

EXECUTIVE SUMMARY

Summative Report on the Earth Science Women's Network (ESWN) NSF ADVANCE PAID Collaborative Award (2009-2013)

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1. Introduction: Purpose, Scope and Structure of this Report

This report serves as a final report on activities conducted by the Earth Science Women's Network (ESWN) under their NSF ADVANCE PAID collaborative awards (9/09-8/13). The stated purpose of the grant was to promote career development, build community, and facilitate professional collaborations for women in the Earth Sciences. In the report, we seek to

- Describe ESWN members, their needs and interests
- Document ESWN's main activities under the PAID grant
- Summarize known outcomes for members of these activities to date
- Characterize aspects of women's work situation, professional and personal perspectives that are gendered and that help to explain how and why the network benefits them
- Describe aspects of ESWN's operations and governance
- Identify challenges and opportunities for the future.

The report draws on several bodies of data, including surveys of ESWN members (women only) in 2010 (491 responses) and 2013 (765 responses); a survey of ES_JOBS list members (women and men, 171 respondents); surveys of participants in intensive workshops held in 2011, 2012, and 2013 (176 respondents); interviews and focus groups; documents; listserv and web center traffic; participant observation and personal conversations. The report is structured as follows:

- Sections 2 and 3 describe the network's members and activities.
- Sections 4, 5, and 9 report outcomes for individuals of their participation in particular activities and in the network as a whole. These outcomes can be argued as deriving from the network's activities in two ways: directly, because individual respondents reported gains as stemming from their network participation, and indirectly, by examining relationships between the extent of participation and the degree of gain.
- Sections 6-8 report on several indicators of members' career status. These include members' perceptions of their own career progress and success, the relation between their professional and personal lives, and their workplace environment and climate—all typically used in organizational climate surveys, but here applied to diverse workplaces within the discipline of Earth science. These indicators do not directly reflect the impact of ESWN but speak to the career challenges that women geoscientists face and the ways in which these are gendered.
- Sections 10-12 offer evaluative observations and analysis of the network's operations: e-mail listserv and web site traffic, governance and member involvement, and challenges and opportunities for the future.

- Section 13 and the Appendix describe our study methods and the strengths and limitations thereof.

2. Characteristics of ESWN Members

ESWN members' demographic characteristics were largely stable from 2010 to 2013. Majorities of ESWN members have a Ph.D., work at Ph.D.-granting universities, work in the U.S., are white, married, between the ages of 31-40, and have college-educated parents. Roughly half live in dual-career households. Roughly half are graduate students or postdocs and half work as faculty or researchers. ESWN members represent a wide range of scientific disciplines, with atmospheric science most highly represented at approximately one third of members. Over 20% of members are international (work in countries outside of the U.S.).

Members identify a range of professional development needs for advancement in their careers. Needs common to all career groups include building more extensive networks in my field, and developing a long-term career plan or goals. Other needs were more strongly identified by certain groups; for example, faculty were much more likely to identify needs for skills in time management and management of people and budgets, while graduate students identified needs for oral and written communication skills and deeper knowledge in their discipline.

3. Activities and Participation

ESWN has about 1500 members, based on web center registration as of September 2013. This is a ~70% increase since September 2009. Discussion forums and groups on the web center are the main vehicles by which members interact. ESWN has also sponsored face-to-face events, including intensive workshops of 2.5 days in length, mini-workshops of 1-3 hours, town halls and receptions at major meetings. In 2011-2013, three NSF-funded intensive workshops reached 50-60 members each; an additional intensive workshop was held in Norway by the ESWN European board. A dozen mini-workshops have been held at meetings of the American Geophysical Union (AGU), European Geophysical Union (EGU), and Geological Society of America (GSA). ESWN-sponsored receptions and member-initiated informal gatherings have been organized at many scientific meetings across disciplines.

ESWN has partnered with AGU to cosponsor meeting activities for several years; AGU also hosts the ESWN web center under a 2012 memorandum of understanding. ESWN has also made some organizational connections with the Association for Women in Science (AWIS) and Association of Women Geoscientists (AWG).

