Agricultural Modeling Team (AMT)
Meeting Minutes

June 9th, 2023
09:00 AM – 11:00 AM
Meeting Materials

Summary of Actions and Decisions

Decision: The AMT approved the May meeting minutes.
Action: Tom Butler will consult CBPO technical staff on ways to spatially distribute crop yield trends. More discussion will occur at the July AMT meeting.

Meeting Minutes

Statement of purpose:

To evaluate the crop yield and land uses in CAST and discuss potential alternatives for Phase 7.

Announcements:

- Fertilizer Expert Group meeting Monday June 5th. Discussion of Phase 6 inorganic fertilizer data sets. Tentative recommendations here.

Introduction: 09:00-09:05 [5 min (Tom Butler, EPA)]

Decision: The AMT approved the May meeting minutes.

Fertilizer Expert Group Recommendations: 09:05-09:15 [10 min (Tom Butler, EPA)]

Tom reviewed the recommendations of the Fertilizer Expert Group for addressing inorganic fertilizer in Phase 7.

Discussion

Chris Brosch (in chat): has the final briefing to the MB happened?
Tom Butler: Not yet. The upcoming schedule is the following:
June 15/June 26: AgWG and WQGIT will be briefed.
July 24: Approval from WQGIT.
Aug 10: MB will be briefed.
Sep 5: Approval from MB.
Oct: Approval from PSC.
Lisa.Duriancik (in chat): I would agree with that survey response feedback from NASS. That is a concern.
Ken Staver: Can you explain what using the percent change means?
Tom Butler: We would be taking % change from the states that do have data and then apply that % change to the states that don't have data.
Jackie Pickford (in chat): Fertilizer expert group June materials:
https://www.chesapeakebay.net/what/event/fertilizer-expert-group-4

Thomas Butler (in chat): https://d18lev1ok5leia.cloudfront.net/chesapeakebay/documents/FEG_Recommendations_6.23.pdf
Dave Montali: For P6, you suggested the FEG recommendations have to go through the PSC before the partnership is in line to put out the next version of CAST? I thought the final decision rested with the WQGIT?
Tom Butler: I'll talk about that with Lee to confirm, but it's my understanding it has to go to the WQGIT, MB, and PSC for approval.
Gary Shenk: It was originally a charge from the PSC, so that's why it has to go back to them for resolution.
Ken Staver: I was wondering if what you allocate to a county matches what the recommended rate is based on the yield goal calculation?
Tom Butler: I can look into it.
Chris Brosch: Ken, it's not easy to access the nutrient spread with any model run, it's not a publicly available output. But as a part of DE's analysis of C21, we compared the increasing rates of nutrient application with data given to us to review with what we expect the yield increases to be (e.g., for corn it is 3% a year), and the fertility allocated to DE for N outpaced that yield growth by two times. That was not at the county scale though, but we only have three counties in the watershed so it's close.
Ken Staver: The AAPFCO data doesn't provide any crop specific data, it's only sales. so we have to have a system to allocate it to wheat vs corn vs grass/hay. Then we do a county redistribution anyway. So it's not really county specific, so in the end the crops and the yields are a big driver of how it gets distributed.
Chris Brosch (in chat): and the manure!
Chris Brosch: At what point in the supply chain are the jurisdictions getting this tonnage data?
Tom Butler: Comes from a lot of the bigger distributors. There are cutoffs for what's reported in terms of nutrient content. If it's under 10 or 15 lbs, they don't have the nutrient content for that and it's often reported as nonfarm. The bulk of it is collected from companies like southern states.
Chris Brosch: Seems like they're aiming for wholesale to avoid double counting. should look into this for phase 7 to see if that's the most effective way.
Dave Montali: In West VA, it's the entity that first offers the material for sale/trade in WV, so it's usually distributors, wholesalers or manufacturers.
Tom Butler: I think that's fairly consistent across states.

