



Evaluation Report

Binary Matrices in Biology Working Group

May 26-29, 2009

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Executive Summary

Brief Synopsis of Event

This report is an evaluation of a NIMBioS Working Group entitled “Binary Matrices in Biology,” which held its first meeting at NIMBioS May 26-29, 2009. 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 (10-15 participants), 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 Binary Matrices in Biology (BMB) group comprised 10 participants, including organizer Josh Ladau (University of California, San Francisco). Participants came from a variety of institutions, including the Spanish Integrative Ecology Group, the National Center for Ecological Analysis and Synthesis, the Argentine Institute of Dryland Research, and several universities (See Appendix A).

The BMB working group is focusing on null model tests of binary data, with a particular emphasis on environmental filtering, competition, and facilitation to be inferred from observations of species ranges, abundance distributions, body sizes, and other similar trait. A key problem with null model tests is that they are generally developed and justified based on intuition. However, multiple tests can all seem intuitively appropriate for the same data, yet yield conflicting conclusions. Hence, a pressing issue is developing and implementing an overarching mathematical framework to guide the development and application of null model tests. One such framework is optimality; for instance consideration of methods that have minimal Type II error rates subject to controlled Type I error rates. Further application of the optimality framework is possible, and the development and application other types of guiding frameworks are worth considering.

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?

The final instrument was hosted online via the University of Tennessee's secure online survey host mriInterview. Links to the survey were sent to the 10 Working Group participants on May 29, 2009. Reminder emails were sent to non-responding participants on June 4 and 9, 2009. By June 16, 2009, nine participants had given their feedback, for a response rate of 90%.

Highlights of Results

- Overall satisfaction with the Working Group was high among survey respondents, the majority of whom (89%) indicated they either agreed or strongly agreed that the Working Group was very productive and met their expectations.
- Almost all respondents (89%) thought the presentations were useful and all thought that the presenters were very knowledgeable about their presentation topics.
- Eight of nine respondents either agreed or 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.
- While the majority of respondents agreed that they had a better understanding of the main issues related to BMB as a result of participating in the Working Group, some participants indicated they either did not gain understanding, or felt “neutral” about the amount of understanding they gained on the topics.
- Most respondents said the multidisciplinary composition of the Working Group was its most useful aspect.
- Eight of nine 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 one of its goals: improving quantitative inference from binary data in biology.
- Sixty-seven percent of respondents felt the Working Group made adequate progress toward its goal of developing an overarching mathematical framework to guide the development and application of null model tests.
- Eight of nine respondents said they left this meeting with a good idea of what their contribution will be at the next meeting
- Most respondents said they planned to take the knowledge they gained during the Working Group and apply it to their own research.
- Six respondents reported they developed solid plans for collaborative research with other Working Group participants, while one indicated he/she saw potential for collaboration in the future.

Conclusions and Recommendations

Overall, the Working Group was 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 travel, housing, and other amenities offered by NIMBioS.

Respondents gained varying degrees of understanding about the issues surrounding the research problem of the Working Group. While the majority of respondents agreed that they had a better understanding of the main issues related to BMB, some indicated they either did not gain understanding, or felt “neutral” or about the amount of understanding they gained on certain topics.

The majority of respondents felt that adequate progress was made toward the goal of improving quantitative inference from binary data in biology. Participants were divided, however, on whether or not the group made adequate progress toward developing an overarching mathematical framework to guide the development and application of null model tests. While one participant said this was a main accomplishment of the group, others said the focus shifted away from this goal during the meeting. Eight of nine respondents said they left this meeting with a good idea of what their contribution will be at the next meeting.

Several respondents indicated they planned to take the knowledge they gained during the Working Group and apply it to their own research. Six respondents reported they had developed solid plans for collaborative research with other Working Group participants, while one indicated he/she saw potential for collaboration in the future.

Several suggestions were offered for improving future meetings, including increasing the diversity of the group, providing information about bus schedules and/or bike rentals, sending out travel information earlier, and using reusable/recyclable materials for meals.

