DIRECTORATE FOR BIOLOGICAL SCIENCES
EMERGING FRONTIERS COMMITTEE OF VISITORS (COV)
FY 2014

Guidance to the COV: The COV report should provide a balanced assessment of NSF's performance in the integrity and efficiency of the *processes* related to proposal review. Discussions leading to answers of the Core Questions will require study of confidential material such as declined proposals and reviewer comments. ***COV reports should not contain confidential material or specific information about declined proposals.*** The reports generated by COVs are made available to the public.

We encourage COV members to provide comments to NSF on how to improve in all areas, as well as suggestions for the COV process, format, and questions. For past COV reports, please see http://www.nsf.gov/od/oia/activities/cov/covs.jsp.

FY 2014 EMERGING FRONTIERS COMMITTEE OF VISITORS (COVs) REPORT

Date of COV:
February 21, 2014

Programs:
Advancing Digitization of Biodiversity Collections (ADBC)and MacroSystems Biology (MSB)

Division:
Emerging Frontiers

Directorate:
Biological Sciences

Number of actions reviewed:

Awards: 7
Declinations: 20

Total number of actions within the programs during the period under review:

Awards: 49
Declinations: 131

Manner in which reviewed actions were selected:
The list of proposals used in this study includes **all competitive proposal actions managed** by the Division during the study period. Competitive proposal actions include all research and education proposals which have gone through the merit review process resulting in award or decline decisions; this excludes supplements, continuing grant increments, and any proposals that were withdrawn or returned without review.

Generally, the Division reviews and manages proposals at the level of "Projects" where collaborating investigators from separate institutions are treated as one unit even though each institutional Sponsored Research Office submitted a cover page and budget request generating an individual "Jacket". The 180 competitive actions covered by the Self-Study encompass a total of 600 proposals. When collaborative proposals are submitted, they are collectively referred to as a project.

Committee members will be able to access any of the 27 sample jackets via the COV web site in eJacket, excepting those that present a reported conflict of interest. Committee members should discontinue reading and alert EF staff members about any proposals for which they find conflicts that were not captured by eJacket. Note: A total in excess of 66 jackets will appear in the eJacket module because the system automatically includes all jackets associated with collaborative proposals even though only one of the jackets was counted in the sample.

The complete listing of sample jackets, except for those with panel-wide conflicts of interest, is available on the eJacket CoV module. In addition, the COV is provided with a list of all the awards made by the Emerging Frontiers over the last three years. The COV can request to see any proposal on this list during the meeting, remaining cognizant of conflict of interest (COI) rules.

Emerging Frontiers
Committee of Visitors
February 21, 2014

Executive Summary

The COV members dealt with all issues noted in the COV template and included a few more items in the COV report. The COV is of the unanimous opinion that the review process, the communication between the program officers and PIs, and the decision-making process relating to funding/do not fund decisions are done with great care and integrity. Conflicts of interest are eliminated conscientiously, reviewers of high quality and great expertise are chosen, reviewer diversity is high with respect to breadth of knowledge. Program officers provide fair assessments of panel discussions and reviewer reports to PIs as well as a detailed explanation of why a proposal was funded or not funded. Both communication from panel to Program Officer and between the Program Officer and the PI make the decision related to funding decisions, rewrites, strengths and weaknesses of the proposal, etc, very clear.

Based on our review, the COV also makes three specific recommendations. First is that NSF should take a long-term strategic look at its data infrastructure needs and plans. For each of these programs, access to data external to a project is of substantial scientific importance and allows the science to advance appreciably. Especially important is to find a way to assess the status of the multiple data efforts that are occurring across the agency (e.g., DataOne, NEON, iPlant, etc.). Perhaps a partnership with EarthCube could develop interoperability, community governance, and other capabilities that are general to the environmental sciences. Second, the COV recommends that NSF continue to pursue interagency collaborations relating to collections. Given that iDigBio is now operating and many collections are being funded to digitize and deposit their data in iDigBio, it seems time for an interagency approach, including digitization of federal collections and the expansion of the central database. Third, the COV believes that it is time for NSF to initiate a plan to develop the tools that will be required for utilizing the massive specimen and environmental databases to their full potential. Just as the sequencing of the human genome demanded new analytical, computational, and sequencing tools, so too will the growing database require creative efforts by computer specialists, engineers, and a variety of scientists to determine how these data can most efficiently and effectively be utilized across disciplines.

