2019 AWG Award Winners Recognized at the GSA Annual Meeting in Phoenix, AZ  By Lisa Tranel

In September 2019 (you remember, back when we could travel!) the Association for Women Geoscientists hosted our breakfast at the Geological Society of America Annual Meeting. We met to recognize the amazing achievement of women across all fields of geoscience. Our members woke up bright and early as always to network, reconnect with friends and colleagues, and enjoy a warm breakfast. We applauded the tremendous achievements of professional geoscientists and the amazing potential of graduate and undergraduate geoscientists. We also acknowledged the hard work of many members of the geoscience community for their tireless efforts to improve inclusion in geoscience education and the workforce.

Professional Excellence Awards
The Association for Women Geoscientists is honored to highlight the significant contributions women professionals make within the range of career paths across the geosciences. Since 2011, AWG has recognized and celebrated women from three professional categories: Government or Regulatory Agencies, Private Industry or Consulting, and Academia and Research. These awards recognize the breadth and depth of professional accomplishments, mentoring of geoscience students and professionals, outreach and service activities, and contributions to professional societies. Nominations are due each year by June 15 and are reviewed by a selection committee.

The AWG Professional Excellence Awards received funding from Noble Energy, 2015 - 2019, which we gratefully acknowledge.

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Dear AWG Members,

To begin this letter, I want to reaffirm that Black Lives Matter. In my winter newsletter I mentioned the key goals of our strategic plan. Inspired by recent events and called to action by our members, the Board of Directors realized the need to include more actionable items to improve inclusion and equity in the geosciences and in AWG. Additional action items that we developed included:

- **Create a webpage** of resources for education and action to communicate the challenges associated with intersectionality faced by people from underrepresented groups in the geosciences including members from underrepresented ethnicities, women of color, LGBTQ+, and visible and invisible disabilities.
- **Develop media resources and use media outlets** to highlight the accomplishments of geoscientists from groups frequently experiencing prejudice.
- **Update existing scholarships and awards** to make sure application requirements are inclusive and equitable and consider opportunities for new scholarships and awards to recognize more people from underrepresented groups.
- **Offer opportunities for community development** and open conversations.
- **Partner** with other organizations to share resources, network, and create greater impact with diversity efforts.
- **Increase education about implicit bias.**
- **Develop a study to understand diversity of women in geoscience world-wide.**

The Board of Directors quickly took on the first three items. Our Website Committee compiled a variety of resources and posted a new page on our website. Our Social Media Committee started an AWG Instagram. As you may have read in the June E-News, the Minority Scholarship Committee is actively working to revise this scholarship, including the name and application requirements to make it more inclusive and accessible. At the local and regional level, our AWG chapters are working together to host joint events or discuss how they can make change in their own local communities. Thank you so much, to all the individuals on the Board of Directors and chapter leadership who are helping to coordinate all of these projects!

*Continued page 3*
The Board of Directors is also extending our AWG network and opportunities through collaborations with other societies and projects. AWG member Kim Schwab served as our AWG representative on the American Geosciences Institute’s (AGI) 2020 Nominating Committee. South Central Delegate Laurie Whitesell served as our AWG representative at the American Institute of Professional Geologists (AIPG) June Board Meeting. President-elect Noelia Carmona volunteered on the AGI Ad-Hoc Committee on Diversity to develop a joint society statement on diversity, equity, and inclusion in the geosciences. In July, we reviewed and formalized our agreement to work collaboratively with the Geological Society of America. We discussed collaboration opportunities or memoranda of understanding with three additional organizations, two of which are international. I know there are many more members representing AWG in additional collaborations, and I appreciate the work that all members do in the multitude of societies that you all serve.

This past year has been an amazing learning experience for me. I am so grateful for the continued and dedicated efforts of so many members for volunteering their time to advance AWG’s mission. The AWG Executive Committee and Board of Directors is made up of a group of truly amazing people. Thank you to you all for your insights, knowledge, experience, and most importantly time and efforts to keep AWG active, organized, and moving forward. Thank you to all the project leads and chapter officers who help us offer scholarships, awards, and programs to reach out to our international, regional, and local communities. I very much appreciate your energy, creativity, and efforts to initiate and sustain these important activities to promote geosciences. I want to also note a very special thank you to Mackenzie Cremeans for your guidance and support as I moved into this position and to Noelia Carmona for your collaboration as you prepare to take over in September as President.

Lastly, to all members, thank you for your continued participation and support of AWG. Your work as members is what makes AWG so impactful to so many people! As always, I ask you to please stay in touch, share your stories, and let us know how we can help support you as you work to uphold AWG’s mission.

Take care,
Lisa Tranel, AWG President 2019-2020
Diversity and Inclusion – The AWG Minority Scholarship

By Jenny Thompson – AWG Foundation President

Diversity in an organization or group increases innovation, improves problem solving, increases productivity and enhances engagement. It is not enough to diversify, we need to include everyone in the process, or we do not gain the benefits of diversity. Diversity without inclusion is not enough.

Geoscience is one of the least diverse groups in the STEM community. In the last few months, the news has highlighted the impact inherent racism and ethnic bias in institutions, companies, and organizations has had on diversity. As I prepared to write this letter, I spent some time educating myself about the topic and one of the terms I came across that resonated with me was “ally”. An ally is any person who is willing to take action in support of another person, in order to remove external barriers that impede that person from contributing their skills and talents in the workplace or community.

As a woman in the geosciences I have seen the value of engaging our male colleagues as allies in our efforts to increase gender diversity. Likewise, I see value in being an ally to all the underrepresented groups in our geoscience community and to those who desire to become geoscientists.

As an ally we need to take an active role to increase the number of geoscientists in under-represented groups. Some actions that you can take are:

• Educate yourself – Listen, read, and learn from different voices. Then challenge yourself to examine your own bias and be willing to change. This can be an uncomfortable process but will make way for personal growth and prepare you to be a better ally for others.

Continued Page 5
• Actively nominate geoscientists from underrepresented groups for awards, scholarships, lectures, and panels. At conferences and in meetings reach out to underrepresented people and make sure they are heard in the conversations.
• Becoming a mentor or sponsor – champion someone from an underrepresented community to support career growth.
• Use inclusive language – Be aware of gendered terms, and use language which embraces all walks of people.
• Attend unconscious bias training regularly and encourage others to do so. AWG has been active in offering and promoting training sessions on unconscious bias. Follow social media for opportunities to attend.

AWG with the support of the AWG Foundation has consistently been committed to encouraging the participation of not only women in geoscience, but underrepresented communities as well. In 2004 AWG established the AWG Minority Scholarship to provide funding to undergraduate women from underrepresented groups within the geosciences, to support their studies and future careers. In addition to funding, awardees are matched with an AWG mentor to provide support in their career and are also given a one-year AWG membership.

Earlier this year Madeline Shaffer and Lina Ma took over as leaders of the AWG Minority Scholarship and recognized the urgent need to update this scholarship with more inclusive language and requirements. The scholarship committee is actively working to update the scholarship application and process to be more inclusive. As an example, the term "minority" is not an accurate description for underrepresented ethnic groups and can carry negative connotations. Thus, the committee is developing a new name for the scholarship that better represents its purpose. Stay tuned for updates and the announcement of the 2020 winners of the AWG Minority Scholarship. A big Thank You to Madeline and Lina for taking over as project leaders. We cannot do the work of AWG without the support of our passionate volunteers.

Continued page 9

SUPPORT

Enclosed is my contribution of $_____________

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Mail to: Kate Johnson, AWGF Treasurer, 652 Glimmerglen Road

Cooperstown, NY 13326

Or donate online at www.awg.org

DONATE TODAY!
**Academia/Research: Dr. Jennifer A. Roberts**

Dr. Jennifer A. Roberts, Professor and Chairperson of Geology at the University of Kansas, has a long record of stellar scholarship, service, and mentoring, and is warmly appreciated as an effective, compassionate, and innovative leader in her department, across the University, and in the scientific and local communities. Assuming the role of acting chairperson in January 2017, she undertook unaddressed daunting tasks including external review and curriculum revision, during a time of shrinking budgets. Dr. Roberts amassed, assembled, and presented data to reflect the strengths of her department’s faculty and students. She also addressed equity in the faculty workload, which led to an improvement in department morale. She transformed her department.

Jennifer Roberts improved graduate student orientation, with the department taking an active role, with sessions on CV-writing and navigating reimbursement procedures; a weekend field trip as an introduction to the geology, hydrology, and hydrogeology of Kansas; introductions of departmental staff members; information about field trip safety, classroom and field etiquette, and the many requirements that graduate students have to successfully graduate. Importantly, she also arranged for a valuable presentation from a representative from the counseling office of the University, who talked about stress, depression, and resources available to students to deal with those issues.

Jennifer Robert’s impressive scientific contributions include being the first to successfully grow dolomite in the lab, with her continued contributions to the lingering “dolomite problem” including the role of methanogenic Archaea (2009, first author is her student, Paul Kenward, in an often-cited publication). Recently she collaborated on a project demonstrating the presence of microbes with multi-drug antibiotic resistance in Arctic soils. Besides her collaborations with other geomicrobiologists as well as geophysicists, hydrogeologists, carbonate sedimentologists, and soil scientists, she has published extensively on conceptual learning and classroom transformations in the geosciences.

**Government/Regulatory: Dr. Lynn Wingard**

Dr. Lynn Wingard’s professional accomplishments at the U.S. Geological Survey and her activities in mentoring, outreach, and other service demonstrate a sustained level of excellence. Her research demonstrates a sustained record of productivity (nearly 150 technical presentations and 75 technical reports published by the USGS and in a range of journals). Her innovative, multidisciplinary geologic studies contribute to society.

Lynn Wingard, trained as a molluscan paleontologist, is recognized for reclassifying an important group of Mesozoic and Cenozoic bivalves, the Crassatellidae. Since then, she has employed her knowledge of molluscan classification, biostratigraphy, and paleoecology to address multidisciplinary problems in both deep and near time. She discovered an invasive, potentially parasite-carrying snail in Biscayne National Park and monitored for its risk to human health. Lynn’s work, especially her “anticipatory target setting,” is at the forefront of the emerging field of Conservation Paleobiology and has important management and policy implications.
AWG’s goals are to **Encourage women to become geoscientists**, **Enhance professional development and career opportunities for women in geoscience**, and **Exchange educational, technical, and professional information among women scientists**. The following three awards recognize AWG members who embody these goals through their actions and support of women in geoscience.

**AWG Encourage Award: Carole Johnson**
Carole Johnson is a hydrologist at the United States Geological Survey Water Resources Mission Area Earth System Processes Division. AWG recognized her for her excellent efforts to encourage women in the geosciences at all stages to engage, participate, and be connected.