Based on analysis of participant response data, the recommendations are as follows:

- The Working Group had a multidisciplinary composition, but consider trying to recruit a broader diversity of participants regarding gender and ethnicity. Also, more mathematicians would create more balance in the disciplinary composition.
- Given that 22% and 33% of respondents, respectively, indicated they did not learn enough about problems with null model testing of binary matrices and application of the optimality framework, consider emphasizing these ideas at the next meeting.
- Consider providing participants with information about bus schedules and, if possible, bike rentals in Knoxville.
- Look into the feasibility of using more reusable/recyclable materials for participant meals.

Binary Matrices in Biology Working Group Evaluation Report

Background

Introduction

The Binary Matrices in Biology (BMB) group comprised 10 participants, including organizer Josh Ladau (University of California, San Francisco). Participants came from a variety of institutions, including the Spanish Integrative Ecology Group, the National Center for Ecological Analysis and Synthesis, the Argentine Institute of Dryland Research, and several universities (See Appendix A).

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 (10-15 participants), 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 BMB working group is focusing on null model tests of binary data, with a particular emphasis on environmental filtering, competition, and facilitation to be inferred from observations of species ranges, abundance distributions, body sizes, and other similar traits. A key problem with null model tests is that they are generally developed and justified based on intuition. However, multiple tests can all seem intuitively appropriate for the same data, yet yield conflicting conclusions. Hence, a pressing issue is developing and implementing an overarching mathematical framework to guide the development and application of null model tests. One such framework is optimality; for instance consideration of methods that have minimal Type II error rates subject to controlled Type I error rates. Further application of the optimality framework is possible, and the development and application other types of guiding frameworks are worth considering.

Working Group Background

Many fundamental questions in ecology cannot be addressed experimentally because at the relevant large spatial and temporal scales, experimentation is impractical, unethical, or impossible. Instead, to investigate these questions inferences must be made from observational data. Null model testing comprises a key tool for making these inferences, allowing large-scale effects of processes such as environmental filtering, competition, and facilitation to be inferred from observations of species ranges, abundance distributions, body sizes, and other similar traits. Three types of ecological data that are commonly analyzed using null models include binary presence-absence matrices, which give the distribution of species over a set of sites; ecological networks such as food webs and pollinator networks; and phylogenetic patterns in community composition. All of these data can be coded in a binary form.

The BMB working group will focus on null model tests of binary data, with a particular emphasis on the aforementioned examples. A key problem with null model tests is that they are generally developed and justified based on intuition. However, multiple tests can all seem intuitively appropriate for the same data, yet yield conflicting conclusions. Hence, a pressing issue is developing and implementing an overarching mathematical framework to guide the development and application of null model tests. One such framework is optimality; for instance consideration of methods that have minimal Type II error rates subject to controlled Type I error rates. Further application of the optimality framework is possible, and the development and application other types of guiding frameworks are worth considering.

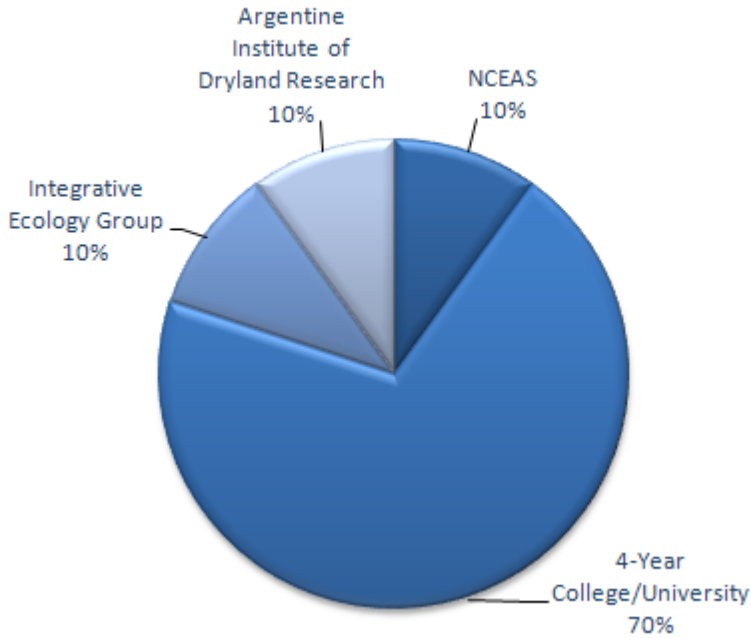
To implement null model tests developed in an optimality framework, it is often necessary to simulate random quantities from non-standard probability distributions. For instance, simulating presence-absence matrices from a uniform distribution over the set of binary matrices with the observed marginal totals is necessary for implementing methods that control Type I error rates under a relatively broad class of statistical models. The algorithmic challenges associated with these simulations can be formidable, and require the development of unbiased Markov Chain Monte Carlo algorithms and analysis of their mixing times and convergence properties.

