Job hazard abatement actions in both fuel management and suppression operations in Gran Canaria (Insular SW Spain) wild lands

Molina, DM[1], Pous, E[1], García, D[2], Blanco, J[2]

Abstract

It is necessary to adapt forestry and firefighting practices to Job Hazard Abatement Actions (JHAA). The purpose of a job hazard analysis is to ensure that potential hazards (i.e., related to a specific project or activity) are anticipated and abated prior to beginning work. Our study contributes to a more safe use of fire as tool (both prescribed fire and backfire) for both foresters and wildland firefighters. We have obtained valuable information mainly from field work and expert interviews in both public and private sector. We are currently implementing theses results in Gran Canaria. Being an insular territory of limited area, and having some 150 people working at the peak fire season in fire management allow us to have a complete application of this methodology and later to assess and validate the outcomes within a single fire season. Major results are:
- Identification of all possible tasks. Eventually, these tasks were grouped in jobs.
- Identification and assessment of major, possible Job Hazard Types (JHT) for every task, including some new JHT not yet reflected in our professional literature. We had to redefine there required professional profile or training (required courses, required knowledge, needed aptitude, training in best management actions, etc)
- We made modifications in standard Job Hazard checklists to accommodate the new hazards coming for the most extensive use of fire like smoke inhalation, loss of direction in dense smoke, etc.
- The proposal of improvement actions in the Job Hazard Plan (JHP) are: An Integrated management plan for JHAA. A specific set of actions for both prevention and control of Job Hazards. A new list of Personal Protection Equipment and Additional Personal Equipment. Criteria for selecting best applicants for each job position and criteria for its appropriate training plan. A specific plan to prevent job related sickness. Lastly, we have modified additional criteria such as: When can we consider that the standard work

[1] University of Lleida – Unidad de Fuegos Forestales, Av. Rovira Roure 191, Lleida 25198. 973 702 847, dmolina@pvcf.udl.es..

[2] Cabildo de Gran Canaria. C/ Profesor Agustín Millares Carlo, s/n. Edificio Insular 1, Primera Planta. E-35003 Las Palmas de Gran Canaria, Spain. dgarciam@grancanaria.com

conditions have changed? Or, when there is an imminent risk situation? This criteria will allow to take sound management decisions regarding choosing among an active action (i.e., backfire) or a defensive action (i.e., burning out, or even to escape to safe zone). It' is also intended to serve as an administrative tool to indicate when to make a new job risk assessment. Moreover, these criteria might establish the specific liabilities (tort, crime, administrative).
KEYWORDS: prescribed fire, backfire, job hazard, imminent risk situation

Introduction

In the last decades, wildland fires have change from a natural element to a dramatic phenomenon in many Mediterranean countries. Economic losses are high, however, the main issue here is that fires threaten human lives (Vélez, 2000). This puts a lot of pressure in both land managers and politicians. Different agencies have react increasing fire suppression resources without really solving the problem and somehow creating new ones (i.e., forest fuel build up, more fire suppression hazards as aircraft are more used and extreme fire behavior more common). All fire suppression organizations are facing today non-regular results: good fire years but also very bad years every five to ten years. Fire suppression crews are good or very good dealing with most fires. However, few forest fires escape and become very large. These are large wildland fire -LWF- events. We define LWF as a fire that presents a sustain fire behavior that it is beyond the suppression efforts of our fire fighters in direct attack or parallel attack. This might mean that we are doing something wrong in to our approach to fire management and some corrections may be convenient to accomplish. In the last decade in Canary Islands (Spain) LWFs are 0.6% of all forest fires but they account for 86.5% of the total area swept by fire. Subtropical Canary Islands are facing similar fire problems than Mediterranean countries although their fire season y longer and ending later (November).

To reverse this process, is to manage under sound ecological constrains, i.e., reducing forest fuel accumulation, using some fire as an ecological process (Molina, 2000a; Castellnou et al., 2002; Lloret, 2003). However, we have our forest in a critical situation and is difficult to mitigate it fast using fire as a sound tool (prescribed burning). It is necessary a high level of education and training to solve this (Martínez, 1997; Molina, 2000b; Martínez, 2001).

