

Agriculture Workgroup (AgWG)

March 16th, 2017

10:00 AM – 3:00 PM

Quarterly Face-to-Face Meeting Summary

Meeting materials: <http://www.chesapeakebay.net/calendar/event/24787/>

Actions & Decisions:

Decision: The AgWG made a formal recommendation to establish statistical confidence standards for uniformly evaluating agricultural BMPs obtained through new alternative BMP verification methodologies using transect survey methods, as outlined in the [Tetra Tech report](#). The AgWG recommendation includes continued approval of existing transect survey programs in Delaware and Pennsylvania, and, provided there is funding for additional resources, an examination of existing transect programs in Pennsylvania and Delaware in order to determine how they align with the recommendations of the report.

Decision: The AgWG approved the AMS recommendation to simulate soil P history by using a mass balance modeling approach combining APLE and soil test data. This decision was made with Pennsylvania abstaining.

Decision: The AgWG approved the recommendations of the AMS to use Dave Lightle's revised RUSLE2 C-factor management scenarios in the draft final version of the Phase 6 model. This decision was made with Pennsylvania abstaining from voting.

Decision: The AgWG confirmed Ted Tesler to serve as a jurisdictional member of the AMS.

Welcome, introductions, roll-call, review meeting minutes

Workgroup Chairs

- Minutes from the February 16th meeting were approved.

New At-Large Membership Introductions

Workgroup Chairs

The workgroup chairs welcomed and introduced the new at-large membership that was confirmed during the February 16th conference call.

Phase 6 BMP Panel Updates

Clint Gill, Tim Sexton

Clint Gill and Tim Sexton, BMP Panel Chairs, will provide their respective panel updates on the Phase 6 Ditch Management and Cropland Irrigation Panels.

Discussion:

- Question on the Ditch Panel regarding whether a timeline will be developed for when report sections will be released. Clint Gill replied that he hopes to have sections released either this week or next.

Roadside Transect Survey Recommendation Report

Steve Dressing and Jon Harcum

Tetra Tech representatives presented their draft [Final Recommendation Report](#) for the establishment of evaluation standards and sampling protocols for alternative agricultural BMP verification methodologies using transect survey methods.

Discussion:

- Tim Sexton: We've had discussions that transect surveys could have been done with fewer observations, and therefore less time and money would have been spent. If we're going to do transect surveys, this is a method that appears to be defensible, and would help to save time and money in the effort.
- Jason Keppler: Are any jurisdictions currently using this methodology?
 - Sexton: PA and DE are using the Hill method. From what I have observed, if the forethought had been used to determine up-front what your n-value is, etc., then less time, effort, and money could have been spent with defensible statistical at the result.
- Keppler: If this is approved, will jurisdictions have to modify their transect protocols in place?
 - Dubin: DE and PA have been using the CTIC method, which was developed specifically for the mid-west. This would create a standard based on our localized needs. We've been coordinating with CTIC – they've provided input on this report and are supportive of this effort. Representatives from both PA and DE, who manage those programs, have also reviewed and provided input.
 - Keppler: So the Bay Program is going to provide technical support to those jurisdictions that have programs in place to help them meet the requirements of the new standards.
 - Dubin: That's correct – and we've been working with those programs from the beginning, and will continue to do so.
- Keppler: Are any other BMPs being included in this report?
 - Dubin: We focused on tillage and cover crops since those are annual BMPs, but we aren't really focusing on any structural BMPs with this.
 - Keppler: I also think it's important to recognize the difference between a traditional cover crop versus a commodity cover crop – has that been factored into this report?
 - Dressing: We haven't looked at that yet. We're just concerned with how many categories have been developed and what needs to be done, statistically, to support that.
- Jill Whitcomb: On page 9 in the report, it should be noted that roadside transect surveys were approved only for traditional cover crops in 2015. Neither fall with manure cover crops or commodity cover crops were approved for this survey. I wasn't a part of this in 2015, so I'm wondering why that decision was made, and also if we should revisit that decision because in Phase 6, traditional cover crops with manure are credited.
 - Dubin: We didn't include commodity crops because they aren't terminated – it's very difficult to determine if a crop was fertilized or not fertilized, which is part of the definition. In both of those programs, we used termination to determine whether it was likely to be fertilized.
 - Whitcomb: So would there be any opportunities to compare the ag census data with what's been reported into the model?
 - Chris Brosch: It is a small credit, but when you're observing the crop in your transect survey, you can't determine whether it was fertilized.
 - Tim Sexton: I think the key point is what the crop looked like at planting, so why would I send a team to look at conservation tillage when corn is mid-way through the season. I think as we move forward, we should give thought to those things, so we can keep

focused on getting the biggest bang for the buck. If I wanted to make sure it was a cover crop, I would survey at the time when it's being burned down.

