some other format we could follow?
Jess Rigelman: Cassie, I assumed that this would be similar to reporting harvested forest and construction. So, you'd report a number every year before progress. The deadline for this one could be changed because, if you need to get all your BMP data together, it's just based on the nutrient managed BMP, then we could do that. So, I guess what I'm saying is that the number wouldn't be zero. We would get that number from you. New York could base that on however they want, and is seems like the acres of nutrient management BMP would be ok with you?
Cassie Davis: If that's ok with everyone else, if it was like a one to one. We report the default rate for forest because we don't have a method of knowing how many forested acres occur in the watershed. We do report the construction acres for construction because we have a requirement that erosion and sediment control be done on all acres. So, we can assume that all the acres that we report have the erosion and sediment control BMP on it. Is that making sense?
Jess Rigelman: It does. I just assumed that states would report their acres of managed hay and managed pasture however they would figure it out. But, I do think that we've been discussing that be based on the amount of nutrient management for those two land uses that's reported. I think that's the exact method we're talking about.
Cassie Davis: Thank you.
Dave Montali: When I heard the original proposal, there was an ad hoc proposal that said, yes, you would base it on your nutrient management and, in West Virginia, our reported nutrient management every year is disaggregated to crop, hay, and pasture. So, there is a record, and that record goes back. Then the default that but out by Bill, I believe it was, was if you don't get this year's, then you use last year's. But I don't know if the level of information that's available for West Virginia is the same and that history issue is also going to crop up. If we do this, we have to figure out not only what's going on this year, but all the years back to '85.
Tom Butler: Good comments, certainly we do want to have that in the account. Does changing the wording of this get us closer to a better understanding? It seems like the idea of a state reporting it provides some level of freedom to their discretion on how to do it. Is that acceptable to the people on the call here, or is that too vague?
Ken Staver: I think any time you have the option of reported data, that's a positive overall. If we are trying to be realistic and people are doing all this work out there, why not use what they have?
Tom Butler: Ok, so some level of support for it. I'll change this up then.
Ken Staver: For folks that are going to base it on where they have nutrient management plans, there's still that blanket N rate. Why not just aggregate from nutrient management plans for application rate if people are a little squishy on the standard number? Again, going with reported data always seems like the way to go. I know it's not what the farmer actually did, but at least it's from the nutrient management plan anyway.
Tom Butler: I appreciate that perspective. I think we got some insight that it's tricky with nutrient management planning because some states don't apply manure or fertilizer to pasture, so they're not going to have a nutrient management plan for it to do that split.
Ken Staver: I have to ask a question to Scott, just because I have a bit of anecdotal information from Pennsylvania. The folks that are serious grass hay producers, they're not applying N on grass hay production?

Scott Heidel: Ken, thanks for reaching out. I would think that there are probably very limited areas that would potentially be doing something like that, but those would be such an anomaly that, to throw a default rate of 10% of all our acreage onto this, would be highly overestimating at this point.
Ken Staver: So you think of your grass hay production in Pennsylvania, less than 10% of it is getting any N? I'm just struck by that. You know more than I do. My only information is anecdotally, and they're putting N on trying to grow nice grass hay. I'm not arguing with you at all, it just seems that in this day and age, I'm pretty amazed by that.
Tom Butler: Thanks for clarifying that, Scott. In terms of working through this acreage part, it sounds like people are on board with removing the defaults and the minimum values and then changing the wording here to be something to the effect of "the acres of managed hay or pasture will be reported by states". Is there an issue with that? Is the wording too specific when it comes to harvested forest and construction, or can that stay?
James Martin: I think when we proposed that, it was just using the practice that we report acres based on this information from the states, not that you had to have a common methodology of how those acres are based compared to forest or construction. So, I just wanted to be clear that, as Jess alluded to, these acres are going to have to be reported by the states at some point before the annual progress cycle starts, and I don't know what the deadline is for the forest and construction off the top of my head, but a similar deadline likely will have to apply for providing those acres.
Jess Rigelman (in chat): November 1
Tom Butler: Actually, I think Cassie is pretty heavily involved in Watershed Technical Workgroup, so she might have an idea on when stuff like that happens. So, we may have to coordinate with her and Auston on some of that information. But, I will change this to remove the default and say "acres of managed hay will be reported by states". I'll do the same here and say "acres of managed pasture will be reported by states". Does anyone disagree with this language?
Tamie Veith (in chat): Tamie Veith - USDA ARS - I had to deal with other things this morning. I will read the minutes to get up to speed.