**AWG Enhance Award: Laurie Whitesell**
Laurie Whitesell is the Near Surface Geophysics Program Manager at the Society of Exploration Geophysicists (SEG). AWG recognized her for her work to enhance the professional growth and advancement of women in geosciences through her leadership as the Women’s Network Manager and community engagement.

**AWG Exchange Award: Mary Hill**
Mary Hill is professor at the University of Kansas. Throughout her career she has made important contributions to modeling and understanding groundwater flow through her work at the United States Geological Survey and University of Kansas. AWG recognized Mary for her efforts to provide support to women in the geosciences through educational, technical, and professional information.

**AWG President’s Award: Rula Deeb**
This award is an honor bestowed on members of the geoscience community who have blazed new trails to make progress toward AWG’s mission. This award recognizes one person who embodies professional excellence as well as promotes AWG’s three E’s: Encourage, Enhance, and Exchange. Rula is a Senior Principal Civil and Environmental Consultant. Her work in private practice and academic work focus on groundwater contamination and soil and water remediation.

*Continued Page 11*
We are delighted to announce the winners of the 2019-2020 AWG Brunton Award:

**Priscilla Martinez**, a senior at California State University, Fullerton

**Katherine Worms**, a first year graduate student working towards her Ph.D. in Geology at Oregon State University.

We look forward to hearing from them in the fall issue of Gaea.

The AWG Brunton Award Committee is making a special request this year. We know that many field camps were virtual this year, and that many women who work in the field had less work in the field than usual. That being said, some field camps were held and some were able to do field work. We need your help in promoting applications (due date is now December 15) so we continue to have high quality applicants. We would appreciate you forwarding the AWG flyer ([http://awg.org/images/awards/Student-Awards/Brunton-Award-Flier-2019.pdf](http://awg.org/images/awards/Student-Awards/Brunton-Award-Flier-2019.pdf)). Anya Hess (Brunton awardee 2007) is the new Chair of the committee and has been co-Chair this past year. I’ll rotate off as Co-Chair.

I found this photo on a Facebook post (photo right) and I grew so excited. Being from a private group, I asked if I could share the photo. It turns out the owner of the tattoo, Maddie Burvant, started the AWG Student Chapter at SDSU and was delighted! Should have known this tattoo would be on an AWG geologist. The Brunton Transit is universally appreciated by field geoscientists.

**AWGF—DEADLINES ON THE HORIZON**

**AWG Foundation FY2020 Reports and FY2021 Proposals**

**DEADLINE SEPTEMBER 30, 2020**

*Remember to submit reimbursement and disbursement requests WELL AHEAD of the fiscal year end of September 30.*

- **DOWNLOAD forms and guidance at [http://www.awg.org/RequestFunding](http://www.awg.org/RequestFunding) on the foundation tab**
- **Contact awgfsecretary@awg.org** AWGF Assistance with Reports and Proposals
- **Contact awgf treasurer@awg.org** AWGF Reimbursement and Disbursement Requests
- **Contact awgfpresident@awg.org** AWGF New Projects

**THANK YOU** to all our attendees for joining our Zoominar especially: Sarah Dewey, Janae Wallace, Jean Crespi, and Donna Jurdy for sharing their experience with Project Leading and Fundraising.

Contact awgfsecretary@awg.org for a link to the recorded Zoominar
At its core, the Minority Scholarship remains vital to the pursuit of diversity among our geoscience community. It directly influences the success of women from underrepresented groups who seek careers in earth science. If you or your company would like to support this endeavor, we urge you to be an ally and take action in the form of a donation or sponsorship. AWG and the AWG Foundation would love to have the funds to offer more minority scholarships and expand the program to include scholarships for both undergraduate and graduate students.

Please consider donating to the AWG Foundation and supporting the AWG Minority Scholarship, providing helping hands to the next generation of women preparing for careers in the geosciences.

Please join me in supporting AWG through the Foundation. Your contributions are what makes the AWG projects possible. You can donate online at www.awg.org. You can also send a check to the AWGF treasurer at the address listed below. Please include your contact info as in the form below.

Just a note: In these times you may be seeking a way to honor someone with a gift in their memory as a way to celebrate their life. If you would like to donate to the AWG Foundation in memory of a family member or a friend you can donate online and then notify our treasurer of your memorial gift by sending an email to: awgftreasurer@awg.org or use the form below and mail a check.

As always, we thank you for your support of the AWG Foundation, and we will keep right on asking for more.

Jenny Thompson
AWG Foundation President
She communicates with stakeholders, managers, and policymakers (e.g., Congressional Research Office, DOI officials, congressional staffers), ensuring the utility of her work in mitigation and restoration. In addition to her outstanding research contributions, Lynn Wingard has demonstrated dedication in service to the profession and the community. She has been an associate editor for the journal *Frontiers in Ecology and Evolution*, and has contributed her expertise to numerous USGS review panels, nine funding agencies and more than two dozen journals. Additionally, she has been an invited speaker at a dozen universities and various agencies.

Lynn regularly participates in USGS-sponsored educational outreach activities, speaks at public lecture series and lectures for the National Park Service. She has organized conferences, helped develop museum exhibits, interacted with the media, and supervised development of online resources. Lynn has also provided educational activities for the Boy Scouts, Girl Scouts, local parks and festivals, and local public schools. She has mentored individuals from K-12 to early career, including high school student projects. Lynn represents AWG on the AGU Mentorship365 Committee, and mentors in the USGS employee program.

Dr. Wingard has received numerous awards from the USGS including the “Going the Extra Mile” Award for service. Her service to AWG includes serving on the Board of Directors as a Delegate for the Southeast Region. Lynn received the 2017 AWG “Encourage Award” in recognition of all that she has done to encourage young women in the geosciences.

from Lynn--
*I feel very honored to have received the Professional Excellence Award for Government in 2019. I have worked for the USGS my entire professional career, first as a Physical Science Technician (PST) and then a Research Geologist. I was very lucky to have been at the right place at the right time to be hired as a part time PST at the start of graduate school in 1982, where I was mentored by many great paleontologists and biostratigraphers. When I completed my Ph.D., I applied for a paleontologist position and was hired in 1990. My initial research focused on taxonomic and biostratigraphic questions, but I soon moved into paleoecology, and what is now called conservation paleobiology. Our research team is working closely with resource managers on restoration of the Everglades and our role is to provide information on what the ecosystem was like prior to anthropogenic alteration. This work has been very rewarding because our results are being used to set goals and targets for restoration. I am very grateful to have a rewarding career and one that I enjoy so much, especially when I am in the field.*

**Industry/Consulting: Sainzaya Tumur**

Sainzaya Tumur is a leading geologist in Mongolia, with a nearly thirty year career. She earned a Masters degree in Geology from the Mongolian Polytechnical Institute, with a focus in mineral resources exploration. Sainzaya then worked for nearly 2 decades in mineralogy research at the Central Geological Laboratory of Mongolia before entering employment in mining. She also taught Mineralogy at the Mongolian National University.
AWG Distinguished Service Award: Donna Jurdy
Each year AWG recognizes exemplary service to the AWG community. Donna Jurdy was recognized with the 2019 Distinguished Service Award for her outstanding service to the International AWG community. She started and continues to support the Professional Excellence Awards. During the two-year campaign she helped raise over $200,000 dollars in contributions to the Chrysalis Endowment. Donna is Professor Emerita at Northwestern University. She has served many roles in AWG, including board member of both the AWG and AWG Foundation.

AWG Chapter Excellence Award: Osage Chapter
The Chapter Excellence Award is given to an AWG Chapter that has gone above and beyond to represent the national organization and support women in Geosciences. In 2019 AWG recognized the important efforts and contributions of the Osage Chapter. This chapter successfully offers several scholarships and awards each year as well as participates in outreach opportunities in the community. Of special note in 2019, was this chapter’s success in hosting a panel discussion offered locally to the chapter, but also streamed through to the Facebook community, reaching many geoscientists world-wide.

AWG Special Recognition Award: Noelia Carmona
The Association celebrates unique contributions to the geoscience field in support of AWG’s values through the Special Recognition Award. Noelia Carmona is recognized for her continued support, energy, and outstanding work to connect the international geoscience community. Noelia is a professor at Instituto de Investigación en Paleobiología y Geología and leads the Patagonia Chapter. Since she began serving on the AWG Board of Directors, she has made great strides to communicate with our chapters outside of the US and help us improve our connections with International members.

What About 2020!
AWG and AWG Foundation are in discussions about how we will honor our award winners for 2020. GSA is virtual this year, so we are considering a virtual presentation ceremony for our members to connect and recognize extraordinary achievements again this year. And, we hope to celebrate with both our 2020 and 2021 awardees in person again at the 2021 GSA Annual Meeting. Please watch E-news, our website, and social media for more details to come!
Through her work as a mineralogist-engineer and geochemist-engineer, Sainzaya has participated in exploration for minerals in Mongolia, and is a specialist in instrumental analysis. Notably, she employed portable x-ray equipment and chemical element analysis to determine geochemical properties in exploration boreholes. Her field laboratory analyzed 100,000 samples in one year, with results directly incorporated into the exploration map. Sainzaya also conducted geochemical analysis in another project to increase the production near the Khushuut coal mine. She participated in international projects with both Japan and Germany, learning analysis methods and introducing novel approaches to Mongolia.

The introduction of the XRD analytical technique, and installation of thermal research equipment as a part of the projects has made a notable contribution adding to the research of the Central Geological Laboratory. Engaged not only in exploration and conducting chemical analysis in a field laboratory, she also has trained young geologists in mineral identification. Sainzaya was awarded the Mongolian "Outstanding Geologist Award" for her contributions to the field of geology, in 2009.

Recognized among her co-workers for her professional qualifications and helpful nature, Sainzaya Tumur is also known among her colleagues and within her profession as an excellent organizer and promoter of young researchers and students. She is one of the leading women taking an active part in work to help NGOs and society. She is active in the Mongolian Female Geologists' Association. Sainzaya and family members established the J. Dugersuren Fund, in honor of her grandfather, a PhD in geology-minerals, who was the first geologist of Mongolia, to support young researchers and students, including sponsoring and organizing an annual conference.

Thank you to the PEA Committee members, Donna Jurdy, Chair, Roxy Bush, Debra Hanneman, Molly Long, Blair Schneider, Dennise Templeton

Bottom Left: Dr Lynn Wingard, Bottom Right: Sainzaya Tumur, center, with colleagues in the field.
The Association for Women Geoscientists is pleased to announce the awardees for the 2020 Jeanne Harris Chrysalis Scholarships. The committee has chosen two awardees this year. The recipients are: Meghan Cook from the University of South Florida and Patricia Jaimes from Michigan State University.