- Dubin: Both the DE and PA programs have worked closely with CTIC – they review and QA/QC the data. I also talked about the traditional cover crop with manure, which is new in the model, and the programs feel that they can pick that up. So we'll probably come back to the AgWG with a proposal on that, but there wasn't a definition until just a few months ago to rely on. The commodity piece is so difficult to pick up and have confidence in, particularly when you're not terminating the crop.
- Whitcomb: So you're saying there's more confidence in the ag census data, than in a visual assessment?
- Dubin: The ag census is 5-years, and NASS data is a state-wide reporting. So for PA it would be very difficult to distill any data at a lower scale.
- Keppler: Realistically you can't determine whether a wheat crop received fertilizer or not.
- Whitcomb: What if, in the future, local ag agents doing the QA/QC could poll the producer to ask him if he applied nutrients or not to those acres. That data could be used to inform the rest of everything. We have so many acres that we're trying to capture, and it looks to me that we're being hamstrung by the process.
- Frank Coale: It's not being hamstrung, because the process can't discern between the tool. You have to use another method.
- Tim Sexton: Cost-share would capture that.
- Lindsay Thompson: I think it's something you could come back with, primarily because this is a tool just for visual observations. If PA determines it's worth the additional effort to identify land owners and ask them if they put down nutrients, then you could come back to the group to ask for approval. Regarding 2015, that wasn't an option, so that's why it was approved the way it was.
- Jim Cropper: If you encounter a field that you don't feel comfortable with categorizing, then you could do a line transect.
- Tim Sexton recommended including the word 'adjusted' to describe data.
- Jason Keppler: I'm still trying to understand how someone in a car will be able to determine whether manure has or hasn't been applied to a field. You may not be able to see it on the field; so how will those be differentiated?
 - Dubin: Manured cover crops will be terminated, as they are traditional crops. So based on the new definition, you'll consider whether the crop was terminated. And if you're still unsure, then it's recommended to use the default value (assuming that manure was applied).
- Chris Brosch: I'm a bit confused about the purpose of this recommendation. These are good questions, but would we be adopting these recommendations as pre-approval of future studies in advance of them occurring?
 - Sexton: I think we're looking for a standardization of how transect surveys should be done.
 - Dubin: The surveys we're doing right now have interest for expanding approval – looking at traditional cover crops with manure. Both the PA and DE programs have adapted over time. CTIC is also very interested because they don't have a standard for cover crops in transect surveys.
 - Brosch: The existing DE survey doesn't account for manured traditional cover crops. If they're not interested in incorporating it into their survey, then I understand that it's still an approved survey technique.

