2014
North American Study Tour
to
Australia and New Zealand

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The 2014 North American Study Tour Group wish to thank those who hosted them in Australia and New Zealand.

The group recognizes the tremendous time and effort that went into planning and executing a successful learning experience for the participants.

There is a long list of people who made the tour successful and the group would very much like to thank each individually, however, there is not enough space for such an endeavor.

The group would like to extend special thanks to their hosts Andrew Graystone and Murray Dudfield, as well as Tim McGuffog and the Forest Fire Management Group.

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Executive Summary

The 2014 North American Study Tour to Australia and New Zealand occurred in April and May of 2014. The group was comprised of eleven Wildland Fire Managers from Mexico, Canada, and the United States. The group toured the Australian Capital Territory, the states of New South Wales, Victoria, and Tasmania, as well as the country of New Zealand. The tour included participation in the first International Symposium on Bushfire Management. This report provides recommendations regarding wildland and bushfire management to the Fire Management Agencies in North America, Australia, and New Zealand.

The eight recommendations are directed to the participating agencies and focus on the following topics:

- Relationships – Maintain and develop relationships across all forums. Of special note is the relationship the group observed in Australia with the Aborigines, a new approach with special meaning.
- Engagement of Stakeholders – Focus on engagement with communities and stakeholders.
- Comprehensive Common Operating Picture – Develop and implement a common operating picture tool for use by all agencies.
- Landscape Approach – Develop a landscape management philosophy with wildfire management as the predominant driver in a strategic risk management approach.
- Shared Responsibility – Firefighting preparedness is a shared responsibility between the public, industry, and the appropriate governments.
- Future Research – Continue and enhance collaborative research initiatives worldwide. Forest Fire Management Groups leverage international support.
- Continuation of Forest Fire Management Group and the Fire Management Working Group of North America relationship – This is a unique relationship and hopefully will continue and expand to other countries.
- Continue the Annual Bushfire Symposium – The identification of rising trends and issues transcends North America, Australia and New Zealand. Nations from around the globe are facing similar and unique conditions that need to be shared.

The passion which exists in all Fire Managers is a testament to the commitment and dedication the study tour group witnessed throughout the tour. A common theme found in North America, Australia and New Zealand is the ecological importance of bushfire on the landscape and the struggles with ensuring the safety of the public. It is the responsibility of Fire Managers to ensure: wildfire research continues and expands; we develop and maintain relationships; we find and develop opportunities to share information and research; we promote a shared responsibility approach; and we develop wildfire management in landscape approaches.

Fire managers throughout the world face an ever difficult task in a dynamic political and natural environment. We've all watched as the challenges mount due to increasing fire activity, climate change, and urban sprawl into the wildlands. One of the ways we find ourselves combatting these challenges is working closer with our partners on a larger scale. The scale is beyond regional and has become more national for most countries involved in wildland fire management. The 2014 Fire Management Study Tour Group quickly recognized that there is another scale which we should be working towards, and that is internationally. There are many strides being made in this area, but much more effort can and should be made in order to take the next step toward more global fire management.

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Overview

During April and May of 2014 a group of North American Fire Managers travelled to Australia and New Zealand to share ideas on wildland fire management. The study tour group included participants from Canada, Mexico, and the United States. The intent was:

- To provide an opportunity to synthesize fire management ideas, concepts and trending issues with experts from Australia, New Zealand, Mexico, Canada, and the United States
- To share information and provide learning opportunities on topics such as future fire regimes, risk assessment and values at risk, planned burning and fire hazard reduction, fire predictions, social science and community engagement, safety systems, and leading change across organizations
- To use the opportunity to create a network of fire experts that can share the synthesized fire information throughout all countries and agencies that have wildland fires
- To provide the five countries and the participating agencies a report of findings and recommendations
- To provide a forum that fosters continued networking, cooperation and information sharing

The study tour group had the opportunity to visit with numerous fire managers and was introduced to ideas which elicited the development of recommendations to take home.

Time was limited, but the Forest Fire Management Group (FFMG) managed to make every hour worthwhile to the study tour group.

The purpose of this report is to provide recommendations to the Fire Management Working Group of the North American Forest Commission and to those agencies represented by the study tour group as well as to provide some observations to the Forest Fire Management Group.

Figure 1. Study tour group in Canberra, ACT.

The study tour group acknowledges the tremendous responsibility they have to continue learning and sharing what they learned into the future. A highlight of the tour was the First International Symposium on Bushfire Management (preliminary report in Appendix C.)

Also included are ideas the individual study tour members found worthy of more exploration; these are found throughout Appendix A, in the Daily Journal portion of the report.

Study Tour Recommendations

The North American Study Tour Group was grateful for the opportunity to see and learn so much about bushfire in Australia and New Zealand. They ended each day impressed with the professionalism and enthusiasm they observed amongst those who took the time and effort to make presentations and to show them the lands where bushfire plays such an important role. As the days progressed the group began to recognize common

themes in bushfire management. These common themes reflected the ideas of the participants in what could be taken back to North America to strengthen the programs there.

1. Relationships

While not always articulated, a very clear message delivered to the study tour group was to develop and maintain relationships. At each stop on the tour the group was exposed to the results of strong relationships. The connections between agencies and states were very clear in nearly every project. The landscape itself supports such partnerships as ecosystems cross human-defined boundaries.

Figure 2. Cooperating agencies displayed in the State Control Center is Melbourne, Victoria tell the story of strong relationships.

As the group traveled from the Australian Capital Territory (ACT) into New South Wales (NSW), there were examples of partnerships along the territory/state border within Kosciuszko National Park. The study tour group's hosts displayed the strength of the relationships as they spoke a common language regarding management objectives for different parts of the lands. The Cross Border Agreement on Fire Preparedness, Response, and Suppression between ACT Emergency Services Agency and NSW National Parks and Wildlife Service is the signatory agreement that is used to formalize the relationship, although the relationships exist even beyond the written agreement. As occurs in North America, the agencies assist each other during bushfire activities, as no one agency can truly handle the response during most large incidents. Within the states of Australian, and even across states, agencies are very dependent on each other for daily cooperation; there does not appear to be any agencies that "go it alone". Singular agency models for Rural or Country Fire Authorities in Australia and New Zealand, which are the primary initial attack forces versus the numerous independent municipalities and jurisdictional fire agencies in North America, likely, foster these stronger relationships across the board.

There was an admirably strong relationship between New South Wales and Queensland. The South East Queensland Fire and Biodiversity Consortium is very active across local borders.

Victoria borders the states of New South Wales and Southern Australia with Tasmania just across the Bass Strait. There was an obvious connection between Victoria, NSW, ACT, and Tasmania. The people, as happens in North America, are mobile in their jobs and move from state to state as they manage those lands that cross boundaries. Their understanding of fire management at a landscape level provides an inherent ability to talk about the areas with no boundary issues.

One of the officials of the Tasmania Fire Service stated, “Tasmania is a small Australian State, we can’t afford to be anything but connected and working together.” And so, they work closely within their state, but also with the other states of Australia and together through the common threads found in the Bushfire CRC (Cooperative Research Centre) and New Zealand’s Scion (a Crown Research Institute).

The Forest Fire Management Group is a prime example of two nations working together. Australia and New Zealand work well at identifying and resolving issues, and collaborating on projects of all sizes. One of the most recent notable accomplishments is the *National Bushfire Management Policy Statement for Forests and Rangelands* completed in 2014 for the Council of Australian Governments.
http://www.sfmc.tas.gov.au/sites/sfmc.tas.gov.au/files/1322-Environment_Fire_Policy_Doc_FA_WEB.pdf

International relationships are helped by the use of similar programs; all of the countries use the principles of the National Incident Management System (NIMS) and the Incident Command System (ICS). The use of these common systems has made it easier for the countries to share resources during times of need. The study tour group was impressed by the number of people who commented positively on the international relationships; the allowance and support for these study tours; and, being able to support one another in times of need. This ability to interact was well-recognized and well-received.

Figure 3. Interagency cooperation can be identified by the uniforms at a gathering.

The First Annual International Symposium on Bushfire Management showcased the importance of relationships. From locals helping each other to international involvement, everyone had a common goal which focused on making sure that the work fire managers do is safe, relevant, and very much a shared responsibility of all stakeholders involved with fire management.

The study tour group strongly recommends the continuation of current relationships and the fostering of additional relationships pertaining to the management of wildland fire and cooperation. Relationship building should be a focus of our work, all day, every day. Communicating the strength of relationships and sharing information learned from one another to all levels in our organizations is an important step. While it seems all parties feel there are good relationships amongst each other, if a wildland firefighter from the United States were asked about the relationship with Australia and New Zealand, the response would likely be “we fight fire together”. As leaders in wildland fire management it is incumbent upon us to share information to all levels, so

everyone in the community understands what is going on and why. The study tour group would be a useful tool for sharing the importance of the relationship between our countries.

2. Engagement of Stakeholders

As the 2014 study tour group traveled across Australia and New Zealand, commonalities between the two countries and their engagement with stakeholders became clear, some of which demonstrated a focus on "engagement" not always apparent in North America. In Australia in particular, because of its significant threat from bushfire, there is an interesting shift in focus from the fire itself, to the people affected by the fire. While there are individual stories of successful and focused engagement with stakeholders scattered throughout agencies in Mexico, Canada, and the United States, as a whole, these agencies remain primarily focused, both with time and budgets, on managing suppression. In addition, while many agencies have been working collaboratively with "cooperators" and other agencies for many years, and quite successfully, there is a lack of across-the-board, routine collaboration and engagement with the general public, especially pre-season.

Figure 4. NSW, Garby Country prescribed burn project with local stakeholders.

In Australia and New Zealand, the study tour group encountered time and again, a focus on the general public or specific, non-agency stakeholders such as Aboriginal groups.

Recognition of Aboriginal people in project planning is truly a representation of being inclusive. These people, who understand the land as no others do, bring an awareness of what the land means and how managing it can be positive or detrimental. The East Central Strategic Bushfire Management Plan states: "Bushfire risk management must draw on the wisdom and experience of the landscape's Aboriginal cultural heritage, and support the landscape's Aboriginal people to rebuild and maintain connections to Country. Aboriginal cultural heritage in this landscape is an important heritage of all Australians, and is of global significance."

The recognition of traditional places by land managers is also incredible; this acceptance that a place has meaning to people and therefore is important in planning and implementation is something all land managers should strive for. In New South Wales, there is a project to "develop and implement an integrated and culturally appropriate program of prescribed burning and bush regeneration at priority coastal lowland and headland sites within the traditional lands of the Garby People of the Gumbaynggirr Nation. The project empowers and builds capacity among traditional custodians to participate in bush regeneration, prescribed burn planning, preparation, implementation and post burn regeneration at culturally important sites which contain Aboriginal heritage assets and provide habitat for endangered ecological communities, threatened species and culturally important resources, foods and medicines" (from a presentation by Jamie Bertram Community Safety Officer, NSW RFS).

Victoria's engagement of stakeholders was recognized by the study tour group as an excellent example of collaboration. The state has been split into seven bushfire risk landscapes and a planning team assigned to each landscape. These teams include social scientists who utilize the Fire Learning Network. "This brings

together community and government to build relationships and to share knowledge through ongoing facilitated conversations – called 'strategic conversations.'"). "The Network contributes to the resilience, safety and wellbeing of Victorians by building community understanding of fire, by strengthening social networks for people to draw on in times of emergency and recovery and by fostering thoughtful local solutions to concerns of local significance." (http://www.dpc.vic.gov.au/index.php/22-html?start=152)

In 2012 the Victorian Department of Primary Industries (DEPI) prepared the *Code of Practice for Bushfire Management on Public Land* (http://www.depi.vic.gov.au/__data/assets/pdf_file/0008/179783/Code-of-Practice-for-Bushfire-Management-on-Public-Land.pdf) which states: "When planning, the Department will engage with the people and groups who have a stake in bushfire management. These include people who are neighbors of public land, groups whose livelihoods may be impacted by bushfires and bushfire management decisions, groups with environmental, health and recreational interests, government and other agencies. Each of these parties has different needs and may seek different outcomes from bushfire management and will be engaged accordingly"; it also directs agencies "to work collaboratively and cooperatively with partners to undertake engagement." The study tour group found this work to be occurring as they were shown the East Central bushfire risk landscape.

Figure 5. New Zealand FireSmart community.

FireSmart in New Zealand is recognized as a collaborative effort: "Organisations, agencies, and all members of the community must work together and share the responsibility for fire prevention and fire protection. To succeed, all stakeholders must band together to become 'partners in protection' and put in place appropriate solutions at the local level." (www.fire.uni-freiburg.de/Manag/Fire-Smart-New-Zealand.pdf) The study tour group visited an area where a small group of people are working to achieve a FireSmart community. They work with the local fire service, talk to neighbors and set a good example of what FireSmart looks like. They are very passionate about the work they are accomplishing, and this passion is what makes this group and others like it so effective.

Hobart, Tasmania has been threatened by wildfire several times in recent history. The Tasmania Fire Service has leveraged this recurring threat of destruction to engage stakeholders in preparing the landscape for the next wildfire by completing hazard reduction burns above the city. The local stakeholders have input in the planning phases of the projects and the work is completed in an interagency manner.

Figure 6. View from prescribed burn in wildland urban interface overlooking Hobart, Tasmania, capturing the nature of their WUI issues.

The study tour group recommends all agencies consider engagement of stakeholders as a critical priority that needs to be taken on in a meaningful way. Bring together stakeholders who have a shared goal of a resilient landscape before a Black Saturday type event occurs and give them the social license to tackle the problem. A policy statement regarding the importance of stakeholder involvement at all levels and in all phases of planning, one that goes beyond the U.S. Cohesive Strategy, would be beneficial, and could be modeled after the Australian National Bushfire Management Policy Statement for Forests and Rangelands. (http://www.tams.act.gov.au/__data/assets/pdf_file/0007/597544/National-Bushfire-Management-Policy-Statement-for-Forests-and-Rangelands.pdf)

3. Comprehensive Common Operating Picture

The concept of a common operating picture is certainly not new. It has been implemented in many ways by numerous agencies worldwide. The challenge is to find a way to make this valuable tool accessible and usable for all agencies involved. The study tour group was introduced to two common operating picture tools.

Figure 7. The displays of ICON.

Ian Stewart, NSW Rural Fire Service (RFS) introduced Incident Control On Line (ICON). Use of ICON is required for all prescribed and wildfire response activities in NSW and serves as the source of information to both internal and external audiences for all response activities. Typically the Incident Commander or Burn Boss is responsible for inputting updates.

"The true shift in paradigm is the realization that providing relevant, timely and tailored information to the public is just as, or in some cases, more important than controlling the incident. We must now do both" http://aemi.edu.au/EMC/assets/10-emap---plotting-a-new-paradigm---anthony-griffiths---todd-gretton.pdf

In Victoria, the study tour group was briefly introduced to eMap which seemed similar to ICON and is a useful tool as it includes prescribed fire, analysis tools, and near real-time situation data feeds. It is used by several agencies and can be queried to produce analytical reports about incidents. Tracking of resources with GPS units is already being utilized. This is of great interest to North American fire managers who are currently engaged in discussion about this technology due in part to the Yarnell Hill Fire of 2013. This common operating picture is interagency. Most information is fed

from the incident level up. This system will also serve as the source of information to both internal and external audiences for all response activities. Responsibility to update incident information will remain at the incident commander or duty officer level in most cases. The ability to communicate alert and evacuation notices has also been incorporated into this system. (http://aemi.edu.au/EMC/assets/10-emap---plotting-a-new-paradigm---anthony-griffiths---todd-gretton.pdf)

Benefits of both these systems include the ability to provide up-to-date information from a single source regarding incident response activities, incident size, threats, and other points of interest. End users know where to go to obtain current incident information and the use of these systems has been institutionalized. The obvious users of this information include Incident Commanders, Operations Chiefs, Duty Officers, Public Information Officers, Agency Administrators, and so on, from multiple agencies with mutual interests and needs. This tool is especially useful for local fire staff on busy fire days; seeing the bigger picture will help them assess some of their options at the local level.

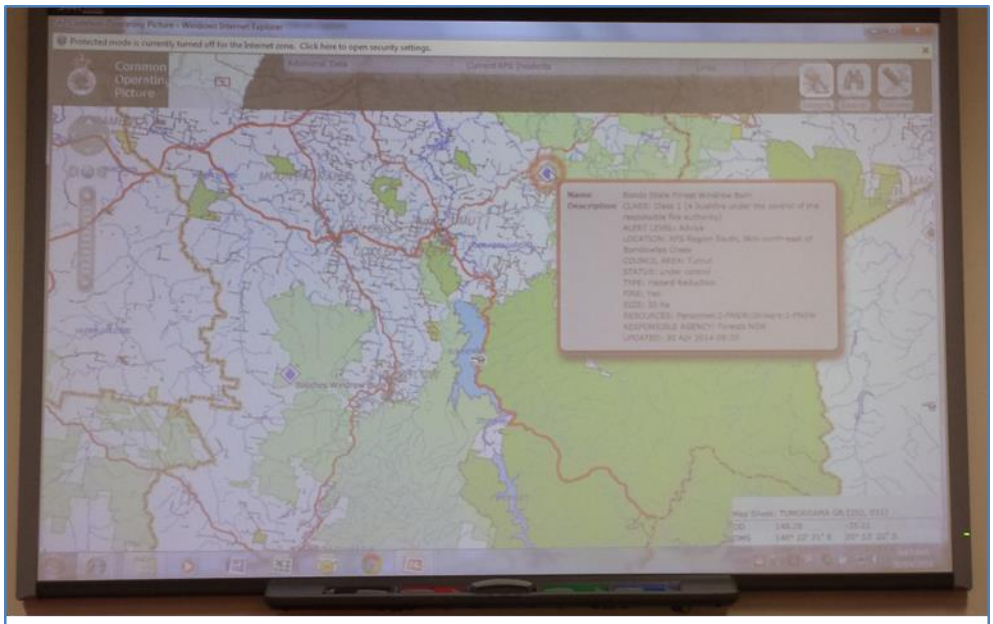

Figure 8. Display from eMap.

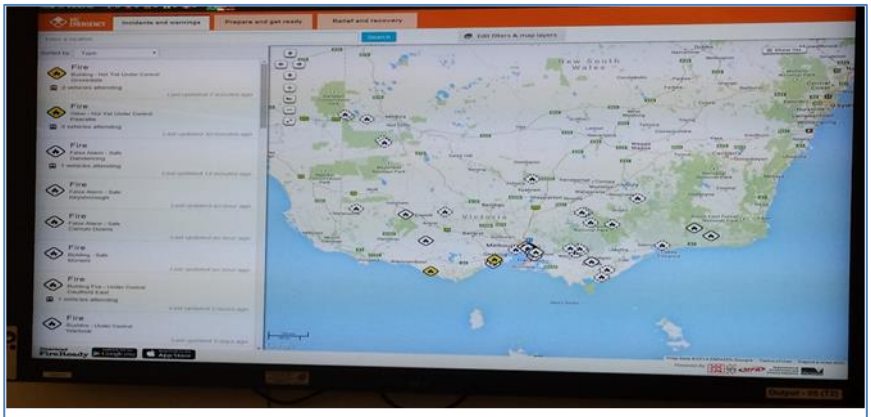

Figure 9. Display from eMap.

The ACT uses a program designated as SPOT (single point of truth). It is "part process and part technology. The SPOT process is a streamlined channeling of all information during an emergency to disseminate emergency alerts, updates and warnings to multiple platforms, including the Emergency Services Agency website, twitter, Facebook, RSS and Geo RSS feeds, personal email accounts and SMS distribution groups." (http://esa.act.gov.au/wp-content/uploads/The-ACT-Strategic-Bushfire-Management-Plan.pdf, page 48)

The study tour group members who work for national agencies (US and Mexico) are interested in the models for a national approach of sharing information in a quick manner in their respective countries. The programs presented were each developed by individual Australian states, which work well for those states, but still does

not provide that national approach that could be a more useful tool. In North America there is the same individual "state" government approach to the common operating picture – and it works very well, until you try to meld the various pictures into a big picture – you end up with a collage rather than a portrait. Numerous resources (time, money, training, equipment, etc.) are put towards these individual efforts by entities that have the resources to make them work. Is it possible to choose one system and implement it nation-wide, or even globally? As our technology and relationships make our world a smaller place, the need to share information in a common way is growing. The study tour group recognized the efforts of developing a common operating picture in both Australia and New Zealand and applaud the results; there is value in developing a national single system providing up-to-date information in conjunction with international partners to show a world-wide view of incidents that may affect everyone (for example, smoke from Russian wildfires in Nevada).

Several attempts at similar concepts have occurred in North America in the recent past. Examples include the development of Inciweb, Geographic Area News and Notes pages, and local interagency dispatch center products to name a few. Two systems are gaining some ground in the United States, the COP (common operating picture) for Google Earth and the Next Generation Incident Management System (NICS). Requirements for incident use and standards for the data being presented are not present and have never been formalized. The end result is duplication of effort at multiple levels, inconsistent business processes, and confusion by end users, both internal and external, regarding the location to obtain current incident data.

The study tour group recommends that an interagency analysis of the current tools and programs that are used to gather and present information occur. Attributes that are desirable for inclusion/communication should be identified and the source for this information should be determined. In addition, further, more in-depth study of what is working in NSW and Victoria should be undertaken.

Providing a single point of information distribution for internal and external audiences would be of great benefit for multiple reasons. These include reduced duplication of effort at all levels, common standards created for the type of information collected and communicated, and a single location provided for all audiences to obtain incident information. In addition, making even basic information available immediately at initial or extended attack would ease public concern at a time when little information is normally available, and when visibility and concerns are high.

4. Landscape Approach

Australia has come to the realization that working on single projects or within jurisdictional or ownership boundaries are not enough to prevent the tremendous loss of life and property that occurred during the Black Saturday Fires of 2009. This is not to say the work they were doing to reduce hazard fuels was not effective, just that doing work piecemeal doesn't achieve a final product that can withstand catastrophic fires. Now, land managers consider the risk associated with a landscape.

"Good land management is good fire management." Neil Cooper, ACT Parks and Conservation

Risk management is done prior to a fire starting on a landscape. It includes the individual stakeholders and communities, as well as fire and land management agencies. It includes hazard fuel reduction, community wildfire planning and standards, home construction standards, communication and information strategies, evacuation planning and homeowner responsibilities. Including the stakeholders is a critical piece that was missing in Australia and is still missing in many parts of North America. The study tour group saw many examples where risk management is the primary focus for landscape scale projects and was impressed with the focus on risk, as well as on the process of identifying assets at risk.

Recommendation 56 of the 2009 Victorian Bushfires Royal Commission is, "the State fund and commit to implementing a long-term program of prescribed burning based on an annual rolling target of 5 percent minimum of public land." (http://www.royalcommission.vic.gov.au/Assets/VBRC-Final-Report-Recommendations.pdf) Following this recommendation, the state has been split into seven bushfire risk landscapes "based on where a bushfire could be expected to start, spread, and impact under catastrophic fire conditions and with maximum fuel loads." (Peter West, DSE, DEPI, presentation May 8, 2014). Work is now being done to plan and implement hazard fuel reduction across these landscapes and thereby meet the intent of recommendation 56. The study tour in Victoria focused around the East Central Bushfire Landscape Project with the intent of sharing information about different parts of the process. Sharing did occur, as the study tour group was asked to comment and provide input on various products.

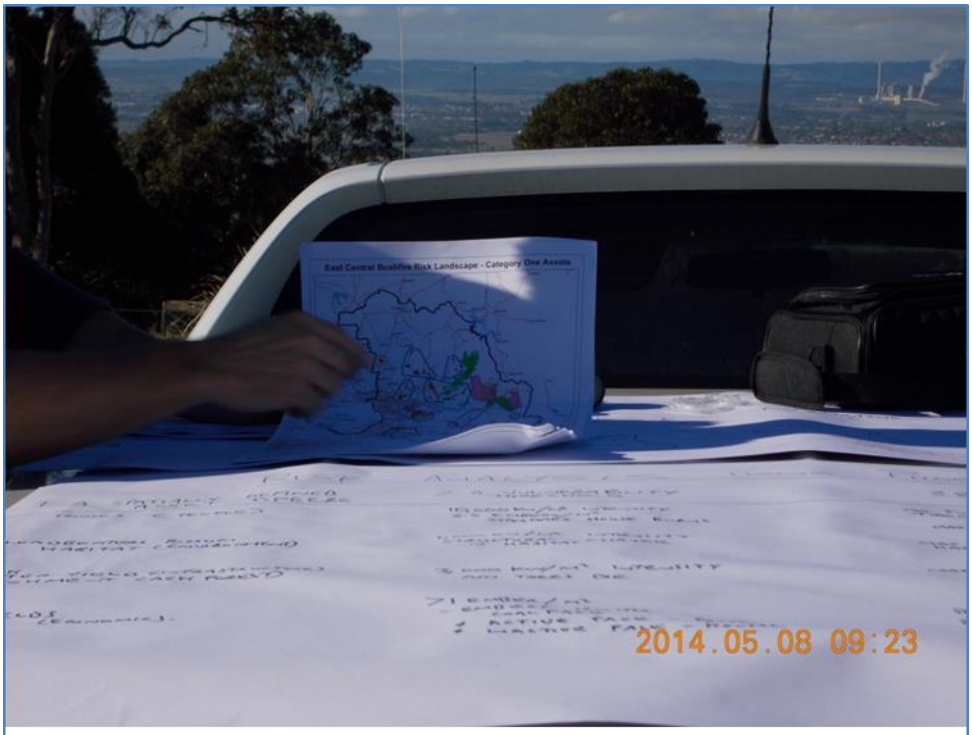

Figure 10. Peter West, team leader, explains the East Central Bushfire Landscape Project at Tyers Lookout with the Latrobe Valley in the distance.

