

**Mechanisms to Increase Recruitment and Retention
of Women and Under-represented Groups in Ecology**

**Report from the Strategic Planning Workshop
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EXECUTIVE SUMMARY

The members of the Ecological Society of America (ESA), like many professional scientific organizations in the United States of America is disproportionately composed of white males -- both women and members of many ethnic groups common in the United States population are under-represented in the Society. ESA has the following vision: to achieve a population of ecologists that reflects the gender and cultural diversity of the general population of the United States of America. This report presents a set of activities to implement this vision; activities range from immediate action with no cost to ESA to long-term activities with significant costs. The ESA is taking a unique approach to improving the recruitment and retention of under-represented groups in ecology by recognizing that the solution includes changing the image of ecology and how it is taught at all levels of the educational system. Thus this report presents as integrated strategy for educational reform and increased representation of women and under-represented ethnic groups in ecology.

To address this issue ESA must take a proactive stance, both as a Society and as individuals, to promote a diversity of colleagues and cultures in ecology. The proposed activities address recruitment and retention of women and other under-represented groups at many levels: the general public, pre-college education, undergraduate education, the profession of ecology, and ESA as an organization. Recommendations include:

- changes in ESA policy and structure
 - new ESA staff
 - ESA committee restructuring
 - broaden ESA journal scope
- education and information for the general public and students of all ages
 - brochures on ecologists
 - videos and other support materials for recruitment and retention programs
- efforts to improve pre-college ecology education
 - collaboration in reform efforts
 - K-12 Ecology Education program
- recruitment and retention efforts at the undergraduate level
 - database and publication of research opportunities
 - mentoring and internship programs
 - Careers in Ecology presentations
 - comprehensive program to improve introductory ecology instruction
- discussions and workshops on the profession of ecology.

This report is only the first step towards changing the face of ecology. The next step needs to include the prioritization of proposed activities and the development of a more detailed implementation strategy. A structured evaluation mechanism for each activity needs to be developed to determine success, provide information for improvement and expansion, and provide feedback to funding institutions.

I. INTRODUCTION

The publication of *Profiles of Ecologists: Results of a Survey of the Membership of the Ecological Society of America* (Holland et al. 1992) documented that the membership of the Ecological Society of America (ESA), like many professional scientific organizations in the United States of America (USA), is disproportionately composed of white males -- both women and members of the many ethnic groups common in the United States are under-represented in every age and professional category measured in the survey (see Appendix A for details). Two of the major issues identified were: 1) women are more likely than men to leave the field of ecology than are men, and 2) ethnic minorities are not recruited into the profession in any appreciable numbers. This matter is of great concern to the Society. As a result, the Executive Committee of the Society commissioned a Strategic Planning Workshop to provide guidance in fostering increased recruitment, retention, and recognition of women and minorities in ecology. The schedule of the workshop along with a summary of presentations can be found in Appendix B. This report is the result of that Workshop and subsequent critique and revision by numerous ESA members, ESA committees, and the ESA Executive Committee.

The workshop participants (see Appendix D for listing) wished to address issues for under-represented groups on a broader basis than simply recruitment and retention. First, we felt that the patterns of membership in the Ecological Society were largely based on patterns of discrimination in the United States society as a whole. Thus, our recommendations reach beyond simply changing the profile of membership in the ESA -- we wish to change the patterns of representation in all groups of people practicing ecology. Second, it was apparent from our discussions as well as from the data presented in *Profiles* that both pre-college and undergraduate education play very important roles in determining attitudes towards ecology, science, and career choice, especially among young women and members of various ethnic groups. Thus, our recommendations also address the need to change the way we teach ecology -- we cannot hope to broaden participation in ecology if we cannot inspire interest and enthusiasm for ecology.

OUR VISION: To achieve a population of ecologists that reflects the gender and cultural diversity of the general population in the United States of America. In order to move towards this goal we must:

- Create a scientific environment that embraces diversity and allows all professionals to flourish regardless of gender, racial, or cultural background.
- Reduce or remove barriers to entry and advancement in the profession.
- Strive to assure that the teaching and research agendas in ecology address the relevance of ecological knowledge to our diverse society.
- Promote and encourage increased participation of all members of society in the application of ecological principles.

The ESA is taking a unique approach to improving the recruitment and retention of under-represented groups to ecology by recognizing that the solution includes changing the image of ecology and how it is taught at all levels of the educational system. Thus this report presents an integrated strategy for educational reform and increased representation of women and minorities in ecology. We recognize, however, that the needs of each of these areas often differ, and thus we will address those differences as appropriate. However, many previous attempts have focused on one or another of these areas and have met with an uneven success rate at best. We believe that our vision demands integration. To implement this vision we propose a set of activities ranging from immediate action with no cost to the Society to long-term and significant cost. In addition, such activities require an evaluation process to determine success, provide information for improvement and expansion, and provide feedback to funding institutions.

II. BACKGROUND AND RATIONALE

Several federal reports have indicated that the nature of the USA workforce is changing dramatically. Many project that by the year 2000, the proportion of women and traditional "minority" ethnic and racial groups will constitute a majority of new entrants into the workforce. Yet ESA's membership is only about 25% women and only 4.1% ethnic minorities (African Americans, Hispanics, Native Americans, and Asians/Pacific Islanders) (Holland et al. 1992, Morrin et al. 1993). At the same time, the world is facing unprecedented changes in the global environment. Ecologists can and should play an important role in addressing these issues. Thus, the demand for ecologists in the workforce is likely to increase at a greater rate than that for many other professions. If we are to meet these needs of the future we must change our methods of recruiting and retaining ecologists today.

The mechanisms by which we recruit and retain members of various groups often differ. Data on women, for example, indicate that girls are attracted to the natural sciences, and to ecology in particular. However, many drop out at certain vulnerable periods, especially during middle school, after the freshman year in college, and after completing their terminal degrees (National Science Foundation, 1989a,b, 1992; Primack and O'Leary, 1993). On the other hand, students from some ethnic minorities are often unaware of ecological issues, yet live in areas where environmental problems are especially pressing. Others, while attuned to the natural world, do not have access to quality training. In spite of these differences, there are a number of common issues that can strongly influence a person's choice to pursue a career in ecology. Some of these are specific to ecology, others are issues for science as a discipline, among these issues are:

- Lack of role models and mentoring
- Family commitments
- Need for increased aspirations, self-assurance, and assertiveness
- The evaluative criteria for hiring and promotion

- Lack of awareness or perceived irrelevance of the field
- Perception that environmental jobs do not pay close to the salaries of those in health sciences
- Sexual/racial discrimination.

A disproportionate share of the environmental problems facing the United States today are located in or near areas with large populations of ethnic minorities, especially African Americans, Asian Americans, Native Americans, and Hispanics. Despite a long history of neglect, there is now a rapidly increasing awareness, both within these communities and among ecologists, of the magnitude of the problems in the affected communities. Coupled with this increased environmental awareness, often referred to as the "environmental equity" or "environmental justice" movement, is an explicit recognition that many of the ecological problems are often inextricably linked to social and economic problems of minority communities. As a result, a number of "grassroot" organizations are starting to work on environmental problems -- and at the same time are addressing larger questions of social justice. Since most environmental problems require a solid understanding of ecological principles, these groups should be bringing ecology, both as a science and as a career goal, to the community.

Ethnic minorities are under-represented in the ESA (Holland et al. 1992; Lawrence et al. 1993a; Morrin et al. 1993). This disparity, as well as the conviction that ecologists must play an important role in addressing environmental issues, argue strongly for a special effort by ESA to develop specific recruitment and retention strategies for these communities. By acting on our conviction that the social, political, and ecological problems facing these communities are linked (Lubchenco et al. 1991), we will not only solve extremely important environmental problems, but we will enhance the image of ecology as an important professional opportunity for young people in minority communities.

Science education frequently discourages interest in science, especially among people who are currently under-represented in science and math. As a result, unacceptably high proportions of young women and minorities either never develop an interest or abandon their interest in those fields. Scientists and educators around the nation involved in the current science education reform movement understand this phenomenon well and are developing strategies that nurture and promote student interest in, involvement with, and commitment to science. Traditional classroom practices that emphasize lecture and textbook learning in the sciences tend to select for only one type of learner. Unfortunately, this does not include a large proportion of those groups now under-represented in the sciences (Mechling and Oliver 1983). Broadening the repertoire of techniques will have far-reaching effects on engaging students with a diversity of backgrounds, levels of preparation and learning styles (Beane 1985). Such techniques include:

- Hands-on learning through studying real organisms and environments. Mechling and Oliver (1983) found that hands-on science programs were more effective at stimulating interest and success in science among disadvantaged

students than were traditional textbook methods

- Learner-centered methods, where individual students' learning styles and interests help shape the learning environment
- Study of phenomena, objects, and problems of immediate interest and relevance, including the environments where students live (even if they are highly urbanized or managed)
- Emphasis on a broader context to learning, including the social nature of the scientific enterprise
- Learning through reflection and self-awareness
- Creative approaches to assessment, where student growth is measured in many dimensions beside simple factual recall, and where a variety of techniques are used.

ESA cannot reform science education alone, but rather would benefit from collaboration with the most vital organizations now engaged in the broader movement for science education reform. We recommend actions along two broad fronts. First, we propose ways to expand the scope of ecology education at both the pre-college and undergraduate level to emphasize the environments encountered by students in their everyday lives. Second, we suggest changes in undergraduate programs, with particular emphasis for our long-term efforts on courses where students first encounter ecological principles. Each recommendation addresses one of the key issues limiting the recruitment and retention of women and other under-represented groups – the overly narrow approach to teaching which limits diversity, and the apparent lack of relevance of ecology to many people's everyday lives. Furthermore, we believe that diversifying the way we teach introductory ecology to undergraduates will have far-reaching effects on ecology teaching at the pre-college level, since most teachers are strongly influenced by the way they learned a subject in college. Since more ESA members are engaged in undergraduate teaching than in any other form of education, this is the most powerful way we can have broad impact on how ecology is taught in schools nationwide.

III. PROGRAMS TO INCREASE RECRUITMENT AND RETENTION OF WOMEN AND OTHER UNDER-REPRESENTED GROUPS IN ECOLOGY

We recommend programs (see Table 1) that address these issues at many levels: A. the general public, B. pre-college ecology education, C. undergraduate education, D. the profession of ecology, and E. ESA as an organization. It will only be through multifaceted efforts on each front that significant and sustained change can be brought about. These levels form the framework of the rest of the document. The general goals for efforts at each level are presented in a brief introduction, followed by specific recommendations including a brief description and details for implementation. Some activities can be implemented at different levels of support. Within each section the recommendations are listed in order from short-term and quick-start efforts to long-term, comprehensive projects requiring substantial inputs of time, resources and creativity.

Table 1: Recommendations from Workshop

ESA Policy and Structure	
ESA Committees ^a E.1, p. 25	ESA policy to increase participation by women and members of under-represented groups in Society activities.
Child Care ^a E.2, p. 25	Child care facility information provided for Annual Meetings and other Society functions
Women- and Minority-Owned Businesses ^a E.3, p. 26	ESA should maximize its efforts to include these businesses in any competition for contracts.
Journal Scope ^a E.4, p. 26	Scope of <i>Ecological Applications</i> broadened to include methods of teaching, recruitment, mentoring, and retention issues.
Database Services ^b E.5, p. 27	1) Expansion of Ecological Information Network to provide lists of women and members of under-represented groups as potential speakers and mentors 2) Directory of prospective and recent degree recipients.
New Office Staff E.6.a, p. 28	Addition of an ESA Coordinator for Education and Human Resources as staff in the Washington, DC office.
Education and Human Resources Committee ^a E.6.b, p. 29	Formation of a standing ESA Education and Human Resources Committee, with education, minority, and women's subcommittees.
Endorsement Policy ^a E.6.c, p. 30	Development of guidelines for ESA endorsement of proposals relating to education and affirmative action activities.
Local Chapters ^a E.6.d, p. 31	Encouragement and assistance for formation of local chapters where members are interested.