Macrosystems ecology was critically examined and the COV concludes that this program is indeed tackling important, scientifically challenging problems that involve processes that intrinsically play out on "macro" scales, including those mediated by transport, teleconnections, biogeographic processes, species invasions, and other processes where spatial dynamics are intrinsic. The program remains an emerging frontier at this time and this program will lead to continued development of research teams to tackle large scale interdisciplinary issues by researchers with expertise across a wide array of taxa, ecosystems, and scientific issues at large spatial scales.

COV Membership

	Name	Affiliation
COV Chair	Michael A. Mares	Sam Noble Oklahoma Museum of Natural History
COV Members:	Carol Brewer, AC Liaison	Independent Consultant
	Janine Caira	University of Connecticut
	Wayne J. Elisens	University of Oklahoma
	Deborah Goldberg	University of Michigan
	Mark A. Miller	San Diego Supercomputer Center
	G. Philip Robertson	Michigan State University
	David Schimel	Jet Propulsion Laboratory

INTEGRITY AND EFFICIENCY OF THE PROGRAM'S PROCESSES AND MANAGEMENT

Briefly discuss and provide comments for *each* relevant aspect of the program's review process and management. Comments should be based on a review of proposal actions (awards, declinations, and withdrawals) that were *completed within the past three fiscal years*. Provide comments for *each* program being reviewed and for those questions that are relevant to the program(s) under review. Quantitative information may be required for some questions. Constructive comments noting areas in need of improvement are encouraged.

I. Questions about the quality and effectiveness of the program's use of merit review process.

Please answer the following questions about the effectiveness of the merit review process and provide comments or concerns in the space below the question.

QUALITY AND EFFECTIVENESS OF MERIT REVIEW PROCESS	YES, NO, DATA NOT AVAILABLE, or NOT APPLICABLE
1. Are the review methods (for example, panel, ad hoc, site visits) appropriate? Comments: All indications for both ADBC and Macrosystems programs are that all review methods are appropriate and carefully performed. The COV saw no indications of problems in this area.	YES

2. Are both merit review criteria addressed
 	
    a) In individual reviews?
 	
    b) In panel summaries?
 	
    c) In Program Officer review analyses?
 	
Comments: We found individual reviewers, panelists, and program officers discuss at length the merit review criteria and use these to inform the decision to fund or decline. The documents reviewed indicate that the criteria were considered very carefully.
	YES

	YES
3. Do the individual reviewers giving written reviews provide substantive comments to explain their assessment of the proposals? Comments: With very few exceptions individual reviews are carefully and thoughtfully done and substantive comments are given as to the merits of the proposal and any weaknesses that were evident. The reviewers' comments reflect their wide variety of training and background and bring different points of expertise to bear on each proposal.	
4. Do the panel summaries provide the rationale for the panel consensus (or reasons consensus was not reached)? Comments: At times the panel consensus differs from that of the individual reviewers. Panel summaries reflect the reviewers' points of view and the consensus of the panel discussion well.	YES
5. Does the documentation in the jacket provide the rationale for the award/decline decision? [Note: Documentation in the jacket usually includes a context statement, individual reviews, panel summary (if applicable), site visit reports (if applicable), program officer review analysis, and staff diary notes.] Comments: Examination of the numerous documents in the jackets, from initial proposal to PI information to reviewers' comments, panel report, and other materials provide a complete packet of information related to the decision to fund or not to fund.	YES

	YES
6. Does the documentation to the PI provide the rationale for the award/decline decision? [Note: Documentation to PI usually includes context statement, individual reviews, panel summary (if applicable), site visit reports (if applicable), and, if not otherwise provided in the panel summary, an explanation from the program officer (written in the PO Comments field or emailed with a copy in the jacket, or telephoned with a diary note in the jacket) of the basis for a declination.] Comments: The information provided, including reviewer comments, panel summary, and context statement, is sufficient to understand the reason a proposal was funded or declined. PIs can also discuss decisions personally with the Program Officer.	
7. Additional comments on the quality and effectiveness of the program's use of merit review process: All indications are that the merit review process is functioning extremely well in both of these programs. Reviewers are chosen with appropriate expertise, diversity of expertise, academic age, and understanding of the program's objectives. Panels give every indication of functioning well, fairly, and with careful consideration of the issues related to the proposed research and methodology and to the program under consideration.	YES

II. Questions concerning the selection of reviewers. Please answer the following questions about the selection of reviewers and provide comments or concerns in the space below the question**.**