- Dubin: Correct – and we would also be able to go back to the program and potentially refine it based on the recommendations in this report.
 - Brosch: So the DE program is still acceptable, and I think this report is statistically defensible.
- Whitcomb: I think Chris is trying to say that PA and DE were ahead in trying to get this through. Now that everyone potentially wants to jump on board, the approval of our survey technique is no longer. We still have to come back through this standardization?
 - Dubin: If we created this standard, it would apply to everyone.
 - Brosch: It's a far-bigger ask to get this recommendation approved by PA and DE if we have to re-evaluate existing programs. If the two states that already do it aren't grandfathered in, then I won't be able to support this.
 - Keppler: Could we build in some flex time to build up those programs?
 - Brosch: I have a lot of concerns about funding going into the future.
- Frank Coale: It seems like a logical approach to say that existing survey methodologies can continue to do them, and they should be able to collect this additional data during their next round. At that point, you can make a decision on whether it's more effective to use one method versus another.
- Chris Brosch: My concern is matrix algebra – and who will be able to go through and do that work. I agree that this is a novel approach, and can be used for additional surveying techniques. But again, I argue that DE's survey is not broken, and until we want to re-develop it, I suggest this group not try to fix it.
- Lindsay Thompson: So how DE and PA's surveys were improved in the past, is that each state presented their methodology and the AgWG either approved or made additional recommendations. So our options today include recommending if the program isn't broken, don't fix it, and this report would be applied to new programs coming forward. But my questions is whether this presents equity issues, if we find existing programs don't meet the standard, but new programs do need to meet the standard.
 - Sexton: I don't think there's issue with the confidence of the transect surveys from PA or DE. My recommendation is that this standard be offered to anyone who wants an opportunity to do a transect survey effectively, that's defensible or cost-effective. But as far as I know, there's no issue with anything that's being done – they're doing more than is necessary, statistically.
- Dubin: Since we've involved the DE and PA project leads, I'd offer to sit down with them and discuss how this fits with what they're already doing. Then we could come back to the AgWG to report back on how this would work. In the interim, I would ask if the AgWG could approve this report for new projects moving forward, and that PA and DE transects would be addressed at a later date.
 - Keppler: Would this include looking at the new cover crop report with manured cover crops and commodity cover crops?
 - Frank Coale: I think this is good to identify what changes are or are not needed. I'd like to offer that this be assigned to a summer intern project: to compare these programs.
 - Whitcomb: I think the overall idea is good, but I'm concerned about being forced into changing a program that had already been approved.
- Chris Brosch motioned to accept recommendations to accept recommendations for all new programs, and to grandfather existing programs. If there is funding for resources to examine the existing programs, then I would also support that along with collaboration between the intern and project leads.

- Seconded by Jill Whitcomb.
- Keppler: Changing programs – what does that mean?
- Brosch: Any protocol.
- Frank Coale reminded everyone that the recommendations in the report are inseparable – they must be accepted together.
- Question whether the motion precluded someone from proposing different protocols with supporting documentation.
 - Dubin: It doesn't preclude that.

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Alternative BMP Survey Methods Statistical Report

Steve Dressing and Jon Harcum

Tetra Tech representatives presented [preliminary approaches](#) for developing a future recommendation report for the establishment of evaluation standards and sampling protocols for alternative agricultural BMP verification methodologies using producer survey methods.

Discussion:

- Frank Schneider: Did you talk with Penn State on the methodology you used to look at this? I don't know if they're necessarily in the loop with what Tetra Tech might be proposing. Also, Penn State work has been published, so you can use that for citations.
 - Jon Harcum: The mean difference they reported – that's their method. In terms of the survey generalized linear model (GLM), we didn't have an opportunity to circle back with them. It was a short timeframe for us to get this done, but that would certainly be something to consider.
 - Schneider: I would recommend that you do coordinate with them.
 - Dubin: Tetra Tech did the evaluation of the results of the Penn State study, so they had access to the information that Penn State provided them.
 - Schneider: I think Penn State may be looking at different methodology.
- Keppler: What exactly do we mean when we say 'verified' in this report?
 - Harcum: Verified indicated that a representative that conducted an on-site interview with the operator themselves.
 - Steve Dressing: Penn State did document what they did to verify on the ground; what we've got in the report is used to an example.
- Bill Angstadt: In NM verification guidance, we have non-visual assessment of BMPs. So is what Tetra Tech is presenting to us applying to all of these annual, non-visual assessment of BMPs? One of the methods we have is farm inventory, and for these annual practices, the guidance is for 100% annual verification. So I'd like some further dialogue on that.
 - Dubin: If you look at the BMP protocols for verification, it's 100% for the initial identification of a practice, but it's 10% verification looking forward. So in this instance, we're looking at alternate BMP verification methods identified in the guidance.
 - Angstadt: So are you saying that core and supplemental NM – the first time it's reported the state has to do 100% verification, but after that the state doesn't have to do 100%?