Impact of Nutrient Managed: Proposed

Dave Montali: If you go down the original approach where you are using your nutrient management and you are using last year's nutrient management as a default, then that's where the penalty will come. If this year you don't do as much as last year relative to nutrient management, then you would get more load going to these two land uses. But if you always report nutrient management, nutrient management is the basis for the base land use, then it's a non-issue. Do I have that right?
Tom Butler: Can you explain that one more time please?
Dave Montali: How are you going to have managed hay and managed pasture that is not equal to the acreage that you report nutrient management on hay and nutrient management on pasture?
Tom Butler: The idea behind it is that once we split those acres, obviously they have the different application rates, and we need to get those through history. Since they're different land uses, they'll have different base loading rate. They'll have a different ratio associated with them. So, they'll behave differently. So, the managed, when it has nutrient management, is still said to be higher. Even if you have the nutrient management on it, you're saying that it's higher than the other hay because you're getting that regular application.

Dave Montali: I'm just trying to figure out how this will work in present day time. If a state uses its nutrient management information to create the base land use, then it'll all go in as the base rate. There would be no multipliers because there wouldn't be any land that would be managed hay that doesn't have nutrient management, for example.
James Martin: I think that's right, Dave. If you report all your acres of the land use at the land river segment scale and it is perfectly aligned with what you're going to report for nutrient management on those land uses, these non-nutrient management multipliers would be multiplied by zero, effectively, because there'd be no acres left. I think, to your point, we have to set them at something but, if these acres are created the way we've been talking about, it's likely that their effect would be negligible if any.
Dave Montali: When you're creating the history and looking at what's the difference between now and what's back in 1995, back in 1995 would all the states also just have no area? There would be no managed hay or pasture in that scenario either, right? So there wouldn't be any change over time.
Tom Butler: I think if that wasn't reported, yeah, you wouldn't see that.
Ken Staver: His logic seems valid to me that we don't have a category now that gets N fertilizer that doesn't have nutrient management, basically. Is that what we're saying?
Dave Montali: I don't know if that's reality, but I think that's the way we are setting this up.
Jess Rigelman: Dave, you were implying that the application of the current day is compared to the application of 1995, and I just wanted to make sure everybody knew it's the application of the current scenario compared to the calibration average, so the whole calibration period. You are right in that if we're using nutrient management to set up these acres, it's always going to be the acres of nutrient management whether that be zero or a different number, but the load is based on the calibration average, not just 1995.
Tom Butler: Does that help with some direction on this? Do these numbers seem out of whack?
Dave Montali: The other thing that occurred to me was that the real loading rate of these things with nutrient management is higher than without, and I don't really know how that plays out. Again, with the idea that you're doing your nutrient management on places that are getting manure, and we're loading it up twice as high. The land use without nutrient management is really applicable to the places that don't get the manure, and that loading scenario is probably less than the ones that get the manure with or without nutrient management. It's almost like that number should be less than one, but I don't know. I need to think about this.
Tom Butler: I think I understand, Dave, with what you are saying about how is the managed rate higher than the unmanaged rate? The thing I'd point to with that is the discussion we had earlier that there's a regular application that may apply. So, I think that's where that rationale is coming from.
Ken Staver: I don't see how you put on that much more N and you're not going to have an effect on loads. He's kind of right. This is going to turn into a thing where nutrient management gives you higher loads from these land uses, relative to where we were before. If we're using nutrient management as a basis for defining these grasslands, they'd get a lot more N, and that's sort of what I think we are doing.
James Martin: That's only if you're comparing collective hay and managed hay in the future world to current hay. If you are looking across the ag sector, I don't think you are going to see a load increase because you are distributing your nutrients over the broader landscape where they are less apt, potentially, than cropland to be lost.