The development of null model tests for species co-occurrence, ecological networks, and community phylogenetics have all relied on the assumption that the presence-absence matrix, food web, or community phylogeny is fully known. In the context of species co-occurrence this has usually been articulated as assuming that the probability of detecting a species if it is present is equal to 1. However, with limited sampling, differences in species' abundance, and differences in species' behaviors, some species are easier to detect than others rendering such an assumption suspect at best. A separate literature has developed arising from statistical inference based on mark-recapture-release data, that has begun to examine community patterns relaxing the assumption that detection probability = 1. Further application of these methods to problems of multi-species co-occurrence patterns (number of species $\gg 2$) or to other community ecological patterns is ripe for development. Focusing generally on these three issues, this working group will aim to foster the investigation and development of solutions to these problems.

Participant Demographics

BMB participants, who were either postdoctoral researchers (40%) or college/university faculty (60%), came from a variety of institutions, including the Spanish Integrative Ecology Group, the National Center for Ecological Analysis and Synthesis (NCEAS), the Argentine Institute of Dryland Research, and several universities (Figure 1). Participants were involved in three areas of research: biometrics, ecology, and statistics.

Figure 1. Institutions of Working Group participants (n =10)



An electronic survey, which included optional demographic questions, was sent to each of the 10 participants to gather information about their perception of the Working Group. Nine participants responded. The nine respondents indicated they were white males, one of whom was Hispanic/Latino. Two respondents indicated their work is currently supported by a National Science foundation grant (Table 1).

Table 1. NSF grants supporting participant research

Name of grant	Institution(s) at which grant is held
The Spider and the Web: Inference in Ecological Networks	University of Michigan, University of Chicago, University of California Santa Barbara (NCEAS)
Moths, Ants, and Carnivorous Plants: The Spatial Dimension of Species Interactions	University of Vermont

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). The evaluation questions were developed according to level one of the model, participants' reactions, in order to gather information about how participants felt about the content and format of the Working Group, as well as the accommodations provided by NIMBioS. 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

NIMBioS' Evaluation Coordinator designed an electronic survey aligned to the evaluation questions with input from NIMBioS' Director and Deputy Director. The final instrument was hosted online via UT's secure online survey host mrlInterview. Links to the survey were sent to the 10 Working Group participants on May 29, 2009. Reminder emails were sent to non-responding participants on June 4 and 9, 2009. By June 16, 2009, nine participants had given their feedback, for a response rate of 90%.

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.

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

Findings

Participant Satisfaction

Overall Satisfaction

Overall satisfaction with the Working Group was high among respondents, the majority of whom (89%) indicated they either agreed or strongly agreed that the Working Group was very productive and met their expectations. Some general participant comments:

“Overall, this meeting of the working group was a great success. Everyone worked well together, and we made significant progress on key issues facing statistical inference from binary data in biology.”

“I enjoyed it and look forward to working more with this group.”

Almost all respondents thought the presentations were useful (89%), and all thought that the presenters were very knowledgeable about their presentation topics. Additionally, all but one of the respondents either agreed or strongly agreed that they would recommend participating in NIMBioS Working Groups to their colleagues (Table 2). The respondent who disagreed commented that he/she felt “[t]he working group could have been better organized and the plans laid out further in advance,” adding, “[t]he first few days proceeded rather hectically and even the schedule and duties of each participant were unclear until a scant few days prior.”

Table 2. Participant satisfaction with various aspects of the Working Group, by level of agreement

	<i>n</i>	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
I feel the Working Group was very productive.	9	68%*	22%	11%	0%	0%
The Working Group met my expectations.	9	56%	33%	0%	11%	0%
The presenters were very knowledgeable about their topics.	9	100%	0%	0%	0%	0%
The presentations were useful.	9	56%	33%	11%	0%	0%
The group discussions were useful.	9	66%	33%	0%	0%	0%
I would recommend participating in NIMBioS Working Groups to my colleagues.	9	78%	11%	11%	0%	0%

* Note: Percentages in tables may not add to 100% due to rounding

Satisfaction with Accommodations

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

“[The accommodations] were excellent -- great hotel with helpful staff, and 5 minutes from the NIMBioS office. I don't see how we could have done better.”