- Dubin: We recommended 100% on year 1, and then a 10% spot check in following years unless there is an alternate method that's presented. If it's a minor load reduction practice, then you could drop down to a minimum of 5%.
 - Brosch: I'm curious why EPA would approve such a protocol since they rejected DE's NM reporting based on the same techniques. We audit more than 10% of our annual reported acres, and they have cut our implementation. So that's an inequity that needs to be resolved with EPA.
 - Jill Whitcomb: I definitely think that should be brought up with EPA as far as equity is concerned.
 - Chris Brosch recommended that be an agenda topic during an upcoming meeting.
 - Lindsay Thompson: I've heard a suggestion that Tetra Tech reach out to Penn State on some of the methods in the summary in order to get their thoughts and reactions on the potential statistical recommendations.
 - Jill Whitcomb: We would like to have our existing approach and programs be grandfathered until future changes be addressed.
 - Dubin: We're not asking for a recommendation – we have a discussion document to launch conversations with Penn State, and the plan is to create a future document. I would ask that the AgWG accept the document from Tetra Tech as a discussionary document at this point in time.
 - Susan Richards noted that she had completed additional work to meet the requirements identified by the AgWG, and we would like to know what the next steps are to include those practices in the model.
 - Jill Whitcomb: We are in full agreement with NRCS to get those practices accounted for in a short period of time.
 - Dubin: It's not a matter of the AgWG approving the data; it's a matter of the CBPO working with PA on this data.

Phase 6 Soil Phosphorus History

Andrew Sommerlot

Andrew Sommerlot, UMCES, [presented on methods](#) for estimating annual soil Phosphorus concentrations through the combined use of a mass balanced based model and soil test data to derive a history of soil P for each land use and county.

Discussion:

- Frank Coale: Any time you're combining multiple data sets and models in this way, you usually have a better, more representative output.
- Bill Angstadt: It's my understanding that after Scenario Builder does EOF, you don't have enough P to meet needs. So then we add P from the soils to meet the needs of the crops. Is some of that P in the soil washed off, and I'm wondering if this answers that question. For example, whether you have enough data points to create averages. When I look at the Mehlich 3 chart, that may not be enough P to be in any saturated soils. I think we need to identify what problem we're trying to solve, and if this solves it?
 - Gary Shenk: The Model has a concept of sensitivities – and loads from land uses are dependent on things we can estimate. For P, we found that the 4 things that determine P load, are changes in WEP, changes in Mehlich 3, changes in sediment, and changes in runoff. So the Ag Land Use Loading Rate Subgroup has also agreed with these things. In order to come up with these numbers, we need estimates of what the Mehlich 3 in each county. We have APLE and these soil samples, and neither are 100% reliable.

- Gary Shenk: The black line is our estimate of Mehlich 3, and that's one estimate that determines P loss from fields. So just from the increase in soil P, you would see increased P leaving those fields. What APLE tells us is that based on how we put together the nutrient inputs, including uptake, we have an increasing storage in this county and land use.
- Frank Coale: I don't want anyone to think Mehlich 3 soil P test levels control the amount of P that's lost from the soil – it's a measure of how much is extractable from the soil. There's a distinction that we need to keep in mind.
- Tim Sexton: One thing identified in the NMP report is the lack of documented soils tests. So if APLE is over-estimating, then the black line is a happy medium to reduce the amount of scatter.
- Matt Johnston asked if the AgWG concurred with the AMS recommendations for improving the statistical model's estimates of soil P history.
 - Motion from Tim Sexton, seconded by Frank Coale.

Decision: The AgWG approved the AMS recommendation to simulate soil P history by using a mass balance modeling approach combining APLE and soil test data. This decision was made with Pennsylvania abstaining.

Agricultural Modeling Subcommittee Update

Curt Dell and Matt Johnston

Curt Dell, USDA, and Matt Johnston, UMD, [presented an update](#) on the work and recommendations of the Agricultural Modeling Subcommittee.

Discussion:

- Chris Brosch: What's driving the difference in something like alfalfa? NY and WV suffer lower seed factors than two clusters of everyone else – why are we seeing that?
 - Johnston: To understand exactly what's driving any difference in these charts, you have to dig into the management scenario and understand soil roughness in the county, the length of growing season, yield, etc. – all of the factors controlling the C-factor. Before we re-ran these management scenarios, this chart was much wider. So I don't have the exact answer, but I'm happy to ask Dave to get back to us on this.
- Brosch: Frank – does this mesh with your BPJ?
 - Frank Coale: I think once you see row crops this will all make much more sense.
 - Thompson: I think at the very least this is an improvement.
- Alisha Mulkey: We had this same question for Dave on pasture. Gary brought up the question that it's not necessarily the absolute value, so much as the relative values.
 - Gary Shenk: If all of the factors influencing this are the same in counties next to each other, there would be almost an order of magnitude difference based on this C-factor – because of the two separate groups. That said, they will all be very low.
- Frank Coale asked what numbers are being currently used. Frank Schneider agreed that he has nothing to compare it against, and was worried about making a recommendation.
- Matt Johnston: The AMS had a chance to review all of the C-factors, and the group agreed with STAC that the original C-factors did not pass the laugh test. I can certainly get you the original numbers after this meeting, but the AMS is asking you, as the group charged to review this information, whether this approach is appropriate.
 - Brosch: Dave's report of the old method was really damning, and this is a major improvement.
 - Agreement from Frank Coale and Tim Sexton.