Ken Staver: I think you're right. I agree with that, and I think being realistic is the way to go. I don't want to see a scenario come back that you're doing a lot of work and trying to get credit for nutrient management and if you happen to be in an area that is dominated by these land uses, you all of a sudden are surprised by having higher loads to deal with. If you don't have all those other land uses within your watershed, you're not likely going to benefit from getting credit for nutrient management, I think.
Dave Montali: I agree.
Mark Dubin: Just a perspective from the nutrient management expert panel and where this came from. I think they had similar discussions, similar quandaries on this, and really the driver of this was the relatively low application rate that was being applied across these land uses that was well below the agrarian rates. So, that's why they felt there was potential for double counting. But, I think really the application rates are the main driver of this and what the resulting loads are. So, I just wanted to share that perspective from what the expert panel looked at.
Tom Butler: Thanks, Mark. That's good insight to have for this, definitely. I think James did make a good point about overall ag, but I'm not going to stop the conversation about if you didn't have other uses locally.
Ken Staver: I am ok, I think that's just kind of the reality of where this is going.
Gary Shenk: I was just going to agree with what James was saying. If there is a certain amount of manure and a certain amount of fertilizer, and more if to goes on to this lower loading in terms of what comes off versus what goes on the land use then, overall, the load for ag is going to drop as you get more nutrient management, because it gets pulled onto that lower loading land use. I think that's probably the way it would work out mathematically. As we get into the second part of today, and we think about how we are dealing with that fertilizer bucket, that has an implication. Is it 1 bucket for the entire watershed? That has an implication for whether jurisdictions loads go up or down.
James Martin: I think what makes that concept a little difficult is this table because here you have pasture and hay relative to pasture, and all the other land uses relative to grain without manure, but you don't have a comparison on this table on the loading rate ratios of how pasture compares to grain without manure. I can't remember the exact number, but based on the loading rate pounds that you see on the right column there, its about ¼ . So, if the pasture group is on the order of 75% less leaky than the crop group, more nutrients going to pasture and hay reduces loads. That's my logic and, again, we'll see when the model is built and we run some test scenarios to see loads, but, conceptually, that's why I think overall ag loads would go down. But, I recognize there's a lot of moving parts, and I may be taking too simplistic of a view.
Ken Staver: I think you are right, but they are going to go up from these land uses. Nutrient management isn't going to get you a benefit if nutrient management means putting on 100 pounds of N from that land use. But, overall, I think you're right and if it's more realistic, it seems like the right thing to do.
Cassie Davis (in chat): In case I have not shared it before here is Cornell's guidelines for fertilizing forages/pasture: http://nmsp.cals.cornell.edu/publications/factsheets/factsheet17.pdf
Cassie Davis: I just wanted to make sure I shared this in case I hadn't before. There's a table in it that has fertilizer guidelines for forages for no manure and manure, just if we needed a reference.
Tom Butler: That sounds like awesome material to use when we help set these up. Thank you. Dave, I know we talked about this a little. I don't think there's anything that makes me say stop

