

**Response to the 2008-2010
COMMITTEE OF VISITORS
Report for
HYDROLOGICAL SCIENCES (HS), GEOBIOLOGY AND LOW
TEMPERATURE GEOCHEMISTRY (GG), GEOMORPHOLOGY AND LAND-
USE DYNAMICS (GLD), SEDIMENTARY GEOLOGY AND PALEOBIOLOGY
(SGP) PROGRAMS
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INTRODUCTION:

The Committee of Visitors (COV) for the Surface Earth Processes Section (SEPS) visited the National Science Foundation from June 6 to 8, 2011. This is the third COV of the Section since the Division of Earth Sciences (EAR) was reorganized into the Surface Earth Processes and Deep Earth Processes Sections in 2004. The reorganization of EAR was driven by the emergence of several sub-disciplines in surface Earth processes, as initially recognized by the Basic Research Opportunities in Earth Sciences (BROES) Report in 2001. The prudence of this reorganization is evident today, from the summary of the "*Status of the Geoscience Workforce 2011*" published recently by the American Geological Institute (June 20, 2011), the spate of SEP-relevant major initiatives within the GEO Directorate and the entire NSF (e.g., Critical Zone Observatory, Climate Research Initiative, and the Science Engineering and Education for Sustainability Program), and the prognosis offered by the GEOVISION (2009). Society expects the science community to deliver science that not only transforms our understanding but also informs critical societal decisions on the planet's future. These are the compelling context of the present COV evaluation: are effective mechanisms in place to efficiently channel the needed resources to research that concurrently transforms science and informs societal decisions?

We sincerely appreciate the effort, observations, evaluation and recommendations offered by Hornberger et al. in their Final COV Report.

BROAD SECTION-WIDE ISSUES:

- (1) We recommend that NSF continue to find ways to deal with the workload problem.

EAR continues to address workload issues within SEP. The 2nd Program Officers (PO) in SGP and GG were secured within the last five years, although new PO additions have not kept up with the increasing proposal workload. The EAR

Division Director has already identified the 3rd HS Program Officer position as the Division's highest FTE priority. HS will shortly be provided part-time help by the GEO front office to a level approximating 0.75 FTE.

- (2) The ad hoc mail review plus panel review system works well and we recommend that it be continued. Furthermore, we think that having two calls for proposals per year is important, especially for early-career investigators and those new to the NSF world, and we recommend that this practice be continued.

Our plan is to continue both the two-tier review system and the two proposal cycles.

- (3) We also recommend that POs across EAR be alert for possible collaborations between SEP and the Deep Earth Processes (DEP) section of EAR.

Discussion is underway to create precisely such a programmatic vehicle for collaboration across EAR. Stay tuned.

- (4) (5) Awards made in the core programs, in general, continue to be of quite modest size and of relatively short duration (<3 years). A size-duration-viability threshold may have been reached for some programs, especially those requiring severe cuts to awarded budgets. It may be useful for SEP to track work that progresses from EAGER through other NSF funding to identify examples where such innovation occurs.

An analysis of funding durations must separate RAPID, EAGER, workshop and supplement support from regular grants to properly assess funding trends. On regular grants, SEP is very interested in determining the sorts of indicators and metrics that would quantify this "limit to viability". We concur that the award size and duration are on the low end of GEO norms, but there is no compelling information yet available that a "threshold" may have been reached for some programs. For example, several of the accomplishment highlights presented to the COV were made possible by very modest EAGER or RAPID grants. It is unclear if we are merely facing a new fiscal reality or if the research that is being performed is indeed more costly than the award level being provided. One possible metric for this viability threshold is the difference between the requested amount and the amount granted, although we note that a change in scope is always advised when POs request the PIs to submit a reduced budget. On balance, we agree that this requires further serious discussions, and all SEP Programs have been advised to monitor this issue.

Only a small fraction of EAGER proposals become full blown projects and proposals, precisely because EAGER ideas are high-risk exploratory initiatives. We are open to the idea of taking a closer look at EAGER grants provided by SEP, to examine the role this mode of support has played in development of transformative ideas.

- (6) (7) We note that proposals reviewed by several panels, especially when reviewed across the Foundation, appear to enjoy a lower success rate than those reviewed by a single panel within SEP, and that, within the core programs, successful proposals have (statistically significantly) fewer ad hoc reviews than do declined proposals. We think that this bears examination by programs and

we recommend that a more robust review and careful analysis be done. We think that the use of modern databases should assist in increasing the efficiency of getting reviews and note that if the NSF does not have appropriate software, they should upgrade. Review requests that ask for immediate response (accept, decline) may prove to be best practice.