- Ken Staver: Where does tillage fit into this? Is this the average of everything, or one particular tillage?
 - Johnston: C-management factors have to be run with a conventional tillage scenario, so we can still provide benefit from the credit of the BMPs.
 - Thompson: These all represent conventional, baseline conditions – the starting points from which to stack BMPs.
 - Staver: So for double crop, does that assume plowing?
 - Johnston: Yes.
- Mark Dubin: We formed a special subcommittee a few years ago to tackle base loading rates from the ag land uses for Phase 6. That group had identified an issue with RUSLE2 during their work.
- Thompson: So it seems like the majority consensus is that the original RUSLE2 results were flawed, and we have a lot of headshakes that this new approach is an improvement from the previous method. I'll ask if we have consensus to approve the use of the revised RUSLE2 results?
 - Chris Brosch motioned, Tim Sexton seconded.
- Jill Whitcomb: I think it would be good in the future to incorporate background information into your slideshows. But when you have the original numbers compared to this – has this been run through the model? I'm trying to figure out if there's a way to look at the actual difference.
 - Johnston: During the fatal flaw review period, we can look at sediment runoff from each land use in the final model and compare that to Beta 4 (which has the old factors in it). I'm happy to come back to this group to present that.
- Tim Sexton: I think it would behoove us to have some workshop sessions so that we won't have to spend so much time individually trying to sort out this data.
- Jeremy Daubert: For the crops, it's more of a worst-case scenario. Is that the same for pasture?
 - Johnston: Yes – it's an over-grazing/continuous grazing scenario so we can credit our grazing BMP.

Decision: The AgWG approved the recommendations of the AMS to use Dave Lightle's revised RUSLE2 C-factor management scenarios in the draft final version of the Phase 6 model. This decision was made with Pennsylvania abstaining from voting.

Decision: The AgWG confirmed Ted Tesler to serve as a jurisdictional member of the AMS.

Phase 6 Nutrient Management Panel Guidance from EPA

Rich Batiuk

Rich Batiuk, EPA, [briefed the workgroup](#) on the guidance developed by EPA for evaluating and crediting "book value" based nutrient management practices in the Phase 6 model.

Discussion:

- Chris Brosch asked how PA reacted to the guidance.
 - Jill Whitcomb: We agreed with the guidance, and we understood the bars that needed to be met. We did the best that we could do meet those.
 - Frank Schneider: I think this clarified to us that what we've put together is protective of water quality. We have regulations on anyone producing or utilizing manure, and so it proves to us that it's protective.
- Alisha Mulkey: How is EPA considering the comments from VA?

- Batiuk: We compiled it as part of the feedback received. There is certainly things that need to be factored in. But at that particular point, we did not consider it a fatal flaw. Other comments I would like to see as a future consideration of the AgWG.
- Rich Batiuk: I think that in the future, we should keep these guidance issues at the workgroup level as much as possible.

Phase 6 Model Fatal Flaw Strategic Review Guide

Rich Batiuk

Rich Batiuk, EPA, [presented](#) a Partnership-wide guidance [document](#) for conducting the fatal flaw review of the Phase 6 model.