NIMBioS arranged housing and travel for eight of the respondents, five of whom said they were satisfied with their accommodations, while three indicated feeling “neutral.” The less satisfied participants commented that, in general, they felt it was difficult to get to Knoxville by plane. The majority of participants also reported being satisfied with the comfort and resources of the NIMBioS facility, as well as the quality of meals provided (Table 3). The participants who were dissatisfied made the following comments:

“Less white bread, processed cheese, better options for vegetarians.”

“I think having a proper lunch would go a long way to making things better. It provides an official amount of 'down time' and would help to break up the day which, by the end of the working group, seemed to be scheduled to last too long.”

Table 3. Participant levels of 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	9	78%	22%	0%	0%	0%
Resources of the facility in which the Working Group took place	9	78%	22%	0%	0%	0%
Quality of meals	9	33%	33%	22%	11%	0%
Quality of drinks and snacks provided	9	33%	33%	22%	11%	0%

Working Group Format and Content

Participant Learning

Respondents were asked several questions to gauge their levels of learning about the main issues related to the research problem, including learning about research in disciplines other than their own, as well as problems with null model testing of binary matrices. Respondents reported varying levels of learning. While the majority of respondents agreed that they had a better understanding of the main issues related to BMB, some respondents said they either did not gain understanding, or felt “neutral” or about the amount of understanding they gained on the topics (Table 3).

Table 3. Participant self-reports of 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
Research in other disciplines using binary matrices.	9	56%	44%	0%	0%	0%
Problems with null model testing of binary matrices.	9	33%	33%	22%	0%	0%
Application of the optimality framework	9	11%	56%	22%	11%	0%

Progress Toward Goals

Eight of the nine respondents agreed that the format of the Working Group was very effective for achieving its goals. One respondent offered a suggestion for change:

“ [The working group would have been more effective if] [t]he original schedule had been stuck to to provide less time for individual presentations and more time for brainstorming and direct interactions between participants.”

Sixty-seven percent of respondents agreed that the Working Group made adequate progress toward its goal of developing an overarching mathematical framework to guide the development and application of null model tests. Participant comments showed differing views:

“We made some progress along this line, but we decided to focus first on individual projects which will hopefully serve as a basis for a more integrative approach.”

“This was one of the main accomplishments of the working group.”

“The focus of the group shifted away from null model testing towards applying other frameworks to understanding binary matrices.”

Eight of the nine respondents felt the Working Group made adequate progress toward its goal of improving quantitative inference from binary data in biology,

“Very good progress for an initial meeting! There are already some specific plans for manuscripts mapped out.”

“The working group developed and began to implement a new framework for making quantitative inference from binary data in biology. This framework will allow more precise and reliable inferences.”

“Yes, I think the working group is off to a very good start toward its goals.”

Eight of the nine respondents also said they left this meeting with a good idea of what their contribution will be at the next meeting. The one participant who did not feel like he/she had a clear idea said he/she would have liked clarification about the agenda for the next meeting:

“It doesn't seem clear precisely what the agenda will be at the next meeting. It could be to recover and continue developing the projects we've set forth on at the previous meeting or to again brainstorm and determine new plans of attack. I think this distinction could have been made and would have gone far in motivating high participation and energy to develop the projects between now and then.”

Impact on Future Research Plans

Most respondents said the multidisciplinary composition of the Working Group was its most useful aspect, as they were able to learn from those in fields other than their own:

“[The most useful aspects of the working group were] [t]he discussions we had with the entire group. I have been part of other (NCEAS) working groups in the past, and I felt this working worked in many ways much better than previous groups. The size was ideal, and participants got along really well. So group-wide discussions were especially useful because we could all participate with our own perspectives.”

“The most useful aspects of the working group were the opportunities to learn about other people's research, discuss issues related to statistical inference in biology, and initiate new collaborations.”

“The incorporation of perspectives from distinct groups that do not interact as much as they could, or possibly should.”

