

NOAA SARP, ASU and DEMA Workshop

Planning for Losses and Impacts Resulting from Changes in Extreme Weather Patterns

Flagstaff, AZ

May 12th, 2015



1. Overview

The joint NOAA SARP and ASU workshop “*Planning for Losses and Impacts Resulting from Changes in Extreme Weather Patterns*” was conducted in collaboration with Coconino County Department of Emergency Management and the Sustainability Program for the City of Flagstaff on May 12, 2015 in Flagstaff, Arizona. The purpose of the workshop was to gain an understanding of the planning perspectives of community stakeholders in reducing potential losses caused by extreme weather events, engage in a deeper dialogue about how this community currently views and plans for extreme weather events and what further information they need in order to understand potential hazards and impacts that could lead to effective plans and actions to lower the risk to lives, property, economy, and social well-being. The most significant findings of this workshop was the type of information this community needed: i) 2-10 year time scale, ii) forecasts with annual updates, and iii) digestible information with infographics using language stakeholders without a technical background could understand.

2. Background

Unusual climate patterns pose challenges for risk and emergency management planning because of the low frequency of extreme weather occurrence and varying impacts across different organization responsibilities. In recent years, unusual weather patterns have impacted the state of Arizona, not normally known for weather-driven disasters. The State has experienced prolonged drought, heavy snowfall events, heavy rainfall and flooding, early and extended fire seasons, and even large tornadoes. The losses from these events have reinvigorated the dialog about weather changes, planning processes and information needs with regard to hazards, cascade of impacts, vulnerability, communications and emergency and risk management.

The first stage of the NOAA SARP funded project established a baseline understanding of how the emergency and risk management communities perceive and plan for extreme weather in hopes of learning how climate information could effectively be infused. After a series of interviews with emergency managers, it became apparent that this community was mainly focused on preparing to respond to imminent events using short-term weather forecasts with some information coming from historical records of events. Planning for future events was

delegated to community mitigation planners to update five-year mitigation plans or create a new one if none existed.

Following observations of all-hazards mitigation planning meetings, the ASU team noticed that there was a substantial lack of climate information in the training program provided by the Federal Emergency Management Agency (FEMA) and in the planning meetings themselves. The group was expected to predict the probability of an event happening and the magnitude of impact it would have on the community without relevant climate information detailing potential frequency and magnitude. It became clear based on the variation of prioritizations amongst the group that these predictions were largely subjective; based on past experiences and beliefs rather than on factual data. Additionally, the team noticed that the majority of the participants involved in developing the mitigation plans were assigned to be there, and as such were largely apathetic about the process and the resulting plans. We hypothesized that, in order to create an effective plan, injecting correct information would not be sufficient; and relevant stakeholders, with adequate training and expertise would need to be present and involved in order to utilize this information effectively. Our team arranged a half-day workshop that brought key stakeholders, who we carefully considered, to be to the table, and engaged them in dialogue about loss, impacts, risk and planning. Stakeholders were interviewed prior to the workshop to assess their role in planning (to avoid duplication of roles and perspectives), and to gain their view of what the workshop objectives should be. Ultimately, the following groups were represented:

- Emergency & Risk Management
- First Responders
- Transportation Planning
- Large Private Business
- Utility Provider
- Sustainability
- Economic Development
- Public Works
- Non-Government Organization

Further, the representation spanned county, city, private and NGO jurisdictions.

3. Goals and Objectives

The interest in assembling this workshop stemmed from our team's prior observations of the FEMA prescribed mitigation process that suggests inclusion of climate change information as part of planning for extreme weather. Upon observing these mitigation meetings, we noticed that the planners did not embody all important stakeholders and that they seemed to lack experience with the mitigation process, despite the fact that most had attended training a day prior to the first meeting. We aimed to observe how the dialogue would change if the right participants were at the table. According to FEMA's mitigation training program, those present at the mitigation meetings should include Emergency Support Functions (ESFs), critical infrastructure, emergency and risk managers, in addition to any locally relevant NGOs and private sector representatives. The team hoped to learn how the interactions and thought processes would differ amongst the participants present at the workshop and the planners present at the all-hazards mitigation meetings.

The goal of the workshop was to elicit expert perspectives from each participant as to their own thinking on *loss, impacts, risk and planning* arising from extreme weather events.