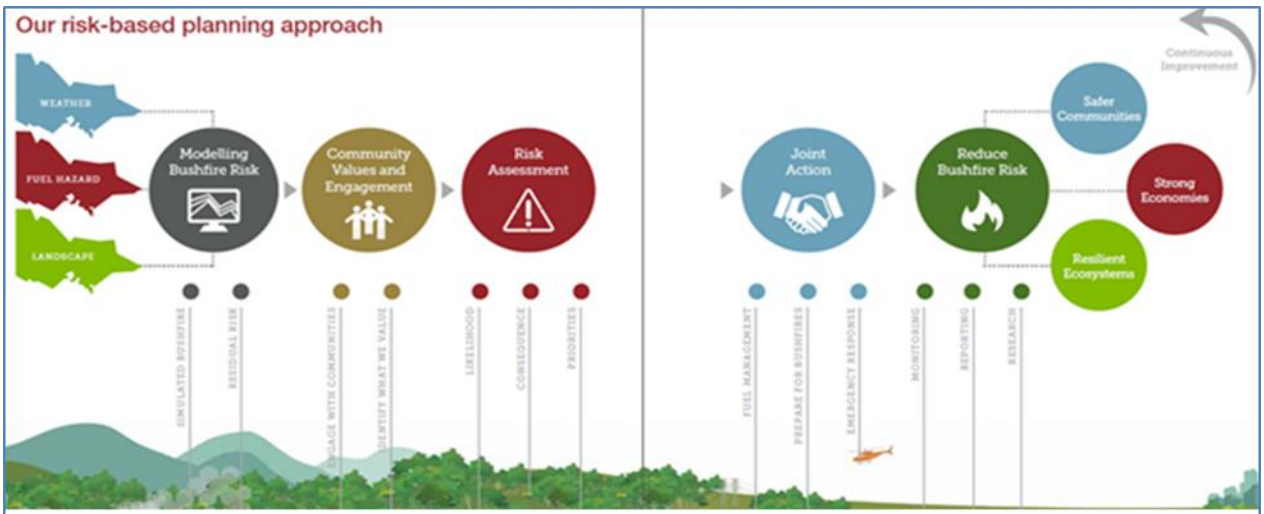

Figure 11. Representation of the Victorian risk-based planning approach from the Strategic Bushfire Management Plan for the East Central Bushfire Risk Landscape. (http://www.depi.vic.gov.au/__data/assets/pdf_file/0004/278248/East-Central_Strategic-Bushfire-Management-Plan_2014.pdf)

Less than six months after the study tour group was introduced to this landscape level risk assessment DEPI published the Strategic Bushfire Management Plan for the East Central Bushfire Risk Landscape. The study tour group found this to be commendable, in that the process was completed relatively quickly as compared to some planning processes in North America (http://www.depi.vic.gov.au/__data/assets/pdf_file/0004/278248/East-Central_Strategic-Bushfire-Management-Plan_2014.pdf).

Victoria is not alone in this landscape scale work. Overall there is a challenging and massive increase in hazard fuel management through prescribed burning that targets areas across jurisdictions (land tenure or ownership). By all accounts, the land management agencies and fire services enjoy widespread public support for this effort. The broader landscape approach used also does a good job of presenting the value of risk management (hazard fuel reduction) to reducing hazard and catastrophic losses, information that is valuable to the public, and is considered by each state during budgeting operations.

In the ACT, the Strategic Bushfire Management Plan recognizes the importance of working at a landscape scale: "Planned fire will be used as the principal management tool to reduce bushfire fuel levels, thereby establishing and maintaining a mosaic of fuel loads at a landscape level. This will reduce the impact of bushfire on life and property in the rural and urban areas of the ACT as well as impacts on water catchment and environmental values in the ACT's National Parks and Nature Reserves." (http://esa.act.gov.au/wp-content/uploads/The-ACT-Strategic-Bushfire-Management-Plan.pdf). In fact, the entire Strategic Bushfire Management Plan is at landscape scale and is a five-year planning document for the ACT.

On each landscape the context, analysis, evaluation, treatment, monitoring, and communication of risk is established. The likelihood of a bushfire starting and how it will spread through the landscape is considered in each case, as are the consequences on assets that may be affected by the spread of bushfire. Detailed modeling and analysis of the probability of bushfires starting and spreading is completed and includes fuels and fire behavior characteristics. Assets that may be affected by bushfire are identified and included in the modeling. While the methodology is similar in each state of Australia and in New Zealand, the modeling tools vary. The assets are considered by landscape and are given values commensurate with their location on the landscape. The work that goes into this risk analysis is tremendous and requires time and effort by numerous individuals.

The study tour group recommends pursuing an elevated level of engagement in accomplishing landscape level analysis and projects, much as outlined in the Cohesive Strategy provided by the US Departments of Interior and Agriculture. The pace and scale of work must increase significantly if North America is to reduce the risk of catastrophic fire. Australia and New Zealand have dedicated people and resources to analyzing and managing the landscape as a whole. North America should do the same; make it a priority, fund it, and send the message from the top down that a landscape approach to land management is an important initiative. The study tour group saw that it works in Australia and New Zealand and upon their return from the study tour saw evidence of these types of projects in North America. The study tour group recommends that all agencies involved in these landscape management projects make a stronger effort to "tell the story" to a diverse audience about these types of projects. In doing so, not only are the successes of these projects made known, but the opportunities to increase the pace and scale of managing for resilient landscapes in a collaborative manner should also increase. A viable example is the Victorian East Central Landscape project. (http://www.depi.vic.gov.au/__data/assets/pdf_file/0004/278248/East-Central_Strategic-Bushfire-Management-Plan_2014.pdf)

5. Shared Responsibility

"Bushfire mitigation and management is a shared responsibility between the community, industries and firms, land and bushfire management agencies and governments – where all take individual action and responsibility in an integrated way. Well informed and prepared individuals and communities, complement the roles of land and bushfire management agencies. A partnership approach is the best way to minimize bushfire risks to lives, property and social and environmental assets." (Page 9, National Bushfire Management Policy Statement for Forests and Rangelands, http://www.sfmc.tas.gov.au/sites/sfmc.tas.gov.au/files/1322-Environment_Fire_Policy_Doc_FA_WEB.pdf)

This statement from the National Bushfire Management Policy is taken to heart by the fire and land managers in Australia. There is a realization that it takes everyone to make a difference, not just the land managers, or the homeowners, but a collaborative relationship between all stakeholders.

In New South Wales the study tour group saw that all landowners are required to participate in firefighting preparedness by clearing their property and creating defensible space. The public is reminded that some of the work necessary to prepare for wildfire is their job, and they are told "you need to prepare." The limited firefighting resources are more effective when the land owners have done their part. District Manager Ian Stewart stated, "I have a responsibility to warn the community under shared responsibility".

Figure 12. Jamie Bertram of NSW RFS explains a Hotspots Project at the Red Rock Reserve.

Many parts of Australia have also passed legislation which requires that newer home construction meet stringent bushfire codes concerning flammable materials, landscaping, etc. Their challenge continues to be older construction and convincing homeowners to take protective action around "pre-legislation" homes.

Also, in New South Wales, the study tour group was introduced to the Hotspots Fire Project (http://hotspotsfireproject.org.au/), which is a training program providing landholders and land managers the skills and knowledge to actively and collectively participate in fire management planning and implementation.

The Australian Capital Territory, although small, is also focusing on shared responsibility. The inclusion of the public is standard practice in their planning process. "Together, an aware and educated community and a government that is committed to mitigating the risk of bushfires can form a partnership to reduce the impacts of future bushfires in the ACT". (http://www.esa.act.gov.au/wp-content/uploads/2011/08/act-sbmp-version-two.pdf page iii.) After the 2003 bushfires in ACT, the government is required to prepare a strategic bushfire management plan annually that includes a goal of the "government and the community working together to suppress bushfires and reduce their consequences on human life, property, and the environment. The

objectives of the goal are for the government to develop and implement an integrated, efficient, and effective bushfire management program, and for the community of the ACT to increase its knowledge of bushfires and to take personal actions to minimize the risk and consequences of bushfire events" (ACT Strategic Bushfire Plan). The Minister's Foreword to the 2014-2019 Plan says, "This plan identifies the vital role the community has to play in understanding and addressing the risk they and their families may face. The capacity of individuals and the community to plan and prepare for bushfires is crucial in reducing their impact people of the ACT, both urban and rural. The government will support the community in facing these risks through targeted programs and information." (http://esa.act.gov.au/wp-content/uploads/The-ACT-Strategic-Bushfire-Management-Plan.pdf)

In Victoria the group was introduced to some of the same principles of shared responsibility. An outcome of the Black Saturday fires in 2009 was stepped up messaging and collaboration with the general public.

Before the 2009 Black Saturday Fires, Australia was recommending people stay and defend their property. But after 173 deaths during the 2009 fires they have changed their message to "Leave and Live" or "Stay and Defend," but only if you have a Bushfire Survival Plan and your property is well prepared. (http://www.rfs.nsw.gov.au/file_system/attachments/Attachment_BushFireSurvivalPlan.pdf). There are templates for these plans and assistance from the local fire services, but the responsibility to complete these plans lies with the homeowner.

The study tour group fully supports the idea of shared responsibility and recommends that the concept of shared responsibility be analyzed to determine how it can be enhanced in North America. This would include an inventory of what is currently occurring and integrate best practices from Australia and New Zealand for use in North America, from messaging, to collaboration, to training landowners and responders, so there is a shared responsibility in how landscapes are managed. "People working together give the best risk reduction outcomes so it is important that we not only do what we can on public land but help empower others to deal with aspects of the communities risk exposure to fire which they can influence", (Victorian study tour outline, 4/30/2014, unpublished.) *The National Bushfire Management Policy Statement for Forests and Rangelands* is an excellent example of a policy that includes the idea of shared responsibility that North America could reference in developing their own policies.

6. Future Research

Wildfire and bushfire management present a multitude of complex issues worldwide. From the effects of climate change and complex weather patterns, to understanding the complexities of combustion chemistry, fire managers around the world depend on dedicated scientists to research and develop solutions and answers to bushfire and wildfire management challenges. Collaborative research opportunities exist around the world and have provided a better understanding of the fire environment, technology development and social interaction.

On May 1 and 2, 2014 an International Symposium on Bushfire Management was held in Canberra, Australia. The Forest Fire Management Group of Australia and New Zealand convened the symposium, bringing together senior bushfire managers and researchers (see list of participants in Appendix C) from Australia, Canada, France, Mexico, New Zealand, and the United States. The symposium focused on the current state of knowledge, both scientifically and operationally, the identification of emerging issues in bushfire management, as well as ensuring the development of bushfire management networks on a global basis, and to identify areas for improvement and collaborative research and development interests. Four priority themes were established to focus the discussion:

1. Rising bushfire trends
2. Questioning our safety and culture
3. Community
4. Practitioners' research priorities

The study tour group fully supports focusing assets on the priority themes presented at the symposium. These themes were strongly reinforced throughout their tour.

1. Collaborative research networks are established worldwide to study, research and develop new products, systems and processes to assist the bushfire/wildfire communities.

2. Forest Fire Management Groups leverage international support to address the topics challenging wildfire managers today from the International Symposium of Bushfire Management.

3. Researchers and practitioners should collaborate to meet future needs in support of worldwide wildland fire management, making fire managers better equipped and prepared in systems, processes, knowledge and safety in dealing with the varying complexities of non-fire and combined incidents. The emerging trend worldwide is the realization that research and development is required in systems and technology to be more prepared for all hazard incidents and disasters.

7. FFMG and FMWG Relationship

The Forest Fire Management Group of Australasia and the Fire Management Working Group of North America form a unique partnership that should be continued into the future. The opportunity to share specialized knowledge and experience is crucial to building a fire management program that will lead the participating countries into the future, and can set the stage for worldwide leadership in fire management.

This relationship was evident to the study tour group on a daily basis and truly epitomized the meaning of partnership. The inherent need to work with others is part of the job of fire managers; however this unique arrangement showcased the efforts put into making successful relationships.

The existence of this international relationship is somewhat hidden, though, and needs to be advertised better in North America. As the study tour group noted, not many knew of the depth and involvement of this partnership and they felt that the practitioners in the field would benefit from knowing more about these relationships, the goals and objectives, and the program of work.

Figure 13. Symbols of a strong relationship.

The study tour group learned that the Fire Management Working Group was established in 1962 under the North American Forest Commission. The objectives of the group are to:

1. Exchange experiences and technological advances regarding prevention, wildland fire management and fire use.
2. Provide mutual aid and technical exchanges between Canada, Mexico and the United States in the development of strategy and appropriate actions to resolve technical problems of the North American Region.
3. Actively support and participate in international fire management programs with fire management agencies throughout the world by developing and promoting activities that support international cooperation and development.

The Forest Fire Management Group is designed to provide a forum for discussion and a center of expertise on forest fire management and control and particularly to:

1. Provide high-level technical and policy advice on fire control matters to the Forestry and Forest Products Committee.
2. Facilitate interstate and international liaison and consultation between fire controllers and managers.
3. Assist in the development of effective fire management and control philosophy and proficiency.

Having similar objectives makes it rather obvious the two groups should work together. But beyond objectives, the people who make up and support these groups make them truly important. The focus on relationships and sharing of knowledge, as well as support to each other is tremendous and should be continued.

The study tour group recommends the continuance of this important relationship and a focus on publicizing the mission, accomplishments, projects, and goals to practitioners in North America. The study tour group members from this and previous study tours would be ideal ambassadors for such an endeavor.

8. Annual International Symposium on Bushfire Management

A draft report from the proceedings is already prepared and distributed to participants (see Appendix C); however the study tour group wanted to emphasize the importance of this first annual symposium and lend support to its continuance.

Overview and Opening

The International Symposium on Bushfire Management began with the Australia and New Zealand Forest Fire Management Group (FFMG) Chair Tim McGuffog opening the forum with regards and respect to the Aborigines. The Australians' regard and respect for the Aboriginal people was almost like having an opening prayer thanking the ancient people for caring for the land, and is very much a part of the land management culture in Australia and New Zealand.

The symposium was attended by Ambassadors from France, Mexico, and New Zealand, a representative from the US Embassy, the US Forest Service Director of Fire and Aviation Management, and Chief Officers of France, New Zealand, and Australian Fire Services. The keynote speech was presented by Senator Colbeck, Parliamentary Secretary to the Minister for Agriculture for Australia (http://richardcolbeck.com.au/2014_transcripts/address_to_international_symposium_on_bushfire_management). The Australians have a very high level of support for their fire management agencies, which has been boosted by significant catastrophic fire events in 2009.

The focus of the symposium was identifying rising trends, safety culture, connecting with communities, and research needs for the international wildland/bushfire community to address looking into the next 20-30

years. New Zealand, French, and American representatives all emphasized the importance of close working relationships with Australian and New Zealand.

Figure 14. Official delegates to the Symposium. Back row (left to right) Captain Jean-Michel Dumaz; Mr. Eric Soulier, Dr. Anne Gantaume, Mr. Tom Harbour, Mr. Tim McGuffog Front row (left to right):Minister Victor Trevino, Mr. Cedric Prieto, Senator Richard Colbeck, Ms. Alison Mann, Mr. Nathaniel Rein.

Rising Bushfire Trends

Concern was given to our ability to perform as a profession in the politically charged environment related to climate change when coupled with invasive species, fuels buildup, and societal shifts in demographics and associated movement into wildlands without the overall understanding of natural systems and the risk inherent with living in high fire risk areas. Future mega-fires are expected which will have dramatic impacts on communities. Water scarcity, impacts of changing climatic conditions, and increasing Wildland-Urban Interface will be the key trends for the international wildland fire community to work on in the future. Social sciences will be very important for effectively engaging the public in both risk and safety arenas.

Safety Culture

The focus of this discussion was asking if we are headed in the right direction with our approach to responder safety. While we already have a "safety culture", we need to reinvigorate it, and need to increase clarity over attitudes and beliefs that drive behavior.

Captain Jean-Michal Dumaz, Consultant/Firefighter Officer with Pole-Risques of France expressed that they are very well connected with fire science and research in the southeast of France. They have invested heavily in training and equipment to improve safety.

Both Australia and France are looking at firefighter safety on several different fronts and include emphasis on the private citizen and their shared responsibility for safety, as well as the government at various levels for placing and enforcing bushfire standards for housing developments.

Figure 15. Day 1 of the International Symposium on Bushfire Management.

Community Information and Messaging

Australia's "Leave Early" or Stay and Defend" message for homeowners is a topic of debate. The 2009 fires and resultant 173 deaths challenged the basis of the "Stay and Defend" message and spurred social science research into community messaging. Jim McLennan (School of Psychological Science, Latrobe University, Victoria, Australia and Bushfire Cooperative Research Centre) provided some insight on the nature

of the public in regard to messaging. He asked if the community pays attention to emergency messaging….and his research shows that they don't, and therefore, he pointed out, we need to change how we message, who we target, and when we message. And, part of this comes back to that stakeholder involvement and shared responsibility, because involving people before an event makes them more aware of the potential danger, and therefore the message has more meaning.

The various agency messages have since changed to a "Leave and Live" or "Prepare, Act, Survive" emphasis. Perhaps there is a message here for North America as well, and it bears further considerations. The concept of homeowners having a written bushfire survival plan is well advertised and may be a template for a national or continental effort in North America. An example from New South Wales can be found at: http://www.rfs.nsw.gov.au/__data/assets/pdf_file/0017/2933/BushFireSurvivalPlan.pdf. This could be a topic for inclusion in the next iteration of the Cohesive Strategy in the United States.

Fire danger messaging has changed from a similar system used in the US and Canada with a color coded wheel from low to extreme, but they have also added an additional "Catastrophic" category (Code – Red in Victoria), beyond "Extreme" to emphasize the critical nature of the worst days such as "Black Saturday" in 2009. Under these conditions, everyone is told to not go into the bush and those living in the bush are encouraged to leave for the day, prior to fires even starting. Social media has become a huge factor in the last two years, not for notification per-se, but for further information once notified. For the study tour group this change in messaging resonated and invoked discussion on what the threshold for an "extreme" category in our fire danger rating might be.

Research Priorities

Long term research priorities explored at this symposium will be forthcoming as developed by the overall group. One topic explored here was the on-going issues and rising complexities of smoke management. Improvement of fire spread models was also an important topic of discussion.

There was some focus on practitioner's research priorities including use of developing technologies enabling real-time data to enhance situational awareness and developing a common operating picture. This would include environmental data and that associated with fire behavior and movement relative to the environment. Research needs include human factors such as type, quality, and quantity of data, to whom it is distributed, how is it displayed, and what might be missed by technology; for example the importance of cognitive cues such as smell and sound, or three dimensions.

Outcomes

A facilitator for each theme set the stage for discussion around key topics within the theme. Following forum discussion, three workshop topics were agreed to for each session, discussed in smaller groups, and a set of suggested actions developed.

The topic of rising bushfire trends led to smaller group discussions on water, climate and vegetation change, and managing risk through planning. Questioning our safety culture resulted in smaller group discussions on safety language, developing a safety (focused) organization, and developing a safety culture. Community – information flow and messaging, brought discussion on identifying houses at risk, public communication and incentive and new models of engagement. Practitioner's research priorities considered predictive services; smoke modeling, impacts of smoke on health, and trade-offs of prescribed fire; and research priorities and collection of real time data.

The study tour group was involved in these smaller discussion areas, trying to have at least one participant in each group. Some of the ideas brought forward by the study tour group were included in the eleven topics to be carried forward to the respective fire management groups for further consideration.

The recommendation of the study tour group is collaborative work on each of the topics with the goal of having some positive feedback to present at the next symposium. The topics are:

1. A risk management approach to wildfire preparedness, response and mitigation. Safe structures and communities, policy and regulation development for safer communities, predictive models in wildland urban interface and bush land, and shared risk concept.
2. The effects of wildfire on watersheds and water catchment areas. Thresholds to water quality and quantity, ecological stability, fire mitigation effects, growth rates, and costs of impacts.
3. Climate and vegetation change. Adaptive monitoring systems, process based models, and adaptive management programs accounting for expected changes in vegetation and fire environment.
4. Questioning our safety culture. Risk analysis, risk assessment, personal protective equipment development for bushfire equipment, technical standards, training, human factors on fire fighters and citizens, understanding defining a safety culture, and understanding the human factors.
5. Developing a safety organization. Define the attributes of a safety organization, critical safety systems, tracking measures for safety, develop a safety culture system, and remove fear of consequence in reporting safety issues.
6. Community information flow and messaging. Standardization of bushfire risk systems for people to understand across states and provinces, toolkits for schools and homes, predictive tools to assist in defining high risk communities, and insurance community support worldwide.
7. Public communications. Development of tools targeting WUI communities, media planning strategies, and leveraging political support in unpopular messaging.
8. Predictive services. Weather prediction models for long term forecasting and evaluation/validation of predictive services products that are available to all agencies.
9. Smoke modeling. Identifying gaps in smoke modeling knowledge, better understanding of impacts of smoke on health and evaluative tools to assist in policy growth with regard to smoke, water, and carbon related tradeoffs in prescribed burning.
10. Research priorities and collection of real time data. Data collection standards, improved information sharing in research community, real time data on fuel moisture levels, improving accuracy of data inputs, and affordable/accurate portable weather stations for fire line use.
11. Develop international information sharing networks, which would improve data collection and research needs. Collaborative research worldwide.

The study tour group recommends such symposiums continue in a similar format in the future. Each member of the study tour group was actively involved in the smaller group discussions/workshops and found it a positive and rewarding experience to have their input considered and even included in topics to be carried forward. For the study tour group the topics to move forward reflect the needs of moving into the future as safe, effective, collaborative and efficient fire managers. They offer opportunities to focus efforts globally as practitioners from the participating agencies work together to lead our wildland fire community into the future. The study tour group members are a resource for sharing the messages and working on the topics from the symposium.

Figure 16. New Zealand Rural Fire Service Apparatus.

Observations for the Forest Fire Management Group

The study tour group was impressed with the overall passion and enthusiasm shown by fire managers in both Australia and New Zealand. The program areas presented (see Appendix A1, itinerary and A2, Daily Journal for in depth topics covered) allow an opportunity to take numerous ideas back to North America, to strengthen programs. The study tour group observed professionalism, working towards common goals and objectives, a willingness to work together in a collaborative fashion to the betterment of the bushfire management community, and an in-depth knowledge of the land and what it takes to manage it for reducing bushfire risk. All in all, the programs are well managed, well-functioning, and very much interagency. After spending nearly a month taking in all that was offered, the study tour group sees a strong program, but would like to offer some recommendations:

1. Keep the Forest Fire Management Group active.
2. Consider a more nationalized approach to fire management, rather than each state setting standards, i.e. FFMG.
3. Enhance and standardize training and qualifications.
4. Standardize personal protective equipment (PPE).
    a. Common and consistent personal protective equipment, such as shirt, pants, helmets, gloves, boots so there is opportunity for interchange.
    b. Nomex or flame resistant materials; consider Kevlar in dense vegetation.
    c. Any other safety gear that is used should become common to all agencies.
5. Set national standards for mobilization rules, such as length of assignment, days off, length of tours, shift length, etc.
6. Consider a national common operating picture that would include aspects of eMAP and ICON, as well as other programs.
    a. Outputs could include that global/national perspective for input at the national level in Canberra and Wellington.
    b. The whole country and possibly the world would see the same information.
7. Take small steps as this journey continues.
8. Understand that especially in New Zealand spreading the message of fuel reduction while working to restore a natural condition will be difficult.
    a. Good work is being done with the FireSmart Concept, but further education of the public would assist – i.e., they are doing good work and are very passionate, but it is still not enough to produce a truly safe environment in which to live or to fight fire.
9. Keep the New Zealand “Blue Book”. In other words, bring the National Incident Management System (NIMS) back to its original state. The group noticed that there was movement from other agencies to change the very core of ICS and NIMS. New Zealand should heavily resist any attempt to change time-tested core principles of emergency management to facilitate political or administrative titles or feelings. Having multiple incident commanders is not following the basic concepts of NIMS. One of the reasons we have a strong history of sharing resources between countries to suppress wildfire is because we have the same framework of incident management (NIMS). When countries start moving farther and farther away from the original framework it becomes confusing and more difficult to work together.

Conclusion

Fire is a natural ecological change process that is common to numerous countries. The way it is managed, dealt with, controlled, or used varies across the world but remains similar, thereby opening the door for sharing of knowledge and experience for the benefit of all practitioners.