Five years ago, both prescribed burning and backfiring (suppression fires) were only traditional, low-tech tools used by rural inhabitants and occasionally by some foresters. On the contrary, today there is a recent, good level of education and training in both techniques: However, there is some opposition to these tools among urban public opinion. Contrary to other parts of Spain, in Gran Canaria (a major island in Canary Island) there is not resistant within the Forest Service supervisors to an increased use of both tools; therefore, its implementation is growing steadily. Today, both prescribed burning and suppression fires are only implemented by the

administration itself (or its companies of services) due to the level of expertise required, the assumed risk of fire escape, the unsure urban public opinion, and the severe legal (administrative) regulations.
In spite of the good level of education and training in both techniques, there are some aspects that need more work, i.e., issues related to job hazard mitigation and job health. The European Union (EU) regulation "directive 81/390" with its translation into national legislations has made employers truly responsible of their workers job hazard mitigation and job health. This includes Government Agencies (employers of fire workers). To fulfill this legal mandate, it is necessary to define job positions first. From job positions we study hazard and best preventive measures (Loscertales, 2002).
A major trouble is how to implement preventive measures in suppression actions because these are often discretional and we are not used to plan then ahead. Spanish legislation (coming form the EU mentioned "directive 81/390") excludes fire suppression although it states that it should have a specific legislation (not yet) within "directive 81/390" principles.

Today's Gran Canaria forest fire management (prevention and control)

This task is run by Cabildo Insular (local "county" Government). This has a Forest Service that manages fire prevention and control through two bodies:

a. Technical Services (engineers, crew bosses, workers)
b. Environmental Protection Officers (Area Supervisors and Officers)

However, a different unit (Department of Human Resources) plans Job Hazard Mitigation Actions. Department of Human Resources does this for the whole Cabildo Insular Administration. There is today a joint effort by Forest Service and Department of Human Resources to carry on a Job Hazard Abatement Actions centered mainly in prescribed fire and backfire operations.
The use of prescribe fire in Gran Canaria is not regulated in a specific norm. Since 2003, there are detailed prescribed burns. This year 2006, more than 100 ha will be treated by planned prescribed fires and some of them (35 ha) will be closed forests.
Suppression fires (SF) are part of the standard education and training programs in the Forest Service since 2002. Since then, there are 5 documented burn-out SFs, 1 documented high intensity SF, and zero safety burnt out (escape burnt out). There have been, also several minor burns to secure already controlled fire perimeters. There is not any a single incident, near-hit or accident reported in either SF or prescribed fires.
In this paper, we report the finding of our effort in providing technical assistance to Cabildo Insular (local "county" Government) under a contract agreement with our University.

This paper objectives

- to identify each job-type regarding a technical use of fire
- to asses the Job Hazard of each previously identify job-type and to propose JHM actions

- to establish best requirements for each job-type to get the best results as a Fire Management Agency
- to improve the management of the JHM
- to improve the complex management of diverse tasks within a single Agency goal
- to improve ergonomic use of some tools and equipments
- to set up human resources selection and an on-going training plan
- to set a specific health monitoring plan

Methods

We have used different edited material from the Forest Service as well as internal documents. Later, several visit to forest fire crew bases and administrative and communication offices. We interviewed at least two workers in each job category in detail. Both visits and interviews followed a standardized protocol. Interviews were carried out filling up a planned questionnaire adapted to the job position. Additionally, there were interviews to the chair of the policy on Job Hazard Mitigation (JHM), the chair of the Job Health Service (physician) and a trade union delegate.
The next action was to teach (this paper's authors) a 20-hour Forest Fire Management JHM course to almost (90% attendance) all Forest Service workers involved in Fire Management. We set up debates on different issues regarding their feeling regarding Job Hazard to each group of workers. We could get additional information not available in the previous interviews. We paid a lot of attention to explain the purpose of this course to get the most from the workers to be us able to make the better possible report.
Job Hazard Mitigation assessment was carried out following the method by Spanish "Instituto Nacional de Seguridad e Higiene en el Trabajo de España (Gómez-Cano, et al., 2001) as well as some modification by Pous & Molina (2005). This implies a semi-quantitative assessment of different issues: management, equipment, infrastructure, etc.
We have to identify every single risk factor and to assign its corresponding hazard. We have use the official (Social Security) list of professional illness in Spain. We have added 11 specific risks that could be possible to occur, i.e., worker lost of awareness of his location regarding risk elements (possible in a thick smoke environment).
Hazard assessment (HA) is categorized in five levels: Very High, High, Moderate, Low, and Very Low) as obtained crossing different levels of Risk (probability of a bad outcome to show up) and Severity (level of the damage or injure if exposed to risk)
Risk is assessed considering existing proactive (prevention) actions and how they match the legal requirements, and /or best management practices. We asses severity in regard to most common consequences of a given accident or professional health sickness. However, when there is no information in the professional literature, we have to use our best educated guesses along with the perception (or opinion) of the concerned workers