The three objectives of the workshop were to:

- Articulate the meaning of weather-related loss from different stakeholders including an understanding of the scale, magnitude and categories of how such losses inform decision-making;
- Describe an initial look at a cascade of potential impacts to the local community from an array of weather scenarios; and
- Make recommendations to NOAA SARP and other stakeholders regarding prioritized information for assisting in long-term planning and to those in operational fields with regard to losses from changes in extreme weather events.

4. Methodology

The workshop was organized into four sessions: Session one was structured as a polling inquiry, designed to ascertain the general demographics of the participants and their initial views on long-term planning, broad definitions of loss and extreme weather, and the level of urgency with which the participants viewed potential impacts for extreme weather events.

The second session was a facilitated focus group where we delved deeper into the perspectives of loss, impacts, risk and planning. This session allowed us to understand how different organizations (e.g. the private sector, the sustainability office, fire, EM) and jurisdictions (County, municipal, private sector) were thinking about loss, risk, impacts, and planning. This session was intended to uncover both consistency of thinking as well as differences on issues underpinning an effective planning process.

The third session employed a scenario-based approach to connect participants to their operational concerns. In this session, a realistic weather scenario was posed and participants were asked to reflect on their definitions of risk and loss from the previous sessions in order to identify how a weather event could result in a cascade of impacts of importance to their organization. This session also aimed to demonstrate the broad extent of impacts, how they are interconnected, and which issues were of primary concern to the community partners. The scenario chosen was a large wildfire resulting from prolonged drought, followed by flooding from monsoon rains.

In light of the exposure to extreme weather highlighted in the previous three sessions, the final session asked the participants to focus on planning for extreme weather, especially with respect to potential changes in patterns of events and the exacerbation of impacts and losses. This session was open-ended brainstorming to elicit the mode and content of climate information needed to confidently, competently and comfortably plan for changing patterns in extreme weather events. This session of the workshop was largely unstructured to allow for a free-flow of ideas, passions, and recommendations.

5. Findings

5.1 Perceptions of extreme weather events

- **The initial polling of the participants revealed that half of those present viewed the effects of extreme weather events as “minor impacts” and none of the participants concluded that impacts had the potential to be “devastating”.** Participants appeared divided on prioritization of mitigation planning when polling inquiries were utilized; roughly half indicated planning was “extremely” or “very” important while the other half asserted that it was only “somewhat” important.

- **When given the opportunity to explain and contextualize through discussions, participants seemed to come to a consensus that extreme weather events exerted a high impact on their organizations.** This differed from the results derived from a polling question, which asked participants to categorize how important they believed planning for the impacts of extreme weather was.

- **While death/injury to people was considered the most severe impact of an extreme event, discussion revealed that participants believed it to be an infrequent occurrence.** Few decision-makers felt death or injury to people was a typical consequence of extreme weather events. Higher priority impact planning focuses on the destruction of property or infrastructure that could impact the well-being of people.

5.2 Perspectives of extreme weather events across sectors

- **Organizational job responsibilities played a role in varied perceptions and prioritization of mitigating against loss resulting from extreme weather events.**

Classification of loss revolved around 1) definition of the term ‘extreme’, 2) frequency of an event’s occurrence, 3) duration of impacts (e.g. road and business closures, and impacts on income and revenue), 4) magnitude (especially if event was out of the realm of expectations) and 5) impact on people, compared to an event where no human population was present.

- **Business sector participants cited multiple economic concerns such as loss of employee time, decreased productivity, and delay of deliveries.** Those present mentioned an example from 2012, during which winds and blowing dust closed I-40 frequently. These events had a tremendous impact on travel and commerce and validated the thinking that shifting climate patterns have the potential to greatly distress the private sector, and ultimately the economy, in Flagstaff.

- **Risk management planning is focused on insuring government or private sector assets. Acknowledging and planning for changes to extreme weather frequency, magnitude, and durations were not found to be high on their planning priorities.** Risk managers presently approach their job by transferring the risk to insurers, though project planning would likely occur if reliable, actionable information were available to indicate that avoidance versus transferal was feasible.

- **First responders' planning priorities were focused on developing capabilities to respond to short-term (less than 1 year) disaster occurrence with a reasonable guess as to what impacts may be caused by all hazards.** Intermediate (2-10 year) or longer planning of extreme weather is not a priority for this group.