North Americans have short term memory….whatever is in the news is where our interest and sometimes where our collective conscience lies. For example, on June 30, 2013, 19 firefighters lost their lives in one event – for a few days or weeks this event brought wildland firefighting to the forefront of the public's interest. But, a year later, it is just another event, with a few casual news stories. The public is not really affected by the events that affect us as fire managers – not bringing our people home. But, if an event such as Black Saturday, which affects the public to a large extent, were to occur, what would be the effect? A lot of change occurred in Australia as a result of the Black Saturday fires – and today, while the interest in the event is waning, there is still a sense of public awareness.

While we do not want to ever face such an event in North America, we must wonder what the public reaction would be – would wildfire become more than just a quick story on the evening news? It seems wise to consider enforcing new standards and practices learned from Australia and New Zealand, rather than waiting for such a tragedy to happen here, forcing our hand.

The Forest Fire Management Group, the Australian Government and several state governments conducted follow-up from the 2009 bushfires. The results include:

- New policy based on a vision that "fire regimes are effectively managed to maintain and enhance the protection of human life and property, and the health, biodiversity, tourism, recreation and production benefits derived from Australia's forests and rangelands" are addressed in *The National Bushfire Management Policy Statement for Forests and Rangelands*;
- "Recommendations giving priority to protecting human life, and that are designed to reflect the shared responsibility that governments, fire agencies, communities and individuals have for minimizing the prospect of a tragedy of such scale ever happening again" in *The Victorian Bushfires Royal Commission into the 2009 Black Saturday Bushfires*; and
- Standards to improve the ability of buildings in bushfire-prone areas to better withstand the passage of the fire front are detailed in *AS3959-09, Construction of Buildings in Bushfire Prone Areas*.

These examples are worthy of review by North American wildfire managers as preparation for a "shock" event such as Black Saturday occurring in North America.

Black Saturday and the other large fire events in Australia have opened up a dialogue with the public, with lawmakers, with practitioners, about fire's role in the environment and have led to some major changes in the concept of bush fire for the public.

The study tour group recognizes the changes that came about because of the 2009 Australian fires – and they wonder how to make those changes come about in North America without the devastating loss of life and property experienced during that event.

As the study tour group listened to and observed the practitioners in Australia and New Zealand, they saw a lot of pride in the organizations. The relationships were real and effective. While there are strong relationships in North American wildland fire management, they are not always as authentic. Getting along and having a common goal are critical factors to success; finding a common way to do something and agreeing on common messages, are not easy to achieve, but are something to strive for.

The study tour group found great camaraderie rather quickly with our international friends due to the commonality that fire professionals share on a global basis. We may talk or look different, but we all share the same passion for the job. It is absolutely worthwhile to foster this bond we share. The issues we face are similar – safety, communication, getting pre-suppression and fuels work done, the need for staff and equipment, budget, laws, dealing with the public, and most importantly being that fire professional who has the heart to take it on.

Our jobs allow us the opportunity to work in the great outdoors, meet new people and quickly find trust in them as we work toward common goals in difficult and dynamic conditions, and travel to many new areas of our world. This line of work is extremely rewarding and provides a sense of purpose, self-worth, and public service.

The suite of recommendations from the study tour group leads to a strong, integrated fire and land management program. Each recommendation could, however, be implemented separately. The study tour reinforced the notion that each of the components of the tour, reflected in these recommendations, leads to a holistic program where safety of the public and firefighters is important, land management is a well-thought out, inclusive program, and everyone's voice counts.

The study tour group recommends North American wildland fire leadership take under consideration:

- Maintaining relationships is very important. Relationships are built on trust. That trust is gained through strong communication of the relationships at all levels and enforced by our leaders setting a good example. Relationships don't just happen and remain; they require effort from all participants and the support of each participant to speak up and deal immediately with anything that may weaken the relationship.
- Engagement of stakeholders is critical for wildland fire management programs to be successful. Examples from Australia and New Zealand offer opportunities to emulate and perhaps be considered in the next steps of the US Cohesive Strategy.
- A comprehensive common operating picture is a valuable tool that many agencies recognize as important as each pursues it on their own. Working together on development and implementation of a common operating picture tool for use by all agencies should be a goal for North America and perhaps, by working with FFMG, lead to a global tool.
- Development of a landscape management philosophy with wildfire management as the predominant driver in a strategic risk management approach is something that is being worked on in several arenas; working together, and following the lead of Australia with their *National Bushfire Management Policy Statement for Forests and Rangelands* as well as the both the Australian Capital Territory and Victoria examples of a strategic bushfire management plan has the potential to develop plans that focus on large landscapes, are interagency in approach, and which will cross borders.
- Focusing efforts on making shared responsibility part of the North American culture in wildland fire-prone areas would go a long ways towards opening up dialogue and collaboration as the population continues to move into wildland areas. The goal would be a national initiative where partnerships are developed between fire and land management agencies, the community, and stakeholders resulting in shared responsibility for reducing risks to life and property from wildfire. This could easily become part of the next iteration of the Cohesive Strategy in the United States.
- Collaborative research will improve our ability to manage wildland fire into the future. Sharing that research, to all levels of the wildland fire community, will provide better opportunities for positive outcomes in land and wildfire management. Collaborating globally will ensure less duplication of effort and more resources to dedicate to research.
- Continuation of the relationship between the Forest Fire Management Group and the Fire Management Working Group of North America; this is a unique relationship and hopefully will

continue and expand to include other countries, and sets a positive example of collaboration and sharing of ideas and resources.

- Continue the Annual Bushfire Symposium: the identification of rising trends and issues transcends North America, Australia and New Zealand. Nations from around the globe are facing similar and unique conditions that need to be shared and this type of forum is an ideal mechanism for such sharing. Involvement of researchers, national level wildland fire leaders, and on-the-ground wildland fire practitioners provides a fertile environment for key issue discussion and movement towards solutions.

The study tour group appreciated the opportunity to participate in the tour. They are dedicated to participating in moving these recommendations forward into the future.

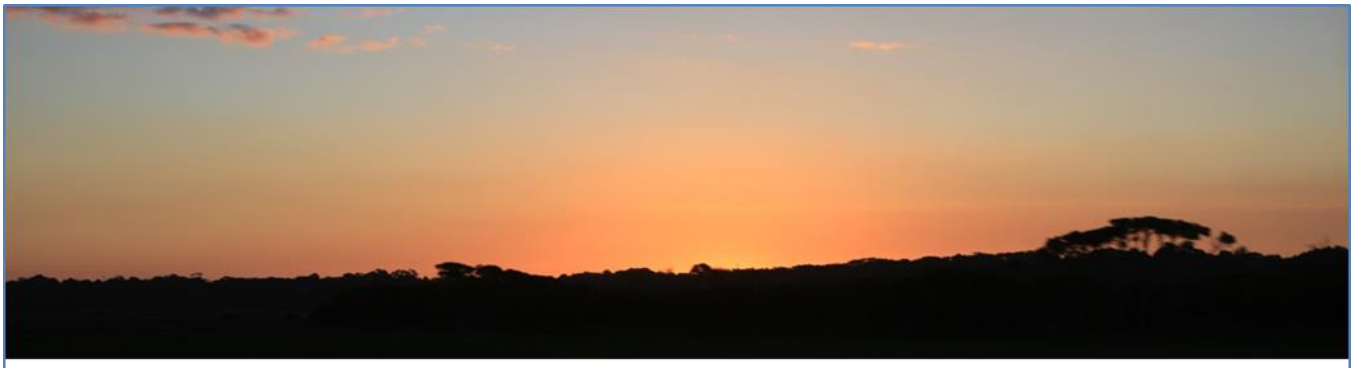

Figure 17. An Australian Sunset.

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Appendix A. The Study Tour

1. The Itinerary

Following is the itinerary the study tour group was provided. It shows locations and topics covered during most of the tour.

DATE Date (Day)	**WAKE** (Location)	**DEPART** (from - location)	**DESTINATION** (location)	**PURPOSE**	**HOST** (ie FFMG member)
28 April (Mon)			Arrive Sydney		
			Canberra	***Arrive Canberra – Travel to Accommodation***	***McGuffog/ Graystone***
29 April (Tue)	**Canberra**	University House	ACT Parks and Conservation Depot	Meet hosts: briefed on field trips and events	MCGuffog/ Cooper
		ACT Parks and Conservation Depot	Brindabellas	Various sites, current hazard reduction activities, Discussion and evidence of 2003 Bushfires, Urban Interface, Cooperative Cross Border fire management	Cooper/ Dicker
		Brindabellas	Bondo State Forest	2006 Plantation Fires, Plantation fire protection, Tumorima Fire Tower	McGuffog
		Bondo SF	Tumut	*Travel/*Accommodation: Check-in and refresh	
30 April (Wed)	**Tumut**	Tumut	Tumut RFS	Cooperative fire management in rural area Grassland fire operations Sturgess Fire overview	(Local FCNSW, NPWS, RFS Staff)
		Tumut	Jindabyne	Strategic hazard reduction program (Black Perry / Brownly), Yarrangobilly Caves - Heritage building APZ and visitor safety and evacuation Kiandra - alpine / sub alpine fire management planning	Dicker
		Jindabyne	Tumut	Accommodation/Evening Meal	FFMG Members
1 May (Thu)	**Jindabyne**		Local	Climate change and fire management in the Alps, Enhanced Bushfire Management program	(Local FCNSW Staff)
		Jindabyne (10:00)	Canberra via Cooma	*Travel* - Accommodation: Check-in and refresh	
		University House	International Symposium /CSIRO	Official Opening and Launch of International Symposium - Senator Colbeck *REFER separate Symposium Agenda*	FFMG Members
			CSIRO Discovery Centre	Welcome Reception (Snack food)	FFMG Members
2 May (Fri)	**Canberra**		International Symposium /CSIRO	Day 2 of International Symposium *REFER separate Symposium Agenda*	FFMG Members
			Stromlo	Evening Meal - provided (At Stromlo)	FFMG Members
3 May (Sat)	***Canberra 0530***	***Qantaslink – QF1510***	***Sydney***	***Connecting Flight to Coffs Harbour***	
		Qantaslink – QF2106	***Coffs Harbour***	***Travel - Met by Coach for day trip to Ballina***	***McGuffog***
		Coffs Harbour	Garby Nature Reserve	*Travel*	
		Garby Nature Reserve Corindi Valley		Welcome to Country • Risk management • Working across agencies and tenures • Public Land Fire Management • Village Protection • Aboriginal partnerships • Hotspots	Denman Allan Bertram Hemer Graham Ball Thompson Parker

		Corindi Valley	Ballina	*Travel*	
		Accom	Ballina	Evening discussion: SE Queensland and Northern Rivers Fire and Biodiversity Consortiums.	Weldon Morrison
4 May (Sun)	**Ballina**	Accom	Jarli Lands	*Travel*	
				Welcome to country • Firesticks Project • Cultural aspirations • BMAD (Bell Miner Associated Dieback)	Parker Ferguson Weldon
		Jarli Lands	Whiporie	*Travel* & BMAD discussions	Morrison
			Whiporie	Plantations, public land fire.	*Lunch arranged*
		Whiporee	Coffs Harbour	*Travel*	
5 May (Mon)	**Coffs Harbour**			**Free morning** Suggest walk up Muttonbird Island, swim	
		Coffs Harbour Airport	***Sydney***	***Connecting Flight to Melbourne***	
		Qantaslink	***Melbourne***		***Alan Goodwin***
		Tullamarine	Accom	*Travel to Lancemore Hill*	Alan Goodwin
				Dinner meet and greet Victorian Context	+ Peter West & Jillian Gallucci & other invited guests
6 May (Tue)	**Lancemore Hill**		Accom	Introduction to Bushfire in Victoria *Community engagement aspects of Risk Landscapes project and community resilience (Suriya).*	Goodwin/ Andrew Graystone/ Peter West / Suriya Vij/ Hayley Coviello
		Accom	East Central Risk Landscape Victoria. Kinglake/ Marysville.	Impact of Black Saturday Bushfires Discussion of implications for future prevention/protection/community planning. *Ecological resilience components of project and ecological health monitoring (Hayley)* *Kate Nolan and Lucas Russell - Murrindindi planning* Planning and operational issues associated with "Ash-kill" sites. Community recovery	Peter West / Suriya Vij/ Hayley Coviello Andrew Graystone
7 May (Wed)	**Healesville**	Accom	East Central Risk Landscape Victoria. Melbourne Water Catchments. Warburton, McVeighs Tower, Mt Dandenong, Emerald (TBC)	Managing the fire risk in Water catchment Interface challenges /Community Messaging/ Arson/ Evacuation/Refuges/ Shelter in place. Integrated Fire Management Planning/Peri-urban environment /Dandenong project.	Jillian Gallucci/ Adam Whitchurch/ Nigel Brennan/ Geoff Scales/ John VanderPaverd/ Craige Browne/ Andrew Graystone
8 May (Thu)	**Walhalla**	Accom	Rotunda (Walhalla)	Community engagement/ Strategic conversations.	Peter West/ Steph Carr Andrew Graystone
			Traralgon/ Regional Control Centre	*Travel to Traralgon via Lookout at Tyers* All hazards issues/pressures Grassland /interface fires/CFA Management of complex incidents	Frazer Willson
			Traralgon RCC	Hazlewood Mine incident and associated broader all-hazards emergency and issues	
		Traralgon	Yanakie (or Walkerville)	*Travel (via Loy Yang lookout) to Foster (Yanakie?)*	
				Ecological objectives / implications of 'unbounded' burning	
				Travel to Walkerville North (as determined)	
				Complex burns and community engagement-finish NLT 1800 in daylight	
			San Remo	*Travel Walkerville to San Remo*	Peter West / Andy Ackland/ Andrew Graystone

9 May (Fri)	**San Remo**	Accom			
			Department of Primary Industries (DEPI)	Victorian Wrap – up	Alan Goodwin/ Andrew Graystone and DEPI/Parks Victoria staff
			Mantra on Russell	Dinner - Mantra	Alan Goodwin & invited guests
10 May (Sat)	***Melbourne 0630***	***Qantaslink – QF1011***	***Hobart***		***Andrew Graystone***
				AM: fly in, meet, transport to MidCity Hotel, briefing at Forestry Tasmania, PM: Rest, Hobart Market, sightseeing Hobart	FT, PWS, TFS
11 May (Sun)	**Hobart**	MidCity Hotel (Day Activity)	Hobart	Styx Valley and SW Tas wilderness World Heritage Area. forest and park fire mgt issues Lunch: Eagles' Eyrie or Mt. Field NP	FT, PWS, TFS
12 May (Mon)	**Hobart**	MidCity Hotel (Day Activity)	Hobart	TFS Cambridge complex. Presentations on contemporary fire mgt issues, solutions, techniques and equipment. Lunch: TFS Cambridge	FT, PWS, TFS
		MidCity Hotel	TFS Social Club	Social Function	TFS
13 May (Tue)	**Hobart**	Hobart (Day Activity)	Hobart	Tasman Peninsula: Dunalley fire and impacts, Community Resilience, Historic Port Arthur fire and site tour Lunch: Port Arthur Historic Site	FT, PWS, TFS
14 May (Wed)	***Hobart***	***Depart MidCity Hotel***	***Hobart Airport***	***Transfer to Hobart Airport and check-in for flight to Christchurch***	
		Hobart Airport VA1313 to MEL	***Christchurch NZ NZ898/UA6 794 ex MEL***	***Fly Tasmania – Christchurch. Change aircraft at Melbourne (Tullamarine).***	***Murray Dudfield*** ***DoC, NZRFA***
			Accom	Travel by Shuttle/ Taxi to Christchurch	
15 May (Thu)	**Christ-church**	Accom		Welcome from NZ National Rural Fire Authority (NRFA) - National Overview	Dudfield, Lochyer
		Accom	SCION Crown Research Institute	Welcome and morning tea NZ's Rural Fire Research Programme	Richard Parker & Grant Pearce]
		SCION	Rangiora	*Travel* Welcome and Lunch at Dept. of Conservation (DOC) Fire Depot at Rangiora	DOC
				Site Visit/Discussion forum on DOC Fire Management in NZ. - Theme Biodiversity & Fire	DOC National Fire Manager - Bryan Jensen
		Rangiora	Hanmer Springs	*Travel*	
				Meet with Rayonier NZ Forestry Ltd - Guided tour of Hanmer Forest - Theme Recreational Use & Fire Management.	Forestry Mgr Darren Mann
16 May (Fri)	**Hanmer Springs**	Accom	Richmond	*Travel* Lunch at Richmond	
				Meet with Waimea Rural Fire District (WRFD) Stakeholders at the Tasman District Council. Overview with discussion on Rural Fire Districts/Fire Management.	Principal Rural Fire Officer/ District Fire Manager Ian Reade.
		Richmond	Nelson	*Travel* Accommodation at. [to be advised]	
				Dinner with the WRFD Stakeholder Representatives at (venue to be advised)	
17 May (Sat)	**Nelson**	Accom	Various	Field visit to sites in and around Golden Bay and Kaiteriteri - Theme Community Fire Safety.	Principal RFO/District Fire Manager Ian Reade & local WRFD Rural Fire Officers

18 May (Sun)		Nelson Airport *NZ5258 Air New Zealand Link to Auckland*	Auckland Airport	*Fly to Auckland*	**Murray Dudfield?**
19 May (Mon)			Auckland - Amora Hotel, Greys Ave Auckland	Travel by Shuttle/ Taxi to Accommodation	
	Christ-church	Accom	(Walk) to New Zealand Fire Service Region 1 HQ Auckland.	Attend Rural Fire Forum - Study Tour Group and NZ Rural Fire Mgr's from the National Rural Fire Authority National Incident Management Teams.	
				Lunch at New Zealand Fire Service Region 1 HQ Auckland.	
				Continue with Rural Fire Forum 14:45	
		New Zealand Fire Service Region 1 HQ Auckland.	New Zealand Fire Service Northern Communica-tion Centre.	*Travel - and* Theme overview of centralised collocated communications & dispatch centre.	Operations Manager Eric Smith
		Northern Comm. Centre.	Amora Hotel		
20 May (Tue)				Dinner with NZ Rural Fire Mgr's from the NRFA National Incident Management Teams.	
	Auckland	Accom	Auckland International Airport	Travel by Shuttle/ Taxi to Auckland International Airport	

2. Daily Journal

The study tour group kept a daily journal of activities. This in-depth look at the trip offers more information than is presented in the main body of the report. Each day recommendations for inclusion in the report or for further consideration were developed. From these came the eight recommendations the study tour group presents as a whole in this report. If you have additional questions on anything discussed in the daily journal, please feel free to contact a study tour group member (Appendix D lists the members). The daily journal is by no means an all-inclusive account of the study tour; study tour members took notes, acquired pounds of handouts, took thousands of pictures, and participated in hours of discussion. They tried to document some of the highlights of each day.

April 29

The Australian Capital Territory (ACT) is a linear tract of land, excised out of the State of New South Wales (NSW). It is the seat of government for the whole of Australia. With an estimated population of about 400,000 people, all of the land within the ACT is owned by the government - private citizens can lease land for up to 99 years but can't own it. ACT Parks and Conservation manages 73% of the land and there is high urban interface because most of the people live within 30 minutes of ACT lands which rely on the Rural Fire Service for all fire suppression.

In 2003, 70% of the ACT burned in a large bushfire, created when four small fires burned together under extreme weather conditions. The study tour visit focused on those events, what lessons were learned, and what policies and procedures have been incorporated since that time. Prior to 2003, the ACT spent roughly $40,000 a year on fire support but did not include active programs for fuels reduction and prevention. Since the 2003 fires, the ACT program now includes a budget in the millions for preparedness, suppression, fuels reduction, and prevention.

For context, the ACT Emergency Services include the following branches; Ambulance, Fire and Rescue, Rural Fire Service, and State Emergency Services. It's important under this model to note that while ACT Parks and Conservation is the primary land manager including fire planning for these lands, they rely on the Rural Fire Service (which includes a large number of volunteers that form rural fire brigades), to act as the primary organization for fire suppression. In addition to the volunteer brigades, agency personnel such as ACT Parks and Conservation also form brigades that assist in the suppression efforts. There are ongoing concerns and issues that include topics such as volunteers staying current on fire suppression training, as well as maintaining an effective level of volunteers with the majority of volunteers entering retirement age.

In response to the catastrophic wildfires of 2003, the ACT put much improved reporting and planning processes into place. These include a government response to bushfires and a community response to wildfires. They include the following scaled plans:

Strategic Bushfire Management Plan (SBFMP) - ACT has a government and a community action plan that incorporates core principals in bushfire management, specific objectives, and strategies applied to fire management zoning areas. The plan has two distinct portions that comprise the SBFMP: ACT Government Action Plan and a Community Action Plan.

Bush Fire Operations Plans (BOP) - This Plan provides a list of actions to meet the standards laid out in the SBMP. The plan outlines, and assists in developing overall work programs, and allocates resources for the year.

Regional Fire Management Plans - These plans are outlined for a 10 year period, built on a landscape basis, and outlined within a GIS process. These plans help to add detail and context to the BOP Plans. It is within these plans that a localized analysis is completed to determine overall fuel loads and establish biodiversity thresholds.

Figure A1. At the boundary of ACT and NSW where an easy relationship exists amongst the land management agencies as they work together to care for a landscape.

A significant amount of time was centered on talking about the need to balance landscape biodiversity (irrespective of land ownership) with the needs to reduce fuel buildup. While the ACT Parks and Conservation program is aggressive about burning when possible for both for fuel reduction and to ease public concerns about bushfire risk, it has to be balanced with the timing needed to establish regeneration of the numerous varieties of vegetative species in Australia such as many of the eucalyptus and acacia species found within the ACT. Ensuring that fire stays out of some areas for at least 25 - 30 years is necessary for regeneration, but often conflicts with the need to burn for risk mitigation. Following the 2003 fires, the ACT has worked hard to develop a biodiversity threshold to help manage decisions when those needs are in conflict.

Some other items to note that have come out of the 2003 bushfires are legislation regarding urban design standards and acceptable construction materials that meet fire resistance standards in fire prone landscapes. The legislation is a key to limiting new construction to a higher standard, but they are struggling with convincing current homeowners to make changes to protect themselves. The message of *urban resilience* and "shared responsibility" is a key part of engagement with the community. The ACT works hard to encourage communities to take an active role in preparing their property and assisting themselves in emergency situations. Part of that assistance is providing communities with equipment and training to be better prepared.

The challenges ACT fire programs face are not unlike those in North America such as climate change; balancing urban development with biodiversity; fire protection balanced with ecosystem management; and community engagement including with indigenous peoples.

Some of the key items to note:

Identifying biodiversity thresholds that develop an agreed upon balance between fuel buildup and biodiversity needs.

Incorporating a methodology such as *Utilizing an Overall Fuel Load* provides a comprehensive method of measuring surface, ladder, and aerial fuels.
http://www.fireandbiodiversity.org.au/_literature_173786/Overall_fuel_hazard_assessment_guide_4th_ed

The Development of *Dynamic Fire Management Zones* that help in planning fuel reduction projects along a modeled *fire path* that adheres to biodiversity thresholds but reduces fire risk along the established *fire path* by staggering projects.

The ACT developed and incorporated a one page double-sided Incident Action Plan (IAP) that was much more focused on and usable by ground crews. It included the IAP Map on one side and critical IAP text information on the other.