The Jeanne Harris Chrysalis Scholarship provides degree-completion funding for women-geoscience graduate students whose education has been significantly interrupted by life circumstances. The awards are intended to cover costs associated with completion of her thesis/dissertation, beyond what is traditionally covered by primary research funding. Such costs can include drafting expenses, child-care, defense travel, late-state research and analyses, or anything necessary to assist a degree candidate during those critical, final days. The award amount varies up to $2,000 and the application deadline is March 31 each year. See the AWG website for additional information. http://awg.org/awards

Meghan Cook
Meghan was born and raised in Lakeland, FL where most of her family still lives. She earned her bachelors and masters in geology from the University of South Florida, focusing on geochemistry. She is currently in pursuit of her Ph.D. at USF as well, but with a focus on geoscience education. She works at the University of South Florida Tampa Library on a team that services the School of Geosciences for all of their research/publishing needs. She has also been an adjunct professor/instructor at numerous community and private colleges for the past nine years. She married a fellow geologist and they have 3 children together, the youngest of whom was just born in March.

Patricia Jaimes
Patricia is a PhD Candidate in the Geocognition Research Laboratory (GRL) at Michigan State University (MSU). Her dissertation research in the GRL focuses on understanding how minority scientists enter, navigate, and succeed in scientific careers with the goal of developing innovative solutions to the problem of lack of diversity in the geosciences. In addition to investigating diversity in STEM, she is working on a dual degree in Environmental Science and Policy. She seeks to use her expertise to develop inclusive and accessible science education and outreach programs that will lead to increased diversity in the geoscience workforce. In addition to her research, Patricia is passionate about mentoring and is actively engaged in mentoring undergraduate and graduate students at her university. She is currently President of the MSU Chapter of the Society for the Advancement of Chicano and Native American Students in Science (SACNAS). Patricia has long been recognized as a leader. At MSU, she has received the Tracy Hammer Award for Professional Development, the MSU Council of Graduate Students Disciplinary Leadership Award and most recently, the MSU Diversity Award for Emerging Progress.
Since its inception in 1996, the Association for Women Geoscientists Jeanne Harris Chrysalis Scholarship has provided degree-completion funding for women geoscience graduate students whose education has been significantly interrupted by life circumstances. Awarded funds are intended to cover costs associated with completion of her thesis/dissertation, beyond what is traditionally covered by primary research funding. Previous winners of the scholarship have gone on to do great things with their geoscience degrees. With this in mind we want to catch up with past recipients to ask a few questions about how the scholarship helped kick-start their new career.

In 2008, Karen Kortz won the Chrysalis Scholarship as a Ph.D. student at the University of Rhode Island. Here, Karen shares her background and the impact of winning the Jeanne Harris Chrysalis award on her career.

Karen: After receiving my Masters in geology, I took a break. My appendix had burst, and I was reevaluating what I wanted to do. A temporary teaching position opened up at the Community College of Rhode Island, and I discovered that I loved teaching, so I applied for and received a permanent position when it opened up. After teaching for a few years, I decided to go back to school and finish up my Ph.D., but this time I would focus on geoscience education research, which I had learned was a new field of study and became passionate about while I was teaching. My husband and I also started a family. Receiving the Chrysalis Scholarship at this time helped me weave together my teaching, getting my Ph.D., and raising a family.

I am now a full professor, still at the Community College of Rhode Island. I love teaching the student population at the community college level. Using the knowledge gained from my research, I published an introductory geology textbook called Focus on Geology. We wrote the book based on how students best learn, and we worked hard to have geoscientists who are traditionally underrepresented (e.g. women, racial and ethnic minorities, and geoscientists with disabilities) represented in the photos. I received the NAGT/GSA GeoEd Division Biggs Award for Excellence in Earth Science Teaching, and I am also the Curriculum and Instructor Editor for the Journal of Geoscience Education and the Coordinator of CCRI’s Teaching and Learning Collaborative.

Did the scholarship help you achieve your goals? How so? Yes! I used the Chrysalis Scholarship to pay for daycare, so I could take classes and attend meetings for my Ph.D. held during the day.

Do you think you would have finished without it? It would have been much more difficult (for me and my family) and taken more time.

What would you say to other female graduate students about the scholarship? People rarely get where they are by following a straight line. My life and career took twists and turns that I didn’t and couldn’t anticipate. For example, I initially thought that stopping school after my Masters was a setback, but it opened up a new, better direction for me, and I am happier and more successful now because of it. This change in direction was made easier by the flexibility of the spending of the Chrysalis Scholarship funds.

We’d like to thank Karen for sharing her story and hope that it will inspire others to apply for this unique scholarship. If you’re a past recipient and would like to be featured in our quarterly article, please contact René Shroat-Lewis at rashroat-lew@ualr.edu.
Increasing International Representation: One of Our Next Goals
By Noelia Carmona, AWG President-Elect, and Renata Netto, AWG International Delegate

During the last couple of AWG officers meetings, we have had enriching conversations and discussions on how to make our Association more inclusive, and how to reach those women geoscientists that are still not fully represented in our organization. Particularly, we have been thinking of AWG international members, which constitute a minority group (see Figure 1). From these charts, it is clear that we need to increase our representation worldwide.

Some AWG members have established a few International Chapters (http://awg.org/InternationalChapters) in regions outside the US, such as Argentina, Canada, Ireland, Mongolia, and South-east Asia. However, the majority of our members are not included in any established chapter.

Why is it important that AWG reach other regions?
If we desire to accurately understand the problems women geoscientists are facing worldwide to help them find solutions, we need to know the different realities they experience in their regions. In that way, AWG will be able to delineate special programs, awards, or scholarships specifically designed for them, and/or to adapt the ones that we already have active, to make sure that everyone can apply to them. This is one of the ways we, as an association, will be more inclusive.

Additional actions we are taking also include reaching other international geological/paleontological organizations to work in cooperation, to promote our shared values and activities. During the next months, we hope to be able to communicate with you all about these new agreements. The present coronavirus disruption led us to rethink about virtual activities, lectures, etc., that can be accessible to all our members, regardless of residence country. This is also something we are discussing and organizing for the near future.

You can help, too. As an international association “devoted to enhancing the level of participation of women in geosciences and to introduce girls and young women to geoscience careers”, we would like to invite you to help us spread the word about our goals worldwide.

What can you do? There are several actions you can take to help AWG increase the participation of international members. For example:

- You can reach your colleagues living in other countries and tell them the AWG mission. Encourage them to be involved with AWG and to contact us. We would be delighted to listen to them, know what their needs are, and help them through their careers in geosciences.
- If you are living in a country outside North America, one way to help is to organize a local team or community to start discussing and sharing information about our associations and its goals. You can also formalize your activities forming a Chapter, and again, we can help you with any doubts or questions that you may have. You can find some more information about this issue on the AWG webpage (http://awg.org/ChapterResources).

Continued Page 16
Updated Photo Release Form

Is your chapter involved in outreach to young people? Does your chapter have a website? Do you post items on social media? We need to be mindful of the rights of members and participants included in photos, and respectful of how we use their photos. AWG’s Board of Directors recently asked the Forms Committee to improve the Association's photo release form for this age of communication by print and by social media. Here is the Link to form:

Please print this new form and have it signed whenever members and chapters photograph participants at events. The new form breaks down the various uses so that participants and parents of minors can easily select how images may be used. This form also covers the use of photos in Chapter Reports, and is critical as your Editing team includes Chapter News in ENews and Gaea, often accompanied by photos from the Chapter Reports. Thank you for your attention to this issue!

International  Continued from Page 15

• You can become a mentor. This is an excellent way to support students and young researchers from other countries (especially those outside North America) to pursue and complete their careers as geoscientists. For example, you can become a mentor joining the Mentoring365 virtual mentoring program (https://mentoring365.chronus.com/p/p1/). This program was developed among different Earth and space science organizations to help “the exchange of professional knowledge, expertise, skills, insights, and experiences through dialogue and collaborative learning”.

Finally, we will continue working to improve the benefits for all our members, and particularly those underrepresented in our association. If you have any additional comments, suggestions, or ideas, please share them with us at president@awg.org. We want to hear from you! Thanks for your help!
Roberta is an active volunteer firefighter with South Australian Country Fire Service (CFS) for over 32 years. *This article is her personal interpretation and observations of events & circumstances -- they may be challenged by others in the industry.*

Australia, mainly the east coast/highlands & adjacent interior (central – SE Queensland down south to New South Wales SE corner & nipping into SE Victoria – Gippsland & Canberra) as well as my home state of South Australia -- targeting the Adelaide Hills, Kangaroo Island, Yorke Peninsula & Southeast -- experienced some “mega” bushfires followed by major flooding, unprecedented in the country’s colonial history. I thought the Victorian “Black Saturday February 2009” bushfires were horrific. The September 2019 to February 2020 bushfires were basically a roller coaster ride of extreme weather/geographic/anthropogenic events driven by several different factors, which of course, the media would not present in an all-encompassing way.

On Sunday 16 February 2020, “Fire Fight Australia,“ a concert for National Bushfire Relief, was held in Sydney NSW, with world-renowned musicians performing. Over $9 million (AUS) was raised to help NSW Rural Fire Service, individuals, families, communities, businesses and local/state/federal organisations affected by the bushfires that devastated Australia during the Austral spring – summer period of September 2019 to February 2020. I “listened” to the 10 hour concert on TV whilst doing my business accounts. Tears were streaming down my face, caused by a combination of listening to the music lyrics and my peripheral vision of the big screens showing imagery of the various bushfires across Australia which were directly linked to my recent fire-fighting experiences. Hopefully, the funds land at grass roots level rather than tied up in administrative hierarchy! Hopefully! If you have the opportunity to look at Ice House’s rendition of “Great Southern Land” -- do it! Lyrics are circa 1982 updated with Cinerama 2019-20. Also, 2 CDs from the Fire Fight Concert were produced, with benefits of sales going to relief for kids of the Bushfires. There are some positives coming out of the “Aftermath”.

We are living in crazy, unprecedented times. “The Day the Earth Stood Still” (18th March 2020) combined the coronavirus (COVID-19) pandemic with the aftermath of the Australian Bushfires. Added to these, are the protests and violence occurring across the globe following a tragic situation in Minneapolis. Quarantine, social distancing/isolation, loss of home and/or businesses, and retrenchment from work depending on the industries, have created a humongous strain on individuals and the global economy and landscape. Some positives are evident. The Land, the Air & the Waters are quietly & slowly recovering. Ironically these three earthly elements come together in the name I gave my company: *Geo-Ocean Horizons*. I have worked in all 3 environmental venues during my professional career(s). What I will concentrate on in this article is my bushfire experiences and the subsequent aftermath and recovery including my unexpected healing processes.

