



Evaluation Report

Food Web Dynamics and Stoichiometric Constraints in Meta-ecosystems Working Group

April 27-30, 2010

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Executive Summary

Brief Synopsis of Event

This report is an evaluation of a NIMBioS Working Group entitled “Food Web Dynamics and Stoichiometric Constraints in Meta-ecosystems” (Food Web), which held its first meeting at NIMBioS April 27-30, 2010. NIMBioS Working Groups are chosen to focus on major scientific questions at the interface between biology and mathematics. NIMBioS is particularly interested in questions that integrate diverse fields, require synthesis at multiple scales, and/or make use of or require development of new mathematical/computational approaches. NIMBioS Working Groups are relatively small (10-12 participants with a maximum of 15), focus on a well-defined topic, and have well-defined goals and metrics of success. Working Groups will typically meet 2-3 times over a two-year period, with each meeting lasting 3-5 days; however, the number of participants, number of meetings, and duration of each meeting is flexible, depending on the needs and goals of the group.

The Food Web group comprised nine participants, including organizers Chris Klausmeier (Kellogg Biological Station, Michigan State University), Mathew Leibold (Section of Integrative Biology, University of Texas, Austin), Francois Massol (CEMAGREF, Aix en Provence, France), and Robert Sterner (Dept. of Ecology Evolution and Behavior, University of Minnesota). Participants came from nine universities in Canada, France, and the United States (See Appendix A).

The Food Web Working Group brought together ecologists, evolutionary biologists and ecologists, geologists, and mathematicians to synthesize ecological stoichiometry and the meta-community/ecosystem theory into a comprehensive model for analyzing food web/ecosystem dynamics, as well as addressing important questions at the community/ecosystem interface.

The Food Web Working Group plans to construct a theoretical framework for modeling the interaction of multiple nutrients and multiple species in spatially heterogeneous landscapes, develop mathematical tools to simplify these unwieldy models and efficient numerical tools to stimulate them, and analyze archetypical models to illustrate the novel phenomena that emerge when ecological stoichiometry is considered in a spatial setting.

Evaluation Design

An electronic survey aligned to the following evaluation questions was designed by NIMBioS' Evaluation Coordinator with input from the NIMBioS Director and Deputy Director:

1. Were participants satisfied with the Working Group overall?
2. Did the meeting meet participant expectations?
3. Do participants feel the Working Group made adequate progress toward its stated goals?
4. Do participants feel they gained knowledge about the main issues related to the research problem?
5. Do participants feel they gained a better understanding of the research across disciplines related to the Working Group's research problem?

6. What impact do participants feel the Working Group will have on their future research?
7. Were participants satisfied with the accommodations offered by NIMBioS?
8. What changes in accommodations, group format, and/or content would participants like to see at future meetings?

An electronic survey aligned to the evaluation questions was designed by the NIMBioS Evaluation Coordinator with input from the NIMBioS Director and Deputy Director. The final instrument was hosted online via the University of Tennessee's online survey host mrlInterview. Links to the survey were sent to five Working Group participants on May 4, 2010 (organizers Chris Klausmeier, Mathew Leibold, Francois Massol, and Robert Sterner were not included in the evaluation). Reminder emails were sent to non-responding participants on May 11 and 20, 2010. By May 27, 2010, five participants had given their feedback, for a response rate of 100%.

An electronic demographic survey aligned to the reporting requirements of the National Science Foundation was designed by NIMBioS' Evaluation Coordinator with input from NIMBioS' Director. The final instrument was hosted online via the University of Tennessee's online survey host mrlInterview. Links to the survey were sent to the nine Working Group participants who had not previously attended a NIMBioS event on April 4, 2010. Reminder emails were sent to non-responding participants on April 11 and 20, 2010. By April 27, 2010, nine participants had filled out the survey for a response rate of 100%. Demographic questions regarding gender, race, and ethnicity, and disability status were optional (disability status is not reported in this evaluation report). All demographic information is confidential, and results are reported only in the aggregate. When feasible, the evaluator filled in missing demographic data from other sources (e.g. address, institution, field of study). The evaluator did not assume race, ethnicity, or disability status for any participant who did not report this information.