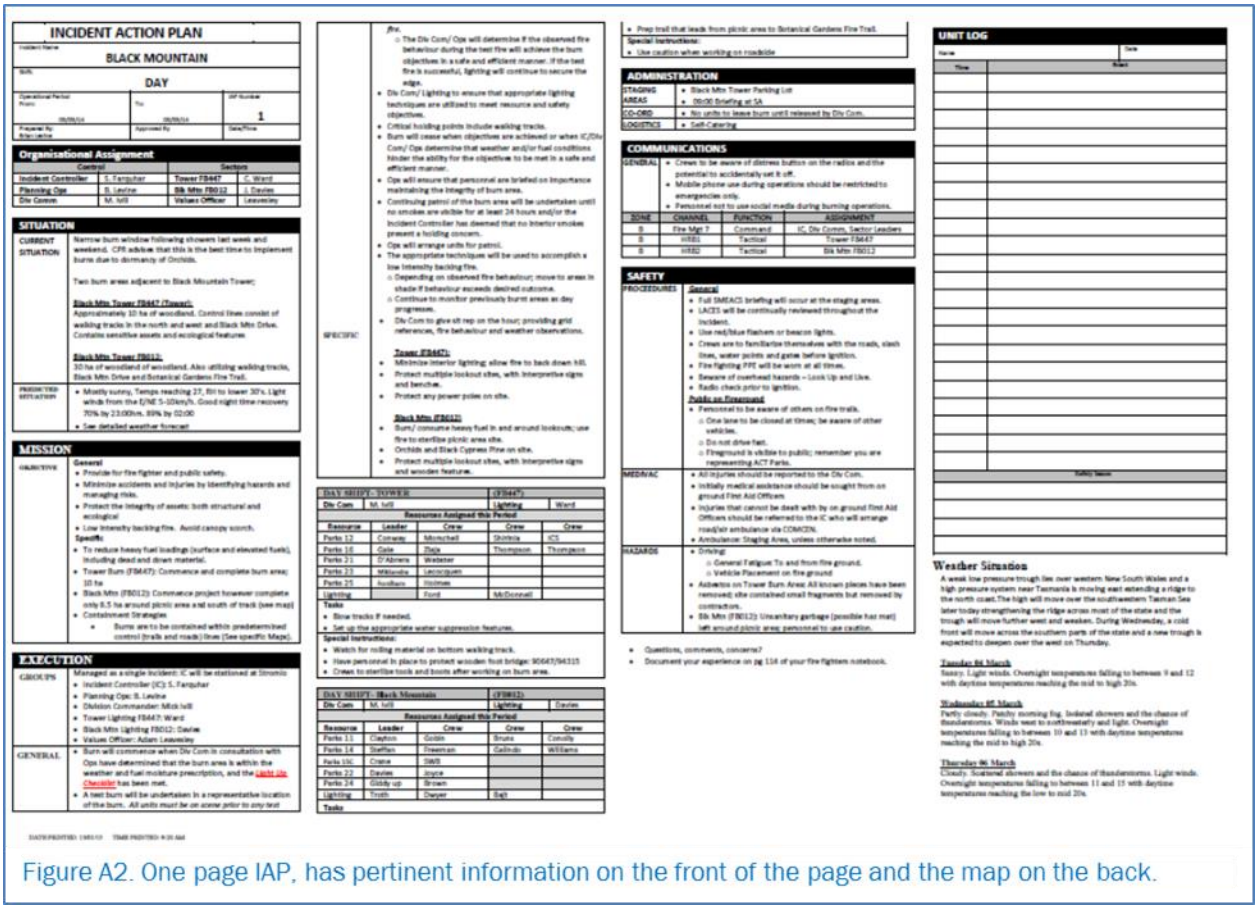

Figure A2. One page IAP, has pertinent information on the front of the page and the map on the back.

April 30 and May 1

The day started in Tumut, New South Wales at the New South Wales (NWS) Rural Fire Service (RFS) Riverina Highlands Zone Office, where we were briefed by Ian Stewart, the District Manager. Ian discussed the Rural Fire Service (RFS) highlighting the importance and challenge of managing the volunteers in the brigades as "they want to be there, they don't have to be there." 70,000 volunteers are currently enrolled in NSW. RFS is trying to encourage a flexible membership model to help in volunteer recruitment efforts. However, as the demographics of the region change (moving toward older), so does the availability and drive of volunteers: the average age of firefighting personnel is in the high 50's.

Firefighting in New South Wales is a shared responsibility: all people are required to participate by clearing their property and making defensible space. They tell the public "you need to prepare", getting more value out of fewer people. As District Manager Ian says "I have a responsibility to warn the community under shared responsibility." Firefighting in NSW is a shared responsibility and all people are required to participate. Incident Management Teams include a community liaison officer, a public liaison officer, and a media liaison officer to help in communicating this message.

One of the tools utilized by the Rural Fire Service is Incident Control on Line (ICON). It is considered as the "single source of truth" for NSW incidents. This program includes input from the ground during fire incidents and allows messages to be posted to a public website very quickly. Serving as a common operating picture, monitoring of the situation becomes easier.

Figure A3. Tumorima Lookout Tower, NSW Forestry Corporation.

A forester from NSW Forestry Corporation (a state owned corporation) provided a briefing of fire detection and suppression actions on plantations. Proximity of assets drives suppression actions in regards to plantations. Assets interspersed amongst forested lands results in limited access, one road in and out, lots of visitors, and very limited communication in many cases. This results in difficult to implement management strategies for many fires. A brief tour of the nursery facility and a discussion about nursery automation processes also occurred at the Blowering Nursery outside of Tumut.

Matt White from Kosciusko National Park (KNP) provided a briefing to the group at the Black Perry Lookout about the KNP fuels management program, specific project implementation processes, limitations, and issues regarding fire use. National Parks are primarily managed for conservation and tourism/recreation. A significant portion of the Park is considered to be fire prone and has a very small staff to support the program. NSW Parks has a very aggressive fuels management

Figure A4. At Black Perry Lookout in KNP, off the Snowy Mountains Highway. The background is all wilderness area. Closer to the lookout are some remnant rainforest patches. There is a need to burn the whole area to increase habitat and biodiversity as well as reduce fuels and protect Bogong Peak. In 2003 1.2 million acres of the National Park were burned, including the area seen from the Lookout.

program that utilizes a rolling target concept, but reluctance is present at all levels to implement fire use programs to help achieve these targets, due to the potential for undesirable outcomes.

Figure A5. At the Yarrangabilly Caves, where Ian Dicker tells the study tour group, "communication is difficult, you are in a hole here." There can be over a thousand visitors a day, with one way in and one way out, and numerous caves that can be visited. The major cave feature has cameras to assist personnel in evacuations if necessary, but the rest of the caves are not so equipped. The road in the middle ground is barely wide enough for two vehicles to pass.

Ian Dicker, Fire Management Officer, NSW Parks and Wildlife Service (NPWS), explained emergency evacuation planning and preparation process utilized by KNP at the Yarrangobilly Caves. Pre-planning for critical response and evacuation is actively occurring and actual simulations are taking place in potentially impacted areas. These hands-on simulations are beneficial in the planning process because deficiencies are identified in a no consequence environment.

On the morning of May 1, Ian Dicker hosted a discussion about cooperative relationships, organizational structure, and initial attack resources at the KNP Lake Jindabyne Works Depot. The risk management process has changed a lot since the 2003 fires. 71 percent of the park burned in 4 to 6 weeks resulting in even-aged stands. Considerations on how to burn the understory without damaging the overstory have resulted in limited prescription windows for project implementation. Issues regarding fire and wilderness, use and values are present and continue to drive resource management decisions.

Figure A6. A visit to the Lake Jindabyne Works Depot at KNP brought out the equipment: top left drip torches and fuel; top right; an engine compartment for the saw; bottom left, the hair dryer, a truck mounted blower to assist in burning operations; and bottom right, the Dragon, a ping-pong ball firing device mounted on an ATV.

Coordination between NSW Rural Fire Service, Parks, and the State of Victoria appears to be very strong. Operational agreements regarding border fires response, payment, and management issues have been developed and agreed to, facilitating these response actions. Liaisons are utilized during periods of enhanced activity to help coordinate requests and ensure issues are identified and dealt with in a timely manner.

May 1 and 2

The study tour group attended and participated in the First Annual International Symposium on Bushfire Management, Canberra, ACT. For a more detailed account of the Symposium, please see Appendix C.

May 3

The group arrived in Coffs Harbor, NSW on the morning of Saturday May 3. Our first stop was with the Rural Fire Service at their facility very near the Coffs Harbor Airport. We were able to visit the local area focusing on the vegetation, the WUI situation, and the relationship with the community and aboriginal tribes. We were immediately impressed with the acknowledgement by the local fire managers from Rural Fire Service, NPWS, and HotSpots, of the Aboriginal tribes of past and present who live as one with the land or "country." We were able to stop and see the heathland vegetation (with a 7-20 year high intensity fire return interval) which has become a WUI problem and some of the hazard reduction burns which are also helping to retain biodiversity and ensure Xanthia grass would grow. This plant is very significant as it is the plant used to make fire sticks by the aboriginal people. The visit to the Arrawarra Headlands and Red Rock Reserve were amazing due to the significance of these areas to the Garby Elders. It's quite remarkable how the local fire managers are working very closely with the tribes to teach them how to, once again, burn these lands. The process is a re-introduction of fire by the aboriginal people, not just fire on the landscape. For more information on the Firesticks Project, see Appendix B.

Figure A7. Heathlands near the coast, NSW.

Figure A8. Yuraygir prescribed burn area.

We were introduced to Australian Standards 3959 (http://www.as3959.com.au/) which covers all construction and retrofitting requirements based on the bushfire attack level of a home. This standard incorporates the concept of shared risk.

Figure A9. NSW Presentation on prescribed fire.

"Under the Rural Fires Act 1997 the Bush Fire Coordinating Committee must constitute a Bush Fire Management Committee for each area in the State, which is subject to the risk of bush fires. Each Bush Fire Management Committee is required to prepare and submit to the Bush Fire Coordinating Committee a draft Bush Fire Risk Management Plan. A bushfire risk management plan is a strategic document that identifies community assets at risk and sets out a five-year program of coordinated multi-agency treatments to reduce the risk of bush fire to the assets. Treatments may include such things as hazard reduction

burning, grazing, community education, fire trail maintenance and establishing community fire units." (http://www.fire.nsw.gov.au/page.php?id=9020)

Figure A10. Jaime Burtram, from NSW RFS, talks about bushfire risk management plans.

These bush fire risk management plans are a strategic 5-year program of work to reduce risk of bushfire to assets. (http://www.rfs.nsw.gov.au/__data/assets/pdf_file/0015/2382/Mid-North-Coast-BFRMP.pdf) A community protection plan is tiered to the bush fire risk management plan. It will include a series of 3 maps: an impact map which is based on radiant heat levels; a preparation map which outlines all the work that has to be done; and a brigade operational map which shows pre-attack information such as water sources and access, and where vulnerable residences are located. The first two maps are shared with the community while the third map stays with the Rural Fire Service.

Although not a requirement, New South Wales has met many of the recommendations from the 2009 Victorian Bushfires Report.

We also learned how each of the fire agencies utilize similar information and fire management plans (FMP) to better coordinate amongst themselves but also to provide an easy to understand product for working with the public and aboriginal people. These map-based FMP's easily display Asset Protection Areas, Strategic Management Zones with overall fuel loading profiles, and Land Management Zones where biodiversity and cultural heritage protection is key. These FMP's were extremely useful and yet simple and provide a great model for others to emulate as most FMP's in other areas are quite voluminous and are not well utilized due to their size.

Figure A11. Making the most out of the time available, our NSW hosts hopped on the bus to talk about fire on the landscape.

As we traveled, one of our hosts rode with us, talking about exploring the consequences of having fire in the landscape. In this landscape, wildfires start at the north and run to the coast. The prescribed fire target in the area is 10,000 hectares per year, and the week before our visit, 4,000 hectares were accomplished, because the burn window was available. The landscape is extremely fire prone. Management of biodiversity is important.

We ran out of time for a full presentation by the Southeast Queensland Fire and Biodiversity Consortium (SEQFBC) so we discussed it over dinner. This network of land managers and stakeholders are devoted to a coordinated response and best-practice recommendations for fire management, fire ecology, and biodiversity conservation. Education, engagement of the community, and applied research are keys to the success of the program. It was very evident that SEQFBC is quite successful and advanced in its incorporation of research and science. We found the hazard reduction burn guidebooks to be quite advanced and very well done.

May 4

Sunday May 4th began at the Ngunya Jargoon Indigenous Protection Area for the Jali tribe of the Bundjalung Nation near Ballina, NSW. We were greeted with a cup of traditional Lemon Myrtle tree leaf tea warmed over a fire which gave us a sense of being at one with the landscape and united as a group. It was a powerful experience to learn how important fire is to these people for cooking, warmth, ceremonies, traveling and pathways through the country, as well as for ecological reasons to increase wildlife habitat or increasing food sources. This stop truly helped us to appreciate the level of sincerity and commitment made by the local fire managers to ensure fire is about the people, the landscape, and their connections with it, not just suppression, prevention, or hazard reduction burning.

Figure A12. At the Ngunya Jargoon Indiginous Protection Area learning of the importance of fire to the Indigenous people and sampling lemon-myrtle tea made from the leaves of plants in the immediate area and picked that morning.

This area is full of plants that could be used for medicinal purposes – termed bio-prospecting.

We had a great discussion with the Forestry Corporation near Whiporie, NSW regarding their challenges of protecting the commercial timber from bushfire. The plantations are mostly comprised of southern pine from the US and are a more fire tolerant species. However, they still have issues with these trees spreading into the adjacent native forests. Cooperation with RFS, NPWS, and Forestry Corporation are critical in assuring a rapid response to suppress fires quickly within the plantations as they are a commodity.

Figure A13. NSW Forestry Corporation plantation near Whiporie.

The prescribed burning window is in the fall. The locals burn grasses during this time, which tend to escape and run into the forests, especially with the winds. Forestry Corporation is working to get their neighbors to communicate about burning, so Forestry knows when it is occurring and is prepared for a possible escape. They are also working to educate the locals about the plantations; the extent and value of these assets. The young plantations are very susceptible to fire and there is no value in the trees if they burn before they are mature enough to make a sawlog.

Forestry Corporation is all about initial attack when there is a fire. They staff fire towers, hire firefighters, and have air resources available. They are protecting over 15,000 hectares with a staff of about 15 people during fire season. They work cooperatively with the Rural Fire Service. Lightning is not much of an issue.

Figure A14. A donation can on the counter of a small store near Whiporie is a reminder of bush fire and the message of the RFS: Prepare. Act. Survive.

The corporation is government owned and controlled, but is privatized. They run a very marginal operation, not making a lot of profit. The trees are hand planted. At about 15 years the first thinning occurs, the thinned material is a utilized product. At 28-32 years, the remaining trees are ready for harvest as sawlogs.

Our final stop was brief, but we were able to meet a HotSpots participant who is originally from Seattle, WA, USA. He mentioned how important the program has been to citizens like him who live in fire prone areas and that it has been successful for him.

Hazard reduction burning guidebooks were all inclusive and could be quite useful in other areas across the globe. We didn't have time to assimilate it all over dinner, but it would be quite interesting to see how these may be used in other agencies, in other countries.

May 5 and 6

May 5 we traveled from Coffs Harbor to Melbourne where we met Alan Goodwin, the Chief Fire Officer of the Department of Environment and Primary Industries (DEPI). Alan provided us a formal welcome to Victoria. He gave a brief overview of fire and the landscape and where fire fits in. There is a respect of fire. The southeast seaboard of Australia is one of the most fire-prone areas in the world. DEPI is custodian of one-third of the state of Victoria.

DEPI has about 800 people within the department who are carded for fire suppression work. They hire about 800 seasonals. Initial attack is a huge workload. DEPI handles the aircraft for the state and supplies the forest firefighting knowledge. Fire can be an awkward fit for the DEPI organization. Parks Victoria is part of DEPI.

They believe in the right resources at the right place. The knowledge, background, and experience required to participate is quite unique. The strategy used to combat deep-seated forest fires is life and property first, but also forest management.

A challenge facing land managers is: "Victoria has big fires, but what does the future look like for fire and land management?" It will burn. Fire is part of this landscape. How do you tell that story? What does the forest look like in fifty years? It's all around fire and the landscape.

We met Lee Miezis, the Executive Director for Fire and Emergency Management at DEPI, who gave us an overview that included policy and legislative context. Managing bushfire risk is a priority of the Victorian Government. DEPI refines its approach as part of continuous improvement to deliver the recommendations of the 2009 Victorian Bushfires Royal Commission. This includes increased prescribed burning; investment in technology to model fire behavior and risk; investment in monitoring the effects of fire and the prescribed fire program on diversity; and establishing clear objectives for fire management on public lands. There is a 390,000 hectare rolling target for prescribed fire.

The Code of Practice for Bushfire Management on Public Land was released in 2012; it puts human life as the highest priority. (http://www.depi.vic.gov.au/__data/assets/pdf_file/0008/179783/Code-of-Practice-for-Bushfire-Management-on-Public-Land.pdf).

Under the Code of Practice, DEPI plans and implements strategies and actions that reduce the impact of bushfires. These will be supported by monitoring, evaluation, and reporting. Under Section 35 of the Code is DEPI's risk analysis framework for bushfire management which is consistent with the Australian/New Zealand standard for risk management, ISO 31000. The objectives of the Code of Practice are: "To minimise the impact of major bushfires on human life, communities, essential and community infrastructure, industries, the economy and the environment. Human life will be afforded priority over all other considerations; and to maintain or improve the resilience of natural ecosystems and their ability to deliver services such as biodiversity, water, and carbon storage and forest products." Under this Code, risk management refers to "measures taken to reduce the likelihood and consequences of events that can negatively impact these objectives." Significant risk includes unnaturally high fuel hazard, increased population at the interface, and fire regimes that are not normal.

Figure A15. A memorial found on a burned log near a church in St. Andrews. A reminder of the fires, the people they touched, and perhaps the changes that come in land management as a result of such loss.

To achieve landscape level planning, DEPI has put together 7 bushfire risk landscape teams. They are interdisciplinary. Each is assigned to a different part of the state based on strategic planning boundaries.

Figure A16. Landscape level management discussion in the field.

The process is to establish the context by identifying assets. Then conduct a risk assessment that includes Phoenix Rapidfire analysis and engagement with stakeholders and experts; risk equals the likelihood times the consequence. The final step is strategy development. DEPI is only responsible for public land. The strategies are informed by their understanding of bushfire behavior. Then a fuel management strategy is set out. The strategies are evaluated at a landscape scale with community and stakeholder involvement. The process involves monitoring, evaluations, and reporting on projects.

Community values and engagement is very important: there is a shift from telling to asking.

Peter West, the leader of the risk management team from East Central Victoria, introduced us to part of his team and we headed out to the field. We discussed processes and looked at the ground where strategic decisions were being made.

A stop at Kinglake National Park included a presentation by one of the incident controllers of the Kinglake Fire. He explained the events of Black Saturday in his area. One thing that stood out was the spotting distances which were measured in kilometers. The number of spot fires made it impossible to catch the fire and at one point he called on the radio and said "it's gone." The fires on Black Saturday ran through drought-stressed paddocks that barely had grass on them. Vegetation along highways was described as "wicks of fire."

We traveled through a lot of the area burned in the Black Saturday fires on May 6. It was a good look at how the vegetation in Victoria recovers from such an event…as well as how communities recover. And, in looking at the landscape, we saw why the work Peter West and his team, as well as the other teams, are doing is so important. When you look at the assets at risk, the incursion of people into the bushland, and the fuels available, you realize there is a big risk of more large fire events. The work these teams, and the State of Victoria, are doing is commendable and should be looked at in North America as a model for landscape level risk management.

Our final stop of the day was at a winery to discuss the impacts of smoke on the wine-producing industry. While we often consider smoke impacts to the public, we don't always realize that smoke has an effect on other assets. The take away message here is to consider all assets when conducting prescribed burns and think about the impact of smoke.

May 7

We started the day off in Healesville, Victoria at the RAVC and traveled to McVeigh's Fire Lookout.

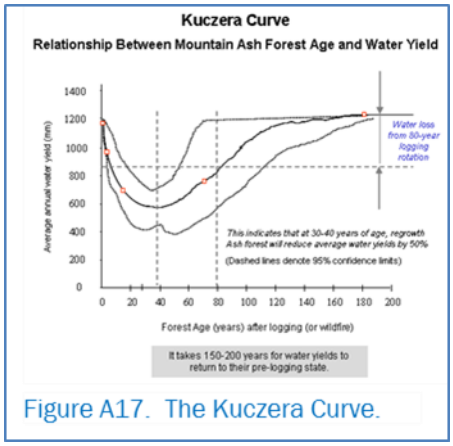

Figure A17. The Kuczera Curve.

Justin Jemmeson and Craige Brown presented information on Melbourne Water. Information was presented on the Kuczera Curve, which was developed in 1985. The curve informs one on the recovery time for water catchment yield post fire event. This was developed using an average from all vegetation and slope types. It is proven to still work today.

The Yarra Valley has been determined to be the highest at-risk water catchment in Victoria.

There is still discussion with land/homeowners about which are more important to the overall efforts and end protection goal: is the loss of homes greater than the loss of a water catchment or parts of it, no water – no life! A structure may be rebuilt in a short period of time whereas a water catchment may take up to 150 years to become fully productive following a fire.

Melbourne Water (MW) is a Victorian owned corporation that is comprised of 9 reservoirs, 160,000 hectares, 8,500 kilometers of waterways (natural and manmade), and 1,800 kilometers of roadways. MW sells water as a wholesaler to 3 retailers, City West, Yarra Valley, and South East. Water catchments were developed early in Victorian history. Catchments were closed and taken out of service due to the spread of disease in the 1880's. All systems are an aggregate of different ownership. Most catchments are closed to recreational use. This also prevents and almost completely eliminates arson activity in the catchments. Some areas have limited timber use.

"NO WATER – NO LIFE", Melbourne Water

Lightning is the main cause of fires in the Yarra Valley catchments. MW has the first attack responsibilities and will be assisted by others if requested. To detect bush fire, there are four lookouts located in the Yarra Valley, and two in Port Phillip. McVeigh's Lookout is an impressive new lookout that was rebuilt within the last two years; the old one was becoming run down and needed upgraded. The new one sits on an all steel platform with catwalk all around. The interior is clean and simple; it has a fire finder and map board. Radios are located in a quick reach. There is a modern fire bunker on site for those that may need the protection from impending fire front. It is a small buried structure with a secure door and a small tubular window for checking outside conditions. There is no flammable material inside the unit. It is a commercially manufactured.

The water catchments have been analyzed using GIS to determine areas that are: within 2 km of a major road; catchments are buffered by 10 km; and that all areas are within a 60 minute drive of a first attack base. The idea is to be able to perform effective initial attack on the catchment areas before much damage is done.

Figure A18. McVeigh's Lookout, part of the Melbourne Water Project. Melbourne Water's commitment to protect the catchments they are responsible for is a critical part of their program.

During fire season MW has about 250 total firefighters; some are year-round staff and some are seasonal. They have fire pumpers, larger trucks and heavy equipment as part of their fire suppression force.

Phoenix RAPIDFIRE was used to analyze the threat to the water catchments under the highest fire conditions. The catchments have a very large road system for fire protection, fire response, and for use as a tactical option during the firefight. They have discussed fuel break 'pushes' vs. shaded fuel breaks. There are currently 600 km of fuel breaks. Phoenix RAPIDFIRE was used to validate the fuel break work. "Risk analysis has identified the townships around Healesville and the Warburton Valley as some of the highest risk areas in the state of Victoria. The Upper Yarra water supply catchment is one of Victoria's critical assets and is vulnerable to impact by bushfire." (Study tour handout from Peter West, May 2014)

Don Tomkins, Yarra Valley Rural Fire Authority (RFA) Operations Officer spoke to us about the Yarra Valley RFA which is comprised of 12 brigades.

Figure A19. An underground fire bunker at McVeigh's Lookout; a safety measure that could prove useful in North America.

The RFS has developed Fire Refuge Areas; a place for the citizens to go that may have not been able to or did not leave early enough. The question is whether this makes people more dependent on the services or do they leave and become more resilient. We toured the #1 Fire Refuge located within the Yarra Valley. Located at a school, this refuge has a direct link with the State Control Center in Victoria for communication.

Adam Whitchurch from Parks Victoria discussed fire modeling. PHOENIX is a good tool for modeling large fires under extreme conditions. They use it to determine which areas are driving the risk within the landscape. PHOENIX uses over 40 fuel models. They use the Woodstock program to model timber growth. The spatial analysis

Figure A20. Fire Refuge in the Yarra Valley.

performed includes fire data since 1969. Bushfire housing loss is attributed to convective energy. Preplanned activities occur on high risk days: they will patrol; staff all equipment; and visit known arsonists. In these conditions fire become weather driven, not fuels driven. Within the Yarra Valley there are 44 communities that are at high risk to bushfire.

Kym Mallamaci of Powelltown discussed Community Emergency Planning. Persistence is the key - if you keep after the effort and have the key stakeholders involved they will bring the 'others' into the fold. Powelltown has its own Risk Emergency Committee. They are sharing their success with their committee and others are using it as a model.

May 8 and 9

The study tour group started the day at the Walhalla Star Hotel with a discussion regarding Community Engagement/Strategic Conversations with Stephanie Carr of the Department of Environment and Principle Industries (DEPI). Although participants learned a great deal about community engagement during the tour already, it was evident that the Fire Learning Network was a new concept, quite intriguing for the group. The Network's approach is merely a facilitation of group discussions regarding fire management with local communities and not just "another program" where government is trying to get something from the community. Another powerful outcome is the chance to acknowledge and learn from the community about what they know.

Figure A21. Stephanie Carr from DEPI (on left) discussed community engagement with no agenda as part of Fire Learning Networks and landscape scale risk management.

The Network sees these engagements as an opportunity to meet the public and have meaningful discussions on *their* terms and just listen to what they have to say. This type of conversation has no hard outputs, but should be quite useful when the time comes that actual public consultation is required for any number of fire management related plans or actions. Following such an engagement, the Rural Fire group will already know what a community is thinking or feeling and will be better equipped having had intelligent dialogue as well as leaving the community feeling empowered. This is thinking "outside the box" at its best. DEPI's role is not to sell a product, but rather to facilitate the discussion and to remain neutral. This relationship pays off when there is an incident; the fire operations folks already have some links into the community. In this program there is the flexibility to engage as needed.

Figure A22. John Crane from CFA at Tyers Lookout, with the Latrobe Valley in the background.