Another respondent felt several aspects of the working group were equally useful:

“This is difficult to pinpoint, because all three major aspects of the working group's activity were extremely useful: 1) the full-group presentations, consisting the description of individual's description of expertise and perspective on biological applications of binary matrices; 2) the full-group discussion of possible research questions and their relative importance; and 3) the small-group discussions of the four research questions selected by the group consensus as the highest priority topics for immediate work. Perhaps the most useful attribute of the working group was our flexibility in structuring these discussions in the way that seemed most productive.”

Most respondents said they felt that the exchange of ideas that took place during the Working Group would (or potentially would) initiate and/or influence their future research. Some participant comments:

“...The exchange of ideas gave me a great deal of information about applications of null model testing, and our agreement to work jointly on specific high-priority research questions should influence the future research of everyone who attended.”

"... the shared conceptual framework of plant-pollinator systems and trophic webs was new to me. I would like to pursue this area of research in the future."

"...this working group was a great opportunity to get mathematicians, statisticians and biologists talking to one another and I am excited about continuing to develop some of the ideas we came up with."

In addition to new ideas for research, six respondents said that they developed unanticipated plans for collaborative research with other Working Group participants, while one said the potential for collaboration was present:

"... I now have plans to look for matrix algebra indices that can be derived from a square form of a species co-occurrence matrix. Nice!"

"... as a direct result of the working group, I am collaborating on two new projects with other working group participants. In addition, a third project is tentatively planned."

"...We found points of contact with other disciplines that could inspire and influence my field of research."

Suggestions for Future Working Group Meetings

Respondents were asked several questions soliciting suggestions for future Working Group meetings. A major theme that emerged from analysis of participant comments was the need for more diversity in the group, especially regarding women:

"...Perhaps make sure there are some women. And it would have helped to have the reading material with more time in advance of the meeting; but this is not something that we can change now."

"Maybe have even more young scientists (i.e. grad students, postdocs and junior faculty). Also, more women."

"More women, more mathematicians needed."

"Try to involve a broader diversity of ideas (i.e. mathematicians) and gender/ethnic representation."

Another participant suggested providing information about bike rentals or bus schedules to participants:

"I would have liked to use a bike to ride in the early morning on the bike trails. But this is really too much, I don't think it's NIMBioS job to deal with this sort of need. Perhaps the hotel could have a couple of rental bikes. Information on buses could also be useful for some visitors."

Other suggestions from respondents included sending travel information earlier, and using more reusable materials during meals:

“I think it'd be nice that NIMBioS does a greater effort at using reusable (washable) dishes and silverware or, if this is not possible, that there is a greater effort to recycle this material. Each meal with had we produced an incredible amount of trash (trays, plates, silverware, cups, bottles, etc.), most of which went to the regular trash bin (only bottles and cans went to the recycle bin). Perhaps NIMBioS could give a mug, a plate, a set of silverware, etc. to each participant on arrival, and ask them to wash these elements as they use them. I think this is something in which NIMBioS could be a leader and give an example about how we can be more environmentally friendly with our activities.”

Conclusions and Recommendations

Overall, the Working Group was 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 gained varying degrees of understanding about the issues surrounding the research problem of the Working Group. While the majority of respondents agreed that they had a better understanding of the main issues related to BMB, some indicated they either did not gain understanding, or felt “neutral” or about the amount of understanding they gained on certain topics.

The majority of respondents felt that adequate progress was made toward the goal of improving quantitative inference from binary data in biology. Participants were divided, however, on whether or not the group made adequate progress toward developing an overarching mathematical framework to guide the development and application of null model tests. While one participant said this was a main accomplishment of the group, others said the focus shifted away from this goal during the meeting. Eight of nine respondents said they left this meeting with a good idea of what their contribution will be at the next meeting.

Several respondents indicated they planned to take the knowledge they gained during the Working Group and apply it to their own research. Six respondents reported they had developed solid plans for collaborative research with other Working Group participants, while one indicated he/she saw potential for collaboration in the future.

Several suggestions were offered for improving future meetings, including increasing the diversity of the group, providing information about bus schedules and/or bike rentals, sending out travel information earlier, and using reusable/recyclable materials for meals.

Based on analysis of participant response data, the recommendations are as follows:

- The Working Group had a multidisciplinary composition, but consider trying to recruit a broader diversity of participants regarding gender and ethnicity. Also, more mathematicians would create more balance in the disciplinary composition.