Highlights of Results

- Overall satisfaction with the Working Group was high among survey respondents, 80% of whom indicated they either agreed or strongly agreed that the Working Group was very productive and 100% of whom indicated it met their expectations.
- All respondents thought the presentations were useful and all thought that the presenters were very knowledgeable about their presentation topics.
- All respondents strongly agreed that they would recommend participating in NIMBioS Working Groups to their colleagues.
- Overall, respondents reported being satisfied with the travel, housing, and other amenities provided by NIMBioS.
- The majority of respondents agreed that they had a better understanding of the main issues related to the research topic as a result of participating in the Working Group.
- All respondents said the small size Working Group was its most useful aspect.
- 100% of respondents agreed that the format of the Working Group was very effective for achieving its goals, and that the Working Group made adequate progress for the first meeting toward its goals.
- All respondents said they left this meeting with a good idea of what their contribution will be at the next meeting.
- All respondents said they planned to take the knowledge they gained during the Working Group and apply it to their own research.
- Four respondents reported they developed solid plans for collaborative research with other Working Group participants, while one said collaborative research was a possibility.

Conclusions and Recommendations

Overall, the Working Group was very successful in making progress toward its goals. Working Group respondents were satisfied with the meeting, indicating that it was a productive experience that met their expectations. Respondents were also satisfied with the travel, housing, and other amenities offered by NIMBioS.

Respondents overall reported relatively high levels of learning about issues related to the group's research problem (with the exception of one who disagreed that he/she learned about the types of data needed to better inform existing models). All respondents agreed that the Working Group format allowed the group to make adequate progress toward finding a common language across disciplines in the research area, and that participating in the working group helped them understand the research happening in other disciplines in the group's research area. All respondents also said they left this meeting with a good idea of what their contribution will be at the next meeting.

All respondents indicated they planned to take the knowledge they gained during the Working Group and apply it to their own research, and several said they had developed solid plans for collaborative research with other Working Group participants.

Two participants offered suggestions for future meetings, including using "more timely data based problems" and better gender equity.

Based on analysis of participant response data, the recommendations to NIMBioS and/or Working Group organizers are as follows:

- Although the small group size was a positive factor for many group members, gender equity is an important aspect of all NIMBioS-funded events. Consider expanding the group to include more females to create more of a gender balance among members.
- NIMBioS should consider a wider variety of offerings for breakfast.

Food Web Working Group Evaluation Report

Background

Introduction

This report is an evaluation of a NIMBioS Working Group entitled “Food Web Dynamics and Stoichiometric Constraints in Meta-ecosystems” (Food Web), which held its first meeting at NIMBioS April 27-30, 2010. The Food Web group comprised nine participants, including organizers Chris Klausmeier (Kellogg Biological Station, Michigan State University), Mathew Leibold (University of Texas, Austin), Francois Massol (CEMAGREF, Aix en Provence, France), and Robert Sterner (University of Minnesota). Participants came from nine universities in Canada, France, and the United States (See Appendix A).

The Food Web Working Group brought together ecologists, evolutionary biologists and ecologists, geologists, and mathematicians to synthesize ecological stoichiometry and the meta-community/ecosystem theory into a comprehensive model for analyzing food web/ecosystem dynamics, as well as addressing important questions at the community/ecosystem interface.

The Food Web Working Group plans to construct a theoretical framework for modeling the interaction of multiple nutrients and multiple species in spatially heterogeneous landscapes, develop mathematical tools to simplify these unwieldy models and efficient numerical tools to stimulate them, and analyze archetypical models to illustrate the novel phenomena that emerge when ecological stoichiometry is considered in a spatial setting.

Working Group Background

A relationship has been noted by scientists between stoichiometry and metacommunity processes. The interaction between the two is likely caused by the transfer of materials as well as the morphing characteristics of certain species as they move among patches of geographical terrain. Ecological stoichiometry and meta-community/ecosystem theory are two successful approaches used to study these large-scale ecological dynamics and patterns. These methods, however, have developed independently of one another, and address different aspects of ecology. To date, no theory links these two fundamental aspects of dispersal involving more than one nutrient (and thus addressing stoichiometric dynamics).

The synthesizing of stoichiometry with meta-community/ecosystem theory will improve science’s understanding of basic issues in ecology, as well as impact studies concerning both nutrient cycles and the connectivity of ecosystems.

Participant Demographics

The Food Web Working Group participants, who were college/university faculty (78%) or postdoctoral researchers (22%), came from nine universities in Canada, France, and the United States (See Appendix

A). Primary fields of study for the nine participants included biological/biomedical sciences, geological and earth sciences, and mathematics (Table 1).