Programs	
Focus on Ecologists Brochures ^b A.1, p. 9	A series of brochures profiling ecologists including those who are women and/or members of under-represented groups.
Support Materials ^b A.2, p. 9	Production of brochures, videos, and other support materials for recruitment and retention programs.
Women in Science Conferences ^b A.3, p. 10	Series of conferences aimed at high school and undergraduate women to provide information on careers in ecology and contact with women scientists.
New ESA Awards ^b A.4, p. 11	Additional ESA awards to recognize excellence in: 1) teaching at the pre-college level; 2) teaching at the college level; 3) mentoring.
Pre-college Education Reform Efforts ^c B.1, p. 12	ESA participation in ongoing efforts to reform pre-college science education to promote the inclusion of ecology and effective and accurate teaching of the subject.
K-12 Ecology Education ^c B.2, p. 12	ESA collaboration in efforts to create programs to assist teachers and their students to explore ecology.
Clearinghouse ^b C.1, p. 15	Centralized database and announcements of research opportunities for students.
Mentoring & Internships ^b C.2, p. 15	Facilitate members involvement in and develop programs that facilitate relationships between students and young ecologists, women and under-represented groups, and more senior ecologists.
Student Participation Program ^b C.3, p. 17	Program designed to bring undergraduate and graduate students from under-represented groups to the Annual Meeting and involve them in all aspects of the meeting.
Careers in Ecology Workshops ^b C.4, p. 19	Programs to facilitate interaction between professional ecologists and undergraduates and their faculty at colleges, aimed at women and under-represented groups, to discuss careers in ecology.
Community Involvement Programs ^b C.5, p. 20	Programs to bring ecologists in contact with grassroots community groups, especially in areas with high numbers of students from under-represented groups.
Introductory Ecology Instruction ^c C.6, p. 21	Long-term project for improvement of ecology teaching at introductory undergraduate level.

Career Advancement Workshops/Discussions^b D.1, p. 23	Workshop(s) and discussions at Annual Meeting to promote career advancement and/or discuss opportunities for personal and professional development.
University Administrator Workshops^b D.2, p. 24	ESA involvement in on-going programs regarding women and ethnic minority recruitment and retention workshops for university administrators.

^a immediate action possible, no-cost involved

^b cost involved, staff needed

^c long-term educational issues

A. THE GENERAL PUBLIC AND STUDENTS OF ALL AGES

ESA has a unique role to play in helping all students and the general public understand the importance of ecology, the exciting and rewarding nature of work in the field and the pathways for pursuing ecology careers. Such efforts must provide role models for women and minorities and embrace a diversity of topics and approaches to assure that diverse interests and modes of thought are respected and valued.

A.1. "Focus on Ecologists" brochures

The Society will prepare a series of one-page brochures profiling ten ecologists, including those who are women and/or members of under-represented ethnic groups. A brochure will be produced annually and will be organized around a particular theme. In some cases this theme may be simply gender or ethnicity. In other cases, however, the theme should profile ecologists who are helping to solve important environmental and social problems at a national level or in a local community. Potential examples of the latter might include: the uranium mining issue in the southwestern United States, the location of incinerators in Washington, DC, or the placement of landfills in areas with high minority populations.

These brochures can be mailed with ESA's Careers in Ecology and AIBS or RNRFF brochures, reprinted in the *ESA Bulletin*, provided to Chapters (see E.6.d), and distributed at educational society meetings, science fairs, etc. The purpose of these brochures is two-fold: 1) to increase the visibility of women and minorities in our Society and thus to help them advance in their careers, and 2) to provide a continuing series of diverse role models of vital and productive ecologists for those students considering a career in ecology. The members profiled should include a balance of early- and mid-career ecologists representing a variety of disciplines, geographic locations, workplaces, and personal/familial situations.

Implementation: The Women and Minorities Committee (see E.6.b) should identify a member willing to organize the preparation of the first edition. Subsequent editions will be prepared by the Education and Human Resources (EHR) office staff (see E.6.a and Appendix C).

Costs: \$3,000 for printing and distribution of the first edition; 0.05 FTE for preparation of the subsequent editions.

Calendar: Target the 1994-1995 academic year for the first edition.

A.2. Support materials for ESA recruitment and retention programs

Materials will be developed throughout the five years of the other recruitment and retention activities described in this report. They should be made available to environmentally-oriented community groups that are located in areas with high minority populations (groups geared to all age groups). Brochures and videos should be advertised to libraries in all universities (starting with those community colleges and universities located in areas with high numbers of ethnic minorities), as well as in

professional newsletters of science educator organizations, and of any organization with an environmental interest. These materials should also be used to describe the role and function of ESA to agencies that fund student recruitment and retention strategies.

a. A video program, targeted to under-represented ethnic groups, that shows how **ecologists are helping to solve locally important social problems**, e.g., profiles on minority ecologists working on solutions to applied environmental problems. This is an expansion of and complement to the "Focus on Ecologists" brochures and thus could include such topics as the uranium mining issue in the southwest U.S., the location of incinerators in Washington, DC, the burial of toxic wastes, and the placement of landfills in areas with high minority populations.

b. Materials that show the **step-wise procedure to become an ecologist**. A video and brochure will be developed to recruit and guide prospective ecologists as to pre-college science and math preparation, diverse college curriculum, field, laboratory, and computer skills needed. Practicing ecologists featured in the video should reflect the diversity of people involved in the study of ecology. The target audience for this program is pre-college students and their parents.

c. Materials that show **how to get a job**, professional opportunities, and average salaries for each level of educational training in ecology and how to choose a graduate school in ecology. The target audience for this program is college-level students and is designed to complement the Careers in Ecology brochure.

Costs: The development of outreach materials can be funded by private industries, foundations, and government agencies. Possible funding agencies for these initiatives include: USDA Forest Service, U.S. Fish and Wildlife Service, the National Park Service, the Department of Energy, the National Science Foundation, and various private foundations and environmentally oriented industries. Proposals should include the costs of salaries and wages (1.5 FTE), and office overhead expenses for the personnel involved in the development and dissemination of the materials, as well as for the direct costs associated with the production of the materials.

A.3. Women in Science conferences

The Society will co-sponsor, with the Department of Energy Laboratory at Oak Ridge (ORNL) and the Association for Women in Science (AWIS), a series of Women in Science conferences aimed at high school and undergraduate women, including members of under-represented groups. These conferences will increase the visibility and stature of women in the Society and will provide information and contact with active scientists for young women who are considering careers in ecology, environmental sciences, and education.

Implementation: Carolyn Hunsaker (DOE/ORNL), Marjorie Holland (formerly with ESA/PAO, now with EPA/EMAP), and Catherine Didion (AWIS) have submitted a proposal based on an ongoing Women in Science conference sponsored by ORNL and ORISE with volunteer help.

Cost: Proposal was submitted by ORNL to the Department of Energy's Office of Science Education and University Programs. Support for ESA's participation in this activity would come from outside funding. Estimated total cost per workshop is \$20,000–\$30,000.

Calendar: The proposal requests FY 94 funding for two conferences in calendar year 1994 (one in the Knoxville, TN, area and one in Washington, DC) and FY 95 funding for two conferences in calendar year 1995.

A.4. New ESA awards

The Society will expand the awards structure to include three new awards designed to recognize excellence in:

- teaching at the pre-college level
- teaching at the college level
- mentoring of women and/or members of under-represented groups.

The awards will be presented annually and named after people whose lives reflect the ability to achieve her/his goals in spite of social or physical obstacles. The establishment of these awards will clearly demonstrate the value the Society places on excellent teaching and mentoring. Awardees should receive a plaque, recognition in the *Bulletin*, and travel expenses to the annual meeting at which the award is presented. Awards could be presented at ESA's Annual Meeting or in conjunction with a science education society meeting.

Implementation: The Executive Committee will appoint an *ad hoc* committee to name and set the criteria for each of the awards, and identify potential sources of funds to support the awards. The EHR Coordinator will oversee advertising and the solicitation of nominees for consideration by the appropriate subcommittee of the Awards Committee. Determination of awardees will be made by Awards Committee.

Cost: \$2,000 per year per award. The ESA EHR Coordinator, in cooperation with the Awards Committee, will seek outside funding to support these awards (preferably as an endowment).

B. PRE-COLLEGE ECOLOGY EDUCATION

Ecology education must be relevant to all students. To do this, it must focus on the scientific understanding of the student's local environment and the ecological context of her or his self. Such teaching and learning is necessarily outdoors and community- or ecosystem-oriented. Humans should be included explicitly as components and their interchanges with the other parts of ecological systems duly noted and investigated. Students should be given the opportunity to discover, investigate and create meaning or to "construct" concepts from their own experiences as opposed to simply being told information and concepts by a teacher or textbook. In addition, students need to be aware of career options and opportunities in ecology at an early age, and benefit greatly from role models.

The goals of our pre-college education initiatives are:

1. To assure that all students in all grades have access to information about ecology careers, role models, etc., and have opportunities to directly experience research practices that ecologists use.

2. To infuse ecology education into the K-12 curriculum to achieve these sub-goals: a) foster an understanding among students of their local environment, and b) enable students to view themselves as ecological units within that environment.

3. To form lasting collaborations with other science and science education organizations in the improvement of pre-college teaching in general and in developing and implementing programs to foster increased diversity in particular.

B.1. Collaboration in existing reform efforts

ESA should be an active participant in ongoing efforts to reform pre-college science education. The purpose of such involvement should include promoting the inclusion of ecology wherever possible; advocating innovative and effective approaches to teaching ecology; and insuring the accuracy and relevancy of what is taught. With reference to the specific aims of this report, these efforts should ensure that ecology is taught in ways that engage a broad diversity of personalities and learners, and that such instruction addresses local environments and local ecology where all students, including those from under-represented groups, live.

Implementation: The current ESA Education Committee has liaison relationships with several of the key science reform efforts now underway (the American Association for the Advancement of Science's Project 2061, the National Research Council's National Science Education Standards and Assessment project, the National Science Teacher's Association's Scope, Sequence and Coordination project, and Project Food, Land and People). This committee should be asked to consider all ways to strengthen those aspects of each project that might contribute to the recruitment and retention of women and minorities to ecology.

Cost: None specific to this report.

B.2. K-12 Ecology Education program

ESA would benefit from work with other professional societies to create a far-reaching program aimed at helping teachers and their students explore ecology as it pertains to their immediate environment and to their ecological roles as organisms. This program will build on the thinking that produced *Ecology Education for Children: A Framework for Excellence* (ESA, 1991), and the results of ESA's regional ecology in education workshops, schoolyard ecology programs, and the work of numerous ESA members and others. To succeed, this must be a collaborative project involving ESA staff and members with education professionals who share our goals and have expertise in K-12 teaching, staff development, and education reform.

a. Establish working relationships with professional societies. These might include NABT, NSTA, NAAEE, AIBS, AAAS, NSSA, and ASCD. A staff representative from each society would involve members of their organization, coordinate participation, plan, and implement specific activities addressing b) and c) below.

b. Identify successes and needs. Surveys will be conducted of ESA members (regional workshop participants, Education Section members, schoolyard ecology project participants, ecologists who engage pre-college students for collecting of data, etc.) and members of the other participating societies who have worked with local teachers on the themes of interest (i.e., local ecology, the individual as ecological entity, ecologists at work). The results of similar surveys/compilations recently completed by NSF and others will also be reviewed. The principal product of this effort will be to identify those areas in greatest need for new effort. Another product will be a compilation of descriptions of programs that have been particularly successful in reaching targeted groups (including African Americans, Asian Americans, Hispanics, Native Americans, and girls or women) will be made. The content of the file will be catalogued in a database to be maintained by the EHR staff. Details of each program, target group(s), personnel requirements, availability of materials, contact addresses and phone numbers, and other relevant information will be made available on request.

c. Develop and promote useful strategies. The long-term goal of this project should be a collection of tested approaches for teaching ecology in primary and secondary schools that address the goals listed under b above, and build on the findings of the surveys (B.2.b). Strategies for urban and rural areas with high percentages of under-represented groups should be emphasized in this effort.

d. ESA should be vocal about the need for funds to continue and increase the opportunities for teachers to participate in hands-on training and research in ecology.

Implementation: The ESA EHR Coordinator or other member of the ESA staff should act as the liaison with the professional societies chosen. Only those groups willing to commit staff time to the project should be involved. Preliminary work surveying some of the members of each participating society may be able to proceed using internal funds. This may be necessary to demonstrate the needs and identify specific targets for grant-supported efforts. At least one major grant will be required to implement the full-scale survey and development phases of the project.

Cost: Initial phases of communication, information gathering, and grant-writing may require upwards of \$5,000 per society. The full-scale project would require \$300,000-\$500,000 for the first five years, with more funds required for dissemination in the future.

C. UNDERGRADUATE EDUCATION

Our proposals for implementation at the undergraduate level cover a spectrum of activities ranging from providing college students with mentors, role models, research experiences and exposure to scientific meetings and ecology careers, to more comprehensive initiatives aimed at broad reform of undergraduate education.