In this last year, my existence in Australia has been extremely challenging -- both physically & mentally exhausting AND stimulating -- with my brain cells going ballistic on:

- My personal involvement in the fires: Why did I take time out of my own business to fight fires, particularly as a volunteer (no compensation whilst working side by side with paid personnel!)...until the Government finally contributed an olive leaf to the volunteers.
- Why the bushfires & associated devastation?

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What are the lessons learnt? How far back in my careers do I need to go to define and/or address my lessons? How can I apply the lessons to my business?

Whose lessons learnt? The outcomes of the state/federal inquests & royal commissions will probably be partly different than mine.

How can I or do I have to, provide intel so these situations never occur again (I hate using “never”).

What the media broadcast globally on the various Australian bushfires versus “me” -- what my human eye and the associated emotions and brain processed from “boots on the ground” intelligence experiences were, in many ways, diametrically opposed. Writing is my best therapy to sum up the my bushfire experience over the last few months, relate those experiences to my various professions AND my associated unexpected emotional and physical tolls. The media produced heaps of stories from many different angles but never accomplished the full 360 degrees of the fires and their aftermath. More intel is yet to come via the national and state inquiries/royal commissions, not to mention the international academic communities and agencies that are listening and sharing. More positive stories of the “recovery” are starting to flow from aid agencies/businesses/communities helping communities/individuals and businesses kick-start again from the impact from the fires. Throughout my involvement at various levels of the bushfires, I did, when possible, send informative updates, to friends and relatives in the USA & Australia. The correspondence came from my heart. I thank those who responded and simply offered “support”, which helped me work through some confronting scenarios of my life.

My Background

I was born & bred in Milwaukee & Seattle and immigrated to Australia in 1985. I am a marine geologist/oceanographer with a career splintering into marine geophysics, environmental sciences, surveying and, for the last 25 years, bushfire prevention/land management. I joined the South Australian Country Fire Service (CFS) as a volunteer fire fighter in 1986, following a childhood dream of being a “fireman” and helping the local community. The CFS fire-fighting branched into training/assessing on specialist courses as well as participating as strike team member at the local/regional/interstate levels for +33years. Unforeseen to me, volunteer fire fighting took me on a different career path from oceanography.

Land Management Background

My business’ bushfire prevention work (BFP) simply evolved, after a downturn in offshore marine geologic industry in the mid 1990s, to mowing (slashing, brush-cutting) blocks during the fire danger season (FDS) for local Council & residential compliance (FDS usually spans 1 Dec to 30 April, with legislation occasionally gazetted during the drought years, to move forward the FDS to early Nov). In 1994, I didn’t know what a brush-cutter was and borrowed one. Now I own 9! BFP programs expanded into additional work in land management -- block clearance (chain-sawing, tree climbing, vegetation clean-up etc., particularly post storm events) and the more challenging weed and pest plant control on residential blocks and reserves/parks (primarily olive & woody weed control and understanding their relationships with the native/exotic vegetation and fuel hazard reduction). I obtained my licenses/qualifications for herbicide use etc. I still work for private, local councils & state/federal governments and local universities.

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I was my CFS brigades’ representative on the local Council Bushfire Prevention Committee for several years in the 1990s. Learnt heaps on the methodology of bushfire prevention and mapping including fuel hazard reduction combined with “integrated weed management”. My newly found profession as a brush-cutter and lawn mower on “billy goat blocks” grass roots stuff, to “hard yakka” steep, uneven surfaced blocks that the standard lawn mowing person won’t touch, proved challenging from several different perspectives. “Fuel Hazard Reduction & weed control” -- what do they really mean in the short and long frames of reference? +26 years fast forward – the answer is “A LOT”, particularly on the fire landscape.

The “science of brush-cutting and mowing” - what’s that? How is it related to the fire landscape?

In 1994 & 1995, as a CFS volunteer, I was directly involved with the Sydney & Adelaide Hills bushfires, respectively. Common observations I made whilst on the front line were ground (vegetation) fuel loading and landscapes related to compliance/non-compliance for vegetation reduction (fuel hazard reduction) and relationships of weed type/height/concentration with the native vegetation (ground level to canopy). In many areas, I noticed incineration of the landscape – just a lunar landscape of ash on the ground and charcoal trees standing (burnt trunks & root stock, some with & without a brown/green leaf canopy). Over the years, I also saw gradual changes in the local council /state legislation for the FDS as well as the Native Vegetation Act/Regulations, particularly around buildings.

As a CFS volunteer in the late 1980s-early 1990s, we used to burn off residential blocks from October to the following February. These were gradually reduced to “today's world” where we basically only do burn off of vegetation heaps (usually pest plants or simple block clean-up of under/overgrowth) on billy goat blocks where removal is not either cost effective and/or viable (access).

By the mid 1990s, instead of burning off blocks, “slashing” via brush-cutting, and mowing became the accepted methods for vegetative ground fuel hazard reduction. Co-incidentally, the Clean Air legislation was introduced to minimise burn-offs in designated areas to only 1000-1500hrs on Monday-Saturday. Large scale burn-offs, particularly in the national parks (NP) were also reduced due to a combination of reduced budgets and staff. In the last 10 years, the NP situation has changed depending on the state, with NP seasonal fire fighters doing the controlled burn-offs in the parks when seasonal conditions and budgets are hand in hand. Ironically, CFS has begun to assist NP in some areas (the oldies of CFS are predominantly retired and the knowledge/skill sets have not been passed on due to these changes). A lot of NP pre-planning is required before the torch is lit! Consideration for timing of controlled burns is given to vegetation, animal and bird breeding cycles, adaptive habitat for predator avoidance, presence of rare and endangered species (flora/fauna/aviators), cool vs. hot burns, follow-up maintenance on secondary weed explosion, budgets, and logistics such as fire appliances being available.

My North American understanding and knowledge of vegetation were on steep learning curves moving to Australia. Grass types, shrubs, trees, weeds and vegetative fuel factors were totally different than what I grew up with in Wisconsin and Washington state. (The conundrums of native local vs. native non-local vs. exotic international somehow introduced – I won’t get into that here!)
Australian native grasses cure later and react differently to mowing/brush-cutting methods to the standard lawn & pastoral grasses (native grasses need to be cut high every few years to keep rejuvenileing).

Pasture grasses grow to +1m height by December depending on the slope aspect (N/S/E/W; rainfall/sun). Slashing these grasses can be challenging, particularly if the paddocks are mowed for hay vs. just “mowed for BFP” unless pasture animals nibble them down. Timing is critical for BFP compliance. November-December rains can affect regrowth which means additional costs related to a second cut for compliance later in the FDS (particularly when complaints occur).

Foreign Weeds love Australia -- exotic woody weeds in particular from similar overseas climates (South African, Mediterranean etc.; examples: broom, gorse, bone seed, bridal creeper, olive, sour sobs, marsh-mellow, St Johns’ Wort, African daisy, watsonia to name a few). Not only do they have different germination seasons, they also have different soil seed stock duration. Different types of woody weeds are prolific because of the “non-munch” factor (stock/native animal avoidance) due to the weed’s toxicity (e.g. goats/cattle don’t munch on broom). If uncontrolled, weeds can take over the native vegetation landscapes. If uncontrolled/not managed/mis-managed, weeds can become the “middle story” vegetation in the fire landscape.

Foreign Plants love Australia – garden escapees/cuttings and pastoral crops take hold of the landscape and/or out-compete the local native vegetation (road side verges for example). These too, can become the middle story vegetative fuel between the surface and tree canopy of the fire landscape.

“Exotic” Native Vegetation (Native Weeds): the garden escapees and translocation of native species that originally didn’t belong in specific areas. Just because native vegetation is “native to Australia” doesn’t mean they belong in the local landscape and associated fire landscape. They can out-compete (just like the foreign weeds/plants) the local native vegetation and contribute to changes in the middle story canopy and associated fire landscape (e.g. Queensland-derived pittosporum in South Australia).

Olives have exploded on the Australian landscapes since their introduction at the turn of 20th century. Adelaide Hills has the ideal Mediterranean climate, with proliferation of at least 5 different olive hybrids. Since the early 1980s, olive shrubs/trees have taken over several areas of the Hills. Background: The Australian olive industry was a major primary producer up to the 1950s-early 1960s when the market crashed. The owners of the massive Adelaide Hills, as well as other areas, vineyard groves abandoned their olive plantations, leaving the crops to nature. This resulted in uncontrolled, explosive and devastating effects on the native vegetation from the take-over species and the fire landscape owing to increased flammability. Olive control, reduction and removal are expensive propositions. Over the years, several techniques for control and removal, have evolved and proved successful depending on their location (e.g. cut/swab/fill vs. drill & fill vs. basal bark spraying vs. explosives of the root base vs. popping tools for the root base with demo outcomes still on “the olive flea,” a biological agent). From my early CFS burn-offs, I learnt to always watch olive trees/shrubs nearby -- they explode due to the oil in them! Hillsides of olives in fire situations, particularly the “fuse line (wick)” up the drainage system” are very quick ways of setting the hillsides ablaze.

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Eucalyptus environment: ("Google" the Blue Mountains in New South Wales to learn the origin of the name!) The remnants of trees will last a century or more. (The old gum fence posts are still standing whilst the perma-pines and star droppers have fallen over.) The trees give off an "evaporate vapour/oil" as best as I can non-scientifically describe. (Eucalyptus leaves/oil are flammable -- the fallen ground fuel in combination with the aerosol fuel.) An analogy is watching the burning of green oak leaves vs. dried ones as my Uncle demonstrated to me as a child following storm events in summertime Wisconsin. The barks of the various eucalyptus trees are also quite variable – tight skinned, scaly to stringy bark. These factors can drastically affect the fire landscape, particularly if plantations are involved.

For brush-cutting blocks with high vegetation, I developed a technique to handle the tall grasses/weeds (+0.5m ht) – a “3 zig zag Zorro cut” to purposely break down the fallen stalks into smaller bits so the microbes could get at them and break them down quicker (in theory, reduce long term ground fuel build up and fuel loading). The cut evolved from observing, over the years, that cut long stalks remain on the ground in-tact for several years (not efficiently broken down – bio-degraded), whilst multi-cut, shortened stalks tended to de-grade/break down quicker. The end results of multi-cut stalks were reduced ground fuel loading year after year of slashing (burn-offs were no longer an option). I also observed the brush-cutting/mowing techniques of other contractors and what their cut remnants left over accumulating ground fuel stalks, were after a few years -- interesting comparisons. What are the microbes doing on various surface areas of the stalks? What are the weather conditions and seasons that are best to bio-degrade the stalks?

For the bushfire compliance work, I invested in quality, heavy duty brush-mowers (robust mowers compared to the conventional ride-on-mowers) which cut and mulch the vegetation rather than the cut and drop of the tall vegetation as results from a tractor/slasher. Sharp mulching blades made a huge difference in not only reducing the ground fuel height but also the ground fuel accumulation and effectiveness in bio-degradation/breakdown. (For several years, I have been working on answers to questions including, What are the microbes doing on the surface area of the cut stalks in the simple cut-drop vs. mulch?; How does the seasonality of cutting combined with seasonal rain fall affect this?; How do these observed results affect weed control with minimal/nil herbicide use and fuel hazard reduction?)