The observation and inferences made by the COV are worth validating and examining closely. The data provided to the COV did not allow statistics of success rates to be evaluated exclusively for co-reviewed proposals, but Program Officers may be able to track this metric for their individual programs in response to the COV comment.

The data that we presented for the COV on the average number of reviewers for awards and declines indeed consistently showed that declined proposals have more reviewers than successful proposals (roughly 4.5 [awarded] versus 5.5 [declined]). SEP will engage a student intern on our next opportunity to examine the statistical significance of this trend, and to inquire into the underlying causality. One technicality has to be pointed out, and that is reviewers who offer fractional ratings (e.g., E/V or VG/G) are not counted by the EIS system. A first order task for the student intern is to include these fractional raters in the data pool to establish that their removal from the pool did not systematically lower the estimate of total reviewers for the successful proposals (i.e., this would happen, for example, if highly rated proposals attract more fractional ratings than poorer proposals).

In general, the more inter/multidisciplinary the proposal is, the more reviews are needed to cover the multidisciplinary facets of the proposal. Conversely, the more technically focused a proposal is, the lower is the number of reviewers required to get a full evaluation of the proposal. Are inter/multidisciplinary proposals generally less successful in our core program competitions (conversely, are thematically-focused proposals more successful)? Furthermore, looking at the reviewer numbers alone may not provide a complete analysis of causality because the substance of the reviews cannot be accounted for by counting the number of reviewers. Unfortunately, poorer proposals (i.e., candidate for decline) tend to generate less interest and non-substantive reviews. Once non-substantive reviews are received, Program Officers will tend to compensate by inviting additional (hopefully more substantive) reviews.

We cannot make recommendations on corrective action until we have fully examined the causal origin of the trends pointed out by the COV.

- (8) We note that there appears to be few opportunities to secure funding for projects that may fall between core grants (~\$100K/per year for 2 to 2.5 years) and broad initiatives (e.g., the Critical Zone Observatories—CZOs). We think that SEP POs should be alert for opportunities that might require cross-program cooperation to fund such projects, if they find a need within the community.

The boundaries between NSF programs are substantially more porous than the COV may have realized. SEP Program Officers are in constant communication when proposals arrive, and they likewise communicate with the rest of EAR, GEO and NSF Directorates. Cross-Program cooperation is the norm, when such opportunities are identified. With this noted, the COV is correct in that there are

no ready opportunities for “mid-scale” (e.g., up to million/year scale) initiatives, especially those that are cross-programmatic in terms of disciplinary interest. SEP and EAR are closely examining this at present, and one of a number of solutions may be announced in FY12.

- (9) The strategy of encouraging SEP investigators to participate in proposals to broad initiatives (e.g., Water Sustainability and Climate) is sound. We think that accessibility of investigators from all SEP programs to broad initiatives should be a consideration in a balanced portfolio for EAR.

New programs are developed within GEO guided by community input (e.g., GEOVISION, community workshops, NRC Reports). Once proposed within the GEO Directorate, the “potential new programs” are considered NSF-wide, and if it succeeds at that level, it then becomes part of the budget submitted to the White House (and the Office of Management and Budget). Whereas all SEP Program Officers are active in soliciting and developing new ideas for new programs, only a small fraction of these ideas are eventually allocated funds and become new Program solicitations. The present funding opportunities are solely a function of the success of individual communities and Program Officers in advocating the science and its alignment with government priorities. **Whenever SEP and EAR identifies communities that have not been able to participate in recent interdisciplinary opportunities, a special effort is expended to champion initiatives that serve this specific community.** FESD is a great example of an initiative at the nexus of accessibility to multiple EAR/GEO communities and alignment with government priorities. There are a number of new initiatives in the mill at present, and if those are successful, a number of SEP disciplinary communities will benefit.

- (11) Participation and funding of minority PIs appears to be relatively static across recent years. We recommend that aggressive measures continue to be taken and new ideas explored. As highlighted in O’Connell and Holmes (June 2011, *GSA Today* 21: 52-53), a continued multifaceted approach seem to be the best way forward. More attention should also continue to be on the overall geosciences pipeline (though this is a much broader issue).