The way we teach ecology in college powerfully influences science teaching at all levels. We refer both to our methodologies (lecture, text-oriented, content-dominated) and our subjects (pristine systems, non-human processes, humans, and negative impacts). These facets of current undergraduate ecology education turn away women and minorities because those who learn less well in traditionally-taught courses are discouraged (Brush 1991) and because science (ecology) is presented as an irrelevant discipline (Alper 1993). By diversifying and improving the way we teach ecology in college we will:

- Foster interest among potential science majors
- Promote general science, including ecology, literacy
- Build effective science knowledge and teaching methodology among future K-12 teachers

Because more ecologists are involved in undergraduate teaching than in any other education activity, the indirect influence we have on K-12 teaching through our instruction of future teachers is the single most important way the ESA membership can contribute to the diversification of the discipline in the long run.

The goals of our recommendations at the undergraduate level are:

- 1) To achieve excellence and diversity in the way ecology is taught, with an emphasis on programs where students, including future teachers, first encounter ecology in college.
- 2) To provide students from under-represented groups who have a potential or demonstrated interest in ecology with opportunities to explore and strengthen that interest.
- 3) To secure the inclusion of ecology coursework or ecological literacy in the general education and/or teacher certification requirements at the undergraduate level.
- 4) To ensure that the biology faculty at every undergraduate institution includes at least some representation of organismal biologists and ecologists.
- 5) To secure the recognition of and respect for excellence in ecology teaching.
- 6) To develop broad and sustained coalitions between academic ecologists and community groups dedicated to social and environmental equity.
- 7) To integrate into courses examples of significant research by women and minorities, U.S. or otherwise.
- 8) To broaden the scope of ecology taught in undergraduate courses to be more relevant to the broad diversity of students by embracing human dominated ecosystems and the role of humans in ecosystems.

C.1. Research opportunities clearinghouse

The Society will create a centralized database of and mechanism for advertising

research opportunities from government agencies, national laboratories, private industry, and academic institutions. Announcements will be available on Ecolog; the PAO Newsletter will continue this service. The EHR Coordinator will ensure that current lists are sent to targeted institutions (e.g., historically black colleges, major universities with a large minority population, AWIS, etc.). This advertising will broaden the pool of ecologically-oriented students in undergraduate research programs.

Implementation: Accumulation and entry of data will be done by the EHR office staff in cooperation with the Education and Women and Minorities Committees or the EHR Committee (see E.6.a). The list will be updated on a regular basis (monthly or bimonthly). Data will be available via e-mail networks as well as in hard copy. For efficiency this database activity should be coordinated with activity E.5, membership database services.

Costs: 0.05 FTE clerical assistance for data entry and retrieval.

Calendar: The first list should be available by the 1994 academic year.

C.2. Mentoring and internships

One-on-one relationships between young ecologists (students and young professionals) and more senior colleagues often play a very important role in both recruitment and retention. These relationships can result from spontaneous, informal interactions, often between a student and advisor, and can function very effectively. However, women and members of other under-represented groups are less likely to be involved in such relationships, and thus their career choices and/or advancement often proceeds in a social vacuum. It is important, then, to devise programs that facilitate such interactions and target these programs for young people from under-represented populations.

The biggest difficulty in designing such programs is that the success of a relationship between the young person and a senior colleague is often very personal and idiosyncratic. In addition, initiating and maintaining the links require considerable organizational skills and commitments to the long-term success of the program. Even the most dedicated senior ecologist is busy with other professional obligations, and students or young colleagues are hesitant to "interrupt" these important daily activities.

Nonetheless, mentoring and internship programs are an essential part of any plan to increase recruitment and retention of young people, especially those from under-represented groups. Thus, we strongly recommend that ESA play an active role in facilitating mentoring and internship programs. Although it is possible that ESA might sponsor such programs in the future, we feel that the ESA as an organization cannot set up such direct relationships at the present time. On the other hand, we do feel that ESA staff can provide substantial logistical support for individuals involved in mentoring and/or internship programs.

First, ESA should actively support proposals from ecologists wishing to set up an internship or mentoring program at their workplace. ESA should be willing to endorse

proposals (see recommendations in E.6.c) and provide as much logistical support as possible, including, for example, providing guidance for the preparation of program proposals, generating lists of senior ecologists willing to serve as mentors or internship directors, scheduling workshops/mixers for program participants attending an annual meeting, and advertising internship/mentoring opportunities in Ecolog or other e-mail networks.

Second, the EHR Coordinator should work closely with PAO staff to design a newsletter focused on issues related to mentoring and internships (or column for the current newsletter). This newsletter/column, modeled after the Science Mentoring Network of the New England Board of Higher Education, could include such topics as: job and internship opportunities, scholarships and other sources of financial aid, news from the Washington Office, and announcements of meetings of interest.

Within the context of these activities, ESA can also monitor closely the quality of the programs the Society sponsors. It is critical that student success not be endangered by programs that lack appropriate social, intellectual, and economic support. The EHR Coordinator can also ensure that recruitment of student participants involves multiple methods to include a broad representation of students in the program. Among the criteria to be assessed are:

1) Are the selection criteria designed to include interviews, letters of recommendation, essays regarding motivation, etc., as well as GPA?

2) Does the program provide support for appropriate members of the Society to visit targeted geographic areas and/or institutions to present first-hand information about the program? As we heard from the American Society of Microbiologists' presentation, these visits are essential in recruiting students who might otherwise be unaware of research opportunities, living conditions, and other details of the program. Such information is best given in person. At the same time, the visitor can serve as a role model for the target student group.

3) Is the funding level adequate to guarantee that the stipend levels are sufficient to allow all qualified students to participate? For 1994, these levels should be approximately \$1,800 stipend + \$900 room and board per student for an 8-10 week summer program.

C.3. Student participation program

One of the most effective means to recruit and encourage students to consider careers in the sciences is to involve them in professional scientific meetings. ESA member Ben Cuker, from Hampton University, a traditionally black institution, has developed a program for the American Society of Limnology and Oceanography (ASLO) that we feel would be equally as effective for the ESA. Thus, the workshop participants strongly recommend developing such a program for ESA Annual Meetings.

Although the ASLO program has been designed for groups of minority students, we feel that the basic structure can be utilized for both women and members of under-

represented ethnic groups of students. We recognize, however, that each of these groups have different and sometimes unique needs. Thus, we are recommending that ESA develop a set of parallel programs designed for specific targeted groups of students. The essentials of the program are outlined here; details will be developed in the preparation of a proposal to be submitted to a major funding agency.

The basic plan entails bringing groups of undergraduate and/or graduate students to the annual meeting within the structure of a series of special programs. These programs will include a pre-meeting field trip, a pre-meeting symposium on issues of concern to the target group, a special symposium at which the participating students present the results of their research, and a number of social events during which the students can meet each other as well as have the opportunity to meet professional ecologists on an informal basis. In addition, each group of students will be associated with both a faculty mentor from their home institution as well as peer mentors at the meeting. Depending on the levels and sources of funding, a number of these programs may be run simultaneously for different target groups. The degree of overlap among the groups would depend on the nature of the groups and desires of their leaders.

The program will involve the following types of personnel:

Program coordinator. As with the ASLO program, this person would be an ESA member responsible for the overall coordination of the program. S/he would contact potential faculty mentors at the target institutions, coordinate the pre-meeting field trip (which could be a part of the regular field trips offered prior to most ESA meetings or could be a separate trip if appropriate), organize the pre-conference symposium, organize the research symposium, arrange for the social events, and assume overall responsibility for the program. Given the nature of the responsibilities of these tasks, the Program coordinator will be paid the equivalent of her/his summer salary.

Faculty mentors. Faculty mentors will be identified and contacted by the Program coordinator, in cooperation with the EHR Coordinator. Faculty mentors will be responsible for identifying appropriate students to participate in the program, and will attend the meeting with the students. Each faculty mentor will receive an honorarium of \$200 plus the costs of attending the meeting. While it is most likely that the faculty mentor will come from the one of the students' home institutions, it is possible that other ecologists, such as those working in national laboratories, government agencies, or private industry, could serve as mentors in this program. Identification and encouragement of these potential mentors would be the responsibility of the Program coordinator.

Student participants. The student participants will be selected by the faculty mentor from her/his home institution or other appropriate college or university. Criteria for selection will include the student's enthusiasm for ecology and the potential that s/he has for high quality research, as well as the usual criteria of academic excellence (GPA, etc.). All costs for

participating in the program (registration, travel, field trips, and room and board while at the meeting) will be paid by the grant supporting the project. In addition, each participant will receive a one-year free membership in the ESA, which will include a subscription to *Ecology* or *Ecological Applications* and the *ESA Bulletin*.

Peer mentors. Peer mentors will be students who have subsequently succeeded in undergraduate and/or graduate studies in ecology. They will be selected for their empathy and ability to be a role model for the program participants. They will assist the student participants in "navigating" the meeting (attending sessions, presenting papers, etc.) and be willing to integrate the participants into the various informal activities at the meeting (introductions at mixers, etc.). After the first year of the program, the peer mentors are likely to be "graduates" of the program. Students serving as peer mentors will have their registration fee waived and will be eligible for additional financial support to attend the meeting as their needs require.

We envision that each target group in any given year will be composed of no more than 20 students. Although it is possible that more than one group will be attending any given meeting, we expect that no more than three such groups could be accommodated per year. While specific funding could be identified by target group (e.g., African Americans, Asian Americans, Hispanics, Native Americans, women), ESA should make every effort to design the program to accommodate groups from a variety of different target populations.

Implementation:

"Quick start" The enthusiasm for this program among the Workshop participants is very high. Thus we feel that the current personnel of ESA (e.g., members of the Executive Committee, Women and Minorities Committee, and the Education Committee) should seek an ESA member to serve as coordinator to arrange for a pilot program at the Annual Meeting in Knoxville in 1994. A subgroup of these committees should be constituted as an *ad hoc* advisory committee to assist the volunteer coordinator in planning the program, identifying the faculty and peer mentors, and designing the pre-meeting symposium. This pilot program should be designed for 10-15 students from a single institution or cluster of institutions in the same geographic region.

Long-term On the basis of the experiences from the pilot program, the EHR Coordinator will prepare a full proposal to be submitted to the appropriate funding agency to support the program for at least five years. After the first year, the Program coordinator will be selected by the EHR Coordinator and the new Education and Human Resources Committee on approval of the Executive Committee.

Costs:

"Quick start" ESA should allocate *at least* \$600 per student participant in the program, for a total of \$3,000 to \$4,500; a larger allocation of funding is strongly encouraged. In addition, the participating students should be given free or reduced

registration fees and a one-year membership in the Society which includes a subscription to *Ecology* or *Ecological Applications* and the *ESA Bulletin*.

Long-term The cost of this program will depend on the number of students involved. As a rough guide, we suggest that a budget based on \$1,500 – \$2,000 per student is appropriate to cover the costs of the coordinator's salary, the mentors' honoraria, and all expenses for the student participants (including all pre-conference activities as well as the registration fee, travel, per diem during the meeting, and membership in the Society for one year), and peer mentors' expenses as required. The nature of this program is such that joint sponsorship with a federal agency (e.g., Department of the Interior) is a distinct possibility.

C.4. Careers in Ecology Workshop program

The Society will develop a program entitled, "Careers in Ecology Workshop." This program emphasizes interaction between professional ecologists and undergraduates and their faculty at colleges hosting the visiting scientists. The availability of "Focus on Ecologist" brochures (A.1) would augment this activity and should be closely coupled with its development. This activity can be accomplished at levels of effort ranging from encouragement of members giving or organizing seminars to include these types of activities to a very organized program developed through the EHR Coordinator. The target audience will be women and/or students from other under-represented groups. The sex and ethnicity of the participating ecologists will be identified to emphasize women and under-represented groups and will represent the diversity of the Society. The scheduled activities will include one or all of the following: formal presentations, informal round-table discussions, one-on-one conversations, and at least one field trip where students take the visiting ESA members to a local ecology research site. A very organized level of effort by ESA could allow teams of three ESA members to travel to colleges and spend 1–2 days of speaking to and meeting with students and faculty. Ideally, groups of three to five area colleges and universities will submit requests to the ESA Headquarters Office. Membership in these teams will be carefully balanced to include ecologists with varied educational levels, employment situations, areas of expertise, career level, and personal/familial situations.

Implementation: The EHR Coordinator will oversee the preparation of a planning proposal to be submitted to appropriate funding agencies, and will coordinate the planning process. ESA will appoint a planning committee to design the program, identify potential team members, and prepare a proposal for grant support of the program.