because if in the end you are basing it on nutrient management, then it doesn't really matter. Does what's been said make you feel better or worse?
Dave Montali: I am just trying to understand. Nothing that makes me say stop. If in the end you are basing it on nutrient management, it doesn't really matter. Hopefully when we add it all up, it's a more accurate depiction of what comes off from all ag. There are just so many moving parts. At least with creating the land use and reporting, I am kind of seeing that it's a one to one. You are not going to get hammered by non nutrient management on those lands. The default could do it. You could have a bigger load be modelled coming off of these managed hay and pasture if you don't have nutrient management on them and, by default, states are forced to have some of that. I don't think that would be the case with our state and states have the autonomy to report what they want. But, if we report something that's less than 10% of hay or 5% of pasture, are we asking for a load increase?
Tom Butler: That's a good point, Dave. I think that's where Scott was coming from, and that's why we, as a group, decided to remove those defaults and those minimums, so that you could theoretically not have to deal with that.
Dave Montali: I just think that, if in the end you've got Virginia saying I'm going to put some acres in here and all the other states are saying no, I'm just keeping it the way it is, then the watershed wide bucket is the real solution. Having the amount be by state and then Virginia can do what they want and everybody else can do what they want.
Tom Butler: If we were to keep the defaults? Or just in general?
Dave Montali: Well, in any event, if it gets down to an ability for all the states to, if they wanted to, just say I don't have any managed hay or managed pasture, then Virginia is in exactly the same boat they are in right now.
Tom Butler: Yeah, and that will be the second part of our discussion today. In terms of where we are with this right now, it sounds like these are reasonable. We will need to then talk a little bit more about those ratios. But, stepping back here, do the numbers in this table currently give anyone heartburn? If there are any issues with these, please speak up now.
Ken Staver: Tom, just to be clear, is there any N currently applied on other hay and pasture?
Tom Butler: Yeah, there can be.
Ken Staver: But, other hay and pasture by definition will not have nutrient management on them. Is that what we are saying?
Tom Butler: Yeah, their application rates are so low you would not get any credit for nutrient management on them. That's, I think, part of the justification for having a managed version with a higher application so that you can get a benefit. You can reduce a part of the load that otherwise you can't touch. We are going to move forward with these as well.
Jess Rigelman: The whole point of creating this land use is so you could get a benefit of nutrient management, and I think that's what Dave was saying. If they're all nutrient management, you don't really get a benefit from nutrient management, because you're just setting the land use up to automatically be nutrient management and, therefore, you don't have an increase to lower the load. So, I don't mean to stop this decision from being made, it's just not going to have the initial effect of creating these land uses so that nutrient management would have an effect.
James Martin: Just to be clear, that was one of the considerations for these land uses when Virginia made its recommendation, not the only one. I think if we want to be able to visualize in the model a benefit of nutrient management, we could certainly report more acres of managed hay and pasture than we actually have nutrient management, and we wouldn't see a benefit. Thank you for continuing to work through this process and identify these necessary components

so that we can create these land uses and get more of the nutrients where they are actually being spread.
Ken Staver: To be clear, there's nothing that constrains a state that their managed hay acres has to match up with a certain number of acres that have nutrient management, right? That's not part of the definition. So, what James was just saying was you can have more managed hay acres than what you have nutrient management, so there could be a case where these factors actually come into play. Is that right, or not?
James Martin: Exactly. Right now it's set up so that the states define how many of their current other hay becomes managed hay, and how much of their current pasture becomes managed pasture. They can make that decision, as we've set it up now, based on whatever lines of evidence they choose. I'm not sure why anybody would want to but, theoretically, a state could report 0. Theoretically a state could report 100% of their hay as managed hay, doing away with the other hay land use.
Ken Staver: But they can also break that category down to with nutrient management and without, right?
James Martin: That's correct.
Ken Staver: Tom, you had showed a bar graph last month with managed hay having 140 pounds of N per acre, and you said that was the managed hay without nutrient management. We have that calculation, so I guess it can exist if states report that way.
Tom Butler: Certainly. It comes down to how states want to report and what they want to report. I do think it does bring fertilizer into question as has been brought up repeatedly. So, hopefully, we can touch on that one at least, because I think that will be a part of this as well.