Table 1. Participant fields of study and areas of concentration

Field of Study	Concentration	# Participants
Biological/Biomedical Sciences	Ecology	5
	Evolutionary Biology	1
	Evolutionary Ecology	1
Geological & Earth Sciences	Geochemistry	1
Mathematics	Applied Mathematics	1

The one female and eight males (none of whom self-identified as being of Hispanic/Latino ethnicity) mostly self-identified racially as white (Figures 1 & 2).

Figure 1. Ethnic composition of program participants (n =9)

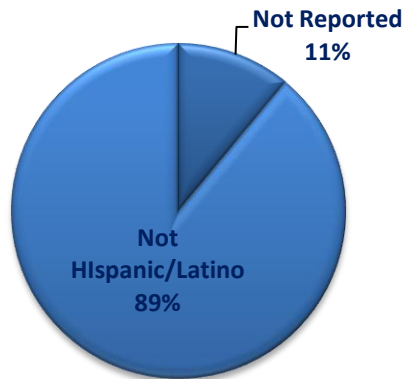
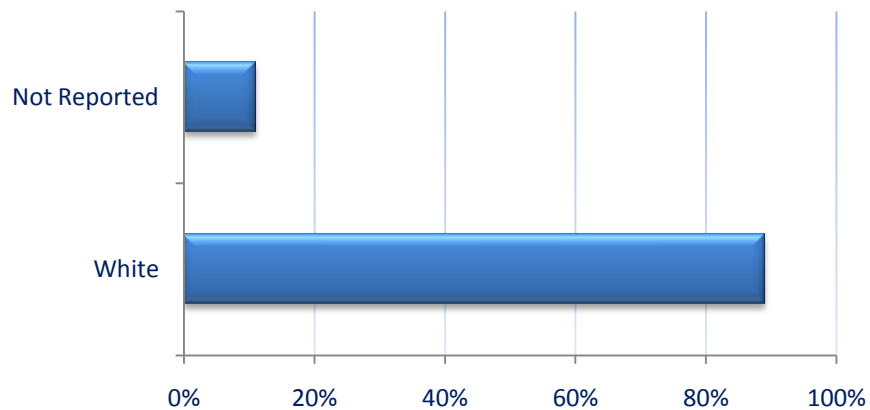


Figure 2. Racial composition of program participants (n =9)



One respondent indicated his/her work is currently supported by a National Science Foundation grant (Table 2).

Table 2. NSF grant supporting participant research

Name of grant	Institution(s) at which grant is held
Robust Theoretical Frameworks for Ecological Dynamics Subject to Stoichiometric Constraints	Arizona State University

Evaluation Design

Evaluation Questions

The evaluation of the Working Group was both formative and summative in nature, in that the data collected from participants was intended to both gain feedback from participants about the quality of the current Working Group and also to inform future meetings. The evaluation framework was guided by Kirkpatrick's Four Levels of Evaluation model for training and learning programs (Kirkpatrick, 1994¹). Several questions constituted the foundation for the evaluation:

1. Were participants satisfied with the Working Group overall?
2. Did the meeting meet participant expectations?
3. Do participants feel the Working Group made adequate progress toward its stated goals?
4. Do participants feel they gained knowledge about the main issues related to the research problem?
5. Do participants feel they gained a better understanding of the research across disciplines related to the Working Group's research problem?
6. What impact do participants feel the Working Group will have on their future research?
7. Were participants satisfied with the accommodations offered by NIMBioS?
8. What changes in accommodations, group format, and/or content would participants like to see at future meetings?

Evaluation Procedures

An electronic survey aligned to the evaluation questions was designed by NIMBioS' Evaluation Coordinator with input from the NIMBioS Director and Deputy Director. The final instrument was hosted online via the University of Tennessee's online survey host mrInterview. Links to the survey were sent to five Working Group participants on May 4, 2010 (organizers Chris Klausmeier, Mathew Leibold, Francois Massol, and Robert Sterner were not included in the evaluation). Reminder emails were sent to non-responding participants on May 11 and 20, 2010. By May 27, 2010, five participants had given their feedback, for a response rate of 100%.

¹ From Kirkpatrick, D.L. (1994). *Evaluating Training Programs: The Four Levels*. San Francisco, CA: Berrett-Koehler.