Cost: Planning stage: 0.3 FTE plus \$10,000 to convene the planning committee. Once the program is initiated, we anticipate that the host institutions will provide housing and food for visiting ESA members. The Society, through dedicated outside funds, will provide travel (\$500 per person), a small stipend (\$100 per day per person), and educational materials. Possible sources of funds to support both the planning process and the program itself include private foundations that support greater participation by women in the sciences (e.g., Sloan Foundation).

C.5. Recruitment through community involvement: meeting the special needs of

under-represented ethnic groups

This program is a unique approach that ties recruitment of young ecologists to grassroots environmental equity and/or environmental justice groups communities of under-represented ethnic minorities. The major thrust of the program is to bring academic ecologists in contact with grassroots community groups to form a coalition focused on a specific ecological problem and its solution. In the initial phase of the program we suggest that two such coalitions be established -- one between a community group and a traditionally minority institution, preferably within the community (e.g., a local junior college) and the other a coalition of a community group and a majority institution located in a minority community (e.g., a research university located in an inner city neighborhood). Faculty and teaching assistants would bring with them students from appropriate under-represented ethnic groups (residents of the target community if possible) who receive either grant funds or university credit for their work on the project.

The project itself would depend on the needs of the community and the feasibility of solutions. In fact, the definition of the project would play a major role in the program -- often identification of a problem and routes to its solution require extensive knowledge of not only the ecological principles but also the social and political implications of the various solutions. Since many environmental issues require a diverse expertise to identify and implement solutions, ESA would seek to work with other professional societies when feasible, e.g., the National Association of Environmental Professionals.

Once a project is identified, additional students would be recruited to be part of the solution via research projects, seminars, and community outreach activities. These students can easily become part of the other student programs outlined in the sections described above (e.g., attend the ESA Annual Meeting, participate in internship programs, serve as peer mentors, etc.).

Community participation in the project should be as broad as possible -- including adult residents, community leaders and officials, as well as children and their teachers. Not only does this breadth increase the likelihood that the project will succeed, but it is one of the best mechanisms for recruitment: if the community values the actions, then they will also value the people involved in those actions, and, if children see adults solving important problems, they may aspire to similar careers. In other words, this program will provide both role models for young people and community recognition of ecologists as important professionals serving the community.

Experience gained from the initial projects can be used to prepare a set of guidelines for the establishment of other similar coalitions throughout the United States. This information can be disseminated as requested.

Implementation: This program will require both dedicated individuals and substantial funds: the role of the Society is to facilitate identification of both. To do so, the Executive Committee should identify an *ad hoc* advisory committee to assist the EHR Coordinator in preparing a proposal for outside funding of this project. At the same time, if a qualified individual indicates her/his willingness to lead this effort, ESA should actively support appropriate proposals (see E.6.c). As the program develops, the EHR

Coordinator will be responsible for developing the guidelines for expanding the program to include additional coalitions as they may be proposed. In addition, the EHR Coordinator will work closely with existing coalitions and other appropriate groups to maintain an updated list of grassroots organizations with whom community coalitions might be formed.

Costs: Costs for each coalition will include salary supplements for participating faculty, stipends for student participants, funds for the student research projects, costs for materials produced by the project, as well as overhead costs to support the ESA office staff contribution. The details of these costs will be determined as the proposal is prepared; however, we envision that any given coalition supporting 5 to 10 students will require at least \$30,000 per year.

C.6. Comprehensive program to improve introductory ecology instruction

The ESA should embark on a long-term project to improve ecology teaching at the introductory level. These efforts complement but also go beyond the scope of this document and are included here to encourage further consideration and facilitate their integration with the other recommended actions. Again, the relevance of this initiative in the current context is that ecology teaching is profoundly important for sparking and retaining student interest in science (Holland et al. 1992) and also in shaping how future teachers teach.

Such a comprehensive program will have many components:

a. Defining excellence in undergraduate ecology education. The Executive Committee of ESA should form a new committee (or sub-committee of the existing Education Committee) to lead the Society's efforts at improving undergraduate teaching of ecology. As a first step, this committee should prepare a "white paper" on ecology in the undergraduate curriculum. Funding needed to convene this committee should be sought by the ESA Executive Director and the EHR Coordinator. The information provided in the "white paper" can then be made available to colleges and universities reviewing their ecology offerings, to other efforts now underway to improve undergraduate biology instruction (e.g., the Coalition for Education in the Life Sciences movement).

b. Promoting adequate representation of ecology in the curriculum and on college faculties. As part of the effort described above, or in a separate activity, recommendations should be made for improving the status of ecology in the undergraduate curriculum and assuring the adequate representation of organismal biology on all college faculties.

c. Develop new curriculum materials. The ESA is already involved in some curriculum development efforts, e.g., the *Experiments in Ecology* project and the SBI's undergraduate initiative. The new committee should identify ways to improve and expand on these efforts, with specific reference to activities that will have the intended effects on recruitment and retention.

d. Sharing ideas through publications. The expansion of ESA's publications to be

useful as a forum for sharing ideas on teaching ecology is discussed in detail in recommendation E.4.

e. Recognizing excellence in undergraduate teaching. The creation of a new award to recognize excellence in undergraduate teaching already has been discussed in recommendation C.2.

f. Faculty development workshops. As possibly the most effective and far-reaching product of this initiative, ESA should aim towards holding an on-going series of workshops on teaching. These workshops should include at least one on teaching ecology at the undergraduate level at each Annual Meeting. In addition, ESA should encourage the development of regional workshops targeted at those who teach introductory biology and introductory ecology courses. The workshops should address the standards of excellence resulting from C.6.a., and capitalize and build on local resources from other science education efforts in each region. Graduate teaching assistants could also be included in such workshops.

Implementation: The first step can be implemented immediately, but the success of the committee will depend upon resources that are most likely to result from the efforts of the new EHR Coordinator. The second and third steps must await completion of the first. Steps d and e can be started immediately as discussed elsewhere. Finally, step f can start immediately with respect to workshops at the annual meetings. Plans for regional workshops should be made by the new committee with the consultation and support of the EHR Coordinator and staff. The workshops themselves will require a combination of sources of support – from participating scientists and their institutions as well as from private or public grant agencies.

D. ECOLOGY AS A PROFESSION

In order to promote diversity in the field of ecology and inform people of the professional options in the field of ecology, workshops and discussion sessions can be organized at ESA Annual Meetings and elsewhere.

D.1. Sessions at Annual Meetings

ESA members would benefit from consciousness-raising sessions at future Annual Meetings. At least some of these should be titled and targeted in such a way that people from more than the under-represented groups and a few (probably not very representative) majority males attend. The AIBS annual luncheon for women in biology might be a model first step in this regard. These luncheons have been important opportunities for young women to learn from more senior women, and such opportunities for mentoring should be expanded in the future. Time for informal discussions is also very important.

a. Lifestyles Workshops

The Society will sponsor at least one workshop at the Annual Meeting designed to promote career advancement skills and/or to discuss the conflicts and opportunities at

the interface between personal lives and professional development.

Implementation: The first year will be organized by a volunteer identified by the Women and Minorities Committee. Later workshops will be organized by the EHR Coordinator. The Program Committee shall ensure that the potential for conflicts with other workshops or meeting activities will be minimized.

Cost: \$500 per year to cover the costs of materials; funding provided by outside sources or by charging a fee to the participants.

Calendar: The first workshop should be held at the annual meeting in 1994.

b. Discussion Sessions

Annual Meeting discussion sessions on topics relating to education, recruitment, retention, or employment which would be of interest and assistance to those currently in the profession as well as those contemplating a career in ecology. A luncheon at the 1994 Annual Meeting in Knoxville, TN, with a speaker to focus on the future of under-represented persons in biology (Ben Cuker or Christina Johnson might be possibilities) would be a first step.

D.2. Recruitment and retention workshops for university administrators

The Society will participate in workshops and encourage members to actively work on recruitment and retention issues at their home institutions. ESA will identify ongoing activities and materials that present creative solutions to employment difficulties faced by women and other under-represented groups [If adequate materials are not available, ESA will develop them]. Ideally 2-3 hour workshops will be presented at professional meetings of university administrators or managers of industries likely to employ ecologists. Topics will include: evaluation of hiring and promotion criteria, employment of dual-career couples, managing dependent care, and facilitation of careers of employees with non-traditional backgrounds. Because these issues are common throughout the sciences, the Society will seek to collaborate with AWIS, AIBS, and other life science organizations in the development and presentation of the workshops. As with item C.4, Careers in Ecology Workshops, this activity can be accomplished at different levels of effort.

Implementation: ESA will contact other organizations (e.g., AAUW, AWIS, AIBS, AAAS, CSSP, NASULGC, etc.) to initiate collaboration on this project. Because this is a new approach to solving issues facing women and other under-represented groups, the first step must be to appoint a planning committee to design the workshop format and develop materials for presentation. ESA, in collaboration with the cooperating societies, will identify the participants for the planning workshop and will assist in seeking outside funding for the development of the project. Oversight of ESA's role in the planning process will be assumed by the EHR Coordinator. Because of the complexity of the project, administrative assistance will be required. The workshops themselves will be conducted by a consultant, identified and approved by the collaborating societies, with possible help from scientists.

Cost: \$25,000 for workshop development (salaries, materials, office expenses); \$3,000 per meeting for workshop presentations (honoraria, materials, travel, and per diem). Funds to cover the costs for development will be sought from outside organizations (agencies and foundations). Host organizations will be asked to contribute to the costs for workshop presentations, but additional funding is likely to be needed to support an on-going and effective program. These funds will be sought from the participating societies as well as outside agencies and private organizations interested in improving the social fabric of our society.

E. ESA POLICY AND STRUCTURAL CHANGES

ESA should strive to become more supportive of diversity through its policies and procedures. Indeed, ESA should be a leader among scientific societies in the strength of its programs in this regard. The goals are to eliminate sexism and racism from all Society functions and decisions, to achieve representation in all society activities that reflects the full diversity of our membership, and to encourage the fullest participation of all peoples in the organization.

E.1. Composition of Society committees

We strongly endorse the actions of the Executive Committee to increase participation by women and members of other under-represented groups in Society activities. We recommend formalizing a policy that all Society committees, symposia, workshops, editorial boards, public affairs outreach, and Society activities generated from sections and committees will have, where possible, some women members and some members from other under-represented groups. The purpose of this policy is to match the participation of under-represented groups in the Society's programs with their abundance in the Society. This policy will apply to other groups with which ESA has a formal affiliation (e.g., joint task forces) and, as such, will send a positive message to other scientific and public groups interacting with ESA.

Implementation: The Executive Committee of ESA will review the composition of Society committees and other activities and will be empowered to make appropriate additions to a group if required. A memorandum on the policy will be provided to the chairperson of a group as they are appointed. Data on the composition of ESA "groups" will be published in the *Bulletin* annually.

Cost: The only cost associated with this policy is for postage required for correspondence between the ESA President, Secretary, or other official, and the group leader.

Calendar: Immediate. Notification to the ESA members in the *ESA Bulletin* after approval by the ESA Executive Committee.

E.2. Child care

We strongly endorse the actions of the Executive Committee to encourage the provision of child care during Annual Meetings. We recommend formalizing a policy that

all Society functions have information on excellent child-care facilities. When Society functions are paying travel costs, a provision for requesting reimbursement for child care should be made available. This may be especially important for activity C.3. This policy will facilitate meeting attendance by Society members with children. Furthermore, we recommend that the Society encourage child-care providers to involve the children in nature-oriented activities. The possibility of liability costs must be explored if ESA itself provides child care.

Implementation: The program chair and meeting committee will coordinate this effort to provide information on child-care at the Annual Meeting. ESA will encourage the preparation of proposals (see E.6.c) for high quality, nature-oriented programs to be offered for dependent children of members attending the ESA annual meeting. Other ESA workshops and Washington, DC, meetings will provide either support for child care or child-care facilities available during the meeting. Guidelines would need to be developed for distribution of any available funds for child care.

Cost: Costs of child care at the Annual Meetings will be paid by the participating parents on a per hour per child basis. Costs for child care at other official ESA functions (committee meetings and the like) where funding is provided from external sources shall include reimbursement of child-care costs in the request for funding.

Calendar: The policy should be in place and implemented for the 1994 Annual Meeting and for all other ESA meetings subsequent to July 1, 1994.

E.3. Women- and minority-owned businesses

The Society will maximize its efforts to include women- and minority-owned businesses in any competition for contracts. This action will demonstrate to Society members and to outside contacts that the Society acts in accordance with its stated belief of equal opportunity.