Why are brush cutting and mowing techniques important for BFP and the FDS? Answer: fuel hazard reduction (height, ground level fuel tonnage) and ground fuel breakup. Basically, less ground fuel accumulation occurs each year if the microbes munch on the downed material, which occurs if conditions of weather, water, soil etc. are right for breakdown. The smaller the bits, the more the surface area for microbes and presumably, quicker degradation resulting, we hope, in less long-term ground fuel loading and potentially re-conditioning the soil, vegetation and animal foraging on the land. The “flow on effect” is also gradual weed reduction with promotion of grasses, provided mowing is done when weeds aren’t flowering. Philosophy of keep the weeds/grasses low through multiple cuts means potential increased “mulch factor” which puts nutrients back into the soil along with growth suppression, less seed germination of weeds, and follow-up cuts instead of herbicide application. (Unfortunately, budgets can be a mega factor on these short/long term maintenance issues.)

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Background: Generalized Fire Fighting Techniques applied in Australia

Wet Fire Fighting

“Wet” fire fighting for grasslands, hillsides and some forest fires, usually occurs from or off the fire appliance tankers which carry the water, water pumps for the hoses and a variety of hoses. Water, possibly mixed with injected foam, is the usual fire suppressant medium. From the mid 1990s, the use of combination of 25mm high pressure hoses with 30m lengths of 25mm lay-flat hoses have been used quite successfully. The lay-flat hoses are lightweight, quite manoeuvrable, easy to carry, add or make-up lengths, particularly on steep, uneven slopes. I have worked on hose lays of up to 400m with the lay-flat (granted the downhill run to get the good pressure despite internal friction loss).

Major considerations with wet fire-fighting include:
- Having locally available sources of water to replenish the empty fire tankers;
- Availability and suitability of a variety of sizes of the fire tankers, depending on the topography(s) encountered (transit routes, slopes, access tracks (narrow, overhanging limbs, rocky etc.); can the larger tankers (2-4000 litre) supply water to the smaller “quick attack” vehicles that can get into difficult access areas;
- Availability, suitability and difficulties of bulk water carriers to access water resources and subsequently supply water to the other fire tankers; some major concerns/considerations include:
  - Drafting from farm dams, and the effect of water loss on stock/crop water supply;
  - Drafting from ponds/lakes/residential swimming pools;
  - Drafting from intermittent water holes in drought affected drainage courses (effects on wildlife and flora etc.);
  - Extracting water from water bores and short/long term impacts on ground water resources;
  - Extracting water from 20,000 - 100,000 litre tankers with different styles of hoses, hose couplings (e.g. donated/contracted milk, petrol, water tankers that have segregated tanks);
  - Extracting water from reticulated sources (mains water) which had variable flow rates depending on distance from the pumping stations which includes taking care of aged underground and exposed pipework infrastructure and getting the water agency approval to extract water (one cannot just tap into a major pipeline on the landscape).

Dry fire fighting

Dry fire-fighting is a combination of a minimal use of water to put out/secure the edges/perimeters (mopping up/black out stages) and limited available water resources. When the water tank hits 0.25 full level and the water tank alarm goes off, “that’s all folks” – time to go for a refill or re-think of the strategies for fire suppression if the tanker needs to remain in place.

A variety of fire suppression strategies are usually applied to different areas of the fire, depending on the intensity of the fire front and pre-planning to get the breaks installed ahead of the advancing fire front.
Dry fire-fighting usually targets the outer perimeter in an attempt to control the forward/sideways spread of the fire front, as fall-back zone for controlled planned burn-off and/or to establish manual fire breaks to slow or impede the fire front. The methods include rake-hoes, rakes, shovels, chainsaws, and axes to create 1-10m wide fire breaks or break up slowly burning fuels, to use of water knapsacks or wet sacks to mop up/black out low intensity fire edges, stomping with one’s boots (to put out small embers and fire edges) and heavy machinery including dozers and tractor/slasher or rippers. I won’t discuss the environmental issues associated with the use of these methods.

Aerial Water Bombing and Mapping

Aerial water bombing became a combatant tool in the early 1990s in Australia including the Adelaide region and some rural centres. The outcomes of their short use on fire ground were that the fire perimeters/areas were reduced. However, the internal part of the fire suppression activities (“boots on ground”) still needed to be completed as well as extended time monitoring of the perimeter to prevent further outbreak(s) depending on weather/topographic/vegetation changes. In addition, with dedicated aircraft, the mapping tools have changed dramatically from mapping perimeters and hot spots and faxing them to the Incident Management Team (IMT) to real time mapping via wi-fi to supply update maps of the fire ground/hot spots at designated time sequences for planning strategies.

Aerial water bombing has been a bonus to fire suppression activities BUT it comes at a cost which depends on type of water bomber (fixed wing, helicopter bucket, heli-tanker, mega fixed wing water/retardant dropper). Basically, the fire is “contained” within boundaries where fuel hazard reduction occurred, and outside of the boundaries, fuel hazard reduction depends on the location (area of burnt ground is reduced by aerial water bombing vs. just letting the fire spread and “controversially let the country burn”). This application comes with controversial outcomes, particularly if there are residential, commercial and/or park infrastructure in the fire path. Comment: some rural areas haven’t been burnt in +10yrs, with the gradual increase in vegetation fuel; nature not allowed to take its course in the fire landscape.

Aerial water bombing and mapping have a few restrictions:

- Depending on the weather, particularly wind and air quality (smoke), planes/helicopters simply cannot fly. Hence the field information and associated “combatant strategy(s)” have to come from ground level. Hence, fire suppression activities can be greatly impacted without overhead assistance.
- Water bombing activities are usually restricted to day time (day light hours), particularly if there are infrastructure issues (power lines, etc.). This may be changing with advances in flight technology.
- Water bombing activities can be severely impacted by topography – narrow valleys with steep adjacent terrain affect flying particularly with helitankers.
- Water bombing activities can be severely impacted by the water capacity of carrier vs. travel distance from both source of water and source of re-fuelling.
- Use of drones: logistical and legislative restrictions on their use on/above the fire ground; their use may increase depending on aero-space legislation. Their use as another tool in BFI has some benefits within the “restrictions”.

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Aerial water bombing is terrific in terms of reducing the time resources are on the ground in particular location(s). However, aerial water bombing is expensive. There are a lot of logistics involved including (not all listed):

- The type(s) of craft used;
- Fuel type & sourcing for the craft(s);
- Logistical teams to get to location to re-fuel as well as re-water the crafts;
- Location of re-watering points in relation to the fire/s;
- Logistical considerations to get possible additives to the water to enhance fire suppression activities (foam, retardant etc.);
- Logistical considerations for contractors to get fuel and water to the remote landing strips (which may require private land owner permission etc.);
- Priorities of locations of fire suppression activities via aerial water bombing and follow-up ground resources;
- Positioning of ground resources/personnel with respect to water bombing drops (so they are not directly impacted by both the water and potential tree branch breakage; escape routes);
- Environmental considerations, particularly water drainage systems, with water drops and what is being used (water, retardant, foam etc.);
- Costs: priorities need to be set; there is never an open cheque book.

Getting back to Australian bushfires. Why? Why AND WHY???

I have been a bushfire investigator (BFI) for several years, investigating the potential causes of small bushfires within the Region. As a result of doing these investigations with associates, my perception of bushfires has changed considerably from just “putting out the fire on the front line” to include, analysis of fire behaviour and cause whilst on the fire ground. Observed variables include location, for example, in paddocks where there may be crops growing vs. cut stubble; pastoral stock type (cattle vs. sheep vs. goat with/without alpacas etc.); fencing; infrastructure age; overhead vs. underground power lines; and maintenance of local vegetation (considerations can include overhanging tree limbs, shrubs on electrical fencing, planting of trees beneath overhead electrical/telecommunication lines and short/long term follow-up maintenance, and maintenance of mowing equipment). My senses of vision, hearing and touch related to fire behaviour, causes, and effects, changed as a result of being on the front line of bushfires, engaging as a BFI and my inquisitive geologic/oceanographic background.

During the period September 2019 to January 2020, I was a volunteer fire fighter “boots on ground” on 2 interstate & several intrastate strike teams. I was based at Glen Innes, NSW for 5-day CFS deployments in November and December 2019, assisting on the final touches of the then “controlled” Gulf Road Fire and Yetman Fire, respectively. I was on the front line of the fierce Adelaide Hills-Cudlee Creek fire on 20-21 December 2019, as well as “mop up – extinguishing operations” of the Kangaroo Island (KI) Ravine Fire in mid-January 2020, after the early January fire storms. In addition, I attended several local/regional bushfires, including one less than a kilometre from my residence. I participated at different levels from boots on the ground – active fire suppression to supplying water from our bulk water carriers (BWC) to other tankers/farm units etc. BWC work is not an easy task, with getting out of/into the BWCs, shifting hoses and appliances, finding and navigating to water fill points (bumpy tracks) and filling from the water points.

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Following are my answers and interpretations to the question of causation, or *The Why Factors*: which may differ from, among others, the on-going Australian Royal Commissions of Inquiry.

1. Arson was suggested by certain media as a main cause of the fires. Arson may have played a small contribution depending on when and where it happened. Some individuals have been caught and successfully prosecuted. However, arson includes illegally lighting fires in the bush as well as lighting brush fence fires, and lighting stolen cars on fire.

2. Illegal camp fires and/or camp fires not appropriately extinguished. Small contribution and usually related to lack of awareness, carelessness, cultural misunderstandings and/or ineptness of the campers. In a few instances in SA in the last year, campers have illegally lived in remote, small, bush habitats and failed to properly extinguish the camp/cooking fire(s) prior to departing for the day. High daily temperatures coupled with wind can result in embers igniting the adjacent non-cleared vegetation. How quickly the fire can be extinguished is dependent on the landscape (ease of access for fire fighters, vegetation, slope), access to water sources, accessibility for aerial support, time of day etc.

3. Car, truck, and train fires. Burning vehicles pulled over on tall grass road verge, or hot parts from, for example, a catalytic converter, on the dry grass verge spark fires. This category includes under-chassis mount of the afterburner with exhaust pipes on heavy work vehicles posing a fire danger that could be alleviated by an additional pipe that vents above the truck canopy. Fires caused by trains, whilst minor, are usually from sparking from the train braking, with sparks igniting the adjacent dried train line vegetation.