- Given that 22% and 33% of respondents, respectively, indicated they did not learn enough about problems with null model testing of binary matrices and application of the optimality framework, consider emphasizing these ideas at the next meeting.
- Consider providing participants with information about bus schedules and, if possible, bike rentals in Knoxville.
- Look into the feasibility of using more reusable/recyclable materials for participant meals.

Appendix A

List of Participants

Participants

Last name	First name	Institution
Allesina	Stefano	National Center for Ecological Analysis and Synthesis
Barker	Richard	University of Otago
Dorazio	Robert	University of Florida
Gotelli	Nick	University of Vermont
Kembel	Stephen	University of Oregon
*Ladau	Josh	University of California San Francisco
Schwgager	Steven	Cornell University
Simberloff	Dan	University of Tennessee Knoxville
Stouffer	Dan	Integrative Ecology Group
Vazquez	Diego	Argentine Institute of Dryland Research

*** Organizer of Working Group**

Appendix B

Binary Matrices in Biology Working Group Survey

Binary Matrices in Biology 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.

NIMBioS will send two reminder emails to Working Group participants who have not responded to this survey. If you would like to be excluded from these reminder emails, please enter your name below. Your survey results will still remain confidential and your name will not be associated with any of your responses in reporting of survey results.

Name:

Please check the appropriate box to indicate your level of agreement with the following statements about this Working Group: (Very satisfied, Satisfied, Neutral, Dissatisfied, Very dissatisfied)

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)

Research in other disciplines using binary matrices

Problems with null model testing of binary matrices

Application of the optimality framework

Do you feel the working group made adequate progress toward improving quantitative inference from binary data in biology?

Yes

No

Comments:

Do you feel the working group made adequate progress toward developing an overarching mathematical framework to guide the development and application of null model tests?

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:

Do you feel that the exchange of ideas that took place during the Working Group will initiate or influence your future research? Please explain:

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

What do you feel was the most useful aspect of the Working Group?

What would you have changed about the Working Group?

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:

Was your housing during the Working Group arranged by NIMBioS?

Yes ->

No

Overall, how satisfied were you with your housing arrangements?

Very satisfied

Satisfied

Neutral

Dissatisfied

Very dissatisfied

Comments about housing arrangements:

What could NIMBioS have done to make your stay in Knoxville more enjoyable (e.g. better information about nearby attractions, public transportation, etc.)?

Was your transportation to Knoxville arranged by NIMBioS?

Yes ->

No

Overall, how satisfied were you with your travel arrangements?

Very satisfied

Satisfied

Neutral

Dissatisfied

Very dissatisfied

Comments about travel arrangements:

Please indicate your level of satisfaction with the 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

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

Additional comments about Working Group accommodations:

Please provide any additional comments about your overall experience with the Working Group:

Demographics

Your participation in answering the following questions is completely voluntary and will be used for aggregated reporting only. Answer only those questions with which you feel comfortable.

I am a(n):

Graduate student

Postdoctoral researcher

University faculty—teaching/research

University faculty—teaching only

University faculty—research only

University staff

Government

Business/industry employee

Non-profit organization employee

Other:

If you are affiliated with a college/university, please describe your institution: (check all that apply)

2-year institution

4-year institution

Minority serving institution

Women's only institution

Not applicable

What is your general area of expertise/research/study?

(Select from a list)

What is your area of concentration within this general area?

(Select from a list)

Gender:

Male

Female

Are you Hispanic or Latino?

Yes

No

What is your racial background? (check all that apply)

American Indian or Alaska Native

Native Hawaiian or other Pacific Islander

Asian

Black or African American

White

Appendix C

Open-ended Survey Responses

Open-ended responses, by question and response category

Do you feel the working group made adequate progress toward developing an overarching mathematical framework to guide the development and application of null model tests? (n=5)

Yes (2)

We made some progress along this line, but we decided to focus first on individual projects which will hopefully serve as a basis for a more integrative approach.

This was one of the main accomplishments of the working group.

No (1)

Too many philosophical differences among group members for this to happen. Besides, I am not even sure that is what is really needed.

Miscellaneous (2)

The focus of the group shifted away from null model testing towards applying other frameworks to understanding binary matrices.

I think it is too early to make reach such a broad conclusion.