4. Outcomes of Intensive Workshops

ESWN created three workshops designed to meet the professional development needs identified in the 2010 member survey. In 2011, 48 women participated in a workshop entitled "Developing Your Research Identity." In 2012, 60 women participated in a workshop on "Skills for Networking and Communication." In 2013, 68 women participated in a workshop entitled "Building Leadership and Management Skills for Success." Each 2.5-day workshop was professionally facilitated by two outside facilitators.

Surveys were used to evaluate the effectiveness of these intensive workshops. On both pre- and post-workshop surveys, members evaluated their level of accomplishment in several domains of career development. Analysis of the mean pre/post differences on these items revealed the largest improvements on items most closely related to the content of the workshops, while

survey items on areas that were not emphasized in the workshops showed little or no change. This suggests that the survey items are sensitive to workshop content and support the validity of the results. On the post-workshop survey, members also rated their level of perceived gain on potential workshop outcomes. We deliberately re-used many of the gains items asked on the 2010 member survey, so that we could compare workshop and general network outcomes.

Analysis of mean pre/post changes for participants in all three workshops shows that members reported high growth in areas of career development that were targeted by the workshop presenters. For the 2011 workshop on research identity, these areas of greatest improvement centered on goal clarity, motivation and preparedness to pursue one's goals, and career planning. For the 2012 workshop on networking, the high-growth areas focused on analyzing one's career needs and opportunities and making use of professional networks to meet these career needs. For the 2013 workshop on leadership and management, the greatest improvements were in supervisory communication skills. Areas of low growth are useful in showing that members were rating their accomplishment in a personally meaningful and overall discriminating way: that is, they did not report blanket levels of high achievement, but discriminated among domains where they perceived greater or lesser growth. These items thus help to validate reports of higher growth in other domains.

The means for common gains-related items administered on post-workshop surveys for all three workshops show a similar pattern to the pre/post changes in career accomplishment. Although the gains items appear to be somewhat less sensitive to workshop content than the pre/post items, there are striking, content-specific differences on a few items. For example, high gains in 'confidence in building professional relationships' and 'expansion of your professional network' relate to the workshop content in 2012. Overall, the gains reported from face-to-face workshops are notably higher than those for general network participation. This reflects the lower impact of electronic vs. face-to-face learning, the supportive collegial atmosphere of workshops, and the fact that workshops are accessible to only a subset of members.

Across all three workshops, participants reported the following features as important:

- Openness and approachability of both presenters and participants
- Warm, friendly, and empowering atmosphere
- Opportunities to network and develop a community, and to make new friends
- Talking to other women who are going through or have gone through similar experiences, since fellow participants represented a variety of career stages
- Workshop content presented as specific to women
- The effectiveness of the facilitators and activities.

5. Outcomes of General Network Participation

Several items on the 2010 and 2013 member surveys probed ESWN members' gains from participating in the network. The areas of greatest gain are in knowledge and understanding, as members share information, ideas, resources and perspectives. Sharing one's own ideas and learning about other women's experiences, concerns or challenges provide emotional support and a sense that one is not alone. Gains in career confidence and career preparedness are of more moderate extent. While network-based information, resources and emotional support can help bolster feelings of confidence and preparedness, these are influenced by many other sources and are more slowly developed. Specific kinds of skills are the least easily developed through network participation.

The general stability of gains from 2010 to 2013 suggests that these items hold some validity as measures of individuals' gains. It also suggests that the network steadily provides individuals with certain types of gains that are plausible as outcomes from a virtual network. The network was already well established in 2010, therefore was already offering benefits to its members at the time of our initial survey.

Two lines of evidence may suggest some cumulative benefit from network participation over time. First, there were some statistically significant increases in the mean level of gains from 2010 to 2013. Members reported higher gains in 2013 for three items: recognition that they are not alone, new understanding of obstacles facing women in science, and emotional support in facing challenges.

Second, we tested for differences in gains by time for a subset of 100 individual members who could be matched as completing both the 2010 and 2013 surveys. Within this group, all gains items significantly increased from 2010 to 2013. We cannot determine how well these 100 individuals represent the larger network.