Implementation: The Executive Committee should notify its offices and members by a memorandum published in the *Bulletin* that all materials to be purchased from ESA funds must include women- and minority-owned businesses in the competition and that a goal of at least 30% of these under-represented businesses should be the target. All sites for future ESA meetings will be investigated as to their EEO/AA policies; sites without policies that support women- and minority-owned businesses will not be used.

Cost: The only cost associated with this policy is the staff time needed to review policies of the institutions/organizations and obtain lists of minority and women owned businesses in areas where ESA meetings are to be held. These may be available from the local Chamber of Commerce.

Calendar: Immediate. Notification to the ESA members in the *ESA Bulletin*.

E.4. Scope of Society publications

The Society will broaden the scope of its publications to include materials on

teaching, mentoring, recruitment, and retention issues. Specifically, *Ecological Applications* will accept articles on methods of teaching ecology and mentoring young ecologists. Another editor will be appointed with expertise in these areas, and the requirement for primary research results will be relaxed for such submissions. These changes will clearly demonstrate the value the Society places on teaching and mentoring.

Implementation: The ESA Executive Committee will direct the editors of *Ecological Applications* to appoint another editor and to solicit articles from appropriate authors. The quality of the articles will be maintained by peer review, using the same standards of quality as those applied to other manuscripts submitted to the journal.

Cost: No additional cost (part of the regular budget of the journal)

Calendar: Immediate. Notification to the ESA members in the *ESA Bulletin*.

E.5. Membership database services

ESA, through its office in Washington, DC, can be a clearinghouse for a number of databases which would be useful to individuals and groups wishing to increase recruitment and retention of women and other under-represented groups in ecology. The Society can play an active role in creating, updating, advertising, and disseminating these databases throughout the U.S. and the world as appropriate.

a. The ESA Ecological Information Network

The ESA Ecological Information Network (EIN) currently maintained by the Public Affairs Office (PAO) should be redesigned to include additional information so the Society can provide lists of women and members of other under-represented groups by such categories as:

- potential speakers
- potential mentors
- persons interested in working with pre-college and public groups.

This expansion will allow rapid retrieval of names of Society members for various purposes and will enable the Society to increase the visibility of targeted members. The Society staff will be able to respond quickly and easily to requests for mentors and speakers from specific geographic areas as well as assist in providing suggestions for committee assignments.

Development and maintenance of this information is not to be based solely on passive responses. ESA, via the EHR Coordinator, will seek out ESA members from targeted groups to include in the various lists and will frequently review the lists to ensure that the data sets are as complete as possible.

Implementation: The Women and Minorities Committee (or the EHR Committee, see E.6.b) will be asked to prepare an information form to be mailed out with the membership renewals. ESA will hire clerical assistance (see Appendix C) to input and

retrieve data. The editor of the *ESA Bulletin* will include an announcement of the information service in the *Bulletin* on a regular basis; announcements will periodically be made on Ecolog and other electronic bulletin boards. A marketing strategy, already developed by PAO staff, will continue to be implemented.

Cost: 0.1 FTE clerical assistance (data entry and retrieval, mailing)

Calendar: An updated EIN information form will be mailed out with membership renewals in 1994. Subsequent updates will be made continually on an ad hoc basis with formal requests for updating every two years.

b. Directory of prospective and recent graduate degree recipients

ESA will develop, maintain, and publish a directory of members, including a coding method to lists women and members of other under-represented groups, nearing completion of or receiving master's and doctorate degrees in ecological disciplines. This directory is to be made widely available to prospective employers.

Implementation: Initial accumulation and entry of data will be coordinated by the Public Affairs Office but will eventually be assumed by the Office of the EHR Coordinator. Prospective job-seekers will be identified from the ESA student membership list. These members will be contacted and asked to submit relevant information electronically, if possible. The list will be appended monthly and updated annually by the EHR office staff.

Costs: 0.05 FTE clerical assistance for data entry and retrieval, and printing, and mailing costs. Costs for computer programming (current system cannot perform these functions). Lists will be sold at cost (to be calculated empirically).

Calendar: The list should be available to prospective employers by June 1995.

E.6. Changes in the structure of the ESA

a. Recommendations for new staff in the ESA Office

The programs outlined in this report are both extensive and intensive: ESA cannot rely on volunteer efforts alone if we are to succeed at achieving our vision of expanded roles for women and other under-represented groups in ecology. Thus, the Workshop participants strongly recommend that ESA commit Society funds to hire a full time professional staff person, to be assisted by at least half time clerical support staff (see Appendix C). In recognition of the importance of educational reform with regard to increasing opportunities for women and minorities, we suggest that the position be called the ESA Coordinator for Education and Human Resources (EHR). This person would report to the Executive Director of the Society.

The EHR Coordinator would be responsible for coordination, development, and oversight of all education programs sponsored by the Society and of all programs designed to improve retention of women in the field and to increase the participation of under-represented groups in ecology. A job description for this position should be

developed by the Executive Committee in consultation with the Education and Women and Minorities Committees. Possible distribution of tasks are outlined in the attached table and include the following:

- begin to implement the programs recommended in this report
- seek funding as required for the planning and execution of the programs in conjunction with other ESA staff and committees
- develop new programs as appropriate and/or as opportunities arise.

Additional personnel will be necessary for a number of projects proposed in this report. Although the Society should be committed to pay salary of the EHR Coordinator from Society funds, we recommend that ESA adopt a policy that all major projects should be self-supporting from outside funds. Because the office of the EHR Coordinator will be responsible for oversight of these projects and personnel, it is also possible that the direct costs to the Society will decrease as outside funding pays all or part of the costs of the EHR office.

b. Recommended changes in the committee structure of the Society

During the course of the workshop there were a number of discussions concerning the structure of the Society, especially as it relates to current standing and *ad hoc* committees, the various sections, and the need to provide guidance to the EHR Coordinator. As a result of these discussions, we recommend the following:

- 1) **Create a standing committee on Education and Human Resources.** This committee would combine and replace the current Education Committee and Women and Minorities Committee, and would advise the President, Executive Committee, and Coordinator of the Office of Education and Human Resources on issues related to education and professional development of ecologists. The chairperson of the committee would attend the meetings of the Executive Committee and report on actions by the committee. Members of the committee would be appointed by the President and would serve for three years. Terms of the members would be staggered so that one third of the membership is replaced each year. Given the broad mandate of the committee, the Workshop participants suggest that the committee be divided into three subcommittees, on education, women, and minorities, each with a subcommittee chairperson and a mandate aligned with the committee as a whole.
- 2) **Review the structure and functioning of current *ad hoc* committees, standing committees, and sections.** We need to improve communication among committees and sections of ESA to avoid duplication of efforts among groups with similar interests, as well as to avoid misunderstandings as to which group is responsible for which project within the Society. At present, members of these various groups communicate only during the ESA Council meeting at the annual ESA meeting. By that time, it is often

too late to avert the potential inefficiency in the functioning of committees and sections.

a) The chairs of all ESA standing committees should get a clear mandate from the ESA Executive Committee as to the scope of their committee's work. If there are ESA committees with overlapping mandates, then this issue should be resolved to avoid duplication of plans, workshops and expenses. If a committee has as its mandate to complete a specific project, then that committee should be dissolved once the project is completed. Such committees should be referred to as "Special Committees" as opposed to "Standing Committees" of ESA. A "Special Committee" should only be appointed to deal with issues that are short-term in nature.

b) The chairs of all ESA committees should attend the January ESA Executive Committee meeting to give an update on their committee's work. If attendance of the chair is not possible, a written report will suffice. New projects may have to be started by ESA at that time (i.e., in January) and can readily be assigned directly to the respective committees. Means of communicating new initiatives from the ESA Executive Committee and current activities of committees are inadequate. Often initiatives of interest to committee chairs are learned of only through meeting minutes in the June *Bulletin*, and the chairs of related sections may not even hear of those projects. Eight months may pass before the ESA committee and/or section affected by the changes or initiatives discussed at the January meeting hear of them. Workshop participants strongly recommend the use of an e-mail or FAX network to keep all chairs of ESA committees or sections updated.

c) The chairs of all ESA committees and sections should submit a one-page summary of the proposed activities for their group to the ESA Secretary one month after the national ESA meeting. The ESA Secretary will then distribute the information to the Executive Committee and all chairs of committees or sections. The ESA Headquarters Office may work with the ESA Secretary to disseminate this information. This action will prevent the committees and sections from duplicating each other's plan of action for the next year.

d) Copies of all reports, pamphlets, brochures, or position papers developed by any ESA committee should be kept on file at the ESA Headquarters Office to be disseminated to the general public when inquiries are received.

e) The current set of ESA Committees should be reviewed by the ESA Executive Committee and consolidated as much as possible. To improve coordination and communication among groups with similar interests, the chair of an ESA section with similar interests to those of an ESA standing committee should be a member of the related standing committee.

c. Mechanisms for seeking ESA endorsement of proposals for funding of special programs. The workshop participants recognize that the Society, as an organization, cannot carry out all possible programs to increase the participation of women and other under-represented groups in ecology. Thus, to ensure that appropriate

projects have the highest probability of success, we recommend that ESA evaluate their existing endorsement policy with regard to co-sponsorship of education and affirmative action activities. An expansion of the existing guidelines could include the following points:

- 1) Provide a copy of the proposal. Include: rationale, target clientele, goals, plan of action, calendar, and criteria for evaluation.
- 2) Review by the appropriate standing or ad hoc committee. Criteria should include: quality, reflection of goals, and values of ESA. Proposal would then be forwarded for approval from the ESA Executive Committee.
- 3) Endorsement does not necessarily imply contribution of resources.
- 4) Request for endorsement must come from a member of ESA

d. Encourage the formation of local chapters of the ESA. Because of the growing need for ecologists to be aware of and responsive to local issues, ESA should actively encourage the development of local chapters of the Society. The Executive Committee (or an ad hoc committee appointed by the EC) should devise an "ideal" distribution of chapters throughout the U.S., then contact individual members interested in facilitating the formation of a chapter in each of the identified areas. ESA should provide guidelines for governance structure, local meeting organization, and other activities that the chapter might wish to explore.

By joining the Society, all members would be affiliated with an appropriate local chapter, where it exists. A pro-rated portion of the dues would be allocated to each chapter to cover the costs of mailings and other expenses associated with chapter activities. Each chapter may, by vote of the membership, obtain additional funds through outside grants or local assessment of dues.

IV. CONCLUSION

In order to reduce and eventually eliminate the many impediments to a more diverse ecological workforce, the Ecological Society of America must change the face of ecology. Efforts must be directed at many levels -- the general public and students of all ages (K-12 through graduate), professionals (teachers, academicians, government, and business) and the organized field of ecology as a whole. We must address the factors underlying the problems of retaining women in ecology through a variety of proactive and far-reaching efforts to eliminate discrimination and broaden the way we go about conducting our science. We must reach out to a broader racial and ethnic diversity of ecologists by linking with social and environmental justice movements at the grass roots level in order to recruit and retain minority involvement in the field. We need to work towards expanding the scope of ecology as it is taught in schools to be more engaging to a broader diversity of personalities and learners, and to address local environments and local ecology where all students, including those from under-represented groups, live. We need to assure that our own teaching of ecology, particularly in introductory undergraduate courses, embraces diversity and models the

best of teaching so that future teachers will gain first-hand experience in positive ways of teaching ecology. And we need to nurture the nascent interest shown by young students and scientists through effective mentoring and peer-support programs and by assuring that the very way we do our science celebrates diversity in its every form. By publishing this report, ESA signals its commitment to making and sustaining, on a long-term basis, the changes described herein.

This report is only the first step towards changing the face of ecology. The next step needs to include prioritization of proposed activities and development of a more detailed implementation strategy. Although the authors recognized the importance of having a structural evaluation mechanism for determining success of such activities, it was not usually possible to provide such information at this time for all activities. Evaluation strategies would be developed as a part of the implementation plan.