SELECTION OF REVIEWERS	YES , NO, DATA NOT AVAILABLE, or NOT APPLICABLE
1. Did the program make use of reviewers having appropriate expertise and/or qualifications? Comments: Reviewers appear to be carefully chosen to have relevant expertise for the proposal topics and methodologies.	YES
2. Did the program recognize and resolve conflicts of interest when appropriate? Comments: Program Officers work diligently to deal with issues related to potential conflicts of interest. Reviewers may be excluded from a panel because of too many conflicts, panelists with conflicts are recused from reviewing conflicted proposals, and panel members may declare unanticipated conflicts. Indeed, COV members themselves were denied access to many proposals because of potential conflicts.	YES
Additional comments on reviewer selection:	Not Applicable

III. Questions concerning the management of the program under review. Please comment on the following:

MANAGEMENT OF THE PROGRAM UNDER REVIEW

1. Management of the program.

Comments:
Both programs are judged to be well managed. The program staff and program officers appear to be a well-integrated and smoothly functioning team, with a high level of commitment to both programs despite the virtual nature of the programs. (In fact, the virtual nature of the programs may be a benefit because it insures that the staff is aware of other programs and developments within the directorate.) The staff members feel valued by the program officers and are key components of the decision-making processes. The COV appreciates the very helpful staff during the preparation for the COV review.

Several specific issues:

First, the COV was impressed with the responsiveness of the Emerging Frontiers (EF) staff to the concern raised at a PI meeting that proposal budgets had often underestimated costs for data management and access. This scale of data and its attendant costs are relatively new to many of the PIs. The program staff understood the concerns and appropriately funded information management supplements.

Second, both programs appear to interface with other NSF programs, based on the number of proposals receiving co-funding from other programs (9 according to the Self-Study provided).

Third, the dwell time for some EF proposals is excessive and should be reduced; for at least one cycle proposals took 6-9 months for a decision to be transmitted to PIs. The program staff members have already considered this and think it may be possible to speed up the process with a simple change of due date and related panel dates to increase availability of panelists. We recommend that this be done.

2. Responsiveness of the program to emerging research and education opportunities.

Comments:
The very existence of both programs can be viewed as evidence of responsiveness to emerging research and education opportunities in the collections and ecological communities.

With respect to broader impact activities, the panels for the proposals we reviewed rated broader impacts as largely adequate, but not innovative. However, many of the proposals, especially for MSB, introduced substantial innovation with respect to the management and governance of large multidisciplinary efforts; this itself seems to us an important Criterion 2 activity that might be pointed out to reviewers.

3. Program planning and prioritization process (internal and external) that guided the development of the portfolio.

Comments:

We encourage both programs to maintain an appropriate balance between relatively safe and high risk/high reward proposals (e.g., some of those with a broad range of scores). The balance seems good so far, and a willingness to shoulder risk is viewed by the committee as critical to both programs' success. Both programs are also doing a good job of balancing their portfolio across different topics and biological systems (e.g., taxonomic groups and habitats).

The yearly PI meetings for both programs appear to be successful mechanisms to provide important feedback that impact planning and prioritization for future grant cycles, as well as communication among the PIs.

4. Responsiveness of program to previous COV comments and recommendations.

Comments:

NA

IV. Questions about Portfolio. Please answer the following about the portfolio of awards made by the program under review.

1. Relating to both the ADBC and MSB programs: Do the programs take advantage of existing and planned research platforms?

   Both programs take advantage of existing platforms. A number of MSB projects are hosted in part at LTER sites, and ADBC projects make good use of the ADBC national hub (iDigBio). There are also plans to interact with the iPlant collaborative. It is too early to know whether the programs will take advantage of planned research platforms, though some projects utilize early NEON data products and sample from NEON sites now under construction.

2. Relating only to the ADBC program:

   a. How has the ADBC program supported efforts in line with the community strategic and implementation plans to advance digitization of biodiversity collections?

      The ADBC program follows recommendations of the community as articulated by NIBA. As a result, its efforts are in line with community strategic plans. The program has funded both a national hub (iDigBio) as a central repository, and has invested in defining a set of processes by which digitization can occur. By implementing a series of workshops, symposia, and website posting, iDigBio has also invested in educating other entities in the methodologies recommended for digitization, and raised awareness of the need for same. The result is a substantial advance in the national digitization efforts. As the central iDigBio database evolves, we expect to see efforts to better validate depositions into what could become the national database for biological specimens. In addition to the central repository, the program has funded Thematic Collection Networks (TCNs), which promote the refinement of digitization along thematic lines, and Partners to Existing Networks (PENs), which support digitization of smaller collections. The former promotes the formation of large collaborative groups that focus on digitization activities, the latter provide a means for smaller institutions to leverage the resources of the larger TCN groups to add additional resources that might not otherwise be captured.

   b. How has the ADBC program supported efforts in line with the community strategic and implementation plans to advance digitization of biodiversity collections?