The next stop was at Tyers Lookout where a great deal was shared about the sheer number of fire management issues that South Gippsland is dealing with including open-pit coal mining, plantations, rare plants/animals, WUI, water, and power transmission lines among others. A risk analysis was developed in Gippsland which can be utilized for any of these issues/risks listed above. Utilizing

Phoenix modeling, a fire manager would conduct the following assessment during the process:

1. Spatially define the assets (homes, habitat, water yield, coal fields, etc.).
2. Define the vulnerability thresholds (will the asset be lost under various fire conditions?).
3. Define the benchmark (without mitigation efforts).
4. State the change that the mitigation created (the residual risk).

At the Traralgon Regional Control Center, the study tour group learned about the Hazelwood Coal Mine Fire of 2014 and how it played a role in shaping all-risk management for Victoria. It was originally a bushfire which then became a coal fire, and then a public health situation. The ensuing communication with the public and the coordination, or lack thereof, of the individual agencies involved was an opportunity to learn. Great lessons learned have spurred action to reduce these issues in the future. This caused the group to wonder if this type of an event could happen in North America and how preparations now might be a benefit.

The balance of the day was spent with Geoff Pike, District Manager for Parks Victoria who led discussions of ecological objectives and unbounded burning in the Yanakie Isthmus. This was a unique area where past land uses have created a very unnatural situation and non-native flora (tea tree) and fauna (emu, deer, etc.) have invaded the dunes. Under somewhat intense conditions, the use of unbounded fire is being utilized to restore the landscape to its more natural state. Follow-up burning will be required within 6 years in order to destroy any residual tea trees prior to them setting a new generation of seeds. Getting enough understory species to grow which can carry a second entry fire may become an issue as the non-native browsers are consuming it quite quickly.

Figure A23. New growth following a prescribed burn in the Yanakie Isthmus.

The study tour group and hosts engaged in a short discussion of the need for fire management planning on a regional scale, about every 10 years. The efforts of the East Central Bushfire Risk Landscape Team should be of great value for any new or updated fire management plans. Community engagement will be a key aspect as was evidenced by one of the local homeowners who approached the group during the discussion wanting to know if the planned burn across the street was going to take place the next day. Although the resident was told that it was likely too late in the year to burn, he seemed skeptical about the answer, due to all the people and vehicles on his street. It was an unscripted lesson on the value of public engagement which faces all fire managers, internationally.

Figure A24. Epicormal sprouting in Eucalyptus. Gippsland, Victoria.

On May 9, the group spent time at the State Control Center for Victoria in Melbourne. We were intrigued by the thought that went into the planning and layout of the center for maximum efficiency of information exchange and decision making. Victoria really seems to be a leader in how to properly engage all functions, groups,

agencies, etc., when incidents occur and could really be a model for others to follow. There is adequate room for logistics coordinators, aircraft dispatchers, public information, and the chief officers of each cooperating agency, along with room for their staff. Several large meeting areas exist along with a facility for feeding and rest breaks.

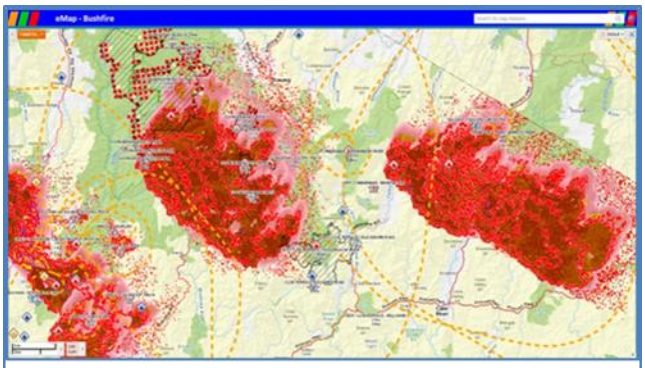

Figure A25. eMap is utilized at the Victoria State Control Center.

The Study tour group was briefly introduced to eMap which seems quite similar to ICON from NSW and should have great value, especially once it becomes available for public use. Tracking of resources with GPS units is already being utilized. This is of great interest to fire managers from the US who currently are engaged in discussions about this technology due in part to the Yarnell Hill Fire from 2013. This common operating picture is interagency and includes live feed data. Most information is fed from the incident level up.

The State Control Center (SCC) demonstrated the value of sending out consistent messages from SCC in order to assist the public with fire danger as it relates directly to them. This one-stop shop directly populates/feeds other great resources/databases and is something that may also be a model for others to utilize. There is a fire danger rating trigger matrix for 1) Advice; 2) Watch and Act; and 3) Emergency Warning.

Planned burning is supported by stakeholders in the state, but they would like better notification of when the planned fires are to occur. The planned burn notification system which is currently being tested is another innovation that could have wide applicability on an international scale.

May 10

The day started with a flight from Melbourne to Hobart, Tasmania. Our hosts, Dean Sheena of Forestry Tasmania, Jeremy Smith, Regional Chief of the Tasmania Fire Service (TFS), and Tony Blanks TFS retired, gave a brief overview of operations in Tasmania.

Tasmania is the oldest state in Australia with a current population 500,000 people. With 6.8 million hectares, 20% is State Forest, 40% is Freehold, and 40% is Reserve (park). The city of Hobart was established in 1873. Tasmania has a very strong reliance on primary industries including forestry, mining, and fishing. This state has the lowest average weekly earnings in Australia. 60% of the people live outside the capital city of Hobart. The population is aging and the young people are moving to the mainland. The tallest peak is 1,500 meters. The mean annual rainfall is over 3,000mm in the high country and less than 750mm in the lowlands. Forest types consist of coastal heathland, grassy woodland, eucalyptus forest, rain forest, and wet forest.

Three entities have wildland fire suppression responsibility in Tasmania. Forestry Tasmania is currently a government business enterprise and has been incorporated. There are four districts, one head office in Hobart and approximately 300 staff. Forestry Tasmania uses fire on the landscape as a tool in forest management to reduce slash loading, and for forest regeneration by preparing suitable seed beds. Aerial seeding is the predominate means of reforestation. The Parks and Wildlife Service was established in 1971 as a stand-alone service and part of the Primary Industry Parks, Water and Environment. The Parks and Wildlife Service uses fire on the landscape for fuel management and ecological manipulation. There is a small core of fire management personnel with the service.

The Tasmania Fire Service (TFS) was established in 1979 and is an amalgamation of the State Fire Authority, Rural Fire Service, and Urban Fire Brigade boards. There are 230 fire brigades across Tasmania, with approximately 250 career firefighters and 4,800 volunteer firefighters. The organization provides firefighting services on private land and has a strong community protection service.

These three fire agencies have created an Interagency Fire Management Protocol which supports the cooperative working relationship. The initial agreement was established between Forestry Tasmania and the Parks and Wildlife Service with TFS joining in 1995. The protocol is a statement of cooperative principles by which each organization will model (http://www.parks.tas.gov.au/file.aspx?id=6582). Legislation in Tasmania requires that all landowners will pay a 'fire service levy'.

Additional legislation stipulates that all land owners or occupiers, 'will not willfully permit fire to escape their lands'. This includes the Parks and Wildlife Service as well as Forestry Tasmania. When minor bushfires occur on the landscape all three fire authorities will act independently but work cooperatively to ensure no fire escapes. With major fires on the landscape the Tasmania Fire Service is the lead fire authority with assistance by Forestry Tasmania and the Parks and Wildlife Service. No standing Incident Management Teams are present in Tasmania. TFS will place team members on standby should the fire hazard dictate.

May 11

Tony Blanks introduced the group to the Forest Practices Code which is the bible for any forestry planning and activities in Tasmania http://www.fpa.tas.gov.au/__data/assets/pdf_file/0020/58115/Forest_Practices_Code_2000.pdf. There was a big environmentalism push in the late 1970s which has led to various political parties in Tasmania leveraging and exerting legislative pressure on reducing extractive uses and enlarging the reservation of government held lands. This pressure has had a large impact on the timber industry and could be likened to the Western US's timber industry decline. Never the less, Forestry Tasmania does harvest timber, although heavily restricted, and fire ecology and management is a centerpiece of its continuance.

Mark Neyland of TFS presented his observations and views on the difficulties and challenges with forest management practices in Tasmania. The day began with a tour to the Styx Forest Area where active logging was taking place and the study tour group viewed a coupe (cut block), which had been recently burned for regeneration purposes. The majority of wood pulled from the coupe is utilized for sawlogs, then peelers and finally pulpwood. Haul distances can be up to 350km for pulpwood, limiting the economic viability of some areas, although utilization is extremely important.

Burning operations are fairly simplistic and use minimal staffing; typically a helicopter, helitorch, and support staff. In some instances hand ignition is utilized. Burn plan site prescriptions will include the ignition plan, water course protection, wildlife habitat protection, sensitive species protection, consultation processes and fuel moisture analysis. On site fuel moisture is verified utilizing fuel moisture sticks. Smoke management is a growing concern in Tasmania and the fire managers are challenged with limiting the impacts of smoke to people, tourism, and the grape industry.

Figure A26. Forestry practices include burning a coupe after harvest to prepare the site for replanting, as well as to reduce the fuel load.

Figure A27. Rain forest vegetation in The Big Tree Reserve in the Styx State Forest.

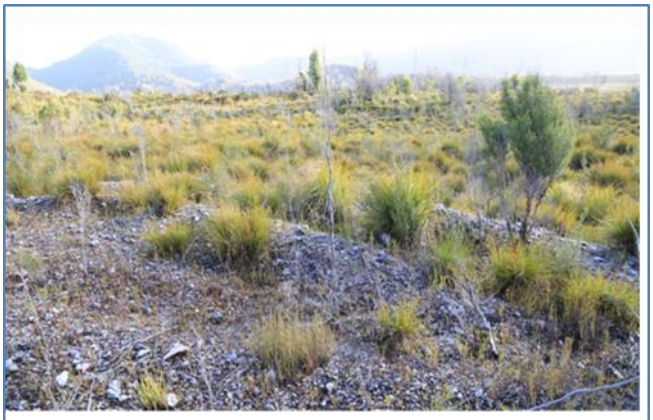

Figure A28. Experimental burn block in McPartlan Pass area where button grass is common.

Figure A29. A close look at button grass which can burn more than once in a season.

Timing of burns is essential as to not affect the grape industry. Ignition patterns are utilized which support venting to limit the impact to people and tourism.

A growing issue is the reduction in coupe size which limits the heat generated through center fire ignition allowing for good venting and control of the burn. Burning is usually conducted in April and allowed to smolder into the winter months. Spring scanning is conducted to ensure total extinguishment. Burning as a silviculture prescription is the preferred method of site preparation due to the reliance of Eucalyptus seed on a nutrient rich mineral soil seed bed and direct sunlight. Research has shown that the tallest seedlings and the highest density of seedlings are most abundant on burned seedbeds. Aerial seeding is the most efficient way to distribute seed through the block. A high wallaby population is a growing concern, as they eat the seedlings prior to the plant having the ability to regenerate through lignotubers or epicormic buds.

Styx State Forest also contains the Big Tree Forest Reserve. The group participated in a boardwalk tour of old growth Eucalyptus forest.

The next stop was McPartlan Pass, a Tasmanian Wilderness World Heritage Area. Button grass shrub land dominates the lowland and slopes, with the eucalyptus forest dominating watercourses and drainages. Rain forest is mainly found in the higher south facing slopes. The study tour group was given an overview of the area by Adrian Pyrke the Manager of Fire Operations for the Parks and Wildlife Service of Tasmania. Adrian explained that this species of grass grows vigorously and has a high volatile chemical content so it will burn right after rain. It also burns with high intensity and rapid rates of spread and can burn the same area several times a season due to layering of fuels. Implications for fire management beyond the ubiquitous and obvious, have become more complex as hereto unheard of dry lightning storms have become commonplace since 2001.

Rain forest types do not rely on fire and do not have a component of eucalyptus in the stand structure. Ignition source consists of dry lightning

storms which pass through the area. It is believed that anthropogenic use of fire did occur by aboriginal people, surveyors and miners in previous times. Experimental burns were conducted in the McPartlan Pass area to determine spread rates and flame heights to build an empirical fire intensity model for button grass. Interestingly the concept of managed natural fires or "fire use" is not ruled out in this region. Although not as much of a programmed exercise, it is considered more an academic exercise due to remote locations, lack of available resources, and assets to be protected. The Tasmanian Parks and Wildlife Service are active in the use of prescribed burning to keep the size and impact of natural fires in a reduced scale.

Our next stop was at Lake Pedder, once a natural lake, but which became a larger reservoir when the Hydro-Electric Commission agreed to dam the Gordon River in the 1960's, flooding the valleys of the Serpentine and Upper Huon Rivers. This move was not well-accepted and this area became a hotbed of environmental controversy, sparking the creation of the first green political party in the world. Today, the lake is part of the World Heritage Site and discussion continues about removing the dams and restoring the area.

May 12

The day began at the State Headquarters of the Tasmania Fire Service in Hobart, which also serves as the State Fire Operations Center. The operation has been on this site for 130 years and is a working fire station. The Operations Center is only activated when there are declared total fire bans. The State Fire Controller is responsible for coordination and may work for any one of the three cooperating agencies. The Operations Center issues warnings for all agencies in the state.

The Tasmanian Fire Service is a single service; it provides protection for both rural and metro areas. There are 230 brigades in the state. About 300 operational career employees and 150 support staff are supplemented by over 5,000 volunteers. Bushfire is common in Tasmania and there are a number of large events that have been recorded with 1967 being the worst: 250,000 hectares burned, 1,400 homes were destroyed, and 62 people were killed.

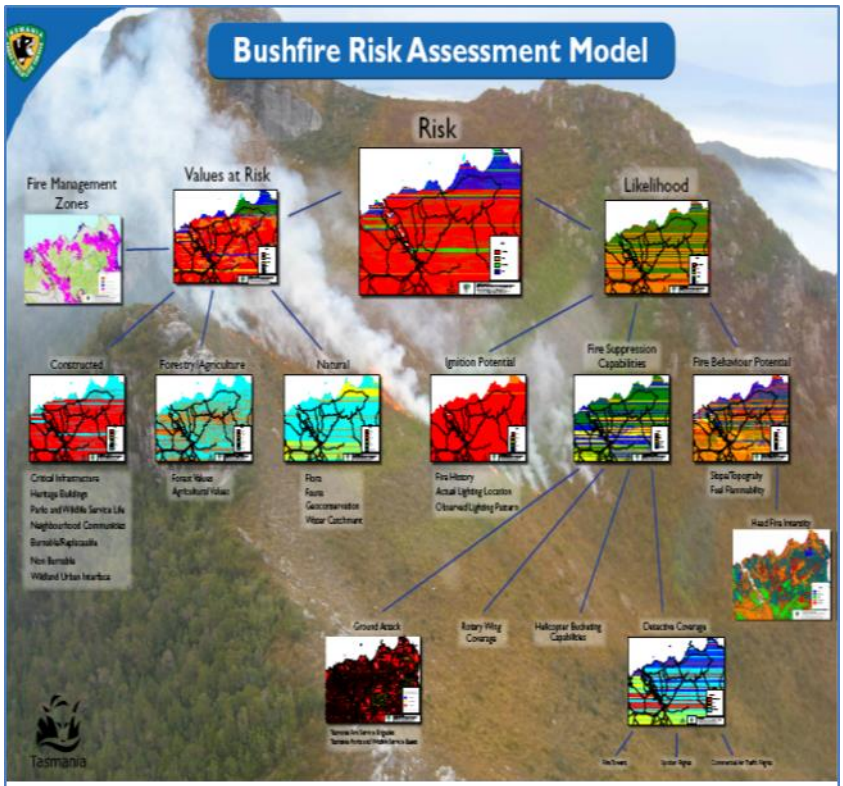

Figure A30. Tasmania's Bushfire Risk Assessment Model is based on the ISO 31000 matrix. The model is tenure-blind.

Dave Taylor from Tasmania Parks is working with a Bushfire Risk Assessment Model (BRAM), based on the ISO 31000 matrix. This is a tenure-blind model (ownership) and is run at a 100 meter resolution. It considers: likelihood of an ignition; suppression capability, looking at the response times of the volunteer brigades on a 90th percentile day; fire behavior potential looking at the vegetation component; and the consequences or values at risk. It took about one and a half years to build the model and Tasmania has been running it for about five years. The model is flexible; all input streams are

weighed differently under a clustering algorithm. To assure the outputs are still valid, the model is run at least annually, and sometimes more often.

Smoke management is a major concern in Tasmania. A Base Line Air Network of EPA Tasmania (BLANkET), which is a network of small air quality stations meant primarily to monitor the spatial extent of smoke events, has been set up. In 2009 a Coordinated Smoke Management Strategy was developed as a means to manage smoke from prescribed burning and was based on the concept of airsheds. The strategy recognizes: the need to encourage planned burning for public safety, ecological, and management purposes; that smoke is a public health issue; and that smoke nuisance can be reduced by ensuring that planned burns are conducted under appropriate meteorological conditions (wind, inversions etc.). The strategy "attempts to integrate ventilation index, mixing height, fuel weight, and dispersion to achieve an outcome which balances competing requirements and meets the requirements of law" (Presentation on smoke management to study tour group, May 12, 2014).

Interaction with the community is very important during bushfires. For example, in January of 2013, "TFS commenced community warnings on 2 January to provide as much lead time as possible. More than 600 emergency warnings were issued through the TFS website (including social media) and media partners. More than 23,500 emergency alerts were issued and delivered by telephone. The TFS website received 1.5 million visits and 7 million page views (2 January – 11 January 2013); with 1.63 million on Saturday 5 January. The TFS Facebook page had 127,000 contacts during the event (TFS presentation to study tour group, May 12, 2014). The TFS utilizes the TasALERT website (http://www.alert.tas.gov.au/Pages/Home.aspx).

Melanie Irons talked about how she was involved in helping out during the fires in Tasmania in 2013. She set up a webpage and a Facebook page, http://www.tassiefireswecanhelp.com,where information was shared about the fires, but also how people could help and get involved, as well as a place to contact people involved in the fires to make sure they were okay. This use of social media was productive and is a good model of how to interact with the public. Melanie says they learned a lot with this first effort and have already identified ways to improve.

Tasmania is working on strategic fuel management. Sandy Whyte, the Executive Officer for the State Fire

Figure A31. A photograph hanging in the Cambridge Fire Center is a reminder of Hobart's proximity to flammable bushlands. October 2006 brought fire to the edge of this city, helping the inhabitants realize the importance of fuels treatment to mitigate some potential impacts of bushfire.

Management Council (SFMC), discussed moving from post-event analysis to a landscape risk assessment that is tenure-blind, using modeling tools, with the goal of recommendations for a strategic fuel management program aimed at reducing the risk of bushfire impacting on human settlement areas. The SFMC divided the state into 10 fire management areas that are generally similar with similar ecology. Each area has a committee which represents local government. Using 99th percentile weather from representative weather stations, Phoenix RapidFire is run to model risk. Thirteen fuel reduction strategies to be implemented over the next five years have been developed. The process considers residual risk and accounts for the fact that the ignition point of a bushfire is not always where the highest risk or the most hazardous fuels are. It was discovered that ownership-blind burning for fuels reduction is the most effective treatment method. Now the task is to prioritize which strategic areas to target first.

This project results from the 2009 Victorian Bushfires Report and the subsequent support by Tasmania of many of its recommendations. Following the 2013 bushfires in Tasmania, the Tasmania Bushfires Inquiry was completed: recommendations 92 and 93 state, "that the Government actively support the timely development and implementation of an ongoing Strategic Fuel Management Plan and that the Strategic Fuel Management Plan includes measurable targets and they are actively monitored and reported on to the community." (http://www.sfmc.tas.gov.au/sites/sfmc.tas.gov.au/files/Bushfire_In_Tasmania%20V1.2%20pdf%20web%20version_0.pdf).

The city of Hobart and its surrounding populations are well aware of the danger of bushfire up close…Hobart was last threatened in 2006 by bushfires. All three agencies participate in this area in setting up burns for hazardous reduction. Private land was included in the plan.

A field trip to a site overlooking the capital city of Hobart showed the intricacy of prescribed burning in this highly visible, populated, and hazardous area. This particular strategic fuels management burn block was very visible to the city of Hobart, providing an opportunity to educate the public. About half the block is owned by Parks and the other half is owned by private individuals.

Figure A32. On the north side of Hobart, driving through an area that has been burned for hazard fuel reduction. The hills in the distance burned in the 2006 fire shown in Figure A31.

May 13

Our last day in Australia was spent looking at areas burned in the January 2013 bushfires. We visited the community of Dunalley, Tasmania, about 57 km from Hobart on the Tasman Peninsula, a small fishing village of less than 400 people, with another 800 living in the vicinity. The main road in and out is the Arthur Highway.

We drove through part of the community to reach the fire station where we were met by Aaron Millar, Brigade Chief; Andrew Skelly, TFS District Officer; and Brad Westcott, Former Brigade Chief of Dunalley.

The Forcett Fire started on January 3 of 2013 when conditions were at the 99th percentile; the TFS staff had received weather warnings that any fire starts would pose significant suppression issues. The efforts that

occurred during this fire event were directly tied to having a solid interagency working relationship with Police, Parks and Wildlife, and Tasmania Fire Service (TFS).

In addition to 49 other fires, 3 significant fires began on January 3rd: Lake Repulse, Middle Tea, and Forcett.

"We saved that house twice and it still burned down." Chief Brad Westcott

By the morning of January 4th, the TFS was strongly advising people living close to the existing fires to relocate early. Staff from the Dunalley area was prepared to engage the Forcett Fire on the morning of January 4th, having been given direction the previous day. But, overnight the temperatures were at a record high accompanied by a line of thunderstorms crossing Tasmania. New fires were started as a result of the lightning. The Forcett Fire, as well as the Lake Repulse Fire and a new start named Bicheno developed into major incidents. A unity of command meeting was held when it became obvious it would not be possible to extinguish all the fires burning in the area. The TFS priorities were discussed, as was span of control and of course, trying to figure out where the fire was going next. During this meeting command structure was established. On the morning of the 4th, the Forcett Fire was north of the Arthur Highway, but by 1300 there were spots over a three mile stretch of the Highway. The temperature was well over 100 degrees Fahrenheit and the wind was blowing up to 50 miles per hour. The TFS knew the fire was headed to Dunalley by now. The TFS and the local volunteers began implementing the TFS Fire Priorities which were developed following the 2009 Victoria Fires. They stated, with warnings, they saved some homes and structures if they could. They had to make a quick decision on where to send people and what assets to protect. Andrew Skelly was in constant contact with the TFS in Hobart. Input from Jeremy Smith at the regional level suggested the canal bridge was the asset to protect – *a different perspective helped him to focus once again.* They identified and stuck with the priority of the Dunalley Pub and the Canal Bridge. Good communication existed between the responders. When the fire reached the community by about 1500, the resources focused on warning people and saving the identified priorities. The main fire front

Figure A33. Evidence of the Forcett Fire's devastation is still visible upon entering the community of Dunnalley.

Figure A34. The Dunnalley Pub became a gathering spot during and after the fire swept through the community.

was through Dunalley by 1630. The responders changed their focus back to primarily fighting the fire. During this short period of time, 3 or 4 fire fronts came through the community. The fire zigzagged with the wind and burned house-to-house. It jumped the bay. The fire burned until about 0300 when the wind finally died down. This event, though extremely severe, brought the community and the agencies together. Because of pre-planning and positive interaction between the agencies, there was no panic on the part of leadership during the incident. What worked was ICS, Setting Priorities, and Teamwork.

One family's perspective of the fire can be found at:
http://www.guardian.co.uk/world/interactive/2013/may/26/fir estorm-bushfire-dunalley-holmes-family.

Local knowledge and experience with burning has been lost as there are not a lot of opportunities to practice. Prescribed burning has all but disappeared from this area. This was the first fire in nearly 40 years with this type of fire conditions.

Leaving Dunalley, we continued south on the Arthur Highway, traveling through more of the areas impacted by the Forcett Fire. A quick stop at Taranna allowed us to see Tasmanian devils up close, as well as some kangaroos. Port Arthur, on the Tasman Peninsula is joined to the mainland by a sequence of two narrow isthmuses. A tour of the one-time penal colony reminded us of the history of settlement in this country. This colony was established to harvest timber in 1830 and was in use for convicts until 1877. Then, the buildings found other purposes as a different section of the population came to the area. Many of the buildings were destroyed in bushfires in 1895 and 1897, although a number of historic buildings still stand today.

Figure A35. The Tasmania Fire Service Priorities were very useful when bushfire threatened the community of Dunalley.