V. REFERENCES

- Alper, J. 1993. The pipeline is leaking women all the way along. *Science* 260: 409–411.
- Association of American Geographers. 1992. Profiles of the AAG membership 1989–1991. *AAG Newsletter* 27(4): 14.
- Beane, D.B. 1985. *Mathematics and Science: Critical Filters for the Future of Minority Students*. The Mid-Atlantic Equity Center, The American University, Washington, D.C.
- Berkowitz, A.R., et al. 1991. *Ecological Education for Children: A Framework for Excellence*. Ecological Society of America.
- Blockstein, D.E. 1990. Women and minorities -- how are the AIBS societies doing? *BioScience* 40(8): 607–609.
- Brown, T.L., D.J. Decker, and J.W. Enck. 1992. *The Wildlife Society membership society: preliminary report*. Cornell University, Department of Natural Resources, Human Dimensions Research Unit, Ithaca, New York, USA.
- Brush, S.G. 1991. Women in science and engineering. *American Scientist* 79: 404–419.
- Celebuski, C.A., and E. Farris. 1990. *Systematic biology training and personnel*. Higher Education Surveys Report, Survey No. 10. National Science Foundation, Washington, DC, USA.
- Chaney, B., E. Farris, and P. White. 1990. *Plant biology personnel and training at doctorate-granting institutions*. Higher Education Surveys Report, Survey No. 13. National Science Foundation, Washington, DC, USA.
- Claudy, N., M.E. Kauffman, M.E. Milling, T.H. Hughes, G.E. Melickian, D.N. Miller, E.G. Newton, G.D. O'Brien, R.D. Ottmann, R.E. Roadifer, E.E. Rue, and D.B. Stewart. 1988. *North American Survey of Geoscientists*. American Geological Institute, Alexandria, Virginia, USA.
- Federal Coordinating Council for Science, Engineering, and Technology. 1993. *Pathways to Excellence. A federal strategy for science, mathematics, engineering, and technology education*. Washington, DC, USA.
- Holland, M.M., D.M. Lawrence, D.J. Morrin, C. Hunsaker, D. Inouye, A. Janetos, H.R. Pulliam, W. Robertson, and J. Wilson. 1992. *Profiles of ecologists: results of a survey of the membership of the Ecological Society of America*. Ecological Society of America, Public Affairs Office, Washington, DC, USA.
- Lawrence, D.M., M.M. Holland, and D.J. Morrin. 1993. *Profiles of ecologists: results*

of a survey of the membership of the Ecological Society of America. Part I. A snapshot of survey respondents. *Bulletin of the Ecological Society of America* 74(1): 21-35.

Lawrence, D.M., M.M. Holland, and D.J. Morrin. 1993. Profiles of ecologists: results of a survey of the membership of the Ecological Society of America. Part II. Education and employment patterns. *Bulletin of the Ecological Society of America* 74(2): 153-169.

Lubchenco, J., A.M. Olson, L.B. Brubaker, S.R. Carpenter, M.M. Holland, S.P. Hubbell, S.A. Levin, J.A. MacMahon, P.A. Matson, J. M. Melillo, H.A. Mooney, C.H. Peterson, H.R. Pulliam, L.A. Real, P.J. Regal, and P.G. Risser. 1991. The sustainable biosphere initiative: an ecological research agenda. *Ecology* 72 (2): 371-412.

Massey, W.E. 1992. A success story amid decades of disappointment. *Science* 258: 1177-1179.

Matyas, M.L. and S.M. Malcom. 1991. Investing in human potential: science and engineering at the crossroads. Executive Summary. American Association for the Advancement of Science. Washington, DC, USA.

Mechling, K.R. and D.L. Oliver. 1983. Activities, not textbooks: What research says about science programs. *Principal* 62: 40-43.

Morrin, D.J., M.M. Holland and D.M. Lawrence. 1993. Profiles of ecologists: Results of a survey of the membership of the Ecological Society of America. Part III. Environmental science capabilities and funding. *Bulletin of the Ecological Society of America* 74(3): 237-249.

National Science Foundation. 1989a. Achieving full participation of women in science and engineering. A report of the National Science Foundation's Task Force on Women in Science and Engineering. Washington, DC, USA.

National Science Foundation. 1989b. Changing America: The New Face of Science and Engineering. Final Report. The Task Force on Women, Minorities, and the Handicapped in Science and Technology. Washington, DC, USA.

National Science Foundation. 1992. Gateway to diversity in the scientific and technological workforce. Directorate for Education and Human Resources. National Science Foundation, Washington, DC, USA.

National Science Foundation. 1992. Fiscal year 1992 annual report, Division of Biotic Systems and Resources. National Science Foundation, Washington, DC, USA.

Primack, R.B. and V. O'Leary. 1993. Cumulative disadvantages in the careers of women ecologists. *BioScience* 43(3): 158-165.

Society of American Foresters. 1992. Unpublished data from dues renewal forms. Society of American Foresters, Bethesda, Maryland, USA.

Stephens, P.L., and C. Kazarosian. 1992. Results of the AMS membership survey. Bulletin of the American Meteorological Society 73(4): 486-495.

Travis, J. 1989. Results of the survey of the membership of the Ecological Society of America: 1987-1988. Bulletin of the Ecological Society of America 70 (1): 78-88.

U.S. Bureau of the Census. 1991. Statistical Abstract of the United States: 1991 (111th edition.) U.S. Government Printing Office, Washington, DC, USA.

U.S. Department of Agriculture Forest Service. 1992. Toward a Multicultural Organization: report of the USDA Forest Service Task Force on Work Force Diversity, Washington, DC, USA.

APPENDIX A: BACKGROUND MATERIAL

The Ecological Society of America (ESA), founded in 1915, is the major scientific society for ecologists in the United States, with approximately 7,000 members. During the last 48 months, ESA members have carefully considered future research directions in the field of ecology. The results of this evaluation were published in ESA's report, **The Sustainable Biosphere Initiative: An Ecological Research Agenda (SBI)** (Lubchenco et al. 1991). The report came as a response to the challenge posed by Dr. Frank Press, President of the National Academy of Sciences, that scientists set their own research priorities. In formulating the SBI, ESA members made difficult judgements concerning the research directions that hold the greatest promise for both advancing the base of ecological knowledge and for improving the human condition.

The 1993 strategic planning workshop on women and under-represented groups was an outgrowth of the SBI, and some background information is presented in this section. The SBI report identified the potential lack of qualified scientists and technicians as a major concern in ensuring that essential basic and applied ecological research can be undertaken (Lubchenco et al. 1991). The research areas identified in the SBI report are of primary importance in addressing current environmental issues. As environmental concerns such as global change, sustainability, and biodiversity had become more prominent within the global environmental agenda, it seemed important to ask who would address and research these issues.

At the request of leaders in the ecological community, the ESA Public Affairs Office conducted a survey of all ESA members (Holland et al. 1992) to try to understand better the current demographics of ecologists. The objectives of the 1992 survey were to:

- 1) determine the pattern of graduate ecology degrees earned over the past 30 years;
- 2) determine ethnic and gender composition in ESA for comparison with the demographic composition of the U.S. work force;
- 3) catalog the nation's environmental science research capabilities according to environmental problem area; and
- 4) analyze current employment patterns of ecologists.

Financial assistance for the survey, and compilation of responses, was provided by the United States Department of Agriculture's Forest Service, the United States Environmental Protection Agency, the National Science Foundation (Division of Environmental Biology), and the Ecological Society of America. Until this survey, neither the scientific nor the policy-making communities had known the demographics of trained ecologists in the United States or elsewhere. Prior to the survey report, there was no document identifying the number of ecologists employed and their areas of specialization.

Fifty-six percent of the ESA membership responded to the 1992 survey. Results indicated that a typical respondent to the survey was a Caucasian male, married with at least one child and between the ages of 36 and 40. The percentage of women

among the older age groups was fairly low, however, the disparity between the number of male and female respondents decreased among younger age groups. Minorities were under-represented among the respondents when compared to the demographics of the population of the United States (Holland et al. 1992). Some information in the 1992 ESA survey can be compared to surveys recently carried out by other scientific organizations. A list of the other studies is given in Table 2.

Gender. According to the results of this survey, the gender composition of the Ecological Society of America (ESA) is most similar to that of the Association of American Geographers (AAG) and the community of plant biologists, which are 75% male and 25% female (Table 3). The remaining scientific groups have a higher percentage of males (ranging from 82% to 95%) than ESA. In contrast, for the United States population the ratio is 49% male to 51% female (data for the year 1989, U.S. Bureau of the Census 1991).

Table 2. Other studies used for comparison (from Holland et al. 1992; Lawrence et al. 1993a).

Study	Citation	Type of survey
United States census data	U.S. Bureau of the Census 1991	Census
American Geological Institute (AGI)	Claudy et al. 1988	Mail
American Meteorological Society (AMS)	Stephens and Kazarosian 1992	Mail
Association of American Geographers (AAG)	Association of American Geographers 1992	Dues
Society of American Foresters (SAF)	Society of American Foresters 1992	Dues
The Wildlife Society (TWS)	Brown et al. 1992	Mail
Plant biologists	Chaney et al. 1990	Mail
Systematic biologists	Celebuski and Farris 1990	Mail

Table 3. Comparison of the gender composition (in percent) of the ESA with other groups (Holland et al. 1992; Lawrence et al. 1993a).

Gender	USA	ESA	AGI	AMS	AAG	SAF	TWS	Plant Biologists
Male	48.7	76.7	94.8	92.7	74.7	90.7	81.7	75.4
Female	51.3	23.3	5.2	7.3	25.3	9.3	18.3	24.6
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Ethnic/Racial. When compared to the racial/ethnic makeup of the United States as a whole, all groups for which data were compared seem to be heavily weighted toward Caucasians (Table 4). The percentage of caucasians ranges from 92% for the AAG to 98% for the Society of American Foresters (SAF). According to United States Census data for the year 1989, the racial/ethnic composition of the U.S. population is 84% Caucasian, 12% African American, 3% Asian/Pacific Islander, 1% Native American, and 8% Hispanic (According to U.S. Census Bureau procedures, Hispanics may be of any origin, which results in a total of greater than 100%). These data show that minorities, with the possible exception of those of Native American origin in the ESA and the American Meteorological Society (AMS), are under-represented in the groups for which data are available.

Table 4. Comparison of the racial/ethnic composition (in percent) of the ESA with other groups (Morrin et al. 1993).

Ethnicity	USA	U.S. ESA respondents	total ESA respondents	AGI	AMS	AAG	SAF
Caucasian	84.2	95.7	93.1	96.0	93.3	92.3	97.7
Asian/Pacific	2.8	1.1	2.4	2.9	4.1	4.8	0.9
Hispanic	8.2	1.1	2.1	0.2	1.2	1.1	0.4
Native American	0.7	1.1	1.1	0.3	0.8	0.4	0.4
African American	12.4	0.4	0.3	0.3	0.6	1.1	0.3
Other		0.5	0.9	0.3			0.3
Total		99.9	99.9	99.9	100.0	100.0	100.0

Age Structure. The ESA appears to have the youngest membership of the four societies for which comparable age data are available. Eighty-two percent of the membership is below the age of 50 (Table 5). The Wildlife Society (TWS) is close to this figure (80%), while the American Geological Institute (AGI) reports 60% and the SAF 64%. The comparable figures for the United States (limited to U.S. residents 20 years old or older) is that 65% of the U.S. population is below the age of 50.

Table 5. Comparison of the age distribution (in percent) of the ESA with other groups (Holland et al. 1992; Lawrence et al. 1993a).

Age class	USA ^a	ESA	AGI	SAF	TWS
<= 30	25.6	9.7	11.8	10.4	17.3
31-40	23.2	40.5	31.2	28.1	33.9
41-50	16.4	32.2	17.3	25.4	28.9
51-60	12.4	11.3	22.0	16.2	10.3
61-70	11.6	4.4	12.7	11.2	9.6 ^b
> 70	10.8	1.8	4.9	8.6	
Total	100.0	99.9	99.9	100.0	100.0

^aFigures are percent of U.S. population 20 years old and older.

^bIncludes everyone age 64 and above.

Summary of 1992 Survey Responses

Role of volunteerism. The Ecological Society of America (ESA) is a nonprofit scientific society that relies heavily on the work of numerous volunteer committees. Thus, it is instructive that 36% of respondents indicate they devote one or more days per year in service to the organization (Holland et al. 1992), which most likely includes participation at the Society's week-long annual meeting. Moreover, six percent of respondents indicate that they devote six days or more to the Society's efforts, and it is this group of members that serve on committees, such as the Executive Committee, various editorial boards, Chapter Committees, Education Committee, Awards Committee, Public Affairs Committee, and Certification Board.

Age structure. The U.S. Census Bureau reports that 65% of the U.S. population aged 20 and above is between the ages of 20 and 50. The ESA survey shows that 82% of the ESA respondents are younger than 50. Survey results suggest that ESA membership is the youngest of the four societies for which comparable age data are available. Eighty-two percent of ESA respondents are below the age of 50, slightly more than The Wildlife Society (TWS), with 80% of its members younger than 50. The American Geological Institute (AGI) reports 60% younger than 50, while the Society of American Foresters (SAF) reports 64% of its members are younger than 50 (Table 5).