Dave Montali: When this was first proposed, I think Virginia summed up all the state college recommendation for pasture and hay like Cassie provided for New York, here. There are nuances between those numbers. Every state's generally similar, but when we end up doing this and creating these things, are we just going to stick with the test loading rates? Are we going to refine those, or are we going to throw that back and say each state can have its own application numbers for these? How's that going to work?
Tom Butler: It's a great question. With a lot of the crops now in CAST, you are able to specify those. I think hay you can specify as it stands now by state, but I will lean on Jess for that.
Jess Rigelman: That's true. They were specified by the states and when I say the states, I mean the land grant universities are the recommended, not just like the state decided this is what it was. So, it was kind of a collective agreement where everybody brough their land grant university recommended rates to the table and they ended up all being kind of fairly similar.
Tom Butler: Then would we want to continue on that line? I think that's a valid question Dave has brought up. If they are all similar, I don't know that that matters too much.
Dave Montali: Maybe that's a rabbit hole for today. If they're all similar, then there's not going to be too much variation. We can go on and figure that out later.
James Martin: Some of the nuance was that some states had it yield to based and others were just kind of a flat number based on an average statewide yield. So, in Virginia, I believe 120 pounds is the recommended rate, but some of the other states were like 30 pounds per ton of dry mass. So, I think when you look at the average yield data for those crops, it probably comes out to about the same. But, I don't see any reason to make these different than all the other crops where a state can use their land grant university recommendations to set that value.

Jess Rigelman: I agree with James that there really shouldn't be anything different on these and, I think that by using land grant university, that kind of equalizes it. When I say equal I mean not the same, but all kind of based on the same premises for the most part. It doesn't really benefit a state to set it super low because, as you know, we have a certain amount of manure and amount of fertilizer that is going to go down anyway. So, it's in the best interest of everybody that it matches reality. I think the land grant universities is the closest thing we have to reality.
Dave Montali: The other little detail I remember from talking with the folks in West Virginia is that there's a lot of instances where the producers don't put down as much as the recommendations that go into a nutrient management plan for practicality reasons or because there was no need. There are details and nuances, but the overall comment was, yeah, we prescribe this, but most people don't do their second application. There are nuances, but it might be better to just standardize this. But, once we get the full go ahead, then that's something we could work on later.
Joseph Delesantro (in chat): The crop yield model does work well for cast crops "other managed hay" and "small grains". I believe that "other managed hay" is the largest component of the land use "Other Hay" by N application.
Tom Butler: We can come back to it. We can put whatever we have in now and then just give you guys a form and say fill it out with whatever you think the rate should be. So like we can test it with what we have now and then people can just adjust as they see fit once we get into it. Joseph's put in a comment about the yield model that he's done. Do you want to elaborate real quick on that, Joseph?
Joseph Delesantro: Regarding the comment about how there are differences and how the nutrient application is done as a flat rate or as a function of yield, I just wanted to point out that, for a couple of the CAST crops in other hay, the model that I've been working on performs quite well, including other managed hay which is the largest component of the land use other hay. If we can move forward with a couple of things, then we could explore expanding that yield application method across the watershed.
Tom Butler: The last part of this is I'd like a few people to be willing to work with me offline to spend some extra time talking about the loading rate ratios. I know people have done it before. There might be new people who want to get involved. Please email me or volunteer now. If you don't volunteer now, please email me within the next week so we can try and get rolling on this because we do have a finite time.
Ken Staver: Something that might be helpful is for the folks that are from those areas that have expertise to go through a description for the group about how nutrients are applied. What's the typical timing? What does it look like when you go to this high management scenario? When are the nutrients applied relative to what the harvest is? Just a basic management description of what these land uses look like in terms of the timing.
Tom Butler: That's a good point. Scott, I know you have said some things that are different than some of the other jurisdictions, so I want to try and specifically tag you to be a part of this.
Scott Heidel: I certainly would like to be a part of that.
Hunter Landis: Tom, this is Hunter. I was drafting you an email if you want to put my name on your pencil list there for Virginia.