The COV comments are well-taken, and we will simultaneously pursue a three-pronged approach:

1. Internal Activities: SEP will commit to engage other sections within NSF that can assist us on being more effective in reaching our goals of broadening participation by:
 - a. Being engaged in NSF wide outreach efforts;
 - b. Enhancing our understanding of the science of broadening participation;
 - c. Being trained on debriefing panels on implicit bias.
2. Review Process: SEP will consistently seek reviewers and panelists that provide the disciplinary expertise needed to evaluate proposals and at the same time we will expand the reviewer/panelist pool to represent the desired diverse set of proposers by:

- a. Using NSF databases and other databases available to the scientific community;
 - b. Constituting panels that are diverse from multiple perspectives;
 - c. Briefing each SEP panel on implicit bias at beginning of panel meeting.
3. Outreach to the scientific community: SEP will actively seek outreach opportunities to engage scientists that are traditionally not part of the SEP PI pool. SEP Program Officers will:
- a. Participate in visits to NSF organized for institutions that focus on broadening participation;
 - b. Seek opportunities to visit academic and research institutions that serve students from under-represented backgrounds in science to communicate how relevant "traditional" disciplines are to SEP sciences.
- (13) Participation in international conferences is very important for the POs to maintain connection with the community and to learn where the frontiers of the field are headed. We recommend that such participation continue to be valued and supported.

NSF continues to value and support PO participation in international meetings and collaborations. The increasing pressure on our travel budget will no doubt lessen international travel opportunities, but we will seek to balance programmatic, local (meetings and outreach) and international travels even with lower travel budgets. Program Officers are provided some discretion on how they spend their travel allocations.

- (15) We recommend that future COVs be provided with the following statistics as part of the reports from each core program.
- a. Success rates by type of proposal (e.g., RAPID, workshop, standard grant), as well as the lumped rates.
 - b. Success rates of co-reviewed proposals.
 - c. Geographic distribution of funded proposals.
 - d. Resubmission success rates (when it is possible to identify such proposals).
 - e. Co-funding and co-review details.
 - f. Longitudinal data (for ~ a decade) for items in which gauging temporal progress is important, for example minority participation.

To the extent that these could be accomplished using the NSF electronic system, these data will be provided to the COV. Where the data have to be generated manually (e.g., items b and d), each PO will be requested to compile these in their individual presentations to the COV next time.

Longitudinal data (e.g., proposal load, success rates) were presented dating back to the previous COV (note that 3 out of 4 Programs reviewed are only approximately 2 COV cycles old!). A decade-long timeline for some* of the data presented will be made in the next COV (*the EIS system cut off some data prior to 2006, hence pre-2006 data may not be available for some metrics).

Specific Responses to the Charge to the COV

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

We appreciate the program-by-program assessments, and generally agree with the suggestions. Panelists are variably used as reviewers in SEP programs, some as emergency reviewers (if less than three reviewers returned reviews) and others in a more formalized manner (e.g. SGP, GLD). We note that this is a common practice in other Directorates (e.g., BIO), but the practice is not prevalent in SEP because programs with large number of proposals could result in large panel review assignments and some unevenness in the quality of the review. NSF records are nevertheless very clear as to which reviews are provided by ad-hoc reviewers versus panelists (Form 7 in eJacket).

The Section will examine letters sent to reviewers and adopt best practices with regards to emphasizing both merit review criteria and encouraging a more substantive review (e.g., use of the GG template). The weighing of intellectual merit and broader impact is not prescribed by the Section or by the Foundation. These are left to the sole discretion of Program Officers because different programs lend themselves differently with regards to broader impact. As was noted in the previous COV, all SEP programs strive to emphasize basic research that has significant impact on decisions and policies made by society. In collaboration with the Educational and Human Resources Program, we also strive to advance public and student awareness of the importance of basic science to their communities and environment.

We also note that with regards to the Review Analysis (e.g., noted for HS), PIs do not have access to the Review Analysis examined by the COV, but POs strive to share as much of the insights in those Review Analysis to the PI in the form of PO Comments. The issue raised with regards to SGP will be addressed by ensuring that documentation of review and decisions is more consistently provided. The PO Review analysis provides some level of reconciliation of inconsistent multi-panel decisions/ recommendations, but we deliberately leave the conflicting recommendations because we view those as legitimate outcomes of the review process given the multiple disciplinary perspectives. The Review Analysis and the PO comments strive to provide a synthesis of the rationale, and the specific concerns raised by the overall review process. All POs instruct Panels on articulating clear rationales for decisions rendered, and addressing dissenting reviews or comments.