An electronic demographic survey aligned to the reporting requirements of the National Science Foundation was designed by the NIMBioS Evaluation Coordinator with input from the NIMBioS Director. The final instrument was hosted online via the University of Tennessee's online survey host mrInterview. Links to the survey were sent to the nine Working Group participants who had not previously attended a NIMBioS event on April 4, 2010. Reminder emails were sent to non-responding participants on April 11 and 20, 2010. By April 27, 2010, nine participants had filled out the survey for a response rate of 100%. Demographic questions regarding gender, race, and ethnicity, and disability status were optional (disability status is not reported in this evaluation report). All demographic information is confidential, and results are reported only in the aggregate. When feasible, the evaluator filled in missing demographic data from other sources (e.g. address, institution, field of study). The evaluator did not assume race, ethnicity, or disability status for any participant who did not report this information.

Data Analysis

Data from the electronic survey included both forced-response and supply-item questions. All data were downloaded from the online survey host into the statistical software package SPSS for analysis. Quantitative data were analyzed using SPSS, while qualitative data were analyzed in SPSS Text Analysis for Surveys. Qualitative responses were categorized by question and analyzed for trends.

Findings

Participant Satisfaction

Overall Satisfaction

Overall satisfaction with the Working Group was high among respondents, 80% of whom indicated they either agreed or strongly agreed that the Working Group was very productive and 100% of whom indicated it met their expectations. Some general participant comments:

"This is one of my best experiences with a working group."

"I learned some new things - that was my hope in accepting the invitation to join the group. As a population biologist I was hoping to learn something about metacommunities and, especially, nutrient recycling/stoichiometry in metacommunities. All the same, I also hoped to extend my research network somewhat and form some new collaborations."

All respondents thought the presentations were useful, and all thought that the presenters were very knowledgeable about their presentation topics. Additionally, 100% of respondents either agreed or strongly agreed that they would recommend participating in NIMBioS Working Groups to their colleagues (Table 4).

Table 3. Participant satisfaction with various aspects of the Working Group

	<i>n</i>	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
I feel the Working Group was very productive.	5	60%	20%	20%	0%	0%
The Working Group met my expectations.	5	60%	40%	0%	0%	0%
The presenters were very knowledgeable about their topics.	5	60%	40%	0%	0%	0%
The presentations were useful.	5	20%	80%	0%	0%	0%
The group discussions were useful.	5	100%	0%	0%	0%	0%
I would recommend participating in NIMBioS Working Groups to my colleagues.	5	100%	0%	0%	0%	0%

Satisfaction with Accommodations

Overall, respondents reported being satisfied with the travel, housing, and facilities provided by NIMBioS during the Working Group (Table 5). One participant’s comments about the overall accommodations:

“I think accommodations are very convenient, hotel staff is friendly and helpful...”

Table 4. Participant satisfaction with Working Group accommodations

Please indicate your level of satisfaction with the Working Group accommodations:	<i>n</i>	Very satisfied	Satisfied	Neutral	Dissatisfied	Strongly dissatisfied
Comfort of the facility in which the Working Group took place	5	60%	40%	0%	0%	0%
Resources of the facility in which the Working Group took place	5	60%	40%	0%	0%	0%
Quality of meals	5	0%	40%	60%	0%	0%
Quality of drinks and snacks provided	5	0%	80%	20%	0%	0%

Working Group Format and Content

Most Useful Aspect

Most respondents said the small size of the Working Group was its most useful aspect, as they were able to have in-depth discussions with others:

“The selection of people, small size (9 people), and interesting topic.”

“Spent enough time to discuss and debate on scientific problems.”

“The group was small enough to allow for rapid progress.”

Participant Learning

Respondents were asked several questions to gauge their levels of learning about the main issues related to the research problem, including the modeling techniques available on food web dynamics, and the types of data needed to better inform existing models. Respondents overall reported relatively high levels of learning (with the exception of one who disagreed that he/she learned about the types of data needed to better inform existing models), agreeing that they had a better understanding of the main research issues (Table 6).