Decision: We will alter the Land Uses in CAST to represent, Managed and Unmanaged Hay as well as Managed and Unmanaged Pasture.

Decision: We will modify the manure spread algorithm to create a fourth group and fill these groups as follows;

e. Group 1: Grain with manure, Silage with manure, managed Other hay, managed pasture,
f. Group 2: Small grains, double cropped, other crops, specialty high, specialty low,
g. Group 3: Other Hay, Pasture,
h. Group 4: Soybeans, Legume Hay.

Decision: The AMT approved the provided definitions for managed and unmanged hay and pasture for Phase 7.

Decision: The AMT approved the language that acres of managed hay and pasture will be reported annually by states by November 1st.

Decision: The AMT accepts the NM effects with a non nm multiplier of 1.2 for N and 1.5 for P for Phase 7.

Action: Please email Tom and Caroline if you would like to help with literature and science review for loading rate ratios.

Inorganic Fertilizer 10:30-10:55 [25 min (10 min presentation 15 min discussion) (Tom Butler, EPA)]

We provided a quick recap the method on which inorganic fertilizer is applied in CAST. This provided a foundational understanding for the way in which inorganic fertilizer is applied across the watershed. Informational.

Discussion:

Scott Heidel: On here, you have counties that are in here and some only have a very tiny portion within the Bay Watershed yet those could be very high agricultural counties that could potentially throw off the actual true numbers. So, has anything been done to account for maybe just the percentage of that county and using the percentage of the fertilizer numbers?

Tom Butler: I'm going to lean on Jess and Gary, but the short answer is that there has been something done to that.

Jess Rigelman: We apply fertilizer to the whole county, so those whole counties count in part of this. It's not as if we are just spreading fertilizer in a small portion of that county. If a county has five acres or it has 1000 acres in it, it doesn't really matter. So, the fertilizer for that entire county counts. So , we calculate loads for all counties that are in any way in any part of the Chesapeake Bay Watershed. So, it wouldn't make sense to discredit the part that is outside of the watershed.

Scott Heidel: So, a county like Berks County that has primarily agriculture and a very tiny sliver within the Bay Watershed is getting counted completely in this calculation?

Gary Shenk: So, we simulate the whole of Berks county, so we have all the crop and everything else in Berks County simulated as land uses, but only that little sliver of the watershed that's in the Bay actually drains to the Bay. The rest of it just sort of goes off into a black hole.

Scott Heidel: Thanks, Gary. I think I am still just a little bit at a loss how all of the information from that county which is heavily agricultural is getting factored into the initial load of fertilizer.

Dave Montali: If this helps, Scott, I've got a couple of counties like that there on the other side, and I worried about those things in the past. There's lots of animals in this county, but only this little piece of forest land drains. I worry about those things but, in the end, it's just like Gary said. They model the whole county, your land use loading rates are what they are, and then it's really only the land use of the drain to the watershed. So, that county that might be having a lot of ag and a lot of nutrients might have its loading rate for the ag land use as a little higher. But,

it's still only those ag land uses that drain to the Bay being part of the load that comes to the Bay.

James Martin: When you look at the model results from CAST, one of the choices you can make is whether you want to see county wide or just bay watershed portion. So, effectively, I think the entire county is being simulated, but when we look at the loads going to the Bay, that's when we only look at that small fraction of the county. So, I appreciate your concern because we have border counties to the West and to the South that are our partials, but I do think for the most part those land use based loads are pretty accurate. The concern we've had in the past is the distribution of ag animals that may not be proportionally spread across those partial counties because we don't currently use land use data to place those. They're just presumed to be distributed evenly. So, that's been our primary concern on those border counties, but I don't think you are getting more load or more fertilizer than then county should get based on the entirety of the county and then, again, just the fraction counts towards the loading.