5.3 Perceptions of losses due to extreme weather events

- **Initial perspectives showed a clear majority of participants associated loss with effects on people, while few people focused on loss of operational capacity.** Polling elicitation showed that participants defined “loss” from extreme weather events in terms of impacts on their community, more specifically, in terms of effects on people (as opposed to effects on infrastructure or dollars). Loss was ultimately more about death or bodily harm to people, that mattered the most and would need to be avoided as much as possible. The example of the Schultz fire and the loss of lives were discussed at length including long-term impacts and recovery efforts to the county costing millions of dollars.

- **Participants concluded that extreme weather events could cause great economic distress, potentially leading to significant changes in utilization of certain industries (i.e. environmental tourism and recreation).** Business closures, loss of employees, loss of revenue, decreased bond ratings, loss of employment, and decreased recreation and tourism were all impacts thought to arise from an extreme weather event. Further, a wildfire in one of the major recreational areas would cause a significant blow to Flagstaff’s revenue in addition to causing stress on the community, the environment and the people who reside there year-round.

- **Participants considered loss through an array of time frames and across several sectors.** Facilitated discussion supplied examples including 1) Dengue fever in Phoenix, if warming trend continued, could spread to Coconino County; 2) Wildfires—impact on several sectors including public health, transportation, and recreation and tourism; and 3) Uncharacteristic heat waves in Flagstaff (temperatures in the 90-100 degree Fahrenheit range) for which the city was not prepared.

5.4 Cascading impacts and feedback loops

- **After exploring the cascade of impacts, participants agreed that extreme weather events have the potential to disturb infrastructure, the economy, people and the social well-being of the community.** The major components the participants thought would be impacted by an extreme weather event (using the example of wildfire), were the community, people, the environment, businesses, and transportation. Analysis from the extreme weather scenario activity revealed that these five major components are all intrinsically connected, indicating that if one of these facets were disturbed due to an extreme weather event, the other four would also be affected.

- **Participants believed, almost unanimously, that compromised transportation could lead to “disaster” because of its effects on the movement of materials and people through a cascade of impacts.** A representative from the private sector gave examples of impacts obstructed roads could have on the well-being of the company; he cited inability to

ship out manufactured supplies, cascading impacts of closing the enterprise for multiple days, and a potential relocation of primary operations offices resulting from inaccessible roads.

- **Given that power outages and damaged Internet pathways were determined to have serious implications for the community, participants agreed that planning efforts to make these services more resilient could become a priority if they were provided with climate information detailing duration, magnitude and probable frequency of events.**

An employee of a power company gave a couple examples of disruptions that would occur if Flagstaff's Internet pathway were disconnected including: a halt to internet communication, and the inability to use credit and debit cards for purchases. Additionally, power outages have important implications for hospitals and nursing homes in which some patients are on life support or require medication that must be kept at a certain temperature.

It was noted that this perceived shift in prioritization of mitigation planning resulted from the extreme weather scenario activity, during which, participants discussed the impacts a wildfire could have on each individual department. This created a sort of a feedback loop as the participants considered not only the individual impacts of their own departments but, how the impacts of another sector could worsen the effects they had to deal with.

- **Participants expressed concern regarding impacts climate change could have on water availability in two scenarios: 1) extended drought resulting in an acute water shortage leading to human health or economic hardship, and 2) extended power outages resulting from extreme event (flood, fire, ice) preventing pumping of fresh water or movement of sewage.** Community planners are very attuned to the cascade of impacts resulting from water shortage and are very interested in climate change in this regard. Further, issues with water served as another example of how interconnected the different sectors are and how one area feeds back to other sectors. This view differs from what is typical of current mitigation planning practices in which each department plans for their own department without considering outside factors that will likely be at play.

5.5 Prioritization of mitigation planning

- **Length of time and experiences in the jurisdiction may dictate how mitigation planning is prioritized.** When surveyed, the group revealed that about half had been in Flagstaff for six years or more while the other half had lived there for three years or less. This is noteworthy because, in absence of first-hand knowledge of the extreme weather events and climate data in the appropriate time frame, decision makers are forced to rely on second-hand knowledge or their own past experiences. Polling of the group revealed that 35% of decision makers from various organizations believed the biggest barrier to planning for extreme weather impacts was that the consequences were not significant enough to prioritize. This seems to mirror the response to a question regarding the number of extreme weather events participants had experienced: 35% experienced 1-2 extreme weather events in the Flagstaff/Coconino County area while only 14% had experienced more than eight. These data are consistent with the idea that length of experiences in the jurisdiction influence prioritization of mitigation strategies.