We asked members to provide details about their level of involvement and use of the online network, including activities such as posting to the listserv, reading and sharing posts, and taking action as a result of listserv content. Using these data we classified members into three levels of online participation—low, medium, and high—using a cluster analysis, which is described in greater detail in the Methods appendix to this report. If the online network is benefiting its members, we expect that as participation increases, so will the levels of reported gains; thus we can attribute these gains, at least in part, to the network's activities.

Additionally, we found that gains differed based on several other network participation indicators: participation in at least one in-person ESWN activity, participation in an intensive career workshop, and membership duration. We defined an in-person participant as someone who participated in one or more of ESWN's in-person activities, including:

- Intensive career workshop
- Short workshop or info session at a meeting
- Reception at a meeting
- Informal meeting or get-together

In-person participants include all workshop participants, but because the intensive workshop experiences are vastly different than other, short-duration face-to-face activities, we elected to analyze workshop participants separately as well.

Members' level of participation in the online network was linked to the largest differences in gains. Across all gains items, high-participating respondents reported significantly higher gains than low- and medium-participating respondents. Additionally, medium participators reported significantly higher gains than low-participating respondents on all gains items.

Gains also differed by in-person participation, workshop participation, and membership duration. Members who participated in any in-person (face to face) activity reported higher gains than those who did not. Similarly, members who attended in one of the intensive workshops reported significantly higher gains than those who did not participate. These results suggest that in-person activities (especially workshops) are more effective in producing gains than participation in the electronic network alone. Moreover, the longer someone had been a member of ESWN, the higher were their reported gains. This makes sense given that many of the gains we

measured may take years to develop, and given that longtime members have had more opportunities (and perhaps encouragement) to participate in the full range of ESWN activities.

Sources of gains

The online network is rated as the most helpful aspect. It is the one activity that all members share and the most important activity for a majority of members.

Only a fraction of members have access to the face-to-face activities, and thus the mean ratings for these are lower, even though they lead to greater gains for those who do participate. For example, a third of respondents who answered gains questions did not participate in in-person activities and thus rated these activities as “no help,” lowering the mean ratings. High-participating members appear to be more active and make more gains from both electronic and face-to-face participation. The greatest increases from 2010 to 2013 are in gains from intensive and mini workshops, both of which were offered more frequently under the grant than previously.

Sense of community

ESWN members agreed that ESWN provided a sense of community. As participation in the network increased, so did sense of community. Similarly, ESWN members who participated in in-person activities and workshops had higher levels of sense of community than those who did not participate. Sense of community appears to develop over time; as membership duration increases, so do levels of sense of community.

Collaborations

Because fostering collaborations was an explicit goal of the network, we probed specific gains related to scientific collaboration: initial steps such as learning about another field and meeting people with mutual interests, and more concrete progress toward developing collaborations with others whom members may meet through the network.

Overall, collaboration activity was steady from 2010 to 2013. We found that collaborations differed by several participation indicators: participation level, in-person participation, and workshop participation. Collaborations were generally a function of participation level: high participants reported higher gains in collaborations, as did members who participated in in-person ESWN activities and workshops. Initiating collaborations showed little to no difference based on career stage.

6. Perceptions of Career Success

We probed several indicators of career success for ESWN members, including career satisfaction, productivity, and professional development. These indicators are complex and influenced by many factors, thus they do not measure direct outcomes of network participation, but they are important factors in determining the status of women in the geosciences. Most of these indicators are drawn from validated surveys of workplace climate at single institutions: here we apply them to the status of women in a discipline.

Career satisfaction

We asked members to report their satisfaction with their career. We found that career progress satisfaction did not differ substantially by survey year, participation level, or career stage. However, this indicator differed by organization type and career change status. Members who

worked at NGOs or at government labs or agencies were less satisfied with their career progress than members who worked in for-profit organizations or in colleges and universities.

Professional development satisfaction

We asked members to report their level of satisfaction with several dimensions of their own professional development. We found differences in this indicator by survey year, career stage, and career change status. From 2010 to 2013 members were less satisfied with their salary in comparison to colleagues and the level of funding for their work; this may reflect the economic downturn and tight federal funding climate for science. Faculty were more satisfied with their sense of being valued as a teacher or a mentor than were members in other career stages, but they were less satisfied with the level of funding for their work than postdocs or graduate students.