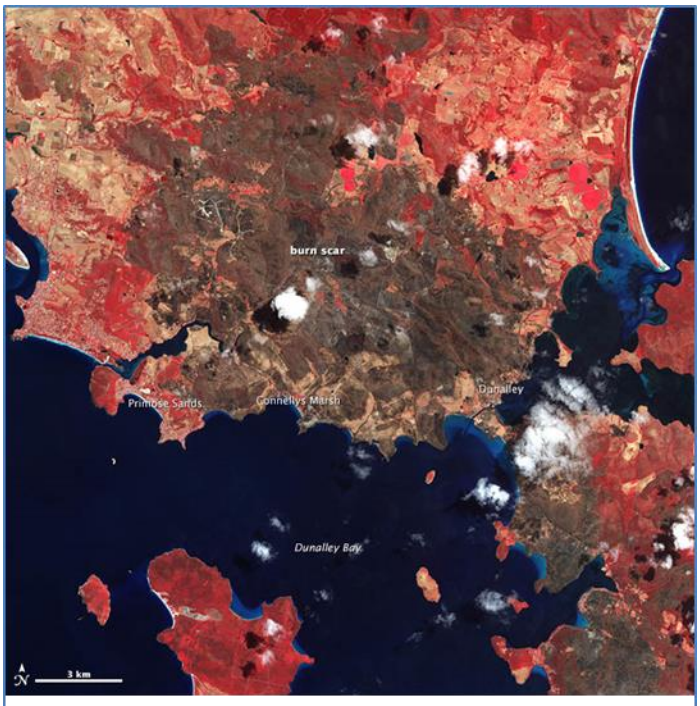

Figure A36. The Forcett Fire. Advanced Spaceborne Thermal Emission and Reflection Radiometer on NASA's Terra Satellite captured this image on January 14, 2013. Patches of unburned forest are bright red. The darkest brown areas are the most severely burned. http://earthobservatory.nasa.gov/IOTD/view.php?id=80252

Next up was a boat tour along the coast of Tasman National Park, between Eaglehawk Neck and Port Arthur. This tour gave us an opportunity for a different view of the landscape, and the challenges of managing bushfire in this remote area. The highest seas cliffs in the southern hemisphere are found here. There is a variety of wildlife in the area, including seals.

Returning to Hobart, we took the time to reflect on the challenges facing fire and land managers in Australia, recognizing the passion of all who take on this type of work.

May 14

Travel day from Hobart, Tasmania, Australia to Christchurch, New Zealand.

May 15

Starting off at Canterbury University, Forestry Building, Christchurch, New Zealand (NZ), Murray Dudfield, Chief Rural Fire Officer of the National Rural Fire Authority gave us an overview of Christchurch and New Zealand. The Christchurch area was rattled by two earthquakes within two years. The second quake hit the Christchurch area directly on 22 February 2011. 6,000 buildings were made uninhabitable. Some buildings pancaked and many others withstood the quakes. Many signs of the quakes are still visible in the Central Business District (CBD). The reason for noting this is that the New Zealanders have shown great resilience in the rebuild of their city. It shows the strength and the resilience of the city and its occupants.

New Zealand is predominantly still "rural", encompassing 27 million hectares, the population is 4.2 million. The country has a temperate, maritime climate, but a diverse range of microclimates due to topography. There are increasingly complex fuel types with higher fuel loads and more continuous fuels. There are approximately 4,000 wildfires each year, burning 4,000 to 7,000 hectares (ha). Fires are primarily human-caused.

Fire statistics for New Zealand have been dropping for several decades. In 1981 25,000 ha burned, in 2010 only 5,000 ha burned, a factor of this is the drop in wildfires. Other changes are occurring in this fire environment. New Zealand is now experiencing a few lighting fires each year. This is a new piece to the evolving fire problem in this country.

The National Rural Fire Authority is responsible for coordination of rural fire authorities (RFA). It sets and audits standards, assesses the performance of the RFA's, monitors fire danger conditions, promotes training and education, provides grant assistance, administers the Rural Fire Fighting Fund, and promotes and encourages rural fire research. The Rural Fire Authority is the main administrator of fire business in NZ. There are few resources compared to the agencies in North America. The dominant resource is a fleet of small and medium helicopters.

The Forest and Rural Fire Act of 1977 consolidates and amends "the law relating to the safeguarding of life and property by the prevention, detection, control, restriction, suppression and extinction of fire in forest and rural areas and other areas of vegetation. It gives authority to the National Rural Fire Authority, and provides direction for Rural Fire Authorities and the general public." (http://www.legislation.govt.nz/act/public/1977/0052/latest/DLM442947.html) Several sections of the Act deal with fire suppression cost recovery and look as though they could be useful in North America. There have been many successful cost recovery cases. Insurance policies are available to land owners and the RFA's in case they cause a wildfire.

New Zealand is a country of invaders: much of the flora and fauna that exists in the country are from somewhere else. The flora species are dominating the landscapes. Much of the original landscapes were covered with native tree and brush species. They were changed to make way for grass and sheep grazing and now are being reclaimed by non-natives. This really has occurred in the last 150 years. Some of the species of flora are of great concern to the fire managers. They contribute to the fire danger index. Some of the fauna are

killing the native trees and spreading the seeds from the non-native species. NZ also has the largest contiguous block of Radiata pine plantations in the southern hemisphere. Wilding pine is a general name for any non-native pine that is invading the landscape.

Forestry in New Zealand is an important business. Currently, outputs are worth 5 billion New Zealand dollars with a projected worth of 20 billion New Zealand dollars by 2025. Forestry accounts for 4 percent of the NZ gross domestic product. 23,000 people are directly employed in the forestry business and 100,000 indirectly employed. NZ is the world's 20th largest producer of wood fiber and the largest exporter of wood fiber.

Figure A37. A fuel moisture scale was just one of many familiar fire management tools found at the Rangiora Fire Depot.

SCION is a New Zealand Crown Research Institute which includes the Rural Fire Research Group. The program has 4 FTE's. Science and research is the focus. SCION interacts with almost every level of the Rural Authority. A key function is technology transfer. There are four new research themes that are emerging with SCION, managing risks, enhanced community resilience, use of fire as a landscape tool, and improving safety and productivity. The staff has developed some key fire 'apps' for use on laptops and 'smart phones'.
http://www.scionresearch.com/research/forest-science/rural-fire-research

We stopped at Rangiora Department of Conservation office for a presentation on the local program and their fire depot. Here we found again, that fire management is universal: similar tools, signage, equipment, and people. The staff was very proud of the work they do and the support they provide to the district.

Tom Barr of the Department of Conservation (DOC) talked about biodiversity and fire in the New Zealand landscape. DOC is currently the largest rural fire authority in the country. The fire team is made up of about 900 paid staff and volunteers.

Fire management issues in the eastern part of the South Island include a growing urban-rural interface, a lack of understanding of good management processes by a changing population, a desire to be closer to nature, increasing domestic tourism, over 2,000 threatened species of flora and fauna, multiple "last of its kind" reserves and ecosystems, and fire bugs and arsonists.

Figure A38. An overview of the forest industry was provided by a forester at the Hanmer Forest.

A complex urban-rural interface, complex terrain and risks, and multiple shared boundaries provide challenges to fire managers in New Zealand. The DOC is fairly well equipped with apparatus, both ground and aerial. There is a good working relationship among the agencies, with strong cooperation.

Biodiversity is a major concern. Very little indigenous biodiversity remains in New Zealand and what does

Figure A39. Plantations grow rapidly in the New Zealand climate. Note the clearcut in the upper right corner, this harvest scheme is very common and does not seem to be an issue for land managers.

remain is a priority to protect. There is ongoing loss of species even though there are protected areas. Fire is a major threat, because even the suppression actions can destroy a species. Planned fire is not a tool utilized by the DOC.

The next stop was at the Hanmer Forest. After an overview of projects, we visited the production forest. The pines grow fast here in New Zealand, putting on 1 to 2 feet or more each year.

In speaking about land management, Murray Dudfield, National Rural Fire Officer, made two statements that resonated with the study tour group: "Everything that was left unprepared becomes a complex problem, and every weakness comes to the forefront"; and "Good land management outcomes bring good fire outcomes!" The last statement reflects the same message we heard from Neil Cooper on the first day of the study tour.

May 16

Leaving early from Hanmer Springs we drove west and north to arrive at Richmond, where we were met by Ian Reade the Principle Officer for the Waimea Rural Fire Authority. At the Richmond headquarters of Nelson Forests, Ian, along with Mark Forward, Acting Chairman for Nelson Forests, provided information about the forest industry and fire management in the area.

The Tasman Bay area is highly dependent on commercial timber production, seafood, and horticulture. Tourism is a valuable part of this area as well. This can also cause an increase in the fire occurrence. The Nelson Tasman area has great variation in rainfall, from 38 inches inland to over 240 inches on the north peninsula.

New Zealand forests were once managed by the New Zealand Forest Service, but were privatized in 1987 and managed by a state-run enterprise, the New Zealand Forestry Corporation. Starting in 1990, the government started selling forests to the private sector and now most of the forests are privately owned. One of those owners is Nelson Forests. But, there are a number of other owners in this area, making it difficult for wildfire control.

The Waimea Rural Fire District (http://www.ruralfirenetwork.co.nz/public/ruralfirenetwork.htm) is responsible for two local jurisdictions, Nelson City and the Tasman District, comprising over 1 million hectares. Of that, 5,600 ha are in the urban fire district, 120,000 ha are commercial forest land, and over 632,000 ha are managed by the Department of Conservation. The district is managed by representatives of the five largest land managers. They form the Waimea Rural Fire Committee. Each of the primary stakeholders in fire management in the area has firefighting resources available. In this instance, the Waimea RFD owns very little equipment or resources, they are owned by the stakeholders. Risks within the RFD are urban/rural interface, high and volatile fuel loadings on steep topography, a high transient tourist population, commercial exotic forests, and about 67 days of high fire danger annually.

Fire is used in land clearing both in forestry and grazing practices, for disease control and crop management, and for property management such as burning weeds. There are permitting processes in place for the use of fire. In winter, no burning is allowed because of smoke impacts.

The RFD utilizes fire danger classes. Trigger points at high fire danger include permit issuance stopped, access to higher risk areas not encouraged, work site preparedness and work restrictions for forest and farming, publicity campaigns are beefed up, lookouts are posted 24/7, patrols are increased, and there are elevated levels of standby.

New Zealand is promoting FireSmart. The tenets of FireSmart include making communities aware of the threat to life and property from wildfire, tapping into cohesive groups, providing education of mitigation and preparedness, and providing resources and tools to assist communities in mitigating wildfire threat.

Risk assessment is also ongoing in the Waimea RFD. Involving the community and following the ISO 32000 methodology, strategic and tactical fire management plans are developed. A product of these plans is risk treatment. The goal of the RFD is reduction, readiness, response, and recovery. Areas at risk are identified and mapped and work plans to mitigate the risk are developed. The current strategic plan identifies FireSmart communities to work with and developing response procedures for Abel Tasman National Park, as well as several other key tasks.

Of key interest to the study tour group is the concept of legislation supporting cost recovery. A case study of this was presented.

On November 26, 2009 a landowner dumped ashes from a woodburner. The buildup index that day was 18, and there were not overly dry conditions. But, in the afternoon, the wind picked up and the ashes, which were still hot, started a fire that subsequently burned over 700 hectares and a house. The fire nearly caused loss of life. Burning through forest owned by Nelson Forests, there was about a $500,000 loss of timber. Suppression costs were borne by both Nelson Forests and the RFD. An investigation into the cause of the fire was started immediately and it was discovered it had been started by hot ashes.

The person who dumped the ashes admitted to dumping them, but said they weren't hot. The case went to court and it was determined the person was responsible and therefore also responsible under law to pay suppression and damage costs. The case became rather high profile and social media was not supportive of the defendants. The defendants were ordered to pay. Another factor in this case was the type of insurance the defendants had, because insurance should cover costs of unintended consequence; they chose to not insure the business they were running on their property that was the source of the ashes. So, in the end, they were fully responsible for suppression costs and damages. This incident has become a learning tool for the Rural Fire Authority. During inspections, liability is explained to landowners using the Glenhope Fire as an example.

May 17

FireSmart (similar to FireWise) is the New Zealand program to make communities aware of the threat to life and property. The fire agencies use this program to tap into cohesive groups; it provides education and tools to assist communities to mitigate threats. Within the Waimea Rural Fire District, four areas were identified as high risk: Split Apple Rock, Kaiteriteri/Marahau, Valleys east of Nelson, Lake Rotoiti, Motueka Valley, and the Milnethorp/Parapara area.

A risk assessment has been completed for these areas. The use of the four R's is used for this program: reduction, readiness, response, and recovery.

The study tour group visited the home of Peter and Pam Holyoake at their property in Split Apple Rock. The area has a few homes built on steep slopes with non-native invasive plants that are highly volatile. The area has an HOA, but is not very keen on fire reduction. The Holyoake's created a trust which gave the area more leverage to complete the 4Rs for their area.

Figure A40. The area known as Split Apple Rock, along the Tasman Sea on the northern edge of New Zealand's South Island has been identified as high risk by the Waimea Rural Fire District. The native vegetation in New Zealand is not fire-dependent, however, many exotic species, which are highly flammable, now cover the landscape, including the area shown here.

Their property, at the end of a narrow road, which has several turnouts, has been cleared of undergrowth. They have planted native vegetation on the property and used non-flammable materials in their gardening. Tanks sit on the property to provide gravity-fed water should the electricity go out. A hose reel is mounted on the back deck and there is a sprinkler system. They have an escape plan, if needed, that takes them down a steep trail to the bay with a backup plan to wait out the fire in the lower level of their house. They really have done a lot of work and put effort into planning to make their place safe from fire. They are working with property owners in the area to help them understand the importance of this work. But not everyone gets it. New residents of the area are accepting of the need for hazard removal while the older residents don't support it; and some property owners don't live in the area full-time. The Holyoakes are involved in the Sandy Bay FireSmart Trust to support this effort; the trust is available to provide information and support to other communities as well.

Figure A41. The FireSmart home of Peter and Pam Holyoake is beautiful, with well thought out landscaping and safety features. But, the house has wood siding and this large wood deck. Located at the end of a narrow drive, there is not a lot of room for fire apparatus. The escape route is down a steep trail to the bay which is off to the right in this photo. Flammable vegetation is still close to the house.

The Holyoakes were very passionate about the work they have done and what needs to be done in the community. They truly understand the cost of making your property fire safe is less than the cost of suppression and rebuilding. When Mr. Dudfield asked our opinion of the work that was done, we had to say it is not enough. This property is not fire safe and the evacuation plan in place is not viable during a fast-moving brush fire. This was the story he wanted us to see.....even though people get it, they are oblivious to the full extent of the work that has to be done to prepare their home for the unplanned fire event.

Split Apple Rock and Sandy Bay are very near the Abel Tasman National Park. This park is the most popular park in the summer and has many visitors annually. Fire management in the park is a concern for the Waimea RFD as they are partners with the Department of Conservation in controlling wildfire there.

Mark Townsend, Conservation Services Manager for the Department of Conservation at Abel Tasman National Park, took us on a short tour of the park, via boat and hiking trails to discuss fire management concerns.

Figure A42. Fire is a concern for the Abel Tasman National Park as shown by this total fire ban sign at the Tonga Quarry Camp.

In most instances a total fire ban is in effect in the park. Access is very limited, as we experienced, with either a long walk into areas of the park, or travel by boat. The large number of visitors to this park increases the opportunity for an unattended campfire to start a wildfire. Much of the vegetation in the park can be damaged by wildfire, some of it irreparably. Habitat here is very important; during the week prior to our visit, twelve kākāriki, or yellow-crowned parakeets, were released into the park in an effort to restore native species.

May 18

The group started the day of May 18 in Nelson on the South Island of New Zealand. The morning was spent sharing ideas and preparing our notes. In the afternoon we flew to Auckland, on the North Island, accompanied by Murray Dudfield, Chief Rural Fire Officer for New Zealand.

May 19

On the morning of May 19 we walked to the Region 1 Headquarters of the New Zealand Fire Service. Mr. Dudfield gave a short presentation, prior to the National Incident Management Team Meeting.

New Zealand has 3 pre-formed National Incident Management Teams (NIMT). Each team is composed of 8 people. They come together every year for a workshop where they revisit the operations plan, share new knowledge, and perform an after action review of the previous year.

Figure A43. Headquarters for the New Zealand Fire Service in Auckland, on the North Island.

The teams make a practice of going out into the regions annually for training and to engage with the local fire staff. Teams are very flexible in size and scope. They can be staged and used as needed. They have worked some all-hazard incidents including the Christchurch earthquake and a coal mine disaster. An issue is getting the local fire staff to accept that a team can be a benefit to them; they want to manage their own incidents without asking for help.

Figure A44. Chief Murray Dudfield, far right, with the 3 National Incident Controllers for New Zealand, center, and Gary Lochyer, the Manager of Rural Fire Operations, on the left.

Safety is important in New Zealand fire management. They utilize 10 Standard Fire Orders, 20 Watch Out Situations, and LACES. Similar to what North Americans are familiar with, these provide a foundation for safe and effective firefighting throughout the country.

There are some safety concerns in New Zealand and there have been some close calls. Common denominators include:

- Sudden change in fire behavior
- Firefighters caught by surprise
- Small or isolated fires
- Light flashy fuels

The Coordinated Incident Management System (CIMS) is utilized in New Zealand and is very similar to ICS in North America and Australia.

The New Zealand Coordinated Incident Management System (CIMS) has been around for a number of years and is known "as the "Blue Book". http://www.nrfa.org.nz/Training%20materials/CIMS%20Blue%20Book.pdf

A new version of CIMS was scheduled to be published shortly after the study tour group visit. (http://www.civildefence.govt.nz/assets/Uploads/publications/CIMS-2nd-edition.pdf). The study tour group reviewed both documents and found the new document focuses more on coordination and planning at very high levels, and really does not deal with incident management. We believe the newer document is less effective for fire managers.

New Zealand utilizes a number of documents and forms in its Coordinated Incident Management System which are very familiar to North America. (http://www.nrfa.org.nz/OperationalFireManagment/Pages/default.aspx).

New Zealand has learned a lot from North America and appreciates it.

Gary Lockyer, Operations Manager at National Rural Fire Authority, talked about the issues facing rural fire in New Zealand. These include:

- Heavy reliance on volunteers, 80 percent of personnel are volunteers.
- New Health and Safety Act, which will go into effect July 1, 2015 – strict liability penalties for fire managers.
- Aging fire managers in rural fire – significant change in Forest and Land Management.
- Lack of succession planning in Rural fire - financial restraints, resistant to change, and central vs. local government.
- Compliance focus at National Level – less on leadership and coordination.
- Financial Restrictions – fire authorities are required to meet higher standards, same or less funding, increased costs.
- Climate Change – here, but we don't know enough, or maybe don't want to?
- Integration of Services – do we all understand, are we prepared?

Bryan Cartelle, Principal Rural Fire Officer, Auckland Enlarged Rural Fire District and IC on a NIMT spoke about his area of responsibility.

The goal of the department is to minimize the negative impacts of fire on the rural/urban interface communities of Auckland. Auckland is one of the smaller enlarged rural fire districts, but is the most populated and the most spread out because of the outer islands. Their challenges include demand for more development, marginal land being developed, conflict with other plans and policies within the fire council, integrating into multicultural communities, and the notion by the public that FireSmart is a complex process.

Figure A45. Three National Incident Management Teams are sponsored by the National Rural Fire Authority.

Bryan sees his department moving forward by influencing the planning process early, being linked to the resource consent process, doing more comprehensive assessments when visiting properties or issuing fire permits, targeting exposure of FireSmart to communities, and integrated and consistent messaging across all agencies and communities.

Richard McNamara, Principle Rural Fire Officer of the Marlborough Kaikoura Rural Fire Authority (MKRFA), presented the question, why be FireSmart?

In the Marlborough Kaikoura area there are common factors to all the rural communities:

- Remote locations – both time and distance to respond,
- Independent individuals and community groupings, often with long-standing community issues - you have to know the community,
- Willingness to help in times of need,
- Strong community representation in the form of residents associations, etc.,
- Emergency response is embedded in the community,
- Community is swelled significantly by retuning holiday-makers and
- Most returnees consider themselves local,
- Defendable space around a number of house and batches is non-existent,
- People value privacy.

Their goal is safer communities that are resilient to the threat of fire. To get there, the MKRFA plans to use an inter-agency, community approach to the risk of fire to the at-risk, rural and urban interface communities utilizing existing community nodes and conduits, including local volunteer rural firefighters, to embed the principles of FireSmart and FireWise into community resilience. The aim is to utilize existing and future strategic and tactical fire management planning to enhance community resilience, front-ended by the FireSmart and Fire Wise programs. The view is that fire resilience needs to be embedded into communities, not bolted on.

So, the answer to the question is

- Make our communities safer to live in.
- Reduce the incidents of fire.
- Reduce the amount of damage to property and life risk when a fire does occur.
- Communities, families and individuals need to get back to normal through the recovery process after an event as soon as possible.

For the study tour group, the take away message was know your stakeholders, build risk awareness, and build resilience in communities.

Rob Hands from Canterbury and Ian Reade from Waimea spoke about plantation forest management, which for the study tour group was a continuation of a previous topic.

The Waimea Rural Fire District works with all stakeholders, pooling resources for response: people and equipment. The involvement of other stakeholders such as town/city councils and the Department of Conservation is an important part of this sharing of resources.

> *"All firefighters have the right to a safe assignment. People go to work in the morning and there is an expectation they go home at night. Awareness = no surprises and staying alive." Murray Dudfield, Chief Rural Fire Officer*

Prior to the study tour group departing from the team meetings, we reported out to the group – one report from each country.

Our next stop was the Northern New Zealand Communication Center in Auckland. Peter Stevenson, the Center Manager, described the dispatch arrangement in New Zealand.

There are 3 communication centers in New Zealand: Wellington, Christchurch, and Auckland. All emergency calls go through these three centers. In Auckland, they have been co-located with the Police for 16 years. In Christchurch, police/fire/ambulance will soon co-locate. The New Zealand Fire Service Communications Centers' Statement of Service Performance defines the standards of service to be provided by the communications centers. There are standards of service for the communications centers, found at: http://www.nrfa.org.nz/Operational%20documents/Circular%202015-01%20Attachment%201%202014%20NZFS%20Communications%20Centres%20Statement%20of%20Service%20Performance.pdf. The dispatch system is redundant, switching of communication centers for backup. Training is on-going and performed every week. Equipment is modern and the center is well laid out.

The day and the study tour ended at the NIMT dinner where we again realized that if you work in fire management you can fit in with just about anyone else who works in fire management. This small community of which we are a part has a strong passion that is evidenced world-wide.

Appendix B. New South Wales Nature Council Firesticks Project

Kim Kelly of the US Bureau of Indian Affairs was immensely impressed with the Firesticks Project the study tour group was introduced to in New South Wales. Her interest in traditional and cultural practices sparked this view of the project.

Through a collaborative approach; the establishment of Indigenous Protection Areas, utilizing traditional use of fire for ecosystem and cultural health, and developing pathways to share traditional knowledge with contemporary fire managers, is the description of the New South Wales Nature Council Firesticks Project.

The study tour group had the honor of learning about a unique and innovative project that is working to reinstitute many traditional aboriginal burning and cultural practices, aptly called the ***Firesticks Project*** that was initiated in 2012 (but has been in the planning stages for several years prior) and is administered by the Nature Conservation Council of New South Wales (NSW). One major goal of the cooperative Firesticks Project is to "increase culturally relevant learning pathways that enable a greater diversity of fire uses, in order to sustain healthy people and healthy country approach to Natural Cultural Management". (Firesticks Project Handout, 2014)

It was expressed throughout the study tour that fire is and has been a central and historical quality of aboriginal practices and culture. As Oliver Costello (project manager for the NSW Nature Council Firesticks Project) pointed out, "from a basic perspective aboriginals believe the landscape is everything that encompasses an area or country; this would include flora, fauna, as well as the people living within". Fire and fire uses are no exception to this, and are considered an integral part of the Aboriginal culture and "country" (which describes the landscape and environment) and not viewed as an element separate from aboriginal life.

Historical uses of fire by the Aboriginal people of Australia within NSW and as described throughout greater Australia, are not unlike those of the North American First Nations of Canada, the Indio people of Mexico, or the Native Americans and Alaska Natives from the United States. However, the significance lies in the history of use and some of the unique methods of maintaining and transporting fire.

Fire uses as described of Aboriginal people include (but are not limited to):

- For the purposes of cooking and warming
- Developing and maintaining vegetation patterns to encourage new growth that would attract various game to the area for hunting purposes (Described by Rys Jones as "Fire Stick Farming", 1969)
- To encourage the development and increase of plants for food and medicines
- Utilized for cultural and spiritual purposes
- Cooraborees – (gatherings of native people)
- Smoke
- Initiation
- Cleansing
- Healing

There are some unique methods of maintaining and transporting fire for practical and cultural purposes

Figure B1. Locations of Indigenous Protection Areas (IPS) in New South Wales.

such as making travel easier through very thick, thorny vegetation patches. Aborigines traveled long distances from place to place utilizing "songlines" as a verbal map of the landscape that connected them to resources, other clans, and significant cultural locations. They would take along with them a "firestick", a constant smoldering ember that could be contained in natural materials such as a Banksia cone, a stalk of grass tree (xanthia), bark, or a decaying piece of eucalyptus, (Stephen Pyne, *Burning Bush: A Fire History of Australia*, 1998).

Figure B2. Banksia Cone

Figure B3. Grass Tree Stalk (Xanthia)

Within the Firesticks Project are reserves identified as *Indigenous Protection Areas* (IPA's). The particular IPA the study tour group had the opportunity of visiting was Ngunyan Jargoon (translated as "my land"). These lands are roughly 6,700 hectares (16,500 acres) of Aboriginal lands along the northern coast and tablelands of NSW. Traditional Jali Lands are owned and managed by the Jali Local Aboriginal Land Council. The day-to-day land management of these areas is conducted by Aboriginal rangers with the support of the NSW Natural Conservation Council staff of land management planners and ecologists. The significance of these lands includes historic use by Jali people for an estimated 3,500 years bp (as stated in Ngunya Jargoon IPA Plan of Management, 2013).