Scott Heidel: I appreciate that. I think this is even more basic than that. How were the initial fertilizer numbers calculated? Was it county based? Because if all those counties are added together and you're picking counties that have a very minimal amount of Bay Watershed real estate but heavy agriculture outside the bay, they're going to have higher numbers. How were the initial loads calculated for this?

Tom Butler: We get the counties, and we sum the counties up. So, your concern is that if we are adding all the counties, we would take a total amount of fertilizer from Berk's county to put towards the stock? Is that your concern?

Scott Heidel: Correct.

Tom Butler: So we do sum by the county. I don't know that it necessarily has the impact that we would think on the total amount. I'm trying to think about the best way to think about that. Again, I'll lean on Jess and Gary.

Jess Rigelman: We simulate the entire county of Berks for manure and fertilizer, so animals, biosolids and fertilizer, so, therefore, we need the entire bucket included in our simulation. The same goes with crops and crop expected application. Let's say Berks County only has five acres in the watershed and those 5 acres are forest, then it's going to get no ag loading rate. It's going to be dependent upon what part of it is in the watershed, but we need to simulate the entire county because all of our crop and animal data is at the entire county scale and that's how the data is reported. That's how we simulate everything.

Dave Montali: I think I get it. You've got the bucket, you've got the expected application, you put the manure and the biosolids down, and then there's some deficit to your expected application, and that pulls then from the watershed wide bucket the amount of fertilizer to fill up that expected application. My question is how is that different from the bottomless bucket? If I do that everywhere in all these counties, is the amount of fertilizer that I'm putting on greater that, equal to, or less that what I say the fertilizer stock is?

Tom Butler: When we bound it, you can say we are out of fertilizer, there's no more that was applied. So you could, theoretically, have less than your crops goal or expected application met. But if it's bottomless, you can fill it regardless. You will fill the need. When you have it bound, there's an actual stop. Then that's the last year that we have data. In subsequent years, it's that proportion that gets used, but the actual implementation of the data puts a stop in it so that you can't apply more than there is sold.

Dave Montali: I kind of recall that it is distributed then, until it runs out, based on the percentage of need remaining. That's the detail that I don't really understand completely.

Ken Staver: We don't have a deficit situation. We have the opposite situation where there's more than what you need, so the question is how do we add the extra on top of the need?
Tom Butler: The last year we have the data is based on what's applied and it's in exceedance in some counties for manure. It's generally a deficit of manure, so that fertilizer gets applied based on our own curves. Based on the amount sold, we are going to say, ok, this was applied because this is what the crop needed, and this is how much went into that. The rule is that there is overapplication up to about 120%.
Scott Heidel (in chat): Please share the calculations used to develop the fertilizer bucket as well as the distribution
Jess Rigelman: I was just going to say that that's not a blanket statement, Ken, that we have more fertilizer than needed. That is true in more recent years, but in the past, it has been not true that we haven't met crop need with the fertilizer bucket. It's just now that fertilizer data is saying we have a lot so there is as much if not more than crop need. To go back to Dave's question, yes, we applied the manure, we applied the biosolids, then there is still for the most part remaining crop need in every county. So we basically take that Bay plus portions of the county outside of the watershed bucket and disperse it to the counties based on the remaining crop need, then it's spread to the crops using the fertilizer curves. So at that point, it's going to prioritize crops that have no crop need met with manure and biosolids, so that is where the proportioning happens. But then it's just going to fill up for as much as it needs, and it can be more than crop need and could be less than crop need. It just really depends on what the remaining crop need is compared to the fertilizer bucket in whatever year.
Dave Montali: Getting back to the point where the fertilizer bucket is bigger than our whole methodology. In other words, we're taking from it, and we've done all that we said we should do, we loaded everything up to the expected application rates, yet there is still fertilizer left in the Bay bucket. That doesn't go down, right? Or are we somehow putting more on than our methodology says to?
Jess Rigelman: Yeah, you're putting more on.
Tom Butler: The curves are in place to represent the behavior and so the curves exceed 100% and the curves for fertilizer in particular will follow that behavior to put down fertilizer where it should go based on those decisions if there's more than the crops need. If you get beyond a certain need, it starts to dump on one place more than another.
Dave Montali: Does a bottomless and topless bucket solve our problem? We're not checking ourselves back against reality, but just a thought.
James Martin: Going back to step one in your process, you start with county scale data from AAPFCO or the states. First comment is, yes I understand that currently in our model Phase 6, 2020 is the last year of fertilizer data. I presume states are going to be asked to provide more recent fertilizer data for Phase 7, so 2020 will no longer be the most current year. I know we've got data in Virginia ready to go. The other question I had is, is there anything that would stop us from using this exact same process but constraining it not to Bay wide, but we just run the same scenario six times, once constrained by each state?
Tom Butler: I don't think there's an issue with that, but Jess is the technical expert.
James Martin: Again, with no default as we talked about for the managed pasture, then some mechanism to drive this down to state level. I wonder whether there isn't an opportunity to use multiple lines of evidence to determine how, within a state, you distribute the fertilizer to the county starting with the county fertilizer sales data where states are able to provide it. That's one line of evidence for what that county should be. The Ag Census expenditure data is another line of evidence as to what that county distribution should be, and there may be others. So, I