Productivity

We asked members to report the most important indicators of productivity in their area of research. We found minimal differences in the nature of indicators of research productivity between 2010 and 2013. Productivity indicators showed no meaningful differences on any of the top five indicators by any participation, professional, or personal variable. Journal articles, number and dollar amount of grants awarded, and professional presentations were the top four indicators of productivity that members said were valued in their fields.

We also measured members' perceptions of their own productivity in comparison to colleagues in their work unit and in comparison to others in their field nationwide. We found no differences in perceived levels of productivity from 2010 to 2013. Members who reported high participation in the network perceived themselves to be more productive than members with medium and low levels of network participation. Members in faculty and research positions reported being more productive than postdocs and graduate students. Members who worked at government agencies and labs indicated the highest levels of productivity within their work unit and nationally, followed by members at Ph.D.-granting universities and for-profit organizations. Members who worked at NGOs and four-year colleges reported the lowest levels of productivity in their work unit and nationally. Members who reported obtaining a higher position while a member of the network reported higher levels of productivity (within their work unit and nationally) compared to members who had no career change or had a lateral change (i.e., same or similar position and a different organization).

7. Perceptions of Work/Life

Both out of biological necessity and from cultural norms, women tend to carry a larger portion of household and parenting duties in families, a pattern which holds true for women academics and scientists as well as for working women more generally. To explore these issues for women in geoscience, we probed members' household and parenting status and their perceptions of work/life issues in relation to their careers. These are general indicators of issues that ESWN members face, not measures of outcomes due to members' participation in the network.

Overall, the results show that, on average, members were fairly neutral about work/life satisfaction; they did not express strong satisfaction or dissatisfaction with their work/life balance. Mean ratings were neutral on statements about working long hours as a sign of commitment, and personal responsibilities having slowed their career progression. On average, members generally disagreed that they have had to forego professional activities because of

personal responsibilities and disagreed that they had considered leaving their job to improve work/life balance.

There were no meaningful differences from 2010 to 2013 in work/life perceptions, thus revealing a core set of work/life issues that consistently face women geoscientists. However, work/life perceptions differed by career stage, organization type, marital or partnered status, caretaking responsibility status, and parenting responsibility. Members who held research positions were the most satisfied with their work/life balance, while faculty were the least satisfied. Graduate students and postdocs reported their career progress and professional activities to be less negatively affected by personal responsibilities than did members who were more advanced in their careers (faculty and research positions). Graduate students perceived that working long hours was an important sign of commitment in their workplace to a greater degree than did those in all other career stages, while members in research positions reported that working long hours was important to a lesser degree than did others.

Members who work for for-profit organizations were more satisfied with their work/life balance and were less likely to have considered leaving their jobs to improve work/life balance, compared to members from all other organization types. Members who work at four-year colleges more strongly agreed that working long hours was an important sign of commitment than did members from all other organization types, but also less often reported that personal responsibilities slowed their career progress and caused them to forego professional activities.

Married or partnered members perceived that personal responsibilities slowed their career progress and interfered with their professional activities to a greater degree than did single members. Similarly, members with caretaking responsibilities agreed that their career progress was slowed and that they could not participate in professional activities because of personal responsibilities, while members who did not have such responsibilities generally disagreed that personal commitments interfered with their career progress or participation in professional activities. Of the members with child caretaking responsibilities, those who handled more or most of the parenting responsibility in their household reported more personal life spillover and less satisfaction with their work-life balance compared to those who handled equal or less parenting responsibilities in their household.

Finally, members' perceptions of work/life also differed by age: members aged 21 to 30 perceived that personal responsibilities slowed their careers and caused them to forego professional activities to a much lesser degree than did those from all other age groups.

8. Perceptions of Workplace

Members reported on several indicators of the quality and nature of their workplace, including job satisfaction, workplace influence and interactions, gender equality and sexual harassment. Comparison with data from non-members on the ES_JOBS list provides evidence that women's work/life situation, satisfaction, and workplace perceptions differ from those of men.