Ethnic/racial composition. The ethnic/racial composition of the United States in 1989 was 80% Caucasian, 12% African American, 3% Asian/Pacific Islander, 1% Native American, and 9% Hispanic (U.S. Bureau of the Census 1991). The total is greater than 100% because the Census Bureau notes that Hispanics may be of any origin. In comparison, the racial/ethnic composition of all ESA survey respondents is 93% Caucasian, 0.3% African American, 2.4% Asian/Pacific Islander, 1.1% Native American, and 2.1% Hispanic (Table 4). The racial/ethnic composition of USA survey

respondents is 96% Caucasian, 1% Asian/Pacific Islander, 1% Hispanic, 1% Native American, and 0.4% African American. These data show that minorities (with the possible exception of those Native American origins) are under-represented in the ESA and the other four professional organizations for which these data are available.

Retention. Forty-two percent of responses suggest that respondents who are not currently employed as ecologists would prefer to be employed as ecologists (Holland et al. 1992). The responses indicated that it may be more difficult for females to secure employment in the field than for males. Seventeen percent of female respondents cite "constraints due to family circumstances" as the reason they are not employed as ecologists. Thus, it appears that if the proportion of female ecologists is to be increased, better ways are needed to combine family and job responsibilities.

Conclusions from 1992 Survey

Needs for ecological education. Education is one of the most important activities that the Ecological Society of America must actively pursue. The goal of any ESA education program must include the production of more and better trained ecologists as well as a better informed citizenry. Over the last 40 years, the percentage of elementary/secondary school teachers within ESA (Holland et al. 1992; Lawrence et al. 1993b) has decreased from 14% prior to 1951 to 0.4% in 1991-92. During the same time span, respondents note an increase from 42% employment in four-year colleges and universities prior to 1951, to 58% in 1991-92.

While 32% of respondents indicate that a college professor was the single most instrumental factor in kindling respondents' interest in ecology, nearly 60% of ESA members became interested in ecology prior to entering an undergraduate college program (Holland et al. 1992; Lawrence et al. 1993a). Further efforts to heighten and sustain pre-college student interest and awareness of ecological principles, especially among minorities, seems warranted. In addition, further development within ESA of appropriate, attractive, and informative materials (especially for grades K-6), and wide distribution of those materials appears critical for achieving a well-informed public on ecological topics.

Recruitment. Since early influences are most important, there is a need to develop programs to encourage and support ecological interests at a young age. Given that 45% of respondents indicate their employers are located in urban metropolitan areas, and given the increasing rate of urbanization throughout the world, it appears particularly critical to encourage young people to pursue programs in urban ecology, and to address questions pertaining to the sustainability of cities and their linkage to rural and conservation lands.

Retention. This survey has highlighted some gender issues which seem critical in retaining female ecologists. These results corroborate an American Institute of Biological Sciences (AIBS) study (Blockstein 1990) that noted that women in science face many barriers, from the balancing of parental and professional activities to the lower salaries at all levels of professional experience. As has recently been recounted (Massey 1992) for minority students, mentoring is critical for both female and minority

students at every step in their educational development. Thus, it is important for educators at all levels to be effective mentors.

Recommendations from "Profiles" Report

(1) The federal agencies need to work on programs to interest minorities to study ecology. A survey of minority recruitment programs in the sciences, as well as in other disciplines (e.g., humanities, engineering), would be instructive to determine which have been successful in the past, and to recommend and implement a program that could be successful for ecological and environmental sciences.

(2) Programs should be targeted (for example, at future ESA annual meetings) for educators in elementary and secondary schools to share their needs for ecological information and to interact with researchers in the discipline.

(3) Future surveys of ESA members should include some of the same questions and response choices from the 1992 survey, so that direct comparisons can be made. Utilization of identical questions in subsequent surveys will allow ESA to document trends over the coming years.

(4) Efforts must continue to connect well-qualified ecologists with appropriate job opportunities. Results of this survey indicate that there are individuals who would have preferred to be employed as ecologists, but are not. It will do little good to initiate programs to attract ecologists to the field unless there are enough jobs for them.

(5) Attractive and informative materials (especially for general audiences) are needed in order to achieve an ecologically-literate public.

Charge to the 1993 Workshop

Project Scope: In August 1992, members of ESA's ad hoc Committee on Human Resources expressed particular concern over the survey findings on "ethnic/racial composition" and "retention" noted above. These concerns were shared by members of ESA's Public Affairs Committee, who brought their concerns to the ESA Executive Committee. The Executive Committee instructed ESA's Public Affairs Office to work with ESA's Committee on Women and Minorities to convene a workshop to develop an ESA strategy to improve retention of women and recruitment of minorities. Thus, the focus of the workshop conducted in June 1993 and reported herein was on the recruitment and retention of women and minorities in the discipline of ecology. ESA members are particularly sensitive to the need to develop materials which will be relevant to different groups of young people with different cultural backgrounds in various regions of the country. Discussions to date have raised several questions relating to the "pipeline" issue, and have heightened ESA's eagerness to reach out to young people with interests in mathematics and science and who may not realize that careers in ecology exist.

Focus: According to "Profiles of Ecologists: Results of a Survey of the Membership of the Ecological Society of America," in the 21-25 year old age group, 58 percent of respondents are male, while 42 percent are female (Holland et al. 1992). Thus, recruitment of women into the discipline of ecology does not appear to be a major problem at the present time. However, retention, promotion, and compensation are

issues of concern for female ecologists.

Members of ESA's Committee on Women and Minorities are concerned about recruitment, retention, and promotion for minorities in ecology, and agree that (given the results of the ESA survey) ESA's first priority should be on recruitment issues. However, ESA members recognize that **an effective ESA strategy must provide a vision for the next decade**, and identify specific steps which must be taken to address pipeline problems for both minorities and women.

The "action" envisioned from the workshop was to develop an ESA strategic plan for the recruitment and retention of minorities and women in ecology. The ESA governing board asked the June 1993 workshop participants to develop a long range plan to be presented to the Board at their 31 July– 4 August 1993 Annual Meeting in Madison, Wisconsin. This plan listed goals for achievement, priorities for action, and recommendations as to how various ESA volunteers and staff should proceed in cooperation with existing programs of other professional organizations and federal agencies. The workshop was convened at the request of ESA's governing board, and the board considered the various recommendations that came out of the workshop during their meeting in Madison.

Outcome: In the past, ESA volunteer committees have developed their own individual plans for activities. However, given the results of the ESA member survey (Holland et al. 1992) the board asked that representatives from five entities within ESA participate in the workshop, and that these entities agree to implement the final plan, as resources allow. The five entities are: ESA Committee on Women and Minorities, ESA Education Committee, ESA Public Affairs Committee, ESA Washington, DC. Chapter, and staff of ESA's Public Affairs Office. **The ESA governing board recognized that the Society has never before attempted to develop a Society-wide plan to address recruitment and retention issues for women and minorities, and wanted input from each of the entities mentioned above in design and suggested implementation for a long-term strategy.**

During the June 1993 workshop, ESA members met for two days with representatives of other professional organizations and federal agencies to learn about efforts that have (and have not) worked for other organizations (see Appendix B for summaries of presentations), and invested two days of strategy development, consensus-building, and writing of an ESA strategic plan.

APPENDIX B: WORKING SCHEDULE

Wednesday, 9 June	Thursday, 10 June	Friday, 11 June	Saturday, 12 June
<p>8:30am Reports and planning efforts from ESA Committees</p>	<p>8:30am Ted Field (AFA) 9:15am Virginia Jackhellm (ACS) 10:15am Christina Johnson (ASM) 11:00am Ben Cuker (ASLO)</p>	<p>8:30am Meet as a group to develop an outline</p>	<p>8:30am Present and discuss</p>
<p>12n lunch</p>	<p>12n lunch</p>	<p>12n lunch</p>	<p>12n lunch</p>
<p>1:00pm Pete Farnham (ASBMB) 1:45pm Kitty Didion (AWIS) 2:45pm Helen Moore (FONZ) 3:30pm John Vickery 4:15pm Ivo Lindauer (NABT)</p>	<p>Patuxent Wildlife Refuge Trip</p>	<p>1:00pm Split up into working groups and write</p>	<p>1:00pm Come to consensus on what to do and how to fund; agree on an ESA strategy</p>
<p>Dinner</p>			
<p>Organizational Meeting</p>			

The following is a short overview of the main points presented by each invited guest.

American Society for Biochemistry and Molecular Biology (ASBMB) Director of Public Affairs– Pete Farnham. The ASBMB Council is very committed to the issues of recruitment and retention. Up until the mid-1970's, ASBMB worked through independent committees. In the early 1970's the Society decided to have a retreat to focus on how the Education Committee and Committee on Women and Minorities could work more closely together. Now ASBMB has a Committee on Human Resources with three subcommittees (education, minorities, and women).

The women's subcommittee put together a directory of female members on a voluntary basis (have 400–500 members listed in directory). Staff maintains the directory on disk in the office and can print copies. Twenty-five percent of ASBMB members are women. Subcommittee focuses on "glass ceiling" issues for women at mid-career levels.

The minority committee has existed since the 1970's. The minority subcommittee wants to develop a directory as well. They sponsored a workshop on the "role of mentoring" at annual meeting; the focus was on how to mentor someone who is just starting out or getting their first grant. It has set up high school teacher workshops on how to improve their pedagogy in science, gives out copies of recently produced Biochemistry textbook, and encourages applications for fellowships in minority teaching. ASBMB probably has only 50 members who are African American; but it is not because African Americans cannot do science. Most kids need a doctor when they are growing up, so there is a role model in a black doctor. There is also a matter of money (physicians make more money than biochemical researchers). Minority problems have been around for many years, so they will not go away overnight. Need to think long-term in dealing with minorities.

Association for Women in Science (AWIS)– Kitty Didion. AWIS has 59 chapters throughout the United States. AWIS is not a discipline-oriented society. Their focus has been at the undergraduate level. The Sloan Foundation has provided a grant for three years for AWIS mentoring. Even with increased numbers of women in science, there are real issues of retention (salaries, tenure, etc.). The issue of gender within different cultures needs to be recognized (gender still an issue for Hispanic or Native American women). A restructuring of the system is necessary. Only 61 members of National Academy of Sciences are women. National Institutes of Health discussed designating a parking lot for parents who have to pick up children, so they have a place to park when they return. Over 40% of undergraduates left biology between freshman and senior year. Elaine Seymour has studied "switchers" to see why they left science for another discipline; science needs to be more inclusive. She discusses the need to make courses more friendly. A "Working Woman" article described a woman who wanted to wear make-up and nail polish, so she chose a field other than science. There is a lack of recognition as to how powerful the written word is. "Tyranny of the token" suggests that outreach effort need to be increased. Thirteen colleges (mostly Historically Black Colleges and Universities) produce most minority scientists, and 6 or 7 colleges produce most women scientists (mostly women's colleges). Undergraduate research opportunities for women and minorities

need to improve; often the experience of working with a woman was critical for women in making the decision to go on in science. Each AWIS chapter is unique, so each chapter has set up programs differently. Older students can mentor younger students (it is part of everyone's job to mentor future scientists).

There are many local chapters in AWIS. Most chapters are at academic institutions, but some are at federal laboratories, some at industries (e.g., Bell Laboratories). What works one place may not work in another place. AWIS has been chapter-based from inception. Chapters can respond on a local level. AWIS provides opportunity for peer support and networking discussions among young women. A key time for mentoring is sophomore year in college. Post-doctoral level (junior faculty level) is also a time when women feel lost and need mentors. Women may not see themselves as having something of value if they are not in tenure-track, academic positions. Women are often in more interdisciplinary fields than men. Personal interaction in a program is essential. Women are more productive when their spouses are scientists as well.

Friends of the National Zoo (FONZ)- Helen Moore. FONZ is a private, nonprofit organization which supports the National Zoo. The Zoo has a research/traineeship program for college students which is very competitive. Some of the traineeships are targeted specifically for minority students. The goal is for the zoo to get really good help. They also run a program on Zoo Olympics, a summer program for DC children. "Zoo animals- a closer look" targets 4th graders at low income minority schools. This is a 7-week program where teachers must agree to work with the program. Children are bused to the program. Students complete lab work, make observations of animals, and help set up habitats. Only one class per school is allowed to participate in the program. Sometimes students prepare a class to present to other classes. Once a teacher participates in the program, they are no longer eligible to participate in program. Students come one day per week. Zoo has limited classroom space available.