5.6 The risk paradox

- **Participants had difficulty articulating their view on how risk was connected to loss and impacts, the effect of which was an inability to define what exact information was needed and how it could affect the planning process.** The facilitated discussion and brainstorming sessions of the workshop were tailored to help us understand the stakeholders' thinking processes. Throughout these sessions, our team prodded participants to explain why certain losses were more significant than others and why certain impacts were worth mitigating while others were not. The goal of these queries was to gain an understanding of how these stakeholders were identifying risk. Though many anecdotes were offered regarding loss and impacts, a lot of ambiguity surrounds classification of risk.

5.7 Timeframes regarding mitigation planning and climate guidance

- **The ideal time scale for climate information was agreed to be 2-10 years into the future as this coincides with budget and planning timelines.** The participants asserted that in their organizations, information is not actionable if it does not fall within their budget and

planning cycles. The timeframe of climate information this group needs in order to plan would be 2, 5, & 10 years into the future based on what the participants voiced during the facilitated discussion and brainstorming sessions. Currently, no forecasts, projections, or predictions exist that address the time frames requested by participants in the workshop.

5.8 Information deficiencies for mitigation planning

- **According to polling inquiry, insufficient information regarding hazards was considered one of the major barriers to planning for extreme weather events.** Besides the belief by some that consequences of extreme weather lack significance, about one third of the group counted lack of information as a major barrier to planning.

- **Communication and comprehension of climate information are crucial to assist with mitigation and adaptation strategies.** With regard to communication of climate information, participants suggested criteria they believed that would allow for greater comprehension of climate information; 1) Digestible information, using language people can understand (fourth grade level recommended); 2) The most important information should be conveyed through infographics; and 3) Technical details should be appended or supplied as links only. One participant acknowledged that when it comes to asking his organization for resources necessary to mitigate, the climate information he is supplied with needs to be in a form that is understandable to both him and his decision-maker. This was seen as a critical issue as many working at the policy level do not have a technical background or expertise.

- **Connecting the impacts of extreme weather events to stakeholders in a way that makes them care, was thought to be more effective than data or statistics when attempting to increase prioritization of long-term planning.** Discussion of recent disasters (e.g. Schultz fire; Yarnell fire) allow for detailed discussions of such events and their impacts that mere data cannot. Associating events with a specific place has more emotional impact and therefore holds greater weight.

5.9 What “we” want: stakeholder requests

- **Stakeholders requested annual updates of climate guidance as information becomes more precise and accurate in order to increase relevance and applicability to planning.**

During the brainstorming session, participants in the workshop agreed that if they received climate guidance in the preferred timeframe (2, 5, and 10 years), they would like updates to this information. This would allow an increased understanding of the data while supplying a context and trends that they can become familiar with. The participants asserted that using an iterative process would allow them to gauge the accuracy of the information they were being given, allowing them to build confidence in the source of the information. Essentially, they want a baseline of what to plan for in years to come with the ability to attain more focused and detailed planning information as time went on.

Engaging the planning community with regular updates to their forecasts will form a trusting and familiar relationship between the climate science community and mitigation planners. This added involvement and feedback could ultimately increase ownership of mitigation plans in the operations community while allowing climate experts to refine their data collection and analysis methods.

- **At the spatial level, climate guidance provided for the city or county was considered to be more useful to prevent extrapolation or misinterpretation by non-experts.** Data at the state and regional level is not as helpful or specific as data at the municipal or county level and therefore, not as useful. (The team recognizes that NOAA cannot necessarily provide information at that spatial resolution, and that local experts can be utilized to scale the information down to this jurisdictional level).

- **The level of explanation required to understand climate information varied amongst stakeholders** owing to different levels of experience with climate information, their respective job descriptions, backgrounds, and responsibilities. For a select group of stakeholders, a discussion (similar to forecast discussions, but not as technical) that accompanies the information that NOAA provides is just as important as the climate guidance itself. This additional information gives some consumers a greater understanding of

how decisions were made, and consequently foster a higher level of trust for the source of information.

6. Recommendations:

6.1 In order to improve ongoing mitigation planning, NOAA should attempt to supply the planning community with climate guidance that includes a time scale of 2-10 years; information regarding frequency, duration, and magnitude of extreme weather events; and any other actionable climate information.