4. Inadequate maintenance of brush-cutting and mowing equipment, tractor slashers, and farm/ recreational vehicles including four wheelers. Build-up of chaff around hot engines and inadequate cleaning can lead to fire which is then exacerbated by insufficient nearby fire extinguishing medium. Static electricity from dried grasses whilst slashing can also cause a fire.

5. Permitted burn-offs by private land owners. Burn-offs on private land involve pile heaps for weed control, small land clearance, and agricultural paddocks, but can go out of control. Personnel may not be appropriately trained or ill equipped to handle the “controlled” burn-off. Problems include non-compliance with permit requirements, unexpected weather changes and/or associated wind direction/speed changes which then lead to fire containment problems.

6. Non-prescribed burns by private land owners, gone horribly wrong. Some land owners felt secure in the proximity of emergency services and decided to do unpermitted burn-offs. For various reasons, emergency services couldn’t respond effectively and, in some instances, temporarily became “trapped”. In some parts of Queensland & NSW, emergency services had to immediately stop planned and approved strategic back-burns because of the dangers caused by the unexpected burn-off of hillsides/paddocks. In planned burns, resources including fire-fighting appliances, air support, medical & IMT personnel, are strategically positioned. Access and escape routes are significant considerations as long transits may have minimal turn around points causing entrapment of fire appliances. In some states, the police have the authority to arrest and prosecute the individuals, particularly if on a TOTAL FIRE BAN day(s).

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7. Certain private land owners and/or corporations are serial offenders in that they continuously or historically ignore the legislative BFP mowing/slashing compliance notices during the FDS, as well as pest plant control, and have allowed vegetation and associated fuel loading to accumulate on their property(s). Adjacent properties are put at risk for fire damage and spread. In South Australia, if someone files a complaint on a property(s) during the FDS, local Council becomes liable if something happens on the land. The work load of local Council BFP officers increased to organise contractors to handle the non-compliance and the “flow on results” with contractors getting the work done in a timely manner (sometimes with police in attendance), and the billing structure amongst contractor, Council and land owner (lots of time wasted to handle challenges to the billing). At least in South Australia, the different tiers of government agencies are unable to enforce the Fire and Emergency Act/Regulations for a variety of reasons, particularly budget and legislative authorization.

8. National Parks (NP): federal, state, local levels including conservation parks. The never ending conflicts of interest (disagreements/disparsity) with the political, cultural, tourism & environmental control and direction on land management, particularly the fire landscape; the ongoing challenges are understanding the “land” and the relationship of vegetation and organisms living on the fire landscape and the associated impacts with weed/exotic native vegetation control and burn-offs whilst preserving the local native vegetation.

- Some areas planned for prescribed burns don’t occur at the specific time(s) allotted due to legislative, budget, breeding/migration/germination seasons and/or weather (rain or drought) problems (clash of politics and the environment). Results are increased ground and middle story fuel loadings if the prescribed burn-offs don’t occur. In some areas of Queensland, New South Wales, Victoria, Canberra and South Australia, the NP planned burn-offs didn’t occur and a safe fire landscape can’t be sustained over a few years.
- “In-house” disagreements on what/when/where to burn-off and most importantly, the intensity of the burn and what vegetation is considered “fragile” during the burn period. Three important issues include budget, seasonality of burns for different vegetative/animal species, and lack of understanding of the ecosystems/life cycles in relation to the landscape including that the aboriginal perspective is only recently starting to be acknowledged within the parks system. Highly contentious issues have arisen and need to be addressed such as low impact burning vs. intense burning with tree trunk/canopy impact.
- Inadequate/restrictive budgets, the numbers of staff/volunteers available and in house disagreements on how to manage small to large scale invasive weeds/exotic native vegetation/local native vegetation which migrate into the middle story as well as drainage systems, the pathway from ground/surface fuel loading to canopy-crown fuel loading; dramatic changes occur in the fire fuel loading/vertical structure with time, which also occurs on private/corporate owned land, particularly tree plantations. These issues are slowly being addressed via 5-10-20 year management plans for the whole of the park(s) and includes the important “follow-up maintenance” issues. Each state, unfortunately, has different philosophies which create boundary issues with fires (fires don’t stop at state borders; for example, the NSW-VIC-Canberra mega-fires at end of Dec2019).
- Jurisdictional disparity on fire suppression activities within the park(s) and adjacent land owners. The disagreements on fire suppression activities may go back to mega disagreements on land management, particularly invasive weeds. (point cont next page)
Interstate deployed fire-fighters and their respective ground level managers have been caught in the cross-fire of highly argumentative parks vs. local land owners fire and land management including the problematic variations in interstate legislation. Some of the outcomes have been “nasty” to the “willing to help” interstate fire fighters from both the local parks and land owners.

- Legislative changes to prescribed burn-offs and land clearance on private and public land, particularly South Australia Adelaide Hills region and National Parks, since the early 1990s. A progressive change was in 2009-2010 in SA, post-Black Saturday fires in Victoria in February 2009, with changes to the Native Vegetation Act to allow clearances of native vegetation to within 20m of structures. This has saved several structures during the major fires BUT... Background: when I joined the CFS in 1986, controlled burn-offs on private land occurred from October to February at least 1-3x per week for ~4 years. I learnt heaps on how to conduct burn-offs, permits required etc. Unfortunately, the “training skills” came to an abrupt halt about 1994-96 with changes to the legislation to reduce the type and number of prescribed burns (air quality, native vegetation etc.). The methodologies for fuel hazard reduction changed dramatically during that period from annual burn-offs to slashing (brush-cutting and/or mowing). These changes affected residential, industrial and government land owners (e.g. National Parks). Access and labour costs were contentious issues for both contractors and land owners/renters. After some major fires started by various slashing techniques with insufficient accessible fire suppression equipment, there was a combination of legislative changes on what tools/equipment for fire suppression were required on site, and increased coverage for public liability insurance. Audit checks on contractors, contractors continually updating JSA/insurances, with added enforcement checks, require additional staffing which requires a budget which requires justification which requires more paperwork which then asks the question “is the job worth the cost” to contractors. Because of the variability of terrain and types of “slashing”, there is a lot of controversy on “immediate accessibility” to fire suppression equipment and the associated quantity supplied vs. the real world and associated problematic logistics/costs getting equipment to the location(s). The legislation, whilst well intended, cannot be applied to all locations/situations.

9. Aerial water bombing and mapping the various local and "mega-campaign" fires were essential tools for the IMT groups and proved extremely effective strategies for the ground resources. Combatant strategies were daily updated including changes to and allocation of fire-fighting resources, the methods for fire suppression and priorities for fire suppression on state-wide basis because ground and aerial resources were stretched to the limit. Interstate and international resources for both ground and aerial operations were brought in thanks to interstate agreements on use of the aerial support.

With all the success that the aerial operations provided, there was also sadness at the loss of a large water carrier that crashed in NSW with loss of life of the three internationals on board. The limitations of aerial water bombing were met BUT what their accomplishments to the “boots on ground” fire fighters, particularly in difficult accessible country, cannot be forgotten. The key issues working against the effective use of aerial water bombing in SA, NSW, Qld, Victoria and Canberra were:

- Logistics aircraft: sourcing and types of aircraft for specific needs, rural air strips to handle the types of craft, sourcing/delivery of correct aviation fuels, water, foam &/or retardant, physically refuelling and re-loading, hours of flying per day and for the roles during the day; ensuring daily routine maintenance of planes and pilots/air operators occurred.
• Logistics water supply: what and where the water supply(s) was, determined the type of craft used; this also affected the usefulness of water drops if distance between water resource and drop was marginal, particularly for northern NSW; the air operational support teams were literally flat out – fatigue factor.

• Weather factor: planes/helicopters/helitankers can’t fly on windy days nor in smoky areas and/or their “usual pin point accuracy” was denied. These factors dramatically impacted the fire suppression activities on the catastrophic day of the Cudlee Creek Fire in Adelaide Hills (Dec19). These factors also impacted fire suppression activities in the late Dec19 – early Jan20 “mega” fires in NSW-Vic-Canberra borders as well as KI in South Australia. One of the bonuses I observed in NSW, was pilots and ground support actively interacting on the radio: “pilots visually inhibited by smoke from the ground” being guided by ground support to do pin point water drops. Believe me, there were moments of silence followed by moments of cheers.

• Budgets: without going into detail, unfortunately governments at all levels do not have an open cheque book. Priorities had to be set (life, property and the environment).

• Use of drones: their use as another tool was beneficial as long as air space restrictions and legislation were abided by. Unfortunately, some drone operators don’t understand the impact of a drone making contact with aircraft and the impact on that aircraft.

10. Lightning is suspected to be one of the major causes of numerous fires in some areas over the years (technology today allows us to monitor the strikes on the ground on “real time” basis). Lightning is suspected to be one of the causes of several rural KI fires in late December19-early January20, as well as contributing to the spread of the mega-fires in rural NSW-Vic-Canberra in November-December 2019. Dry lightning display on a crystal-clear evening...watch it touch the ground...“is that smoke I see in the distance or on the computer screen”... yep....in the middle of no-where land...no problems until suddenly impacts anthropogenic landscape and ouch! Lighting is a by-product of the mega-fire, which can create its own atmospheric conditions/weather. An outcome of the recent (ongoing) SA royal commission on the SA 2019-2020 fire season, was improvements in “lightning tracking” technology for quicker responses by the fire services.

11. Weather patterns: predictable and unpredictable scenarios:

• Adelaide Region: predictable scenario(s) of typically warm-hot, dry (low humidity) NE- N windy morning days followed by an afternoon sea breeze and/or approaching weather front from the west during late spring and summer days; if fire starts morning to early afternoon, these winds fan the existing fires and then, the afternoon W-SW sea breeze or W-SW wind change from the approaching western weather front opens up (the “narrow SW long oriented” fire front opens up into a E-NE directed very wide fire front (Adelaide Hills Ash Wednesday February 1983 fires and other Adelaide and SA Regional fires including Sampson Flat 2016, Pinery 2017, Cudlee Creek 2019). Unfortunately, despite this “recognized” pattern (part of IMT planning for the day), fire suppression activities were impeded by extremely strong winds (aerial operations drastically reduced) and basically, despite pre-planning, insufficient resources to combat the fires as the fire spread/advance was quicker than resources could attend to (particularly Cudlee Creek fire) – simply despite every effort to have appliances on “alert”, stand-by at station, in transit and on the scene, there just were not enough to save every house/property. All the government and private agencies worked together in a positive way – but Mother Nature simply had the upper hand.
• Weather patterns combined with steep topography – up one ridge and down another almost unstoppable (radiant heat “pre-heat”/convection created by topography (up/down drafts) /conduction means the transfer of heat up/down the valley; the parts of the fire tetrahedron are invoked: radiant heat upslope pre-cooking the landscape, conduction via the variety of fuel loads available (grasses, weeds, middle story, canopy) and convection related to terrain). This was apparent in the late December 2019 fires in the highlands of NSW-Vic-Canberra and some of the coastal areas – the slopes just “went up in flames” and drainages were a conduit for flames up the valley.