Table 5. Participant learning about issues related to the Working Group’s research problem

As a result of participating in this Working Group, I have a better understanding of:	<i>n</i>	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
The research data available on food web dynamics	5	0%	40%	60%	0%	0%
The modeling techniques available on food web dynamics	5	60%	20%	20%	0%	0%
New methods and modeling techniques that need to be developed	5	60%	20%	20%	0%	0%
The types of data needed to better inform existing models	5	0%	40%	40%	20%	0%

Progress Toward Goals

All respondents agreed that the Working Group format allowed the group to make adequate progress toward finding a common language across disciplines in the research area, and that participating in the working group helped them understand the research happening in other disciplines in the group’s research area. One participant’s comment:

“It exceeded expectations.”

Impact on Future Research Plans

All respondents said they felt that the exchange of ideas that took place during the Working Group would initiate and/or influence their future research. In addition to new ideas for research, four respondents said that they developed unanticipated plans for collaborative research with other Working Group participants, while one said the potential for collaboration was present.

Expectations for Next Meeting

All respondents said they felt the expectations for the next working group were clear (in the sense that they were leaving this meeting with a good idea of what their contribution will be at the next meeting). One participant commented that he/she didn't have a solid idea of what his/her contribution would be, but was not concerned:

“We kind of free-floated in our first meeting and it was very productive without a firm agenda, so, even though I have no razor sharp idea what the second meeting would be, I think it will be productive even if guided by the same free-floating spirit.”

Suggestions for Future Working Group Meetings

Respondents were asked several questions soliciting suggestions for future Working Group meetings. Overall, participants were highly satisfied with the content and format of the current meeting. Two participants, however, did offer suggestions for future meetings, including using “more timely data based problems” and better gender equity:

“The gender balance was terribly skewed, not intentionally so, but that’s how it turned out. I was the only woman in a group of 10, and in addition most of the participants knew each other and/or had worked together before...”

Other suggestions included providing isolated rooms for subgroup meetings, and better coffee and breakfast choices.

Conclusions and Recommendations

Overall, the Working Group was very successful in making progress toward its goals. Working Group respondents were satisfied with the meeting, indicating that it was a productive experience that met their expectations. Respondents were also satisfied with the travel, housing, and other amenities offered by NIMBioS.

Respondents overall reported relatively high levels of learning about issues related to the group’s research problem (with the exception of one who disagreed that he/she learned about the types of data needed to better inform existing models). All respondents agreed that the Working Group format allowed the group to make adequate progress toward finding a common language across disciplines in the research area, and that participating in the working group helped them understand the research happening in other disciplines in the group’s research area. All respondents also said they left this meeting with a good idea of what their contribution will be at the next meeting.

All respondents indicated they planned to take the knowledge they gained during the Working Group and apply it to their own research, and several said they had developed solid plans for collaborative research with other Working Group participants.

Two participants offered suggestions for future meetings, including using “more timely data based problems” and better gender equity.

Based on analysis of participant response data, the recommendations to NIMBioS and/or Working Group organizers are as follows:

- Although the small group size was a positive factor for many group members, gender equity is an important aspect of all NIMBioS-funded events. Consider expanding the group to include more females to create more of a gender balance among members.
- NIMBioS should consider a wider variety of offerings for breakfast.

Appendix A

List of Participants

Participants

Last name	First name	Institution
Daufresne	Tanguy	Institut National de la Recherche Agronomique
Gravel	Dominique	Universite du Quebec a Rimouski
Jones	Laura	Cornell University
*Klausmeier	Christopher	Michigan State University
Kuang	Yang	Arizona State University
*Leibold	Mathew	University of Texas, Austin
Loladze	Irakli	Bar-Ilan University
*Massol	Francois	CEMAGREF
*Sterner	Robert	University of Minnesota, Twin Cities

*** Organizer of Working Group**

Appendix B

Food Web Working Group Survey

Food Web Working Group Survey

Thank you for taking a moment to complete this survey. Your responses will be used to improve the Working Groups hosted by the National Institute for Mathematical and Biological Synthesis. Information supplied on the survey will be confidential, and results will be reported only in the aggregate.

Please check the appropriate box to indicate your level of agreement with the following statements about this Working Group: (Strongly agree, Agree, Neutral, Disagree, Strongly Disagree)

- I feel the Working Group was very productive.
- The Working Group met my expectations.
- The presenters were very knowledgeable about their topics.
- The presentations were useful.
- The group discussions were useful
- I would recommend participating in NIMBioS Working Groups to my colleagues.

Please check the appropriate box to indicate your level of agreement with the following statements.