Do you feel the working group made adequate progress toward improving quantitative inference from binary data in biology? (n=5)

Yes(4)

I think we identified a number of issues that will lead to specific collaborative projects to tackle them.

Very good progress for an initial meeting! There are already some specific plans for manuscripts mapped out.

The working group developed and began to implement a new framework for making quantitative inference from binary data in biology. This framework will allow more precise and reliable inferences.

Yes, I think the working group is off to a very good start toward its goals.

Miscellaneous (1)

I think it is far too early to make such a conclusion.

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=4)

Yes(3)

Yes, marching orders were specific and realistic for the next meeting.

We have assigned tasks to each group member, and we have specific goals we are supposed to meet for the next meeting.

Before the next meeting, I have several specific tasks to complete for the two research projects on which I am collaborating.

No(1)

It doesn't seem clear precisely what the agenda will be at the next meeting. It could be to recover and continue developing the projects we've set forth on at the previous meeting or to again brainstorm and determine new plans of attack. I think this distinction could have been made and would have gone far in motivating high participation and energy to develop the projects between now and then.

Do you feel that the exchange of ideas that took place during the Working Group will initiate or influence your future research? Please explain: (n=8)

Yes (7)

Yes. As an ecologist, the interaction with the statisticians made me realize that some of the methods we use are not ideal, and that we could do things differently. But I am still not convinced that what they have proposed is really going to work. I hope everything will become clearer as we make progress in our specific projects during the next few months.

More attention to statistical testing, more rigorous model definition.

Yes, I have new ideas that I can apply to my own projects, and new contacts for collaborative projects.

Yes, the shared conceptual framework of plant-pollinator systems and trophic webs was new to me. I would like to pursue this area of research in the future.

Yes, this working group was a great opportunity to get mathematicians, statisticians and biologists talking to one another and I am excited about continuing to develop some of the ideas we came up with.

Yes, certainly. As a direct result of the working group, I am now collaborating on two new research projects. In addition, I fully anticipate that the framework that we generated will be applicable to numerous other research questions.

Yes. The exchange of ideas gave me a great deal of information about applications of null model testing, and our agreement to work jointly on specific high-priority research questions should influence the future research of everyone who attended.

Possibly (1)

I think it is possible, but the ideas alone are unlikely to be sufficient to have such a strong influence. Upon reaching meaningful conclusions or tackling meaningful problems, I think the results of the working group will be easier to appraise.

Did you develop unanticipated plans for collaborative research with other Working Group participants? Please explain: (n=8)

Yes (6)

Collaboration plans were unanticipated in the sense I did not know most of the participants. But I did expect some sort of collaborative project to originate in this working group.

Yes, I now have plans to look for matrix algebra indices that can be derived from a square form of a species co-occurrence matrix. Nice!

Same answer as last question.

Yes, as a direct result of the working group, I am collaborating on two new projects with other working group participants. In addition, a third project is tentatively planned.

Collaborative plans resulted all unexpected

Yes, as just mentioned, the working group agreed to work jointly on specific high-priority research questions. I did not anticipate this, but it was a welcome development.

Possibly (1)

Possibly. We found points of contact with other disciplines that could inspire and influence my field of research.

No(1)

No

What do you feel was the most useful aspect of the Working Group? (n=8)

Multidisciplinary composition of the group (7)

The discussions we had with the entire group. I have been part of other (NCEAS) working groups in the past, and I felt this working worked in many ways much better than previous groups. The size was ideal, and participants got along really well. So group-wide discussions were especially useful because we could all participate with our own perspectives.

Diversity

Meeting new people, getting new ideas, engaging in conversation.

Assembly of scientists with related, but diverse, views of the research topics.

Bringing together scientists from different disciplines - having biologists and statisticians talk to each other in this setting was very productive.

The most useful aspects of the working group were the opportunities to learn about other people's research, discuss issues related to statistical inference in biology, and initiate new collaborations.

Interacting with extremely bright ecologists and statisticians on problems I wouldn't have thought about previously

The incorporation of perspectives from distinct groups that do not interact as much as they could, or possibly should.

Discussions and presentations (1)

This is difficult to pinpoint, because all three major aspects of the working group's activity were extremely useful: 1) the full-group presentations, consisting the description of individual's description of expertise and perspective on biological applications of binary matrices; 2) the full-group discussion of possible research questions and their relative importance; and 3) the small-group discussions of the four research questions selected by the group consensus as the highest priority topics for immediate work. Perhaps the most useful attribute of the working group was our flexibility in structuring these discussions in the way that seemed most productive.