Suggestions made on tracking gender and race of reviewers is already being done NSF-wide, and we will present this information to the COV next time. It should be noted however, this voluntary registration of gender and race for reviewers only get response rates of less than 25%.

II. Questions concerning the selection of reviewers.

The daunting task of selecting reviewers in such broad programs with a heavy proposal workload is a challenge we take very seriously. It is virtually impossible to be familiar with the breadth of reviewers available and the ever changing and renewing reviewer base in a program that intellectually covers much of surface Earth sciences. Program Officers also seek recommendations from other Program Officers and from reviewers who are unable to review a proposal.

Assignment of reviewers is based on the need to evaluate the components and holistic goals of the research plan. The number of ad hoc reviews received is governed by an anticipation of what reviews will be returned. In the case of a large number of ad hoc reviews, this may or may not be attributed to co-review and/or co-review panelist reviews being included. This circumstance may lead to overemphasis on specific aspects of the overall proposal although there may also be times when the breadth of reviews requested do not match the breadth of reviews received. To counteract this apparent overweighting, the panelists assigned to each proposal are distributed by expertise with at least one individual providing the "generalist view". Beyond that, the Program Officers provide the final oversight.

The existing reviewer tracking system of NSF is quite extensive, and easily rivals many high end journals. The problem identified by the COV concerning the issue of variable numbers of reviews is quite complex, and we do not believe it can be primarily attributed to the reviewer tracking system that we use. The bottom-line is every potential reviewer balances that sense of collective responsibility to the science community with reviewer (and other) load they get from NSF (and not just SEP!) and journal reviews. Sometimes they say "yes" (on which they may or may not deliver), and sometimes they beg out. In some cases, we do not get reviewer responses to the invitation to review, and it is largely in these cases where a PO sends out additional invitations, only to see later that a review was provided by the scientists who did not respond to the invitation. Reviewer commitment is a special challenge for young and emerging disciplines because that sense of community has not been cemented fully in some of these communities.

Since the HS panel typically meets before other co-reviewing panels, HS may be able to identify reviews received after panel has met. HS may also consider identification of co-review ad hoc and co-review panelist reviews.

III. Questions concerning the management of the program under review.

We fully appreciate the confidence of the COV on the excellent overall management of all the SEP programs. The issue of high mortgage rates raised by the COV on the SGP is being addressed, and we expect the current SGP POs to aggressively lower their mortgage.

IV. Questions about portfolio

The remarkable diversity of projects supported by SEP is to be expected from the emergence surface Earth sciences, and the SEP Program Officers are being responsive to strategic developments in their respective field. We appreciate the confidence of the COV on the scope and diversity of our programs. This diversity, along with the challenge of attracting more resources to SEP programs is responsible for the modest sizes and durations of SEP grants, as well as the increasing difference between the requested and awarded project amount (e.g. Tables 1 and 2). The introduction of cross-cutting programs in GEO and across NSF, has generally been beneficial to the SEP community, and our Program Officers are untiringly active in defining these solicitations (e.g., WSC, ETBC, EaSM, FESD, SEES), and inviting the SEP community to partake of these initiatives.

Table 1: Percentage of funded projects without and with budget reductions for GG.

FY09				
	FY08	FY09	w/out ARRA	FY10
0%	39	68	85	51
up to 20%	17	5	8	37
> 20%	43	25	8	12

Number of awarded proposals falling into budget reduction categories (by percentage)						
	Total awards	<10%	10-20%	20-50%	>50%	Total awards with >20% reduction
F07	30	13	8	5	4	30.0%
S08	18	8	8	1	1	11.1%
F08	21	13	5	3	0	14.3%
S09	6	2	3	0	1	16.7%
F09	32	4	11	14	3	53.1%
S10	13	5	3	5	0	38.5%

Table 2: Number of proposals with budget reductions for COV period by panel. Spring 09 panel excludes ARRA awards.

Surface Earth systems are complex and inextricably interlinked, and demands an interdisciplinary approach to observation, experimentation, data management and modeling that often extends beyond the confines of SEP. These “forced” collaborations (i.e., required in virtually all cross-GEO or cross-NSF programs) have helped acclimate our PIs to collaborative partnerships that enhanced the community’s interdisciplinary reach. We understand that these cross-disciplinary partnerships can be quite

intimidating to new (and seasoned) researchers, and we organize workshops, town hall meetings and NSF visits that serve as catalysts for young investigators participation in interdisciplinary activities. Our core programs have also paid particular attention to nurturing new investigators (Table 3).