      The decision to organize and award TCNs with a thematic research focus means that they are well positioned to enable future research by others that are in the same thematic area. This seems to be a very efficient way to encourage rapid adoption and early discoveries from digitization efforts. This can provide early examples of the benefits of digitization. Other ways of dividing up the digitization process may have resulted in a delay to being able to realize the research benefits of the effort. Although it is still too early to know with certainty, proposals that have been funded have focused on areas with compelling promise for future research in ecology, evolutionary biology and systematics. From the reviews it is clear that the enabling potential of the TCN for future research is a key funding criterion, and the committee feels this will increase the impact of the program.

   c. How has the ADBC program supported collections digitization activities that will enable future research?

By investing significant resources in digitization, the ADBC program has effectively rallied the community towards the development of a valuable national resource. It is the COV's opinion that this has been a highly effective investment that has produced a strong positive and innovative, and unifying impact on the community. In addition to investing resources, the program has demonstrated a strong commitment to accountability among its TCN and PEN awardees. The program requires its awardees to contribute their data to iDigBio, and monitors performance of these awardees to insure depositions of digital data are made. This accountability is a valuable part of the programs contribution to creating an integrated national collections community and advances the national initiative by building community buy-in and use of standardized data resources. The focus on a diversity of taxa, not just those known to be important, is vital to future innovative research.

    d. How has the ADBC program facilitated an integrated national collections community and data resource?

The awards made by the ADBC program include more than 200 institutions, largely at PhD granting institutions, but including commercial and NGO entities. As the digitized collections created under program funding come on line, there will be ample opportunities for other disciplines to utilize digitized collections. The committee would like to see additional plans for collaborating with federal collections.

3. Relating only to the MSB program:

    a. Has the MSB program received and funded research proposals that are responsive to the MSB solicitations?

The proposals received by MSB have been generally responsive to the solicitation. With the completion of several cycles, it now seems appropriate to revisit the solicitation to ensure it is aligned with the current aims of the program as reflected in funded proposals.

    b. Does the MSB program provide opportunities for other disciplines and agencies to participate in macro scale biology research?

Yes, a number of disciplines are represented in MSB awards, an expected outcome of the nature of the program. This is reflected both in the disciplines represented by the PIs as well as the sites at which work is being undertaken, such as Critical Zone Observatories (CZOs) supported by GEO. There is also evidence of other agencies participating by incorporating data from other agencies into their projects and by centering work at field sites that are already under study (e.g. USGS, USFS). However it is less clear that opportunities for data and site collaboration are being sought out by other agencies that should be natural collaborators. As the program matures the foundation should consider reaching out to NASA, USGS, DOE, and other such agencies for partnership opportunities.

    c. Do the MSB program funding modes enable the research and emerging field to advance?

Exploratory awards provide a valuable opportunity for smaller, less mature research efforts to build towards critical mass and the size of regular awards. It is too early to tell if the exploratory track will ultimately be successful, but early evidence that several exploratory awards having advanced to full proposals suggests that this will be a useful path. Even if

exploratory awards do not advance to full proposals, however, these awards will have been useful for building teams and providing investigators the training needed to go on to large team efforts elsewhere.

The trainingship awards are also too early and too few to judge their ultimate success. These awards will likely be very important to build workforce capacity towards the ability to engage in macro-scale questions. The program is urged to consider a targeted call for proposals based on input from the community about emerging needs. The program is also urged to consider EHR as a potential funding partner for trainingships, as well as other agencies.

Macrosystems ecology is a new focus for NSF and questions come up about whether it is actually novel, just a relabeling, or redundant with macroecology. After reviewing the program, including evidence of productivity and impact presented to us, and available in the jackets, the COV concludes that the program is indeed tackling important, scientifically challenging problems that involve processes that intrinsically play out at large spatial scales, including those mediated by transport, teleconnections, biogeographic processes, species invasions, and other processes where spatial dynamics are intrinsic. The program also supports the type of science that intrinsically requires a large effort, whether because of the scope of the data collection, the breadth of skills and knowledge required, the need to develop infrastructure such as software or other work that requires support of a larger team than 1-2 PIs and their labs. This type of support is important to the community, and well matched to the macrosystems theme.

OTHER TOPICS

1. Please comment on any program areas in need of improvement or gaps (if any) within program areas.

   Given the evolving nature of both the MSB and ADBC programs, it is time to revisit the program descriptions to ensure they are aligned with proposals that are successful and to integrate solicitation modifications into the body of the solicitations themselves. In both cases, including pointers to additional sources of program information will be helpful. In the case of ADBC proposals, it would be helpful to specifically include additional information about the hub site (iDigBio) so as to encourage growing community use of its resources.