Job satisfaction

In the aggregate, members were satisfied with their current jobs. There were no meaningful differences in job satisfaction by network participation level or career stage. Job satisfaction did differ by organization type and career change status. Job satisfaction was considerably lower for those who worked at an NGO compared to those from all other organization types. However, this

result may not be generalizable to all women working in NGOs in the Earth sciences as only 48 respondents (4% of the sample) worked for this organization type.

Influence in the workplace

We asked members to report their level of influence in their workplace. In the aggregate, members were generally neutral on their level of influence in their workplace in all but one item. Members generally agreed that meetings in their workplace allowed all participants to share their views. There were no differences in perceived levels of influence from 2010 to 2013, but there were several differences by career stage and career change status. Members in more advanced career stages (faculty and research) reported higher levels of influence than members in earlier stages of their careers (graduate students and postdocs).

Workplace interactions

We asked members about their interactions in their work unit, which are reflective of respondents' perceptions of their workplace climate. In the aggregate, members had positive impressions of the workplace interactions we measured. Interestingly, members' perceptions of interaction items that were negatively worded were generally neutral, while the positively worded items were reported more favorably. From 2010 to 2013 there were no significant differences in members' perceptions of their workplaces.

Perceptions of workplace interactions were shown to differ by career stage, however most differences were minimal. Members in faculty positions felt more isolated, and reported doing more work that is not recognized and having to work harder than colleagues than did members in other career stages. Postdocs reported most interactions more favorably than did members in other career stages. Interactions also differed by career change status. Additionally, perceptions of workplace interactions differed by members' age. Older members perceived several workplace interactions less favorably than younger members, including having to do work that is not formally recognized, working harder than colleagues, encountering unwritten rules, and retribution for bringing up issues about colleagues.

Gender equality

Members were asked to report their perceptions of gender equality and discrimination in their workplace. Generally, members reported favorable impressions of gender equality and low levels of sexual discrimination. Perception of gender equality and discrimination were nearly identical from 2010 to 2013.

Perceptions of gender equality and discrimination differed minimally by career stage and child caretaking status, but differed substantially by members' age. Generally, younger members perceived their workplace more favorably, while older members reported less favorable workplace conditions in relation to gender equality and discrimination.

Unwanted sexual attention

Sexual harassment is a barrier to career success that can impede women's workplace productivity and satisfaction. As a measure of harassment, we asked members to report whether they had experienced unwanted sexual attention in their entire career and in the last two years. Separate items probed harassment in their current workplace.

Overall, a sizable fraction of women reported experiencing unwanted sexual attention: 10% in the past two years, and nearly half over the length of their career. From 2010 to 2013 a slightly

smaller percentage of respondents reported unwanted sexual attention in the last two years and in their careers. We found that reports of unwanted sexual attention differed by career stage and age, which are highly correlated. Generally, members who are younger and earlier in their careers reported more instances of unwanted sexual attention within the last two years but less unwanted sexual attention in their entire careers, than did members who are older and further along in their careers. These results indicate that unwanted sexual attention occurs more often earlier in members' careers than later. However, the career-long data show that this is a persistent problem for women in the geosciences.

Additionally, we asked members to report the prevalence of unwanted sexual attention in their current workplace. In the aggregate, approximately 90% of members reported instances of unwanted sexual attention to be rare or not at all prevalent, while roughly 10% reported occasional to frequent unwanted sexual attention. Prevalence of unwanted sexual attention was slightly higher from 2010 to 2013.

Unwanted sexual attention in the workplace differed by career stage, although the differences were minimal. Postdocs reported less unwanted sexual attention than women in other career stages. Unwanted sexual attention also differed by members' age. Members aged 51-60 reported less frequent unwanted sexual attention in their current workplace; this may be related to older women's reports of greater career-long incidence of sexual harassment, as these women may have worked in the same workplace for longer times than have younger women.

9. The Nature and Development of Gains: Findings from Qualitative Data

In the 2013 member survey, we asked several open-ended questions of ESWN members regarding how their involvement in the network has influenced their career change or career decision-making (if any), how their participation in ESWN has positively or negatively influenced their career, and how ESWN has facilitated collaborations. Approximately 28% (n=213) of respondents of the 2013 members survey provided at least one text response. These respondents were fairly representative of the entire 2013 sample in terms of their level of participation in the online network.