just want to plant those seeds so folks can start thinking about them in advance of next month's meeting, where I assume we will come back to all of this.
Tom Butler: I think that's a great idea, James. That should be a good wrap up point as well. I think anything is theoretically possible. It's just what do we want to do? If we can start to think about that, I would certainly say that's something to come to next month.
Jess Rigelman: I just wanted to say there's plenty of ways we can do it in a state bucket and I would encourage states to look at the way it is done for urban. I'm not saying it's right or wrong. It's definitely simpler, but they definitely do a state bucket there that doesn't in some way include the non farm data and such. Not that I am saying that that is the method that should be used, but it's something that should be considered and has been done by the urban stormwater workgroup. So. I just encourage everybody to maybe look at that and see if that is in any way palatable for you guys.
Ken Staver (in chat): I support anything closer to state reported data.
James Martin (in chat): please point us to the right place to review the Urban data

Action: AMT members are encouraged to look at the reporting methodology for urban data and consider this methodology for our use.

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

Action Items:

- Discuss:
    - Required details for new Ag Land Uses for Phase 7.
    - Inorganic fertilizer in CAST.

Adjourn – 11:00

Up Next:

Office Hours: Friday, March 14th, 2024, from 8:00 - 9:00 am.

AMT Meeting: Friday, March 14th, 2024, from 09:00 - 11:00 am.

Participants:

Zach Easton, VT
Tom Butler, EPA
Caroline Kleis, CRC
Jessica Rigelman, CBPO
Chris Brosch, DDA
Olivia Devereux, Devereux Consulting
Tad Williams, VA DCR
Joseph Delesantro, CBPO/ORISE Fellow
Eric Hughes, EPA
Jeff Sweeney, EPA
Mark Dubin, UME/CBPO
Curt Dell, USDA-ARS
Tyler Trostle, PA DEP
Hunter Landis, VA DCR
Helen Golimowski, Devereux Consulting/CBPO
Auston Smith, EPA
Candiss Williams, NRCS
Lisa Duriancik, NRCS
Alisha Mulkey, MDA
James Martin, VA DCR
Ken Staver, UMD Wye REC
Cassie Davis, NYSDEC
Emily Dekar, USC
Alisha Mulkey, MDA

Dave Montali, Tetra Tech
Scott Heidel, PA DEP
Hunter Landis, VA DCR
Tamie Veith, USDA-ARS
Gary Shenk, USGS

**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