• Daily changes in weather patterns and approaching weather fronts: depending on the wind speed/direction and time of day, aerial water bombing operations may cease – planes can’t fly safely much less land, fill and drop their water load accurately (SA: Pinery Fire 2017, Cudlee Creek 2019, KI 2020 and several fires in SA southeast & Yorke Peninsula).

• Global weather patterns: 1+5yr droughts in sections of Queensland, New South Wales, Victoria & South Australia (also different years affected Tasmania, sections of Western Australia & Northern Territory). The rains simply did not come or they are hanging out above the equator (Southern Ocean Oscillation with El Nino – La Nina)...relevant for the 2019-2020 bushfire season on Eastern Seaboard with the “extremely positive Southern Ocean Oscillation event”...the moisture/rain just didn’t come down and the coast/interior dried up. OUCH. I watched the media presentations but until I SAW the landscapes around Glen Inness (northern NSW) in Nov 2019, my brain cells finally connected as to the devastation:

• Private dams were bone dry with 1m dried grass growing in the middle of them; stock had nothing to drink much less eat. Bull-dust/barren ground with no vegetation on them; if there was vegetation, it was dried cured grasses on ground with dehydrated shrubs/trees suffering with changes in colour to brown leaf foliage & lots of fallen branches. What hurt emotionally, was watching hay trucks drive along the dirt roads and sheep would turn around and run towards the truck – knowing they had some sort of feed. Australia created the “truck hay – rural aid” which basically consists of lots of truckies and farmers donating their time/energy/costs to convoy cart the hay to the drought affected areas and offer a bit of financial relief to the property owners so they can feed their stock (Rural Aid)!

• Drought long term impacts: some areas were affected by bushfires a few years ago. Trees did the “leaf drop” as a result. Minimal recovery of the trees post bushfire due to drought. Leaf litter on ground accumulated without much degradation – hence ground fuel build-up. Lightning strike (usually dry lightning) and/or other means of fire, area burnt again, primarily from build-up of the ground fuel and drought.

• With the drought, come water restrictions. I was based out of Glen Innes NSW for the two deployments (Nov & XMAS 2019). I was based out of base camp “tent city” in Nov19 whilst had the luxury of motel accommodation in Dec19. Regardless of the accommodation, I watched my daily water consumption (use as opposed to hydration). The township had basically run out of water and was relying on carting in water via water tankers to supply the township/residents. My showers, after long days on fire front, were 4 minutes max. Considerations were given to how many times I flushed the toilet. Amazing how much water is used to flush! Aussies are lucky in that we have a “half or full” flush tap on the toilets to use less water!

Continued Page 30
• What does this mean for fire-fighting: re-think from wet fire-fighting extinguishing to dry fire-fighting extinguishing and increased use of infrastructure – mechanical equipment like rake hoes / shovels (crew line), dozers etc. to create fire breaks (which may require permits and time associated to get the permits, not to mention logistics to source and get the mechanical equipment/s to the location/s).

12. Eucalyptus (various) and Pine Plantations, Natural Preserved Pockets and Windrows: each species has their own flammability rating depending on their stages of development (seeding to harvesting to re-vegetation). The ground story through to middle story to canopy can create different environments for fires (ground vs. canopy fires). Whilst there are numerous fire access tracks and boundary breaks in the plantations, fire coming from adjacent areas can be of concern, particularly if the wind is up (a lot of ember spotting in advance of the main fire front) and aerial support cannot be implemented effectively (Kangaroo Island Ravine fire affected several plantations). Windrows, whilst creating sheltered environments for native and pastoral animals, can occasionally act as a “wick” with fire spread quicker (sections of the Cudlee Creek fire). With advances in milling technology, some of the burnt standing trees can be harvested but not with the dollar value originally expected. Effects of fire on the plantations and windrows, usually along fence-lines, is also dependent on how cleared the adjacent boundaries are. Some of the fires in the plantations were caused by sparking from slashing equipment along the boundary.

13. Underground burning stumps and roots: extinguishment of stumps and the roots systems was a mandatory part of the mop-up/black out operations, particularly 50-100m inwards of the fire perimeter. Some of the fires were re-ignited when the burning roots extended into unburnt ground and ignited the surface vegetation. Three of the main injuries that occurred on the fire ground could be related to burning stumps and roots:
• Both are “an oven” which can burn the ankles/legs of fire-fighters;
• Both can cause steam burns to fire fighters during the extinguishing phase if the inappropriate method of water is applied (direct jet vs. distant cone) – the hot ash can rise up to head height to an in-experienced fire fighter;
• Both are hollows in the ground which can lead to ankle injuries.

Related Issues

As a geologist who has worked in hydrogeology, I learnt the importance of water reserves, both on the surface and underground. We have an understanding of regional long-term storage and use of water, but the occurrence and effect of anthropogenic ground water with-drawl is less known. This results in water restrictions for fire-fighting (where does the water come from for the aircraft AND fire appliances -- the ground, 50,000-100,000 litre water tankers, private & public dams [put out the fire but just lost my stock as the last drop of water in dam was taken], drainage areas including isolated water holes). We drafted water from one isolated water hole and it was black water. Crews commented the next day on colour of water coming out of the branch (nozzle). I passed our concerns that the water tanks and pumps would need a really good clean out afterwards from the black water due to the potential for damaging the tanks and plumbing. Other contentious issues were the use of sea water and its affect on native vegetation (KI Ravine fires and coastal NSW).
Dry fire-fighting methods were used frequently in several of the fires where water wasn’t readily available and accessible (sometimes bulk water carriers have to travel +1hr, each way, to get 10-13,000 litres of water which could be used among 3 to 7 fire appliances depending on their water tank size). The “dry” methods were physically demanding on personnel, particularly with hydration an active issue (hand tools with or without machinery). In some areas, even the heavy machinery couldn’t get access safely to create an effective fire break and/or “create” a safe access track. The methods were applied to different areas of the fire: outer perimeter in an attempt to hopefully “control” the forward/sideways spread of the fire front and/or as fall-back zone for controlled planned burn-off.

There are days that certain types of the water bombers can’t fly because of high winds. This happened at Cudlee Creek in the morning of 20 Dec 2019, as well as on KI fires, numerous times in late December 2019 -mid January 2020. It is critical to know the water bomber type and its associated cost before arguing for their presence and effectiveness; integrated long term planning is necessary. There are background logistical considerations on use of aerial support, that the media is not privy to.

The Aftermath & The Recovery

The list is truly endless on personnel involved in attending to the Australian fires of 2019-2020. The volunteer personnel were from a wide ranging background: fire-fighting (Country Fire Service & Metropolitan Fire Service – South Australia, New South Wales Rural & Urban Fire Services, Queensland Rural and Urban Fire Services, Western Australia Rural and Urban Fire Services, Northern Territory Rural and Urban Fire Services, Tasmania Rural and Urban Fire Services, Victorian Country Fire Brigade and Metropolitan Fire Brigade, Canberra Rural and Urban Fire Services), State Emergency Services (all States & NT contributions), medical volunteers, volunteer emergency support agencies/industries including Salvation Army, charities and others, the “Locals” who spent endless hours on the front and back lines besides defending their own properties and the contributions from international personnel on IMT and air operations from Canada, USA and Europe. (The IMT international contingent from Canada/USA gave the Aussies a bit of “reciprocation” boomerang help after Aussies helped in previous years' mega fires in those countries.) Paid staff from the fire services, police, medical, and other sectors also provided enormous expertise and support. All these people gave up family and holidays plus more to assist in whatever capacity they could. In some cases, they lost their houses, crops and stock or business whilst on the fire ground.

The Australian Military (active and reserves) was called upon to help in both combatant and recovery roles, particularly during the Kangaroo Island Ravine Fire in January 2020 and NSW southern coast fires in late December 2019. The troops provided valuable assistance ranging from active fire-fighting operations to back-up support for the fire fighters on the ground and air (logistical supplies/equipment/vehicles, labour including establishment of fire breaks around residential and fauna/flora sanctuaries, set up base camps, installation of drinking water facilities and sanitation, aerial, water and ground evacuations, etc.). The medical teams provided both humanitarian and veterinarian assistance to back-up the overworked local medicos and vets.

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The bushfire responses throughout Australia, dropped considerably in February 2020. The rains finally came to the Eastern Seaboard in January 2020. Due to the barren grounds from the fires, massive flooding in some areas occurred—similar to California a few years ago. Remember Woodstock circa 1969, dancing in the rain....yes, the rain was wonderful and unfortunately a double whammy for those impacted by the Christmas – New Years' coastal fires; from hot, burnt ground to boggy mess. Dams and dried drainage systems were gradually filled and ground water was slowly replenished in some areas. Unfortunately, in other areas, because of the intensity of the rain, the ground didn’t get saturated to a deep level (only 1"-2"), hence only offering a temporary reprieve to the drought. On a positive note, as a result of the rains, the Australian landscape quickly started showing signs of greenery on the ground and the trees.

Queries which need to be addressed as a result of either the bushfires or the flooding include:

- What is the impact on the landscape and catchment to the coast/oceans?
- What native vegetation species have been impacted and what is their recovery?
- What native wildlife (animals, birds, reptiles, amphibians) have been impacted and what is their likelihood of recovery?
  - Some burnt animals have been released back into their native environment; others will remain in sanctuaries for the rest of their lives.
  - There is post-fire monitoring in some locations. Some of the wildlife and bird life is slowly recovering and amazingly, breeding, for example, on Kangaroo Island—hurrah!
  - Monitoring programs have been set up to record the wildlife recovery in some areas of the bush.

Troublesome questions which will probably never be answered:

- What are the effects on the environment from asbestos (catchment to ocean)?
- What are the effects on the environment from burnt & unburnt plastic (catchment to ocean)?
- What are the effects of the drainage run-off on the coastal and oceanic environs – nutrient and anthropogenic debris; how does this impact, short and long term, the fishing and shell fish industries (habitat, recreational and professional)?
- With the re-building, where are the contaminated infrastructure materials being disposed and what is their long term security? (building compounds, perma-pine fence posts, asbestos etc. transported to local/regional rubbish tips; metal recycling, etc.)
- What short and long term weed management programs can be designed and implemented to take advantage of the ground level re-growth following the fires? This is a time of opportunity for ground level maintenance work to start.
- What are the short and long term philosophies for maintaining a landscape severely damaged by fire
- Will there be changes to the cold vs. hot burn-off models to maintain ground fuel loadings at a manageable level for the long term, rather than budgets forcing short term efforts.