   Both programs suffer from the NSF-wide problem (see 3.) of fragmented and overlapping data management system options. The importance of this issue, in terms of NSF investment, is underscored by the number of supplements requested and awarded to MSB proposals as a result of PIs underestimating resources required for this element of their projects underscores this issue. Additional interaction/integration between the ADBC and MSB programs might be useful to identify and solve common data management challenges. For MSB proposals, increased emphasis on accountability for management of data, models, etc. in the annual report system for Category II proposals is important for both ensuring that commitments are met for providing BIO information about what PIs are doing with respect to information management, what is effective, and where problems remain.

2. Please provide comments as appropriate on the program's performance in meeting program-specific goals and objectives that are not covered by the above questions.

   Both programs are new and the first round of proposals are only just now coming to fruition. Nonetheless, preliminary signs for both programs are positive. With respect to ADBC, the information resources developed through the hub (iDigBio) are mature enough to support research and are gaining momentum in the collections community. MSB program research is already having an impact on the field; the program has already yielded a special issue of *Frontiers in Ecology and the Environment* and four papers in press in *PNAS*. The EF programs have done a particularly good job of mobilizing early to mid career scientists in generating proposals. It was good to see big collaborations led by relatively early career scientists developing and thus signaling the successful nurturing of emerging leaders. The annual PI meetings appear to serve an important function in the case of both programs. The level of success seems appropriate for the stage that both programs have reached (year 3 completed).

3. Please identify agency-wide issues that should be addressed by NSF to help improve the program's performance.
   The need for the directorate, or perhaps even NSF overall, to take a larger look at data infrastructure is readily apparent from examining these programs that support larger scale projects. Many MSB projects in particular rely on databases not created by the projects and the time and effort spent harmonizing disparate data is time and effort that could otherwise be applied to research per se. It may be time to assess the status of the multiple data efforts occurring across the directorate (e.g., DataOne, NEON, iPlant, LTER-NIS, etc.) and identify a means to apply a common wrapper such as that provided to the GEO community by EarthCube. A joint effort to develop interoperability, community governance and other capabilities that are general to environmental data management broadly would be a highly valued effort.

   It also seems time for NSF to begin an interagency collaboration relating to collections. The fact that iDigBio is now operating, and that numerous collections are being funded to digitize and deposit their data in iDigBio provides strong support for such an interagency approach, including digitization of federal collections and the expansion of the central database. The COV also felt that it is also time for NSF to

initiate a plan to develop the tools that will be required for utilizing the massive specimen database to its full potential. New tools and technologies and methodologies are required. Just as the sequencing of the human genome demanded new analytical, computer, and sequencing tools, so too will the growing database require creative efforts by computer specialists, engineers, and a variety of scientists to determine how these data can most efficiently and effectively be utilized across disciplines.

4. Please provide comments on any other issues the COV feels are relevant.

The increasing number of proposals submitted attests to the level of community interest in these programs. The COV is concerned about the long-term prospects of both programs. While it appears that ADBC may move to DBI, the future of the MSB program is less clear. The committee feels it is essential to make sure there is a long-term home for integrative, highly collaborative science, whether it is MSB or some evolution from MSB, is identified. The future will also see even more resources/platforms for managing large volumes of data (iPlant, iDigBio, NEON, LTER) coming on line. The need to have resources that allow teams to use all of these in an integrated way is clear and we strongly endorse this approach. The new generation of scientists is more integrative and team oriented.

5. NSF would appreciate your comments on how to improve the COV review process, format and report template.

The COV process has been greatly streamlined over the last few years, in large part due to digitization of most of the materials required for COV members to assess the programs under consideration. The COV doubted that the work that was proposed for this COV could be completed in a single day (it used to be 2+ days in the past), yet by having access to the digitized data ahead of time, the work became much easier to accomplish given the ready access to materials. Being granted earlier access to the eJacket system several weeks before the COV meeting would have been useful.

We, as members of the Emerging Frontiers Committee of Visitors, hereby submit this report to the Assistant Director of the Directorate for Biological Sciences.

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Michael Mares, Chair
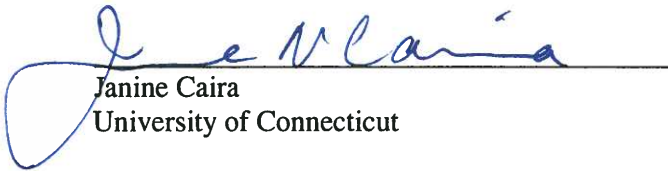Sam Noble Oklahoma Museum of Natural History

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