Qualitative comments offered by a large subset of respondents offer corroboration of gains reported on numerical items and describe the processes by which members extract benefit from the online network and the informal face-to-face activities that members arrange. Benefits appear to arise in a progression from less to more powerful and from awareness and knowledge, exploration of multiple perspectives, to affective benefits including confidence and motivation to take personal action.

10. Nature of Online Activity

The online interactions made possible by the listserv and now the web center are the connective tissue of the network. Taking part in face-to-face activities often spurs greater participation in the electronic community, and in turn the online tools are used to organize informal face-to-face activities such as get-togethers at conferences. Therefore we analyzed listserv and web center traffic for some key indicators.

First we analyzed the ESWN listserv archives for the PAID grant period (2009-13) to determine the topics raised. For each month, we identified the single thread topic (with at least 3 posts) that generated the most discussion, then classified these threads into four categories:

- General career topic: these topics were related to career development, but were not gender specific; e.g. funding opportunities, job opportunities, books and resource advice.
- Woman-specific career topics: career topics specific to women such as discrimination, underrepresentation of women, name changing as a result of marriage.
- Maternity or childcare topics: breast feeding, maternity leave, childcare, etc.
- No major topic: some months did not have any thread that generated over two responses.

Over the grant period, woman-specific career thread topics dominated more months (32.5%) than any other category. Overall online traffic is roughly evenly split between general professional topics and gendered topics.

Analysis of the number of listserv posts, authors, and original threads per month during the current grant period (9/09-05/13) reveals that the listserv experienced increases in posts, authors, and original threads over this period. There is some evidence for boosts in all activity measures in the months following workshops.

11. Governance and Operations

In this section of the main report we offer some observations of how the board works, its decision-making processes, and member involvement.

Governance

The board has a participatory, consensus-based governance structure that appears to be well suited to ESWN's current, flat organization. Consensus-based decision-making can be cumbersome at times but yields a sense of joint mission and high willingness to contribute as new tasks arise. The most difficult area of governance was managing priorities for the grant-funded staff position. This is a structural issue that can be addressed by making clear processes such as how new work will be assigned and with what priority. During the grant period, the board took steps toward a governance model that extends beyond the original founding members. In the future, the board may require internal structures and processes for bringing ideas forward and making decisions.

Member engagement

ESWN members are a vast resource of enthusiasm and ideas. The new web center offers significant opportunities for members to initiate topics and share career-related resources in a manner that is less ephemeral than listserv threads. In addition to the general discussion forum, public and private groups can be initiated that have more limited, interest-based membership and their own discussion forums. Both explicit messaging and modeling by active contributors will continue to be important in encouraging members to participate and take leadership roles, and in setting norms for respectful communication that recognizes members' diverse perspectives.

Members are already involved in organizing informal, local or conference-based, face-to-face activities; this type of activity has the potential to further expand. We see additional potential for members to assist with network-level activities such as organizing formal events and producing the newsletter. Members see taking a leadership role in ESWN as professionally beneficial, both for learning new skills and in holding a visible, professional leadership role.

12. Sustainability: Opportunities and Challenges for the Future

As the ESWN leadership group considers its future, several questions arise. Some were raised by board or network members in the 2009-10 interviews and focus groups, and they remain pertinent today. These issues and the decisions made about them will continue to shape the organization's path as it moves forward. The full report details these questions, which address three key areas: identity and audience; network activities; and governance and organization.

13. Strengths and Limitations

This section of the full report details strengths and limitations of our study methods, especially the survey methods on which most of the findings rely. Strengths of the member surveys include reliability and validity of items, appropriateness of self-report for most measures, and triangulation of results through multiple study methods. The main limitation was a lack of knowledge about the size of the population and characteristics that would let us make statements about the generalizability from the sample to the population. Strengths of the workshop surveys are similar, plus the ability to match individuals' pre- and post-workshop responses to a high degree. The main limitation was that we could not follow up to measure outcomes on a longer time span. An Appendix provides more detail about our study methods.

14. Acknowledgments

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