The New Opportunities in Animal Health Sciences (NOAHS) Center has programs to target inner city DC schools. A mini-career day allows students from elementary and secondary schools to talk with employees at the Zoo and to learn about different scientific careers. Evaluation is very important to FONZ. There have been a lot of budget cuts at the National Zoo, so some evaluations have been on hold. Evaluation forms go out to teachers, but few are returned. The program just celebrated its 15th anniversary. Teachers in DC can earn recertification credit if they participate in the FONZ program.

The Zoo has a Hispanic Heritage Day and African American day. Hispanic Day includes roving guides who speak Spanish. Afro-American Day includes different dance groups and double-dutch jump rope contests. FONZ is founded on educational programs, but unfortunately those seem to be the first programs to be cut.

ESA's Sustainable Biosphere Initiative Project Office- John Vickery, intern (former teacher). John gave an overview of his teaching experiences in New York City, on a Hopi Indian Reservation, in Mexico City, and in Guam. John provided a

handout on what ESA is already doing and what ESA members could do.

ESA members should take the ESA Exhibit to local meetings. The Education Committee should try to reprint experiments from "Experiments in Ecology" in educational society journals— break up experiments, and rewrite slightly to publish separately in different publications.

More ESA members are likely to do something if they have "ecology kits" readily available to take out to district science coordinators. The EPA's Office of Research & Development's funds environmental education programs. EPA's Environmental Education program focuses on community—action programs, such as recycling programs (Karen Hollweg has served as a reviewer for proposals for last two years).

Would ESA make a bigger difference in reaching school counsellors and teachers rather than trying to target the students?

President of National Association of Biology Teachers (NABT)— Ivo Lindauer. NABT has 50% men and 50% women members. How can you get kids turned on? ESA may have missed an opportunity in not trying to bridge the gap between high school teachers and ESA members. NABT has 9 publications. NABT conducts regional workshops as there is a strong need to bring about changes in education. There are twenty—five cities identified in NSF's Cities Initiative; twenty—six states involved with systemic change initiative. ESA may want to stand up and ask about funding for ecology within the systemic change initiative.

Often only one or two science courses are required at the high school level. Ivo suggests that ESA really needs to focus on the junior high school level to convince students to consider careers in ecology. Knowledge doubles every 14 months, so we need to focus on students' skills at processing information. Communication is so effective today that we can communicate anywhere very quickly. It's often one individual that makes a difference (e.g., one professor or one high school teacher). A single field trip can be very influential in convincing students to pursue ecology.

Grades 7—10 are the critical grades to try to reach students, especially girls, in getting them to consider careers in science. The American Society for Microbiology (ASM) has a cooperative agreement with NABT; ASM gives symposia at NABT meetings for teachers. NABT has an elementary section as well as a college section. Teacher training should include enough science training to let teachers deal with new interdisciplinary concepts.

American Forests (AF)—Urban Forests Program— Ted Field. "Reaching out to young professionals"— The American Forests Association was founded almost 120 years ago; name changed to American Forests last year. AF was involved in massive reforestation campaigns in 1930's; and recently involved with the climate change program. AF sponsored a Global Releaf program in 1988 fostering conservation and science—based citizen action. AF has had a formal intern program for 5 or 6 years. The Young Professional program includes a mentoring program (advising a protege). Young Professionals sign a learning contract of what they can accomplish in 4—5

month programs, including some indication of their success, and how they will report back to supervisor. Usually students are undergraduates, at least past second year. Most AF interns seem to be young women coming into the field. AF has a very small stipend (\$50/week for interns; provide references to housing places). They require that everyone try to write something for an AF publication, so they are looking for a professional product.

AF works with K-12 teachers. They want to develop a team process through teachers and mentor students; are working in depressed areas, so it is late in the game to contact people in sophomore or junior level in college. May work with some of the fraternal and sororital organizations, especially those for minorities.

Interns attend hearings on the Hill, go to briefings, and attend meetings around Washington, DC. Urban foresters work with the human species, and other foresters work with tree species. They have to be concerned with liability of putting someone out on the street. AF had to create own standards for the program to maintain its professionalism. No one will come to AF for the money; they must want to for professional reasons. Money is a real problem for AF in attracting minorities to intern program.

American Chemical Society (ACS)- Virginia Jackhellm. ACS has 145,000 members. They are concerned about public understanding of chemistry. The "Expanding Your Horizons" program was used as a model for a mini conference at ACS Headquarters for girls from Montgomery County, Maryland public schools. Girls start losing interest in math and science around the 6th grade. The conference consisted of a plenary session with a video from AAAS, four smaller workshops, and lunch with ACS President, Helen Free, who did a demonstration on testing for diabetes. ACS's Headquarters Office ran the pilot program with the idea that ACS Sections would do future programs on a local level. The ACS Headquarters is now planning another workshop for girls. ACS received funding from businesses in the local community, \$2,500 from Montgomery County.

The students filled out pre-conference and post-conference questionnaires, and ACS will follow-up with teachers to track girls. Sixty girls participated in the conference; teachers also came. ACS contacted the science coordinator for middle schools in the county, and the science coordinator contacted three schools to let science teachers know about conference. Many girls signed up for conference, but could not attend because of space. The three schools were in Olney, MD; the group was racially diverse.

American Society of Limnology and Oceanography (ASLO)- Ben Cuker. Ben is a member of both ESA and ASLO, and has attended meetings of both societies since 1979. He taught at Shaw University (historically black) for 7 years, then moved to Hampton University. Joan Mitchell of Ocean Sciences Directorate at NSF was concerned with how to get minority students into aquatic sciences. The first year ASLO brought 40 participants (including mentors) to a pre-conference workshop prior to the ASLO meeting. The workshop included presentation of background talks by

Ph.D.s about careers in aquatic sciences, field trips, and speakers in the evening. The cost is \$89,000 per year for the program. The Ocean Science Program has special pot of money for minority recruitment programs. The second year Ben instituted a program of meeting mentors. Ben brings a heterogeneous group of students (undergraduate and graduate), mentors from within agencies, and faculty members to the meeting. Each meeting mentor gets four students and has the job of plugging the students into the meeting. They go to sessions together and introduce the students to presenters. The mentors get a small honorarium. Regular mentors come from historically black colleges or from federal agencies. Ben began by contacting historically black colleges with a mailing about the program.

NSF's Ocean Sciences Directorate has been funding the Research Experiences for Undergraduates (REU) program for awhile and moving into a minority program seemed to be a logical expansion. There are various levels of presentation: attendance at meeting, participation in meeting, and student presentations. To date, only minority students have presented papers at ASLO meetings in the student symposium. The symposium is designed to be supportive, students attend each other's papers- 3 students present, then 10 minutes of questions for all 3 students. ASLO Board members try to attend the student symposia. Mentors need to make sure the students are involved in all social events (banquets, receptions, etc.). Students were invited to be peer mentors- relied on early graduate students who had gone through the program. Students become members of ASLO, and receive copies of journal. The average cost per student is \$1,100 (includes airfare, tee shirts, lodging, banquets, ASLO membership). ASLO picks up cost of ASLO memberships, and Ben builds into funding requests the cost of transportation to the meeting. Ben suggests ESA consider hosting a minority program at a historically-minority institution.

Ben thinks that ESA's Committee on Women and Minorities needs to be split into two committees, or subcommittees- two different issues, so need different approaches, with different foci.

American Society for Microbiology (ASM)- Christina Johnson. ASM uses the term "under-represented," rather than "minority." Fifteen years ago ASM developed a gathering at the Annual Meeting, and asked to have a committee on women and another committee on minority activities. The first group was formed by black microbiologists, then expanded to Hispanics and Native Americans. It was formed out of ASM's Public Affairs Board, and still resides there. ASM wants to increase minority involvement. Microbiology is a science which NIH supports, so ASM took a proposal to NIH about 12 years ago. ASM based their idea on FASEB Visiting Scientists program. The original grant was not funded in first year, but was funded on subsequent submission. The grant requested funding for full-time staff person, had a small focus, and focused on ASM members. Mailings were sent out to numerous minority institutions. ASM pays for 8-10 weeks of research activity, including work on developing paper for poster presentation. Also instituted BIOFAX (the Biological Careers Factual Exchange), includes information on training programs, and grant opportunities.

Christina called ASM members at institutions, told them about program, and asked

who the contact person should be at that minority institution. Then she sent information directly to that person. Travel money is included for Christina to go to schools to describe programs.

It is very important that Christina works full-time on the recruitment program: if she had other responsibilities, she would not be able to work on this program. She does not look at overall GPAs, but does look at GPA in science courses. There is a need to look at the total student and their motivation. The first summer, they had 8 students. Currently they are supporting 24 students. Every year they are able to increase the number of students in the programs. Sometimes host schools will pick up part of the student's stipend; usually work with institutions where ASM members are located. ASM budgets \$900 travel, \$1,800 stipend, \$500 cap on housing for an 8-10 week program. ASM has lots of competition because they can choose from over 35 sites. The greatest number of applicants was 70, so ASM could only place less than half of the applicants. The students are only part of the ASM program: Phase I is the Visiting Scientist (VS) program, where scientists go out to schools to discuss careers in microbiology and will consult on microbiology research. An ASM contact person identifies students, and the VS must return with at least two mentees- a lot of visiting scientists are post-docs who have more of a connection to students (students already know what they want to do); VS receives Honorarium of \$100/day. Phase II is the Summer Program- program also sent to minority students at majority schools (information goes out to all schools that offer degrees in microbiology and ASM members). Phase III takes students to meetings (supports both graduate and undergraduate students; graduate students must be presenting at the meeting). At summer program, they make sure each student has a host student to interact with. The students must be involved with research. The students need to feel connected- Christina becomes their connection to ASM, she listens to complaints. The program gives the students opportunity to see what graduate school is like- and gives the school an opportunity to see the student. Five students have been accepted into graduate programs where they had done a summer program. It is very important to look at students off of paper. ASM has follow-up to all their programs; follow-up forms are sent out once a year, so Christina knows how students are doing over last seven years. ASM Programs let students know that someone cares about their academic careers. ASM's goal is to get more minority students into microbiology Ph.D. programs. Success is evaluated on number of students going on to graduate programs. Phase IV is BIOFAX, an electronic bulletin board available through the ASM's Minority Student Science Careers Support Program.

APPENDIX C: STAFFING

Office of the EHR Coordinator 1 FTE professional + 0.5 FTE clerical assistant

		% effort year 1	% effort year 2
Direct responsibilities			
data bases	expanded EIN	4	2
	recent PhD recipients	3	2
	research opportunities	3	1
planning workshops	students at meetings	5	
	career workshops		5
	administrators		5
	community outreach	10	5
	education	10	10
proposal preparation	students at meetings	5	
	career workshops		5
	administrators		5
	community outreach	10	
	education	10	15
	videos	5	
on-going "in house"	focus brochure	5	5
	awards	2.5	1
	lifestyles workshop	5	2.5
	career workshop coordination		5
	administrators coordination		5
	internship newsletter	2.5	2.5
	brochures	2.5	1
Oversight responsibilities*	mentoring/internships	3	2
	students at meetings	3	2
	community outreach	3	2
	videos	5	2
	education programs		15

* The programs will require additional personnel as grant funds are obtained; time estimated here is for ESA oversight and coordination only.

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APPENDIX E: ACRONYMS

AAAS- American Association for the Advancement of Science
~~AAG~~ Association of American Geographers
AAUW American Association of University Women
~~ACS~~ American Chemical Society
~~AFA~~ American Forestry Association
AGI American Geological Institute
~~AIBS~~ American Institute of Biological Sciences
~~ASBMB~~ American Society for Biochemistry and Molecular Biology
ASCD Association for Supervision and Curriculum Development
~~ASLO~~ American Society of Limnology and Oceanography
ASM American Society for Microbiology
AWIS Association for Women in Science
~~AMS~~ American Meteorological Society
CSSP Council of Scientific Society Presidents
DOE Department of Energy
EHR Education and Human Resources
EIN Ecological Information Network
EPA Environmental Protection Agency
ESA Ecological Society of America
FONZ Friends of the National Zoo
NAAEE North American Association for Environmental Education
NABT National Association of Biology Teachers
NASULGC National Association of State Universities & Land-Grant Colleges
NOAHS New Opportunities in Animal Health Sciences
NSF National Science Foundation
NSSA National Science Supervisors Association
NSTA National Science Teachers Association
ORNL Oak Ridge National Laboratory
ORISE Oak Ridge Institute for Science Education
PAO Public Affairs Office
REU Research Experiences for Undergraduates
RNRF Renewable Natural Resources Foundation
SAF Society of American Foresters
SBI Sustainable Biosphere Initiative
~~TWS~~ The Wildlife Society
UF Urban Forests
USDA United States Department of Agriculture