Scenario Discussions: Crop Yield trends 09:15-10:55 [100 min (15 min presentation 85 min discussion) (Tom Butler, EPA)]

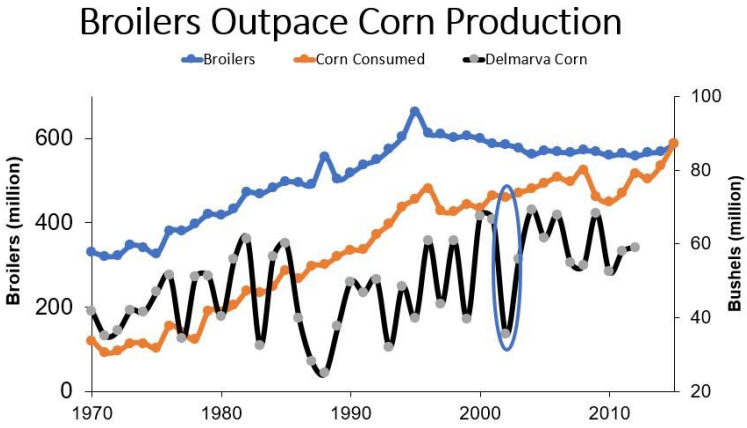
The AMT discussed the trends of crop yields used in CAST and how we can improve the ability of CAST to capture the behavior of yields over time.

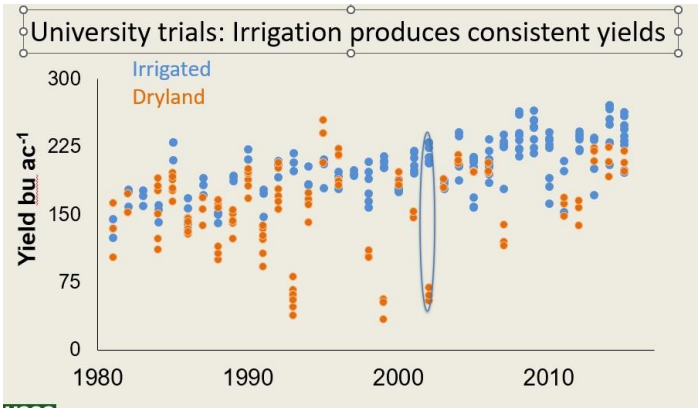
Discussion
Chris Brosch: Do you know why these are so different?
Tom Butler: This is purely speculation but I think we have a lot of older information that informs our max yields. I suspect that if we updated that max yield value, it would be lower and draw down the expected yield.
Gary Shenk: The smoothing method that we use could be a huge factor, too, because we use the best 3 of 5 ag census data, so we could potentially be using 25 year old census data.

Ken Staver: There were a few ag census's in a row that were below average. if you go back far enough you pick up low values.
Chris Brosch: When we built P6, by using that average 3 out of 5, we were inadvertently capturing one or more drought years just because the ag census was lining up with droughts at a higher than average rate, therefore suppressing the average inaccurately. I thought that was why we mixed in the NASS county information for big crops to help inform. Just as big of a problem overestimating in 1985 as underestimating current years.
Tom Butler: We're trying to get behavior over time as an average. NASS data is census and annual survey data and it's smoothed. If we feel we're underestimating because of the smoothing, would there be interest in just using the trend over time without smoothing it?
Mark Dubin: Want to point out that for Phase 7 we will have a new ag census to use and should actually be a record yield that might help level out the odds on this. Also, when we do look at ag census reports over time, we go back to 1982. We put more emphasis on recent ones, not all years are valued the same. So hopefully we'll see improvements in this data as new information comes forward.
Chris Brosch: The problem we've tried to solve historically is filling in information where we don't have it, by year or county. There may be a geographic way to fill in those blanks that might help the blue lines look more like the red or green. Not sure what is most representative, but i trust the slope of red and green more than the blue slope. Also, are we actually weighting recent years more than previous years? When we evaluated the 2012 data in 2015, I don't remember it being this far off. Maybe a GIS routine to help fill in these gaps, using data from neighboring counties to fill that in.
Tom Butler: What do you all think about using the raw data trend instead of a smoothing method?
Ken Staver: My understanding about NASS data is that the counties that don't have data reported have very limited acreage about that crop. So are these weighted averages points or just numerical averages for all counties?
Tom Butler: There is no weighting. Just a regression of the yields.
Ken Staver: Small acreage counties probably aren't the best corn producing counties in terms of yields, so that could contribute to what's going on here. Also, overall smaller acreage counties are not that big of a deal because it's not that big of a percentage of most of the major crops.
Mark Dubin: Thinking the same thing as Ken. In the past, we've had the same scale for everyone. where we have the data, we should use it. where we don't, let's apply the trends.
we shouldn't abandon good data because we don't have it in another state.
Chris Brosch: I'm afraid the de-filling procedure is responsible for suppressing a response in the blue line through time. Because to fill that it looks backwards and forwards in time before it looks around the county in the same year. The ag census has an increased weight when data is withheld from a county. Ag census is an anchor on yield growth in this model.
Chris Brosch: Separate question - we are having trouble how corn can diverge so much between the red and green lines when the other two crops seem to be better fit?
Tom Butler: That was the data that I was able to get from NASS. That's not saying they didn't have overlapping data points, the regression just showed a different line. Seems like there needs to be another way to fill in other counties.
Dave Montali (in chat): Is there a way to address that at the State growth region scale?
Dave Montali: Seems like variability between counties may not even be real. Might be a different way to come up with the value that we need if we looked at growth regions. Not understanding why there is such a big difference between the red and green lines.