What would you have changed about the working group? (n=5)

More diversity (4)

Not much, really. Perhaps make sure there are some women. And it would have helped to have the reading material with more time in advance of the meeting; but this is not something that we can change now.

Maybe have even more young scientists (i.e. grad students, postdocs and junior faculty). Also, more women.

More women, more mathematicians needed.

Try to involve a broader diversity of ideas (i.e. mathematicians) and gender/ethnic representation.

Better organization (1)

The working group could have been better organized and the plans laid out further in advance. The first few days proceeded rather hectically and even the schedule and duties of each participant were unclear until a scant few days prior.

Working group format would have been more effective if: (n=1)

The original schedule had been stuck to to provide less time for individual presentations and more time for brainstorming and direct interactions between participants.

Name of NSF grant: (n=2)

The Spider and the Web: Inference in Ecological Networks, NSF Program: THEORETICAL BIOLOGY , Award Number: 0827493

Moths, ants, and carnivorous plants: the spatial dimension of species interactions.

Institution at which NSF grant is held: (n=2)

University of Michigan, University of Chicago, University of California Santa Barbara (NCEAS)

University of Vermont.

Comments about housing arrangements: (n=5)

It was fine (5)

They were excellent -- great hotel with helpful staff, and 5 minutes from the NIMBioS office. I don't see how we could have done better.

The Four Points hotel was very convenient.

No comments. It was excellent and at a very convenient location.

Nice hotel, convenient location.

All good except internet connection was erratic.

What could NIMBioS have done to make your stay in Knoxville more enjoyable (e.g. better information about nearby attractions, public transportation, etc.)? (n=4)

Nothing--everything was great (2)

The information that was provided was excellent.

No changes, it was fine.

Miscellaneous (2)

I would have liked to use a bike to ride in the early morning on the bike trails. But this is really too much, I don't think it's NIMBioS job to deal with this sort of need. Perhaps the hotel could have a couple of rental bikes. Information on buses could also be useful for some visitors.

I think we had all the information we could use; because of the intensity of the meeting, more info would only have made me feel bad about the interesting local activities I did not have time for.

Comments about travel arrangements: (n=4)

Miscellaneous (4)

Travel arrangements were excellent.

My preferences about travel were completely honored; my flight reservations were exactly what I requested. My one suggestion is to send the email giving the group members full travel information --

instructions on how to get from TYS to the hotel and the hotel to the NIMBioS offices, confirmation and contact info for the hotel, rules on reimbursement for meals, etc. -- a little earlier, at least a full week in advance.

It's a bit difficult to get to Knoxville by plane.

Getting to Knoxville required the better part of a day, the flight options were not great.

Please indicate any changes NIMBioS can make to improve the resources and/or accommodations available to Working Group participants: (n=5)

Miscellaneous (5)

Less white bread, processed cheese, better options for vegetarians.

I think it'd be nice that NIMBioS does a greater effort at using reusable (washable) dishes and silverware or, if this is not possible, that there is a greater effort to recycle this material. Each meal with had we produced an incredible amount of trash (trays, plates, silverware, cups, bottles, etc.), most of which went to the regular trash bin (only bottles and cans went to the recycle bin). Perhaps NIMBioS could give a mug, a plate, a set of silverware, etc. to each participant on arrival, and ask them to wash these elements as they use them. I think this is something in which NIMBioS could be a leader and give an example about how we can be more environmentally friendly with our activities.

I think having a proper lunch would go a long way to making things better. It provides an official amount of 'down time' and would help to break up the day which, by the end of the working group, seemed to be scheduled to last too long.

I can't think of anything. This is good news, because I tried!

Better coffee! Is it possible to get an espresso machine? There are no decent coffee places close by.

Additional comments about Working Group accommodations: (n=0)

Please provide any additional comments about your overall experience with the Working Group: (n=3)

Miscellaneous (3)

Overall, this meeting of the working group was a great success. Everyone worked well together, and we made significant progress on key issues facing statistical inference from binary data in biology.

I'm looking forward to our next meeting.

I enjoyed it and look forward to working more with this group.