As a result of participating in this Working Group, I have a better understanding of:

(Strongly agree, Agree, Neutral, Disagree, Strongly disagree)

- The research data available on the Working Group's topic
- The modeling techniques available on the Working Group's topic
- The types of data needed to better inform existing models
- New methods and modeling techniques that need to be developed

Do you feel participating in the Working Group helped you understand the research happening in other disciplines in the group's topic area?

Yes

No

Comments:

Do you feel the expectations for the next Working Group are clear (in the sense that you are leaving this meeting with a good idea of what your contribution will be at the next meeting)?

Yes

No

Comments:

How do you feel about the format of the Working Group?

This was a very effective format for achieving our goals

This was not a very effective format for achieving our goals

The Working Group format would have been more effective if:

Is your work currently supported by an NSF grant?

Yes

No

Name of NSF grant:

Institution at which NSF grant is held:

Please indicate your level of satisfaction with the following Working Group accommodations: (Very satisfied, Satisfied, Neutral, Dissatisfied, Very dissatisfied)

Comfort of the facility in which the Working Group took place

Resources of the facility in which the Working Group took place

Quality of meals

Quality of drinks and snacks provided

Do you feel that the exchange of ideas that took place during the Working Group will influence your future research?

Yes

No

Did you develop unanticipated plans for collaborative research with other Working Group participants?

Yes

No

Do you feel the Working Group made adequate progress, for its first meeting, toward finding a common language across disciplines in the research area?

Yes

No

Appendix C

Open-ended Survey Responses

Open-ended responses, by question and response category

Do you feel that the exchange of ideas that took place during the Working Group will influence your future research? Please explain: (n=0)

Did you develop unanticipated plans for collaborative research with other Working Group participants? Please explain: (n=1)

Not yet. But there is always hope for the next meeting.

Do you feel the expectations for the next working group are clear (in the sense that you are leaving this meeting with a good idea of what your contribution will be at the next meeting?): (n=2)

Sort of.

We kind of free-floated in our first meeting and it was very productive without a firm agenda, so, even though I have no razor sharp idea what the second meeting would be, I think it will be productive even if guided by the same free-floating spirit

What do you feel was the *most* useful aspect of the Working Group? (n=4)

Spend enough time to discuss and debate on scientific problems.

I learned some new things - that was my hope in accepting the invitation to join the group. As a population biologist I was hoping to learn something about metacommunities and, especially, nutrient recycling/stoichiometry in metacommunities. All the same, I also hoped to extend my research network somewhat and form some new collaborations.

The group was small enough to allow for rapid progress.

the selection of people, small size (9 people), and interesting topic

What, if anything, would you change about the Working Group? (n=4)

I will like to see more timely data based real problems.

The gender balance was terribly skewed, not intentionally so, but that's how it turned out. I was the only woman in a group of 10, and in addition most of the participants knew each other and/or had worked together before.

Not much

Don't fix it if ain't broken :)

The Working Group format would have been more effective if: (n=0)

Name of NSF grant: (n=1)

NSF DMS-0920744, Robust Theoretical Frameworks for Ecological Dynamics Subject to Stoichiometric Constraints

Grant institution: (n=1)

Arizona State University

Please indicate any changes NIMBioS can make to improve the resources and/or accommodations available to Working Group participants: (n=4)

Offer isolated rooms for sub groups

Stronger coffee!

Not much to say, great resources and accommodations.

I think accommodations are very convenient, hotel staff is friendly and helpful (free apples!). If anything, perhaps breakfast could be better on some days (those sweet pastries/yogurt days are a bit lame). Those pyramid teabags rock!

Please provide any additional comments about your overall experience with the Working Group: (n=1)

This is one of my best experience with a working group.

NIMBioS is creating a web page with links to blogs written by our participants about relevant research topics. If you maintain a blog and would like to be included in our list, please provide the URL of the blog, along with a brief description: (n=0)

Please use this space for any comments you have about the Wiggio: (n=1)

We actually started to use during the meeting and I yet to upload some files. So I will have a better idea of usefulness after the second meeting.

Why did you not use Wiggio? (n=0)

Do you feel participating in the Working Group helped you understand the research happening in other disciplines in the group's topic area? (n=0)

Do you feel the Working Group made adequate progress, for its first meeting, toward finding a common language across disciplines in the research area? (n=1)

it exceeded expectations