Tom Butler: I'm not sure, I would have to talk to NASS. Ken gave a good explanation earlier that maybe the state data is weighted.
Mark Dubin: On the annual NASS survey, they aren't contacting all producers, only a sample. In some of these counties, you don't have many data points, so they won't report it if they don't feel like they don't have enough data points for it to be accurate. Not just the privacy element for this.
Ken Staver: Going back to the increase in crop yields vs increase in N application- the reason this is a big deal is we are trying to use "real" fertilizer sales data. So if this yield data is flattened like the blue line shoes, compared to our "real" fertilizer sales data, it really makes it look like we are really getting worse. Because we're overestimating yields early in the effort and underestimating yields now. So it makes it seem like our difference between yields and N application is not responding to our efforts.
Chris Brosch (in chat): Yeah, we've inadvertently suppressed assimilative capacity of ag and ag nutrients.
Mark Dubin: I'm wondering if this format is not the best way to look at this information and maybe we need to look at it in another format? More representative of the intent behind the decision? This may be too simplistic.
Tom Butler: Sure, any suggestions?
Gary Shenk: Ken was saying the difference between application and uptake is what drives loads. When we put sensitivities in the model in P6 (load sensitivity to application and uptake), we found at the time that a lb of additional application created much more load coming off than a lb of additional uptake decreased the load coming off. So this uptake amount is needed for the fertilizer application calculation, and it does have an effect on loads, but it's relatively small. I agree w/ what Ken said. However, it doesn't affect loads very much in the current model, but it might in the future because we might change this in phase 7.
Chris Brosch: Having the blue line in 1985 be so much higher than the red/green lines, also minimizes the effectiveness of our BMPs compared to the baseline in the model. Also, i think this group should discuss the actual assimilative capacity of these crops because the efficiency of a corn crop in the model is static and that's not the reality. Genetics have increased the efficiency for these crops' nutrient uptake.
Mark Dubin: Can we represent the actual points of data across the period of time so we can see the highs, lows, and change?
Ken Staver: It would be good to overlay the trend line but still have the raw data shown. Maybe try spatial or regional averages? Why wouldn't we use the trend line provided by NASS county data? Maybe we could estimate the percent of total corn acreage that there's no reported data for?
Tom showed the actual points of data from the county and state (no smoothing) compared to the NASS trend lines.
Chris Brosch: We might have to work with some others to see if we can incorporate the use of geospatial tools for this data.
Tom Butler: I'll work with the technical staff at CBPO to figure that out.
Olivia Devereux (in chat): There are a number of methods to estimate values using spatial statistics. Kriging is just one way, as Chris mentioned.
Gary Shenk: To summarize - we want to make sure the trend we represent is the actual trend and not influenced by the best 3 of 5 rule. We also want to find a good way to spatially distribute those trends where we don't have information. For the methods, we will gather at CBPO with technical staff about good ways to do that, and then come back to the AMT with suggestions.

Alex Soroka (in chat): About yields, I was thinking about inter-annual variability in crop nutrient usage and I wondered about how we look at variability from growing conditions. From the university variety trials we see that irrigation produces consistent yields regardless of growing conditions. However, Dryland shows variability. What this means is that some years, like 2002 circled in the broiler figure, we have a shortfall on Delmarva. This means that some 36 million bushels had to be brought in from the midwest. We know the grain was shipped in because corn consumed remains constant (reported by broiler industry). This means 2 things 1) Nutrients applied to cropland did not go into grain (as the plants didn't grow well, so those nutrients were likely still in the landscape. Then 2) we add nutrients to the region by importing corn grain. I brought this up because I wanted to know how we handle the difference in production consistency between dryland and irrigated land in the model. See figures below:





Closing –10:55-11:00 (5 minutes)

Adjourn – 11:00

Next AMT Meeting: Friday, July 14th, 2023 from 09:00 - 11:00 am.

Participants

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