Table 3: Success rate percentages for overall versus New Investigator awards.

		2008	2009	2010
GG	Total	20	37	27
	New PI	23	42	25
GLD	Total	13	32	24
	New PI	14	22	20
HS	Total	26	39	14
	New PI	16	32	10
SGP	Total	23	31	21
	New PI	16	27	8

Portfolio imbalance must be examined integratively over long periods of time, and we believe that it is unwarranted to ascribe an imbalance in the SGP portfolio for one competition to decisions made by a rotating Program Officer. Rotating Program Officers serve the science community to the best of their abilities, and NSF is thankful for their service. Any thematic imbalance noted by the COV in SGP's portfolio will be monitored closely by the permanent PO, who takes full responsibility for managing long term portfolio balance.

All our programs are strongly committed to the integration of research and education, and we appreciate the COV's vote of confidence. SEP will continue to include under-represented minorities and scientists/faculty from minority-serving institutions to participate in panels, and seek their guidance on how best to increase minority participation. PO decisions rest primarily on the intellectual merit and broader impact review criteria, but diversity is a consistent programmatic consideration in PO decisions on awards. We nevertheless agree with the COV that more work remains to be done, and we described examples of approaches that we will use in enhancing the participation of under-represented minorities in SEP Programs (e.g., item 11 in the Broad Section-Wide Issues).

We have a long way to go to provide adequately for the major infrastructure needs of the community, but investments in CZOs, CUAHSI, CSDMS, NCED, CRONUS, CZEN, CHyMP, Hydrologic Information System, the Hydrologic Measurement Facility, Paleobiology Database, Macrostrat, GeoStratSys, NEOTOMA, Morphobank and other facilities and databases are a start. SEP will continue to seek opportunities for providing additional infrastructure in the future.

SEP defines its overarching goal as one of transforming the frontiers of knowledge in surface Earth science through discovery, education and infrastructure, and ensuring that

knowledge gain benefits society. We are proud that the present and the previous COV highlighted the significant role our research communities play in enhancing understanding of and informing critical societal decisions on water, soil, landscape and holistic environmental services. We emphasize, nevertheless, that our long term ability to continue to innovate for society depends on the vibrancy of core programs in geobiology and low temperature geochemistry, geomorphology and land use dynamics, hydrologic sciences and sedimentary geology and paleobiology. We also note that public interest in dynamic surface processes, hazards and human-environmental systems has great value in helping educate a diverse public, especially the young, on the methods and importance of science to society.

CLOSING COMMENTS:

We appreciate the time and effort invested into the insightful review of GG, GLD, HS and SGP by the COV. We are delighted that the Committee was favorably impressed with the performance of SEP personnel and by the qualifications and dedication of the current Program Officers and administrative staff. We are pleased with the COV's conclusions that (1) the review process of our programs is handled very well, with proper consideration given to intellectual merit, broader impacts, and transformative review criteria, and (2) our program portfolios are diverse, of high quality and well-balanced (sub-disciplines, award size/duration, high risk, interdisciplinary, collaborative, investigator/institution types, underrepresented groups, infrastructure). It is also gratifying that the Committee shares our view that our programs are very relevant to society, national priorities and the NSF overall mission.

We concur with the COV's assessment that the challenges will remain substantial for the SEP programs in the future, and the present budget climate will likely increase that challenge. The leadership of EAR and GEO are committed to addressing the issue of proposal workload and personnel needs (e.g., HS). The issue raised by the COV on needed collaborations between SEP and DEP communities, as well as the lack of funding vehicles for mid-range projects are topics of advanced discussions within EAR, and at least one strategy for addressing both is currently being planned. Issues related to lower levels of funding and shorter durations (e.g., "limit to viability"), apparent lower success rates for cross-disciplinary projects, and "apparent disadvantage" to proposals receiving more reviewers are all worthy of further examination; SEP will pursue these evaluations accordingly. The recurring problem of enhancing the participation of underrepresented minorities in our programs will be met with a more aggressive approach beginning this year (e.g., item 11 in the Broad Section-Wide Issues).

SEP communities are major participants in cross-disciplinary programs in EAR, GEO and NSF. Our Program Officers will continue to be aggressive in soliciting community input, articulating these in collaborative planning for these cross-disciplinary initiatives and in engaging relevant SEP communities in the proposal development process.

We thank the COV members again for their helpful comments and recommendations.