The Vision and Intent of the Ngunya Jargoon Indigenous Protection Area Ngunyan Jargoon Plan of Management, 2013 (as described by the Goori people):

> *We, the Goori people of Cabbage Tree Island (Nyangbul Clan) of the Bundjalung Nation:*
> *We recognise and respect our culture and country; it is our spiritual identity and our heritage.*
> *This is our homeland which we value and respect.*
> *We acknowledge our ancestors and the land that has been looked after since the Dreaming.*
> *Now it is our cultural responsibility to reconnect, protect and respect the land.*
> *We will manage, preserve and sustain the land.*
> *We will keep our cultural connection to ngunya jargoon (my land).*
> *And we will pass it on for our jargums (children).*
> *It is our duty.*
> *It was, it is, and will always be, Goori land.*

With these intrinsic values and visions of the local Aboriginal people, the Firesticks program is exploring opportunities to reinstate traditional knowledge systems and practices which work to protect, and in many cases, to replenish traditional resources and bush foods as they related to fire. The land management goals are to utilize integrated fire with weed and pest management strategies in order to enhance ecosystem health and habitat condition and connectivity, while enabling and empowering Aboriginal and non-Aboriginal communities to work together towards a "healthy people and a healthy country". According to Oscar Costello and Mark Graham, this could include different seasonal burning and other burning strategies creating a patchiness of burned and unburned areas encouraging biodiversity, as well as other strategies to protect or enhance native species of plants and animals that have both ecological and cultural importance on these lands such as a multitude of native grasses, emu, black grevillea, potoroo, various bushfoods, and a number of threatened and endangered species.

Figure B4. Sampling lemon myrtle tea.

Some indicators and measures of success have been identified as *Cultural Indictors of Healthy Country*.

The Firesticks process is seeking to help identify, strengthen and, reinstate indigenous knowledge systems and management practices which result in the protection and replenishment of species. Indicators of success include elements such as:

- Facilitate Aboriginal communities and non-aboriginal stakeholders to better understand and implement cultural burning, through workshops and participation in planning and project events.
- The engagement of local aboriginal understandings of country, including the development of seasonal fire calendars to help provide indicators of seasonal changes in country, in relationship to fire.
- Through the design and implementation of culturally and ecologically appropriate evaluation and monitoring tools using a process called "MERI" which is to: Measure, Evaluate, Report, and Improve. Each MERI plan is adapted to meet local community requirements. These plans are designed to choose a set of measureable indicators tied to strategies in the plan that include not only land use, land management and ecosystem health, but governance, and financial obligations as well.

The study tour group asked about barriers or key roads to success that were discovered in the development of the IPA's. They learned that a key hurdle to overcome, but which was certainly a key to success, "has been establishing trust and communications (which have not been won easily by non-Aboriginal members) based on a history of mistrust and broken promises", states Jane Baldwin, NSW Rural Fire Protection. "Consultation was a key aspect, as there were several meetings with elders and tribal members that were conducted at the indigenous protection lands that have been important in moving forward for both Aboriginal and non-Aboriginal land managers and communities". "This process took time", said Waminda Parker, Hotspots and Fire Sticks Manager, "we recognized that our current systems were not allowing the time necessary to engage and build the necessary trust, we couldn't just run in and run out, we had to take the time necessary to make this successful". The group estimated that the consultation process took roughly 2-3 years over several gatherings but that the time taken has been invaluable to all parties in establishing this trust and has assisted greatly in

developing a living, sustainable plan for the Ngunyan Jargoon IPA (as well as other IPA's). Oliver Costello stated, "It's important to understand the desires of the local community and what is important to them in regards to re-establishing a healthy, productive, and culturally viable country or landscape. Much of the oral history has been lost, but many of the practices are being revived in these reserves". Aboriginal people's living knowledge systems can help support contemporary fire management concerns facing our society and environment. Firesticks is a way to build stories; share the relationship and meaning of fire, people and C ountry; and to explore the common ground on how burning makes us all feel. Collectively people and Country can teach us this."

References:

Oliver Costello, Fire Sticks Coordinator, NSW Nature Council
Waminda Parker, Healthy Ecosystems Program Coordinator, NSW Nature Council
Jane Baldwin, Nature Conservation Trust of NSW
Mark Graham, Hot Spots Ecologist, NSW Nature Council
Stephen Pyne, Professor Arizona State University, Author, Burning Bush: A Fire History of Australia, 1998
Rys Jones, Fire Stick Farming, Australian Archaeologist, 1969

Appendix C. Account of the International Symposium on Bushfire Management and Preliminary Report from International Symposium on Bushfire Management

Study Tour Account of the International Symposium on Bushfire Management

The study tour group was very taken with this first symposium. Perhaps because participation in such an event was new for all of them, but more because they were included in the final recommendations that will be carried forward by the fire management groups to a larger world-wide audience.

Wildfire and bushfire management present multiple complex issues worldwide. From the effects of climate change and complex weather patterns to understanding the complexities of combustion chemistry, fire managers around the world depend on dedicated scientists to research and develop solutions and answers to bushfire and wildfire management challenges. Collaborative research opportunities exist around the world and have provided for a better understanding of the fire environment, technology development and social interaction.

On May 1 and 2, 2014 an International Symposium on Bushfire Management was held in Canberra, Australia. The Forest Fire Management Group of Australia and New Zealand convened the symposium bringing together senior bushfire managers and researchers from the United States of America, Canada, France, Mexico, New Zealand, and Australia. The symposium focused on the current state of knowledge, both scientifically and operationally, the identification of emerging issues in bushfire management, as well as ensuring the development of bushfire management networks on a global basis, and to identify areas for improvement and collaborative research and development interests. Four priority themes were established to focus the discussion:

1. Rising bushfire trends
2. Questioning our safety and culture
3. Community
4. Practitioners' research priorities

Overview and Opening

The International Symposium on Bushfire Management began with the Australia and New Zealand Forest Fire Management Group (FFMG) Chair Tim McGuffog opening the forum with regards and respect to the aborigines. The Australian's regard and respect for the aboriginal people has followed suit through the trip thus far almost as if having an opening prayer in many occasions and is very much a part of the land management culture.

The symposium which was attended by Ambassadors from France, Mexico, and New Zealand, a representative from the US embassy, the USFS Director of Fire and Aviation Management, and others in similar positions in Australia, New Zealand, and France. The keynote speech was presented by Senator Colbeck, Parliamentary Secretary to the Minister for Agriculture for Australia. (http://richardcolbeck.com.au/2014_transcripts/address_to_international_symposium_on_bushfire_management). The Australians have a very high level of support for their fire management agencies, which has been boosted by significant catastrophic fire events in 2009.

The 2009 Fires in Victoria have invigorated the public and politicians interest in bushfire protection and prevention. Prevention is used in Australia as a synonym for aggressive fuels/land management both by prescribed burning and by bushfire building code regulations for the maintenance of defensible space, ingress and egress, and building materials. **"***Fire Management is Land Management"* is a principle and practice with support in Australia.

The focus of the symposium was identifying rising trends, safety culture, connecting with communities, and research needs for the international wildland/bushfire community to address looking into the future 20-30 years. Tom Harbour significantly noted as that we are challenged to be considered a profession when we continue to make the same mistakes with the horrendous loss of life in 2013 which was similar as 1939 for the US. He presented challenges to the group to address new ways of thinking, and need for young stars and sparks of genius to make a difference; technology is not the ultimate answer. He is looking at water and watershed management as being a key issue to connect with communities in the future, and is concerned about the mega-fires of the future. New Zealand, French, and American representatives all emphasized the importance of close working relationships with the Australians.

Rising Bushfire Trends

Concern was given to our ability to perform as a profession in the politically charged environment related to climate change when coupled with invasive species, fuels buildup, and societal shifts in demographics and associated movement into the wildlands without the overall understanding of natural systems and the risk inherent with living in areas of high fire risk. Future mega-fires are expected which will have dramatic impacts on communities. Water scarcity, impacts of changing climatic conditions, and increasing Wildland-Urban Interface will be the key trends for the international wildland fire community to work on in the future. Social sciences will be very important for effectively engaging the public in both risk and safety arenas.

Safety Culture

Captain Jean-Michal Dumaz, Consultant/Firefighter Officer in Pole-Risques of France expressed that they are very well connected with fire science and research in the SE of France. They have invested heavily in training and equipment to improve safety. Notably they have a 3-D fire simulation training program that seems to be a robust and immensely useful tool. This program was described as something that their common fire ground trainers could use to teach and exercise their firefighters and IMTs without extensive technical training on the system. We would recommend that our fire agencies explore this French system and incorporate its use into applicable courses – right down to fire refresher simulations. (http://vr-crisis.com/index.php?lang=en)

Figure C1. Alan Goodwin, Chief Fire Officer for Victoria's Department of Primary Industries, challenges symposium participants to question their safety culture.

They have also been testing the use of UAV's in wildland firefighting in the southeast of France. Real-time information including fire location and movement and 3d wind-field mapping is fed into their developing Common Operating Picture (COP). Fire behavior modeling is enhanced and the COP tool enhances their incident commander's and firefighters' situational awareness.

There is an interesting tact developed by the Australians and the French as

represented here – that the safety of firefighters is being presented on several different fronts. Some of these are similar to the US, but also include emphasis on the private citizen and their shared responsibility for safety, as well as the government at various levels for placing and enforcing bushfire standards for housing developments.

Community Information and Messaging

Surely one topic with high interest and hot debate after the 2009 Victoria Fires, and coincidentally the last North American study tour group contingent, as well as the Royal Commission Inquiry is that of Australia's "Leave Early, or Stay and Defend" message for homeowners. The 2009 fires and resultant 173 deaths challenged the basis of the message and spurred social science research into community messaging. Jim McLennan from Latrobe University provided some insight on the nature of the public in regard to messaging. Whereas the 2009 fires resulted in a significant change in messaging from the Australian government, the research done on how the public perceives and reacts to risk are enlightening, but maybe not surprising.

His research found that the vast majority of people ignored "Leave Early" messages, less than 1 out of 5 had a plan, and half of those intended to "stay and defend". The majority of these people did not have an actual survival plan, but instead had a plan to risk themselves and protect their assets. Most people understated their risk and many adopted a "wait and see" attitude despite warnings. Less than half of those that were planning on "staying and defending" actually had prepared to do so previously. The various agencies' messages have since changed to a "Leave and Live" or "Prepare, Act, Survive" emphasis.

In addition to this message, he recognizes that some will stay and defend regardless; there is an awareness that the public as a whole are not prepared for the terror of dealing with a forest fire on the worst days. Fire danger messaging has changed with the addition of the "Catastrophic" category (Code – Red in Victoria), beyond "Extreme" to emphasize the critical nature of the worst days such as "Black Saturday" in 2009. Under these conditions everyone is told to not go into the bush and those living in the bush are encouraged to leave for the day, prior to fires even starting. Learning aspects were that social media has become a huge factor in last 2 years, not for notification per-se, but for further information once notified. There is need to focus on those who are actually at risk, keep messages and information on risk reduction simple, and to be prepared to take advantage of those key events that bring wildfire issues into the media and political forefront.

Figure C2. The tried and true method of fire messaging, found throughout Australia, New Zealand, and North America, needs to be used in conjunction with social media and other methods to inform the public quickly and effectively.

Research Priorities

Long term research priorities explored at this symposium will be forthcoming as developed by the overall group. Topics explored here were the on-going issues and rising complexities of smoke management. Improvement of fire spread models which are determinate in a real world of fire behavior being different than "average." The average fire behavior being a distribution around a bell shaped curve where the outliers matter. Conveying uncertainty better may be a method for relaying this information on fire behavior and weather for that matter.

Of some focus were practitioner's research priorities including use of developing technologies enabling real-time data to enhance situational awareness and developing a common operating picture. This would include environmental data and that associated with fire behavior and movement relative to the environment.

Research needs include human factors such as type, quality, and quantity of data, to whom it is distributed, how is it displayed, and what might be missed by technology; for example the importance of cognitive cues such as smell and sound or 3 dimensions.

Figure C3. Fire prediction systems have been developed over time, but there is still a need to find the system that will provide the "right" answer all the time.

Topics to Carry Forward

Through presentations and discussion by each nation the symposium illustrated the common issues and requirements by each agency. Collaboration and joint technical development in some aspects of bushfire and wildfire management exist today. The symposium clearly demonstrated that further collaboration is required and needs to be expanded to ensure efficiencies in research and international development of equipment, systems and standards.

The discussions and breakout sessions developed a series of topics challenging bushfire managers today that include:

1. Risk management approach to wildfire preparedness, response and mitigation. Safe structures and communities, policy and regulation development for safer communities, predictive models in wildland urban interface and bush land, and shared risk concept

2. The effects of wildfire on watersheds and water catchment areas. Thresholds to water quality and quantity, ecological stability, fire mitigation effects, growth rates, costs of impacts

3. Climate and vegetation change. Adaptive monitoring systems, process based models, adaptive management programs accounting for expected changes in vegetation and fire environment

4. Questioning our Safety Culture. Risk analysis, risk assessment, PPE development for bushfire equipment, technical standards, training, human factor on fire fighters and citizens, understanding defining a safety culture, and understanding the human factors

5. Developing a Safety Organization. Define the attributes of a safety organization, critical safety systems, tracking measures for safety, develop a safety culture system, and remove fear of consequence in reporting safety issues

6. Community information flow and messaging. Standardization of bushfire risk system for people to understand across states and provinces, toolkits for schools and home, predictive tools to assist in defining high risk communities, and insurance community support world wide

7. Public communications. Development of tools targeting WUI communities, media planning strategies, and leveraging political support in unpopular messaging

8. Predictive Services. Weather prediction models for long term forecasting and evaluation/validation of predictive services products available to all agencies

9. Smoke modeling. Identifying gaps in smoke modeling knowledge, better understanding of impacts of smoke on health and evaluative tools to assist in policy development in smoke, water, and carbon related tradeoffs in prescribed burning

10. Research priorities and collection of real time data. Data collection standards, improved information sharing in research community, real time data on fuel moisture levels, improving accuracy of data inputs, and affordable/accurate portable weather stations for fire line use

11. Develop international information sharing networks, which would improve data collection and research needs. Collaborative research world wide

An Action Plan is being developed by FFMG on behalf of, and in consultation with, the participant agencies following agreement on the key priorities for future action.

Figure C4. Many of the participants of the First Annual International Symposium on Bushfire Management.

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Preliminary Report International Symposium on Bushfire Management

The study tour group includes the preliminary report in its entirety, to demonstrate the content of the Symposium and to show how the topics to carry forward were selected.

INTERNATIONAL SYMPOSIUM ON BUSHFIRE MANAGEMENT

Waterhouse Lecture Theatre, CSIRO Ecosystem Sciences, Black Mountain Laboratories, Acton, Canberra, Australia
1-2 May 2014

PRELIMINARY REPORT

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Contents

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BACKGROUND

A North American Fire Management Study Tour, in cooperation with the Australasian Forest Fire Management Group (FFMG), was scheduled to visit Australia and New Zealand during April-May 2014. Tom Harbour (U.S. Forest Service National Director of Fire and Aviation Management) coincidentally also planned on being in Australia at this time. Several French personnel including Capitaine Jean-Michel Dumaz (Director General Pôle Risques, the Research Innovative Cluster for Risk Management) were also keen to meet concurrently for a fire management symposium to capitalise on this unique opportunity for international collaboration.

With some adjustments to proposed schedules, FFMG convened the International Symposium of Bushfire Management, bringing together senior bushfire managers and researchers from Canada, France, Mexico, New Zealand, the United States of America, and Australia. Among these six nations are the three most fire-prone regions of the globe. Hence they were afforded the opportunity to identify and progress issues of mutual interest and benefit. The preliminary outcomes of this Symposium form the basis of this report.

AIMS

The Symposium aimed to:

- Share the current state of knowledge regarding fire management, both operationally and scientifically;
- Identify emerging and prospective priority issues in fire management for the next 15-20 years ;
- Further develop fire management networking amongst the countries involved; and
- Identify possible future areas for improvement in fire management and potential collaborative research interests, should future funding become available.

DELEGATES

Delegates from Canada, France, Mexico, New Zealand, United States of America, and Australia attended the Symposium. A full listing of delegates and their email contact details forms APPENDIX A

OFFICIAL OPENING

Senator Richard Colbeck, Parliamentary Secretary to the Minister for Agriculture welcomed delegates on behalf of the Australian Parliament and officially opened the Symposium with a challenge to progress recurring issues from previous bushfire events. Mr Cedric Prieto, Charge D'affaires a.i. Embassy of France, and Ms Alison Mann, Deputy High Commissioner, New Zealand High Commission also formally welcomed delegates. The Embassy of Mexico also supported the opening through the attendance of their Deputy Head of Mission, Minister Victor Trevino; and the United States Embassy by Nathaniel Rein, Environment, Science, Technology, and Health Officer. Mr Tim McGuffog, Chair of FFMG also welcomed delegates and wished the symposium well in pursuing its aims.

AGENDA

The Symposium agenda focussed on four priority themes, viz:

1. Rising bushfire trends (ie the impacts of apparent increased bushfire frequency and size)
2. Questioning our safety culture (ie improving our 'safety cultures' to produce the results our industry wants)
3. Community – information flow and messaging (ie is our information flow and community messaging producing the desired results?), and
4. Practitioners' research priorities (ie what research questions do firefighting practitioners want researchers to answer?).

Priority areas for discussion within each theme were identified by consensus of the forum and a set of suggested actions developed following each workshop session. These are discussed below.

A copy of the Agenda forms APPENDIX B.

OUTCOMES

An invited speaker (or speakers) initiated each of the four symposium sessions with a presentation intended to provoke discussion around key topics within their respective themes. Following forum discussion, three workshop topics were agreed to for each session, discussed in smaller groups, and a set of suggested actions developed.

The workshop topics identified and discussed in smaller groups for each session were:

Session 1: **Rising bushfire trends**
(ie the impacts of apparent increased bushfire frequency and size)

- Water
- Climate and vegetation change
- Managing risk through planning

Session 2: **Questioning our safety culture**
(ie developing our 'safety cultures' to produce the results our industry wants

- Safety language
- Developing a safety (focussed) organisation
- Developing a safety culture

Session 3: **Community – information flow and messaging**
(ie is our information flow and community messaging producing the desired results ?)

- Identifying houses at risk
- Public communication
- Incentive and new models of engagement

Session 4 : **Practitioners' research priorities**
(ie what research questions do firefighting practitioners want researchers to answer?)

- Predictive services
- Smoke modelling, impacts of smoke on health, trade-offs of prescribed fire
- Research priorities and collection of real time data

Each workshop identified a series of suggested short-, medium-, and long-term actions. These were validated and voted on by the Symposium as part of Session 5. The outcomes of this voting are presented in APPENDIX C. It must be noted that this is 'raw data' and as such can only be effectively interpreted by Symposium delegates. This data will form the basis of future discussions between Alan Goodwin, Tom Harbour and Jean-Michel Dumaz to identify and progress issues which would benefit from collaboration between the 3 global zones.

FUTURE ACTION

The actions identified from the Symposium will be discussed by Alan Goodwin (on behalf of FFMG) and Tom Harbour (on behalf of the North American Fire Management Study Tour) when they meet in mid-May 2014 (date yet to be confirmed). They will determine a set of recommended priority actions for discussion with Jean-Michel Dumaz (on behalf of Pôle Risques) shortly after when Alan Goodwin visits France in early June.

An action plan will be developed by FFMG on behalf of, and in consultation with, the participant agencies following agreement on the key priorities for future action.

ACKNOWLEDGEMENTS

The contribution of the French Embassy in Canberra, in particular Marie-Helene Wehr and Edwina Hollander, is gratefully acknowledged. Their support was critical to the delivery of this Symposium. CSIRO support through Dr Andrew Sullivan and provision of the venue is also appreciatively acknowledged, as are the untiring efforts of Neil Cooper (ACT Parks and Conservation Service) for ensuring that local arrangements ran as smoothly as possible.

APPENDIX A
DELEGATE LIST
(updated post Symposium)

Dr Raphaele Blanchi Research Scientist Ecosystem Sciences, CSIRO Canberra e: raphaele.blanchi@csiro.au	**Liam Fogarty** Director of Knowledge and Engagement, Fire and Emergency Management Division Victorian Department of Environment and Primary Industries. e: Liam.Fogarty@depi.vic.gov.au	**Dr Stuart Matthews** Research Scientist CSIRO Canberra e: Stuart.Matthews@csiro.au
Craige Brown Team Leader, Water Supply Catchments and Bushfire Melbourne Water VIC e: craige.brown@melbournewater.com.au	**Anne Gantaume** Researcher, Fire Risk – Fire Ecology Institute of Science and Technology for Environment and Agriculture (IRSTEA) e: anne.ganteaume@irstea.fr	**Juan Manuel Villa Mejía** Chief of Technical Assistant Mexico's National Forestry Commission (CONAFOR). e: jvillam@conafor.gob.mx
Brook Chadwick USFS Deputy Fire Staff Officer, Uinta-Wasatch-Cache NF e: jhchadwick@fs.fed.us	**Alan Goodwin** Chief Fire Officer Victorian Department of Environment and Primary Industries e: Alan.Goodwin@depi.vic.gov.au	**Gary Morgan** Chief Executive Officer Bushfire Cooperative Research Centre e: gary.morgan@bushfirecrc.com
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Neil Cooper Manager Fire, Forests and Roads ACT Parks and Conservation Service e: Neil.Cooper@act.gov.au	**Tom Harbour** U.S. Forest Service National Director of Fire and Aviation Management e: tharbour@fs.fed.us	**Bernie Schmitte** Wildfire Manager Fort McMurray Fire Centre. CANADA e: Bernie.Schmitte@gov.ab.ca
Murray Dudfield National Rural Fire Officer, New Zealand Fire Service e: murray.dudfield@fire.org.nz	**Ed Hiatt** USFS NP Fire Management Officer e: erhiatt@fs.fed.us	**Jason Steinmetz** USFS Emergency Operations Specialist e: jsteinmetz@fs.fed.us
Captain Jean-Michel Dumaz Project Manager, Pôle Risques, the Research Innovative Cluster for Risk Management e: jean-michel.dumaz@pole-risques.com	**Kim Kelly** DOI BIA Fire Ecologist, NWRO e: Kim.Kelly@BIA.gov	**Mick Stephens** Strategic Policy Manager Pulp and Paper Australian Forest Products Association e: mick.stephens@ausfpa.com.au
Mark Edwards National Forest Policy, Department of Agriculture (DAFF) e: Mark.Edwards@daff.gov.au	**Frank Lepine** Associate Director Forest Management Division, GNWT, CANADA e: Frank_Lepine@gov.nt.ca	**Naomi Stephens** A/Director, Park Conservation and Heritage Branch, National Parks and Wildlife Service NSW e: Naomi.Stephens@environment.nsw.gov.au
Stuart Ellis Chief Executive Officer Australasian Fire and Emergency Service Authorities Council e: stuart.ellis@afac.com.au	**Tim McGuffog** State Fire Manager Forestry Corporation of New South Wales e: Tim.McGuffog@fcnsw.com.au	**Dr Andrew Sullivan** Senior Research Scientist, Group Leader, Bushfire Dynamics and Applications Group, CSIRO Canberra e: Andrew.Sullivan@csiro.au

Kris Eriksen USFS Public Information Officer National Incident Management Organization (NIMO) e: keriksen@fs.fed.us	**Prof Jim McLennan** Adjunct Professor School of Psychological Science, Latrobe University e: J.McLennan@latrobe.edu.au	**Marva Willey** USFS Regional Fuels Program Coordinator Pacific Southwest Region e: mwilley@fs.fed.us

APPENDIX B
Agenda

Thursday 1 May

1345	***Registration***		
1400 - 1445	**Formal Opening**	Welcome	*Senator the Hon Richard Colbeck* *Parliamentary Secretary to the Minister for Agriculture* *Tim McGuffog (FFMG)* *Invited officials*
1445 - 1515	*Afternoon Tea*		
1515 - 1700	Session 1 *Chair: Neil Cooper*	**Rising Bushfire Trends** - Mutual support - Mega-fires - Ecosystem resilience or managed change - Carbon accounting	*Tom Harbour* *Dr Anne Ganteaume (WUI fire in the Mediterranean)*
1700 - 1715	Close	Day 1 wrap up	*Neil Cooper*
1730 - 1930	*Welcome reception*	*CSIRO Discovery Centre*	