- The all-hazards mitigation process lacks climate information that would allow the creation of an effective plan. In addition to adjusting the time scale of information so that it coincides with planning and budget cycles, information about the hazards themselves including frequency of occurrence, duration, and magnitude of the hazards are critical to the efficacy of the plan. It has been established that this information is most useful when it comes at the county or municipal level. [Note: However, it is suggested that NOAA provides predictions at the regional level. With this information, local experts can make interpretations specific to their respective counties and municipalities. Further, efforts should make sure that communication of this information to planners is done in a manner that a non-expert could easily comprehend and explain to a decision-maker (e.g. using infographics and disseminating information at the 4th grade level).]

6.2 An assessment of the current mitigation planning practices is needed to update the process, the information needed, availability of expertise, and current training procedures.

- Although significant issues exist around the lack of climate information in the mitigation process, it is equally important that the process itself undergo a series of changes. The training of persons involved in the process needs to be improved such that the participants in the planning process have the skill sets to understand risk, vulnerability and impacts of hazards pertinent to their fields. Without revision of the process, the insertion of actionable climate information will not greatly alter the resulting outcomes. For this reason, FEMA may need to reexamine their training

protocols as they relate to mitigation if they hope to make progress in planning for climate change.

6.3 An improved understanding of how planners incorporate hazards, vulnerabilities and impacts into their understanding of risk is critical to increase the efficacy of information dissemination strategies.

- Due to the significant ambiguity that surrounds the process by which planners define risk, steps should be taken to understand the type of climate guidance this community needs in order to prioritize mitigation planning with the appropriate amount of urgency.

6.4 Establishing a direct line of communication between consumers of climate information/guidance and those providing it would allow for enhanced understanding of climate information and potentially improve precision and accuracy of data.

- Setting up a direct line of communication between the planning and climate science communities eliminates guesswork for both parties and could ultimately result in increased trust and accountability. This straightforward system could also help increase buy-in, currently lacking, in the mitigation process. If the climate science community is able to see that their guidance has a direct effect on the mitigation measures implemented by the planning community, it will likely motivate them to continually adjust their techniques to improve precision and accuracy. Conversely, the planning community will increasingly trust the source of the climate guidance if they are able to see a trend of increasing accuracy.

6.5 Findings of community planning processes and information use needs to be confirmed at a larger scale to help improve the infusion of climate information for mitigation planning.

- Variations in perspectives, job descriptions, level of experiences and locations may point to a need for different types of information. Further, more research is needed surrounding emotional buy-in to all-hazards mitigation planning in order to improve ownership of the planning process.

7. Long-Term Outcomes

The outcomes of this workshop are intended to benefit several stakeholder groups:

- National Oceanic and Atmospheric Administration (NOAA) about information needs;
- Emergency Management (EM) mitigation officers about the potential hazards and their impacts, and information that would improve planning, and
- Community leaders and other stakeholders about potential extreme weather hazards and potential changes that could result in significant community impacts.

This guidance will enable information providers and users alike to assess what programs and planning changes may be required to improve the mitigation of potential weather impacts.

Acknowledgements

This workshop was conducted in collaboration with:

- The City of Flagstaff’s Sustainability Program
- The Coconino County Department of Emergency Management

A special thanks to those who participated in the workshop and helped our team develop an informative and interesting workshop:

- Arizona Public Services Co. (APS)
- The City of Flagstaff—City Manager’s Office
- The City of Flagstaff’s Economic Vitality Division
- The City of Flagstaff’s Fire Department
- The Coconino County Public Health Services District
- The Coconino County Public Works Department
- The Flagstaff Metropolitan Planning Organization
- Northern Arizona University
- The Red Cross Northern Arizona Chapter
- The Summit District Fire Department
- W.L Gore

NOAA SARP Team at ASU & AZ Dept. of Emergency and Military Affairs

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- Nancy Selover, Ph.D. AZ State Climatologist, and Research Professor, School of Geographical Sciences and Urban Planning, ASU
- Hana Putnam, B.Sc. (Research Associate), ASU
- Anthony Cox, Assist. Director, Operations and Coordination, AZ Dept. of Emergency and Military Affairs

Funded as part of the NOAA SARP project, “*Informing Emergency and Risk Management Climate Knowledge in Arid Regions,*” grant number NA14OAR43102