- Chris Brosch: I'd like to note that prior to, and going into the fatal flaw review, the WQGIT has come up with a 2-month review. Some of that review is only able to be accomplished once there are new model review tools and workshops held to acclimate everyone to these tools. We can't get caught in the trap of letting the schedule slip with this period because 2 months is already tight.
 - Batiuk: It seems to me that the WQGIT will be moving towards recommending a relative schedule for the model, so that if one deadline gets missed, it doesn't shrink time for other review periods and timelines.
- Kelly Shenk: When would a webinar looking at this review by sector or ag type happen?
 - Johnston: I don't think we've talked about the schedule between now and June, but I know for the next two weeks I will be working on fine-tuning all of the inputs so we can get them to the modelers by April 1. Then, I'll be able to start working on webinars and finishing documentation – the deadline for that documentation is June 1.
- Chris Brosch: We need to prioritize who gets webinars based on the amount of effort they will put into a fatal flaw review. We haven't had a lot of involvement from poultry industry to get to this point other than having them as a member at the table. But when it comes to verifying NM works, there's a subset of people here that can do that with very little extra information.
 - Batiuk: I would ask everyone here to identify those relative priorities and let us know what they are.
- Bill Angstadt: You promised to make a list of the changes from Phase 5.3.2 to Phase 6.
 - Lindsay Thompson: The onus will still be on the partners to make judgements on those changes.
- Mark Dubin: I would consider a webinar that may be targeted to a specific sector to be a different one from what Chris is recommending – which may be from a state perspective.
 - Batiuk: Absolutely. And if you could describe what you need and who the audience is, then we can set up that webinar.
 - Thompson: I don't think Chris was suggesting we combine those efforts – it was more a prioritization of timeline of things during the fatal flaw review period, and things after calibration hits.
- Lindsay Thompson: Are there any quality assurance protocols/processes on Tableau? I've heard that Tableau is a great tool, but I've heard from people that they've found something that looks wrong. But I've heard that sometimes this is an error in the tool and not the model run. So moving forward, there should be a process for not having to determine what is an error in the tool versus an error in the model to identify that.
 - Batiuk: We'll be depending on our modeling team – Matt Johnston and Olivia Devereux specifically.
- Tim Sexton: Could those not familiar with Tableau learn how to access them and utilize them so that it's not a big learning curve?

- Batiuk: Absolutely.
- Bill Angstadt: Everyone should think of this as a Partnership and Jurisdiction review – the interconnectedness of everything we’ve done over the past few years – the logic should make sense. We won’t be doing any outreach until this review is completed.
- Mark Dubin: We’ve made a tremendous effort to reach out to the ag industry, and it’s important to make sure they stay involved and have a seat at the table with us. If it wasn’t for their support, we wouldn’t have this model built. So I’d like to recognize them, and make sure they are a big part of this fatal flaw review.

Wrap-Up/Review of Action and Decision Items/Announcements Workgroup Chairs, M. Dubin, L. Gordon

Lindsey reviewed the actions and decisions from the meeting.

Next meeting: Thursday, April 20th 10:00 – 12:00 Conference Call

Participants:

Name	Affiliation
Lindsay Thompson	DE-MD Agribusiness Assoc.
Mark Dubin	UMD
Lindsey Gordon	CRC
Tim Sexton	VA DCR
Bobby Long	VA DCR
Karl Huber	VA DCR
Roland Owens	VA DCR
Scott Ambler	VA DCR
Chris Brosch	DDA
Clint Gill	DDA
Jason Keppler	MDA
Alisha Mulkey	MDA
Robin Pellicano	MDE
Ted Tesler	PA DEP
Jill Whitcomb	PA DEP
Frank Schneider	PA SCC
Matt Monroe	WV DEP
Dave Montali	WV DEP/Tetra Tech
Amanda Barber	NYS
Marel King	CBC
Kelly Shenk	EPA
Rich Batiuk	EPA
Emily Dekar	USC
Frank Coale	UMD
Matt Johnston	UMD
Ken Staver	UMD
Jeremy Daubert	VT
Peter Hughes	Red Barn Consulting Inc.

Jennifer Reed-Harry	PennAg Industries
Bill Chain	CBF
Christian Richter	US Poultry and Egg Assoc.
Marilyn Hershey	Ar Joy Farms LLC
Tim Garcia	USDA NRCS
Curt Dell	USDA
Joe Montenegro	PA Farm Bureau
Chris Thompson	Lancaster Co. Conservation District
Jeff Hill	Lancaster Co. Conservation District
Jon Harcum	Tetra Tech
Steve Dressing	Tetra Tech
Kim Snell-Zarcone	Choose Clean Water Coalition
Ron Ohrel	Mid-Atlantic Dairy Assoc. NE
Jim Cropper	Northeast Pasture Consortium
Steve Levitsky	Perdue Farms
Bob Woods	Campbell Foundation
Bill Angstadt	Angstadt Consulting
Gary Shenk	USGS