Friday 2 May

0830	***Registration***		
0900 - 0915	Welcome	- Reflections on Day 1 - Scene-setting Day 2	*Tim McGuffog*
0915 - 1040	Session 2 *Chair: Alan Goodwin*	**Questioning our safety culture** - Incident Control System (ICS) - High Reliability Organisation (HRO) - Mantras (eg LACES, Watchouts) - Human factors	*Jean-Michel Dumaz* *Alan Goodwin*
1040 - 1100	*Morning tea*		
1100 - 1230	Session 3 *Chair: Naomi Stephens*	**Community – information flow and messaging** - Connecting with neighbours/ community (pre-season) - Community warnings - Managing expectations - Using social media	*Prof Jim McLennan*
1230 - 1315	Lunch		
1315 - 1330	PLENARY	Recap	*Max Coulter*
1330 - 1500	Session 4 *Chair: Murray Dudfield*	**Practitioners' research priorities** - Smoke - Fire prediction - Technological - Risk - Carbon accounting	*Andrew Sullivan* *Jean-Michel Dumaz (New technologies and innovation)*
1500 - 1530	Afternoon tea		
1530 - 1645	Session 5	**Validation of Priorities** - Short term actions - Immediate/short-term actions towards objectives - Long term objectives - Agreed research priorities	*Max Coulter*
1641700	Close		*Tim McGuffog, FFMG*
1715	*Depart for evening function*	Barbeque dinner at Stromlo *(informal)*	Transport provided for international delegates

APPENDIX C
RAW ANALYSIS OF SYMPOSIUM OUTCOMES FOLLOWING SESSION 5 "VOTING"

(NB: Voting was carried out for each session individually. Delegates were requested to indicate their highest priority across all suggested actions for that session by allocating it '3' votes, '2' for their second, and '1' for their third (priority). These were then tallied and recorded in the 'VOTES' column. The numbers in red are totals for each individual workshop)

SESSION 1: Rising Bushfire Trends	VOTES
Water Issues	39
Short term:	
• Cost of fire impacts	-
Medium term:	
• Educate the public on the natural processes of different topics, fire prone, flood plains, watersheds.	16
Long term	
• **Decision making tool to evaluate the value of different resources: water, life, and property.**	**20 (2)***
• Research programs: How does fire mitigation effect catchment stability; growth. How much mitigation is enough before it effects the balance.	3
Climate and vegetation change	44
Short term:	
• Investigate the relative value of: 1) developing new systems from existing knowledge; versus 2) researching new knowledge.	10
• Re-new efforts to monitor the systems we are managing	3
• Investigate whether there are any good adaptive management monitoring systems for addressing the climate change challenge?	11
Medium term:	
• **Establish adaptive management programs taking into account expected changes in vegetation and fire weather.**	**17 (3)***
• Capture the existing knowledge and put into a functional framework for practitioners.	-
Long term:	
• Development of process-based models may be a better approach than empirical systems heading into a dynamic future	3
Managing Risk Through Planning	68
Short term:	
• Start selling message of shared risk	14
• What are safer houses/communities?	7
• What policy/regulation settings are required for safer communities?	10
Long term:	
• **Policy/regulation/development settings for safer communities**	**24 (1)***
• Develop predictive models for WUI bushfire risk	13

SESSION 2: Questioning our Safety Culture	
Safety Language	62
Short term – Risk analysis	
• **Understanding the risk (risk assessments) – Engagement with stakeholders**	**18 (1)***
• Passing on experience	4
• Understanding the classification of firefighters and environment we are sending them into	5
• Training firefighter culture: – encourage culture of speaking up	9
Long term	
• International research – human factors	8
• Reconsider role terminology (e.g. safety officer), human elements of risk, strategic risk advisor	14
• Technical standards	-
• Understanding culture (human factors within and without)	1
Developing a Safety Organisation	49
Short term	
• **Define the attributes of a safety organisation that we all agree on**	**15 (3)***
Medium term	
• Describe critical safety system elements of a learning organisation and their relative efficiency and effectiveness in achieving safety outcomes	7
Long term	
• Establish relevant measures of safety outcomes that track how well we are achieving them and how the elements are working.	11
• Define the critical components of a safety culture/system and determine the importance of each element in delivering safety to the organisation and the people in it.	**16 (2)***
Developing a Safety Culture	36
Short-term	
• Leaders to use personal stories	3
• Ask safety questions per month: Zero out west program-- NPWS	-
Medium-term	
• Pursuing a legislative framework to assist with no-blame culture	10
Long-term	
• How to change and instil culture in training, top down	3
• Remove fear of consequence in reporting safety issues.	11
• Are there legal solutions to absolve liability to allow participant's to feel comfortable reporting safety issues.	9

SESSION 3: Community Information Flow and Messaging	
Identifying houses at risk	52
Short-term action	
• **Target high risk communities with mapping, meetings and interviews etc (Costly?)**	**25 (1)***
Long-term actions	
• **Standardise the bushfire community risk system across the country, but with messages targeted locally.**	**21 (2)***
• Build general awareness through school curriculum, promote weekly fire preparation work around the family home during the fire season.	6
Public Communication	72
Short term strategy	
• Tell the public the truth (e.g. our capabilities)	14
• Explain when you are living in the bush – WUI	9
• Concentrate messaging at the time of the event or when conditions indicate the potential and risk	6
• Campaign messaging when an event captures public attention--must have campaign tools/messages etc prepared and ready to go.	2
Long term	
• Appropriate necessary changes to planning strategy and regulation	12
• High level political support and legislation that Emergency Services can't/won't be able to defend your property if you live in these situations	**16 (3)***
• Incentives for people to maintain appropriate insurance	2
• We will concentrate on protecting life first and foremost, your house can be re-built.	11
Incentives and new models of engagement: How do we share learning's and identify gaps. Has the gap already been filled by other jurisdictions	24
Short-term:	
• Share info, models, lists, incentives	3
Medium- term:	
• Identify gaps by analysing lists	-
• Learn from other programs	3
• Develop methods for assessment of effectiveness of engagement and other strategies (subsidies, bushfire risk rating, etc); how effective is for each	10
Long-term:	
• Look at new ideas and models for the future	8

SESSION 4: Practitioners' Research Priorities	
Predictive services	50
Short term	
• Define levels of predictive services products – Strategic (management of resources), tactical (support of incidents), and public notifications.	5
Medium term	
• **Define/refine product needs, inputs, uncertainty factors (thresholds) with input from practitioners and researchers**	**32 (1)***
• Better weather predictions	7
Long term	
• Validation and feedback of products and systems	6
Smoke modelling, impacts of smoke on health, trade-offs of prescribed fire	46
Short term	
• Identify gaps in smoke modelling knowledge	6
Medium-long term	
• Impacts of smoke on health (communities)	9
• Development of common policy for smoke impacts	-
Long term	
• **Use available knowledge to assist policy makers and practitioners to make trade-offs, e.g. smoke, water, carbon, etc from prescribed fire vs natural fire**	**18 (2)***
• In parallel develop frameworks to incorporate community values into trade-off decision making process [Social impact of smoke (community understanding)]	13
Research priorities and collection of real time data	54
Short-term	
• Determining the current tools available and current research	5
• Identify needs by personnel to help drive research	3
• What are the standards of data collection, can global collection be utilised	7
• Improve information sharing between research and practitioners	11
Medium-term	
• How to improve realtime fuel moisture collection, real time data on fine fuel material. How to make less labour intensive.	6
Long-term	
• Develop pop up (remote, disposable/temporary) weather network across fire to assist IMT, where skill and knowledge to set up is not high or expensive.	5
• **Develop international information sharing networks which would improve data collection, research needs**	**17 (3)***

* Number in brackets indicates the ranking of this vote relative to the other votes for this session. eg: 20(2) = the total number of votes for this suggested action was 20, this being the second highest for that session.

End

Appendix D: The Study Tour Group

Brook Chadwick - Deputy Fire Staff Officer, Uinta-Wasatch-Cache National Forest

Brook has worked for the US Government for 20 years and currently is the Deputy Fire Staff Officer for the Uinta-Wasatch-Cache National Forest in Salt Lake City, Utah. He has a BS degree from Utah State University in Wildlife Management and he spent the first 6 years of his career with the US Forest Service in this capacity. He switched to fulltime suppression as an Initial Attack Squad Leader and then as a Module Leader for the Bonneville Hotshots. He spent the next 10 years as a Fuels Program Manager with the BLM. He treated over 150,000 acres of landscape scale watershed restoration treatments with multiple resource benefits utilizing various partner funding sources. He was recognized for nearly 50 wildfires impacting those treatments with reduced fire behavior and ecological impacts due to more resilient landscapes.

He has performed in wildfire suppression, prescribed fires, and other emergencies all over the U.S. and enjoys the diverse experience these opportunities provide. He has taught many fire and prescribed fire courses both locally and at the Great Basin Training Center. He is currently an Operations Section Chief on a Great Basin Type 2 Team with aspirations of becoming a Type 1 Operations Section Chief and a Type 2 Incident Commander.

Kevin Conn -- Fire Management Preparedness Specialist, US Fish & Wildlife Service, National Interagency Fire Center, Boise, ID

Kevin's current position is as a Fire Management Preparedness Specialist for the US Fish & Wildlife Service at the National Interagency Fire Center (NIFC). Interagency work includes interagency participation on National Wildland Fire Coordinating Group (NWCG) Operations and Workforce Development Committee. Equipment Technology Committee and Fire Observation Environment Unit to develop various agreed to interagency standards and processes.

He served as the facilitator for the National Multiagency Coordinating Group for resource allocation activities during the 2013 fire season. His current efforts of significance include the integration of wildland fire and all hazard training, qualifications, and response procedures. His work with the NWCG Fuels Management Committee and Fire Use Subcommittee to develop or revise prescribed fire position qualifications, the prescribed fire complexity determination processes, and Wildland Fire Module standards also carry significance from a planning and operational perspective at all levels.

In the past, he has served as both the National and Assistant Fire Management Training specialist for the USFWS at NIFC. Field level fire positions held include Engine Boss, Station Manager, and Assistant Fire Management Officer for the USFWS. Work was performed on the on the Sheldon/Hart Mountain Refuge Complex as well as all USFWS units in Nevada. He also worked on the Fremont National Forest Service in Range Management and participated on hand and engine crews on an as needed basis.

He attended college at Oregon State University and graduated with a Bachelor of Science in Range Management with a minor in Crop and Soil Science.

Kris Eriksen - Public Information Officer, National Incident Management Organization (NIMO), U.S. Forest Service

Kris Eriksen began working in fire in college as a summer job, never thinking it would become a career. She has a degree in *Organizational Administration* and a minor in *Journalism* with more than 15 years in corporate public relations and 12 years as a reporter. She began her 30 years in fire in 1984.

She has extensive experience in public relations for a variety of corporations, worked in hospital marketing, owned her own public relations and graphic design agency which expanded to teaching fire and emergency response classes.

Kris has been deployed with National Type 1 teams, responding to many of the nation's largest wildland fires and all-hazard assignments. She was responsible for creating the first multi-agency Fire Information website (NMFireinfo) in New Mexico in 2006. She successfully set-up and ran a two state, multi-jurisdictional Joint Information Center during the largest fire siege in Georgia/Florida history in 2007. She also worked with the FEMA Region 10 Public Affairs Cadre for six years handling public information & media functions during national events like floods, tornados, earthquakes and hurricanes.

Kris began working on the Portland NIMO (National Incident Management Organization) team in May of 2008 when it was created. Her role on the team focuses on working with National Forests and their stakeholders/cooperators, to improve pre-season collaboration and communication and mitigate communication failures by employing solid, pre-season risk communication.

She has also taken the lead among national Public Information Officers in pushing for the use of Social Media on incidents. She has piloted the use of VOS (Virtual Operations Support) on wildland fires and helped create and train 3 more VOS teams, now in use on National Incident Management Teams. Her focus is on trying new tools (for crowdsourcing, live-streaming, documentation, etc) to find a good fit for wildland fires, and sharing that information nationally with Public Information Officers. She teaches Crisis Communication and Public Information Officer classes across the nation.

Ed Hiatt - Fire Management Officer, North Kaibab Ranger District, Kaibab National Forest

Ed has worked in fire management now for 24 years. He started in California on fire engines and hotshots.

He has worked for three different units of the National Park Service (Saguaro National Park, Bandelier National Monument and Grand Canyon National Park), three different National Forests (Eldorado National Forest in California, the Wallowa-Whitman National Forest in Oregon and the Kaibab National Forest in Arizona), MacKay Island National Wildlife Refuge in North Carolina.

Currently Ed's position is a Fire Management Officer for the North Kaibab Ranger District of the Kaibab National Forest and the North Rim District of Grand Canyon National Park. His position supports a well-rounded fire program that includes prescribed fire, managing wildfires and a large fuels program that routinely treats about 10,000 acres a year.

Ed is a member of one of the Southwest Area Incident Management Team 4 as an Operations Section Chief and recently attended S-520.

Ed travelled to Ethiopia in 2012 and spent 30 days in the Borana region instructing prescribed fire with two other US Forest Service employees.

Kim Kelly - Department of Interior / Bureau of Indian Affairs (BIA), Tri-Regional Zone Fire Ecologists (Alaska, Northwest, and Rocky Mountain Regions)

Kim is currently one of the Zone Fire Ecologist/Monitoring Specialist for the Bureau of Indian Affairs Hazardous Fuels Program. Kim provides program oversight and technical support to Tribal and Alaska Native programs within three Bureau Regions: Pacific Northwest, Rocky Mountain, and Alaska.

Kim has a B.S. in Geography with an emphasis on Biogeography and Landscape Ecology. She began her career with the USDA Forest Service in the Pacific Northwest Region in 1994 as a Geographic Information System (GIS) Specialist, working on both the Fremont National Forest and the Columbia River Gorge National Scenic Area within Region 6.

Prior to her current ecologist position, Kim worked for the Northwest Wildland Fire Interagency Coordination Center (NWCC) located in Portland, Oregon, where she provided predictive services product analysis and support to the emergency operations managers, intelligence officers, and fire weather meteorologists for the Northwest Geographic Area and for the National Predictive Services Group (NPSG).

Kim's relevant project and group affiliations include: Northwest BIA Geographic Editor/Coordinator for Wildland Fire Decision Support (WFDSS), National Fuels Treatment Effectiveness Monitoring (FTEM) Task Group, Northwest Regional Fire Environment Committee (FENC), Association of Fire Ecologist Member (AFE), as well a cadre member of the National Advanced Fire Danger Rating Course.

Frank Lepine - Associate Director, Forest Management Division, GNWT

Frank started out as a Wildland Firefighter in 1981 with the Canadian Federal Government Forestry Program in the Northwest Territories, Canada.

Completed a Technical Diploma in Renewable Resource Technology in 1984.

Became a Forest/Lands Officer in 1985.

Completed a BSc Forestry from University of Northern British Columbia 2001

Worked as a Department Wildfire Forester from 2001 to 2005.

Became the Manager of Wildfire Operations Government of the NWT 2005 - 2012

Appointed Associate Director Forest Management Division 2012 – 2014

Frank is an experienced Fire Behaviour Specialist and has worked in many capacities within Northwest Territories (NWT) and western Canada on wildland fires and wildland fire programming. Frank has been the Forest Management Division lead in the Wildland Fire Program for the Northwest Territories for many years. He worked the Resource Management Working Group for Canadian Forest Fire Centre (CIFFC) for several years working on National Standards and Mutual Aid Sharing. He was also the NWT representative for several years on the Northwest Compact of northwest states and provinces. He is now part of the CIFFC Board of Directors representing the NWT and is part of the Wildland Fire Working Group of the Canadian Council of Forest Ministers (CCFM).

Taiga Rohrer - Fire Management Officer, Zion National Park and Utah Parks Group

Taiga is the Fire Management Officer, since 2009, for Zion National Park and 8 other NPS units in Utah including Bryce Canyon NP, Capitol Reef NP, Glen Canyon NRA, Rainbow Bridge NM, Cedar Breaks NM, Pipe Spring NM, Timpanogos Cave NM, and Golden Spike NHS.

Taiga has a somewhat unusual background having worked for the Bureau of Land Management (BLM), US Forest Service (FS), National Park Service (NPS), and Department of Defense in wildland fire, but also for

National Aeronautics and Space Administration as an engineer. He started his wildland fire career in 1988 with the BLM as a fire engine foreman in Lander, Wyoming. 1988 was a big fire year in Wyoming with the notorious Yellowstone Fires, and he was hooked. He eventually moved on to an engine foreman position on the Boise National Forest in Lowman Idaho in 1994 and on to the Beaverhead/Deerlodge National Forest in Ennis, Montana in 1995. He worked with the Forest Service's Northern Fire Lab as a fire/fuels/smoke research assistant with the University of Montana in the spring of 1996, out in the field inventorying fuels, fire behavior, and smoke emissions in the southeast US. He worked at Eglin Air Force Base in Florida during the spring of 1997, undertaking extensive prescribed burning and fire suppression. He also spent a few years on the Grand Mesa, Uncompahgre, and Gunnison National Forests in Norwood, Colorado before eventually landing in Cedar City, Utah on the Dixie National Forest in 1999. While on the Dixie NF he held the positions of District FMO, AFMO operations, AFMO Fuels, and Forest Fuels Planner until joining the NPS in 2008.

He has worked on engine crews, helitack crews, hand crews, hotshot crews, and as a tractor plow and dozer operator as well. He ran a Type 3 Incident Management Team as Incident Commander for 5 years, and has been on Type 2 Incident Management Teams for 8 years. He maintains qualifications as Operation Section Chief Type 2, Prescribed Fire Burn Boss Type 1, Strategic Operational Planner, Incident Commander Type 3, etc. and is currently an Incident Commander Type 2 Trainee. He has a municipal/structural fire background and attended Texas A&M Municipal Fire School and on served on several volunteer fire departments. He has an extensive fuels management background with prescribed burning experience and some very large mechanical fuels reduction projects as well. He initiated, developed, and carried into implementation the largest Wildland Urban Interface fuels reduction project in Forest Service history with the Duck Creek Fuels Reduction project on the Dixie National Forest. This 13,000 acre (5,260 hectare), project has been instrumental to reducing an extreme WUI fuels hazard and was proven to be effective on the 2012 Shingle Fire which ran into the treatment. On the fire operations side he has been involved in some of the most complex fires in the US. This has been as an Operations Section Chief, Division Supervisor, and as a Type 3 Incident Commander including, among others, the largest fire in Utah history (Milford Flat Fire) at 363,000 acres. He has managed large scale fires for "other than full suppression objectives" as well for the National Park Service and the Forest Service to meet natural resource and fuel reduction objectives.

He received a Bachelor's of Science Degree in Aerospace Engineering from Embry-Riddle Aeronautical University in 1993, and worked for NASA Johnson Space Center at one point. He also has a Master's of Science Degree in Forestry – Fire Ecology and Management from the University of Montana in 1998. His thesis involved analyzing drought indices and correlating them to fire occurrence across Idaho to determine their effectiveness at measuring fire danger.

Bernie Schmitte - Wildfire Manager, Alberta Environment and Sustainable Resource Development, Fort McMurray Fire Centre

Bernie is a Wildfire Manager for Alberta Environment and Sustainable Resource Development, in North Eastern Alberta, Canada. The Fort McMurray Wildfire Management Area covers approximately 61,000 km2 of boreal forest and contains 13 fixed detection lookouts, two primary fire bases, one air tanker base, and two wildfire cache warehouses.

Bernie attended Sault College in Sault Ste. Marie, Ontario, and graduated with a Forest Management Technologist diploma in the spring of 1988. Bernie's forestry career started in northern Ontario as an initial attack crew member and timber management technician. Bernie then moved to British Columbia and worked as a harvesting inspector for the BC Forest Service on Vancouver Island. In October of 1992 Bernie started with the Alberta Forest Service in High Level, Alberta. Bernie has held several positions within the Forest Service and has been posted in Grande Prairie, Fort Chipewyan, and Rocky Mountain House. Bernie's wildfire

experience includes ignition specialist, operations section chief, and air operations branch director. Bernie is currently assigned to one of Alberta's four Type 1 Incident Management Teams as the Incident Commander.

Jason Steinmetz - Emergency Management Specialist, USDA Forest Service (FS), Fire and Aviation Management, Disaster and Emergency Operations, Washington, DC.

Jason's current position is Emergency Management Specialist, specializing in the National Incident Management System (NIMS) and Incident Command System (ICS). Jason is the liaison between the FS and the Federal Emergency Management Agency (FEMA) in all NIMS and ICS related issues. He works closely with FEMA to help revise and create NIMS doctrine and policy for the nation.

Jason began his career with the FS on the Wallowa-Whitman National Forest in Oregon. Beginning with his first job with the FS at the age of 15, he has worked on a variety of aspects of wildland fire and emergency management. Jason worked in the field for over 10 years on wildfire engines, wildfire Hotshot crews, and helicopter rappelling crews responsible for the suppression of wildland fire. He spent over 13 years working in interagency dispatch centers and eight of those years as the dispatch coordinator at the Virginia Interagency Coordination Center.

Jason has vast experience in teaching domestically and international. He has taught classes and presented on basic firefighting, National Fire Danger Rating, Leadership, Emergency Operations Centers, and Expand Dispatch Supervisors Classes. Some examples:

> *How lessons from a fire tragedy can make you a better leader*. Presented at the Curry School of Education, University of Virginia 2011, 2012, 2013
> *Overview of USFS Fire Programs*. Presentation to the Avialesookhrana, Moscow, Russia, 2011 and 2013
> *EOC Management and Operations*. Lead Instructor, New Delhi, India, 2012
> *National Wildland Coordination Group Function*. Poster presentation at the 5th International Wildland Fire Conference, Sun City, South Africa, 2011
> *EOC Management and Operations*. Instructor, Addis Ababa, Ethiopia, 2011
> *Aviation Safety in the US*. Panel presentation at the 4th International Wildland Fire Conference. Seville, Spain, 2007

Juan Manuel Villa Mejía - Chief of Technical Assistant, Mexico's National Forestry Commission (CONAFOR)

Juan Villa graduated as a Biologist from the University of Guadalajara, Jalisco, Mexico in 2006.

Currently, he is a Fire Technician in the "Fire Forest Prevention National Program" of Mexico and works for Mexico's National Forestry Commission" (CONAFOR).

Juan started his development on the fire management and public policies five years ago when he joined the "National Forestry Commission".

Since 2009 until 2011, Juan was part of the Jalisco Estate Fire Program, there he provided support for forest land's owners, to improve, encourage and implement activities to prevent wild fires. These activities have involved, on break lines, black lines, and crew equipment preparation. Such activities were performed and supported by the "PRONAFOR" (National Forestry Program) subsidies program. He also collaborated in other special programs, "PET" (Season Job Program), this program provided financial support and resources for people in poor or indigenous communities to perform the previously mentioned forestry activities. In addition he has fought in some local wildland fires, and has received specialized training.

During this period working in the *Jalisco's Fire Program*, in 2010, he participated as a firefighter type II, in the "Wildland Fire Resource Management and exchange program" between the state of Jalisco (Mexico) and the province of Alberta in Canada.

Since 2011, Juan has been working in CONAFOR´s headquarters. His current position is Chief of Technical Assistant for the Fire Program National Director. He has been part of several projects, among them are: Regional Centers of Fire Management, strategic planning activities, design new public policies and support to National Fire Forest Protection Direction during the fire season. In the same year, he traveled to Moscow, Russia to participate in the "Study-Course on Wildfires Management in the APEC Region".

Last year, (2013), Juan was in New Mexico, USA conducting prescribed burns, taking part in the "Exchange and Training in prescribed burns in Spanish speakers". On this same event, He was a member of the crew formed by participants and firefighters from different countries of Latin America. He also participated as an instructor in the "National Fire Course in Mexico" twice.

The current focus of his office is now to carry and support the upcoming fire season and the Regional Center's start of operations.

Marva Willey - Fuels Specialist, US Department of Agriculture, Forest Service, Pacific Southwest Region.

Marva has worked for the US Forest Service since 1984. She is currently a Fuels Specialist for the Pacific Southwest Region, out of Vallejo, California. She holds a BA in Geography (specializing in Resource and Environmental Management) from Central Washington University and completed the Technical Fire Management Curriculum (Colorado State University).

With a background that includes many aspects of fire management, Marva has a well-rounded view of the program. She has worked as a fuels specialist and wildland firefighter at the local ranger district level; fuels specialist, initial attack dispatcher, and assistant dispatch center manager at the local Forest level; and as the Intelligence Coordinator, Deputy Geographic Area Coordination Center (GACC) Manager (previously known as Emergency Operations Coordinator), Geographic Area Coordination Center Manager, and Fuels Specialist at the Forest Service Regional level. All her work has been in California.

Marva has served as the Forest Service Multi-Agency Coordination (MAC) representative for both the Northern and Southern California MAC groups, and was also the Coordinator for the Northern California MAC group. She was the Intelligence representative to the National Predictive Services Subcommittee for several years. For two years she was the GACC liaison/advisor to the California Wildfire Coordinating Group (CWCG). As a member of the SIT/209 redesign project, Marva was involved in improving the Incident Status Summary reporting program utilized for all-hazard incidents. She is a geographic area editor for the Wildland Fire Decision Support System (WFDSS). Marva has instructed a number of courses and has provided on the job training and mentoring for fuels specialists, dispatch personnel, intelligence specialists, GIS support personnel, and mobilization coordinators. She has been selected to serve as the Coordinator for the California Multi-Agency Coordination Group (CAL MAC).

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