Continued Page 33
We have an opportunity to make valuable changes, but realizing ideas will require dedicated budgeting. In my area, there were two bushfires in late January - February, back to back – both caused by nondiligence by the property owners. Sparks from welding ignited tall grass on a rural property where accessible extinguishing medium was inadequate. The property owner was fined; the grape crop in the adjacent vineyard was lost to smoke taint and burning, just before harvest. On another property, a bee keeper didn’t have the “legislative required” water knapsack near the hives when “smoking them”; the hot smoker apparently was put in the tall cured grass. A few nearby koalas were treated for burns and smoke inhalation. Some of the hive boxes survived – honey production doubtful for a while.

Soul Searching & Healing

A friend’s entire property was burnt in the 20 December 2019 Cudlee Creek fire. I called them from the fire ground that day – we live on “Hope”. Two days later, they called and said the property, on a ridge top south of the township of Woodside, including pastoral land, a few sheds and the house was “levelled”. We met them on 15 January 2020, to help open their large storage shed which was one of few structures standing along the entire road. It was an eerie experience when the four of us looked inside to see “time stand still” with the majority of the contents incinerated. The tractor and mowers had rims with nothing on them whilst there were piles of ashen boxes where the boxes were stored and the hay bales were aligned ash particles. In the garden nearby, an immature male joey kangaroo was hiding in the bushes – its top paws & tail were still burnt (1 month on). I put some water from my water bottle into a clay pot plant holder, and left it for him in the bushes. The paddocks around the house were black with no greenery. The house was a mangled mess of metal and brick. The pine trees that surrounded the house entry were a charcoal mess (later they admitted “part of the problem” they inherited when they bought the property).

I visited the property in mid March 2020 and the greenery was fantastic. I cried with glee at the beauty before me. The family of kangaroos including “Joey” were surviving quite nicely on the newly sprouted greenery and water supply from the leaking concrete water tank. The blackberry patches (declared pest plant in SA) were about one foot high – regrowth from being burnt to ground level. I talked with my friends and said we need to get onto controlling the blackberries now! They successfully applied for a bushfire relief land grant to tackle the blackberry infestation.

In March-April 2020, I sprayed the burnt blackberry patches. The first two days were spent in spraying with tears flowing whilst my mind wandered onto bushfire investigation indicators for both the property and the region. I had my personal laboratory of burnt out paddocks, vineyards, plantations to investigate (yes, I was also socially isolated due to corona virus). The daily visits were really enjoyable....the kangaroo families were bouncing around; the blackberry patches I had sprayed were gradually showing signs of degradation; the windrows of burnt trees had “fur” on them – a sign of regrowth post-fire; the secondary weed growth was developing so it was easy to target; and I found a nest of European wasps which no longer exists thanks to the assistance from the local Council to eradicate them. A positive contribution from the fire, was to get control of the burnt weeds, post fire, at their Woodside property. The blackberries were at right height for spraying. Gorse pockets were starting to re-grow – they are small and their root stock had been impacted. Basically, for weed control post fire, the herbicide spraying has greater effectiveness with less amount.
Having the open laboratory for identifying bushfire indicators has been part of the healing process. To the west of my friends’ place is an old mine site that presently has an application to re-start the mine and check the old tailings. One of my BFI observations was discovering the mine area was part of “the head of the fire” (most intense). Six months on, whilst the adjacent sides of the mine are re-growing with green ground and furry gum trees, the “fire head” ground is still black, the gum trees +30m high are still charcoal, and the path of fire destruction can be traced back towards the N-NW to Woodside Township and in the distance, Lobenthal (Cudlee Creek Fire was to the N of Lobenthal). Looking from the mine area to the north where fire came from, not only were vineyards burnt out but also pine & eucalypts plantations/windrows which I didn’t initially factor in until “the penny dropped” -- the explosive and flammable atmosphere that the plantations/windrows create.

The properties are slowly rebuilding as well. With the April-June rains (the most in many years), the ground is an abundant green. However, one only has to shift the blades of grass to see the burnt blackened earth beneath. The stocks of cattle, sheep, alpacas etc, are freely munching away. Fences have been torn down and rebuilt thanks to the combination of a variety of volunteers and paid contractors. The Federal Government has given the land owners some subsidies to rebuild, including grants to tear down and remove the burnt structures and assist with re-planting and weed control. There is also local/state/federal assistance for medical and mental health for both those that stayed and fought and those that weren’t present and lost. Some land owners will re-build, some land owners will sell up, some businesses have been destroyed and may or may not rebuild (particularly the vineyards). Some of the regional vineyards have bonded together to have “bushfire sales” with proceeds going to the community – one of a variety of attempts to get tourism back into the area. In addition, there is some fantastic “research and trials” starting on re-establishing the burnt out vines (Federal government initiative). Thanks to huge support from the State/Local Council to assist with roadside clean-up post Cudlee Creek Fire, a few of the stages of the Australian Tour de Under were held in mid January 2020, giving the local communities a massive boost. The Australian spirit has thrived.

On that note, I close with a question about marine geology:

*Will there be a seabed indicator of the Fires of 2020, if someone opens up cores of the coastal and offshore seabeds in 100 years time?*
AWG Awards and Scholarships

Association for Women Geoscientists

Professional Excellence Awards

The AWG Professional Excellence awards will go to women who, throughout their careers, have made distinguished contributions in each of the three following professional areas:

- Government/ regulatory,
- Private industry/ consulting and
- Academia/ research.

Nominations will be solicited from the AWG membership at large. Professional excellence is broadly defined, and may include accomplishments such as:

- Breadth and depth of professional accomplishments
- Mentoring of other geoscience professionals
- Outreach and service activities
- Membership in professional societies

Nominees need not be members of AWG and those without memberships will receive a one-year professional membership with their award. Recognition will be made at the GSA Annual Meeting and other appropriate annual meetings, in GAEA and online e-news. Nominations can be submitted using the following link, which can also be found on the AWG website at www.awg.org/awards. If you do not have a google account, please submit your nomination as one complete pdf package to pro-excellence@awg.org

- A one to two-page letter summarizing the nominee's most important accomplishments in professional areas that demonstrates multidisciplinary geologic accomplishments within their realm of expertise;
- The nominee's CV
- Two letters of support, which can be from non-members of AWG, with a maximum of five letters.
- Specify which of the three awards for which you are applying

Nomination deadline: **June 15th each year (note new date!)**

The nomination files can be e-mailed to: pro-excellence@awg.org
The AWG Brunton Award promotes the future of field mapping and data acquisition for the upcoming generation of women geoscientists. The award will go to a female geoscience student at the senior level or in her early graduate studies who has been a summer intern, excelled at field camp, or performed field data collection that leads to a senior or graduate thesis. The award is funded by Brunton.

**Awardees receive...**
- an engraved Brunton compass
- a one-year AWG membership

**Requirements**
- Performed field work as an essential component of a senior thesis, summer internship, field camp, graduate thesis or other type of field project
- Have future plans to continue in the geosciences, with fieldwork as an integral part of graduate degree or career
- Promote the fundamental value and need for field-based studies within the geoscience profession through project results, quality of work, and capabilities of applicant

**Application**
- Personal statement, including explanation of past and current field work experience (≤500 words)
- Statement of future career goals as related to field work (≤150 words)
- Sample of past or ongoing field work, which may include a report, map, photos, and/or model based on collected data (≤500 words and not to exceed 4 pages including figures)
- Resume, including your physical mailing address (1-2 pages)
- Letter of recommendation from the primary field mentor
- Send compiled (single PDF) application via email to office@awg.org. Please note ‘Brunton Award’ in the subject line. Letters of recommendation should be sent by the recommender.

**Selection Committee**
The selection committee consists of AWG members with varied and significant field experience who are committed to promoting field data acquisition methodologies among geoscience students – our future professional geoscientists.

**Applications due December 15**
Advertisements and Announcements

Association of Environmental & Engineering Geologists
2020 Annual Meeting

"Hazards in Hindsight...Lessons for the Future"
Virtual Meeting
September 16-20, 2020

The Association of Environmental & Engineering Geologists (AEG) has been monitoring the ongoing situation with respect to the COVID-19 virus, with our members, friends and 2020 Annual Meeting attendees’ health and safety as a top priority. It is with sincere regret that, for the first time in AEG’s history, we have no choice but to cancel the in-person 2020 Annual Meeting, which was due to take place this September in Portland, Oregon. The Governor of Oregon has mandated that no large gatherings can take place through September 2020.

The in-person Portland Annual Meeting has been rescheduled to September 19-24, 2023 at the same hotel, the Portland Marriott Downtown Waterfront following the 2021 Annual Meeting in San Antonio, Texas and the 2022 Annual Meeting in Las Vegas, Nevada.

To register, submit an abstract for the virtual meeting and for complete details, visit www.aegannualmeeting.org.
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We are looking for applicants with expertise, research and teaching interests in Earth and planetary geophysics, seismology, geodynamics, or mineral physics. The Department is especially interested in candidates who will contribute to the diversity and excellence of our academic community.

The successful candidate will complement our existing strengths and areas of concentration, and enjoy cross-disciplinary ties with University Programs such as the Program in Applied and Computational Mathematics (PACM), Princeton Center for Complex Materials (PCCM), the Princeton Institute for Computational Science and Engineering (PICSciE), the Princeton Institute for the Science and Technology of Materials (PRISM), and other Science Departments.

Applicants should send a curriculum vitae, including a publication list, a statement of research and teaching interests, a separate statement outlining how they see themselves contributing to our mission of building a diverse and inclusive discipline with a strong department, and contact information for three references to: https://www.princeton.edu/acadpositions/position/17221. Evaluation of applications will begin as they arrive; for fullest consideration, apply by December 21, 2020, but applications will be accepted until the position is filled.

Diversity and inclusion are central to Princeton University's educational mission and its desire to serve society. Members of the Geosciences department have a deep commitment to being inclusive. We believe that commitment to principles of fairness and respect for all is favorable to the free and open exchange of ideas, so we seek to reach out as widely as possible in order to attract the ablest individuals as students, faculty, and staff. In applying this policy, we are committed to nondiscrimination on the basis of personal beliefs or characteristics such as political views, religion, national or ethnic origin, race, color, sex, sexual orientation, gender identity or expression, pregnancy, age, marital or domestic partnership status, veteran status, disability, genetic information and/or other characteristics protected by applicable law in any phase of its education or employment programs or activities.

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AWG Membership

ENCOURAGE participation of women in the geosciences
- Scholarships
- Girl Scout Activities
- Congressional Visit Days
- Student Awards for Geoscience Excellence (SAGE).
- Outstanding Educator Award
- Geoscientists in the Park,
- Women in the Geosciences Day

ENHANCE professional growth and advancement of women in the geosciences
- Free Resume Review Service
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EXCHANGE educational, technical, and professional Information
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