Lastly, to establish best requirements for each job, we have analyzed n detail both legal tasks assigned to that given job, and real responsibilities assumed by that given job. These requirements have five chapters:
- Required knowledge
- Required skills (leadership, manual skills …)
- Previous experience in that job
- Education (college degrees, specific driving licenses …)
- Desired attitudes

Many ideas exposed above are shaped after reading many fatal or near fatal forest fire reports (Rothermel, 1993; South Canyon Fire Investigation, 1994; Weick, 1995, USDA, 2001) and Beaver (2001) discussion on: "Evaluating risk and reward relationships in wildland firefighter safety"

Results and discussion

Job Hazard database

The Gran Canaria Forest Service does not have a sound Job Hazard database. It is true that accidents (injured workers) are documented and registered but in common for all workers in the local administration. Incidents and near-hits are seldom registered despite the fact that they are most times results of unsafe acts that we have to recognize. The tactics that may be most effective in meeting the agency control objectives may not be the best in terms of firefighter safety (Bawer, 2001). For a better understanding of fire fighter safety we need data on incidents and near-hits too.

Job-types

We have identified 20 Job-types within the 20 different job-categories in the Forest Service. In this paper, we report only those having responsibilities, often, in forest fire management.
There is a Forest Service chair supervising
a. Technical Services (engineers, crew bosses, fire fighters) including Presa and Bravo groups (suppression items)
b. Environmental Protection Officers (Area Supervisors and Officers)
Job-types (and number of workers of each one)
Technical Services

1. Forest Fire Supervisor (1)
2. Engineers
2.1. Fire Suppression Boss (4)
2.2. Forest Fire Analyst (2)
3. Crew Leader
3.1. C. Bravo Crew Leader (8)
3.2. C. Presa Crew Leader (6)
4. Crew Member
4.1. P. Bravo Crew Member (40)

4.2. P. Presa Crew Member (30)
5. Driver (of special vehicle) (13)
6. Lookout or Forest Fire Watcher (40)
7. Radio communication officer in CECOPIN (8)
8. Logistic officer (1)
9. Radio communication keeper (1)
10. Warehouse keeper (2)

Environmental Protection Officers
1. Inspector (1)
2. Area Supervisor (5)
3. Officer (20)

Job Hazard Analysis in each Job-type

There are diverse hazards but none of them "Very Severe" and only ten cases "Severe" as we show following:

- Environmental Protection Officers do have overlapping responsibilities with engineers and crew leaders in forest fire command duties. This could lead to bad coordination, accidents and frustration. Now, coordination is better due to recent role reassignments. There is a new fire cause investigation crew than provides new appealing tasks to Forest Rangers.
- Some 6% of workers that may end up in technical use of fire (both prescribed burning and suppression fires) do not have specific training yet.
- There is not a pre-planned action plan in case of emergency (i.e., burning out to escape, accident, and entrapment)
- There is a lack of standardized preplanned procedures in technical use of fire (both prescribed burning and suppression fires). Workers do follow instructions given on site.
- When planning actions involving the technical use of fire, Job Hazard Mitigation Actions are not specifically account for.
- There is not a sound Job Hazard database. Incidents and near-hits are seldom registered despite the fact that they are most times results of unsafe acts that we have to recognize. There is only detailed reports on fatal or near fatal accidents.
- Personal Protection Equipment and additional equipment do have some defects (i.e., some protections clothes are limiting transpiration). Additionally, there is not guaranteed repositions but are this replaced on workers demand. Fire crews have been reshaped and have received, as an additional task, the fire tools and machinery management.

- Both fuel transport and purchase for burning operations are carried out in as "unsafe" manner (i.e., non leak proved containers, fuel containers on the full sun truck roof, drip torches are fueled to close to heat sources). Today this point is solved.

- Communication is not ensure either in all areas in the island or at every moment. This is because either some areas are out of communication coverage or some workers do not have communication equipment assigned to them. Today, the Forest Service is writing a comprehensive communication service, that includes issues like GPS. An additional technical coordination center has just opened that would help in communication effectiveness.

- Weather monitoring and forecast, in both prescribed burning and suppression fires, is not good enough because Spanish National Institute of Meteorology is providing much worse service that in mainland Spain. This leads to an increase in safety margin planned by forest engineers and, therefore, compromising efficient suppression and fuel management actions. Job Hazard levels do not differ from suppression and fuel management actions. However, as mentioned above, Spanish legislation treats them very differently. Today a new net of meteorological weather station is under construction for the whole Island. And portable meteorological units are bought to be used by the forest rangers.

Main modifications in the Job Hazard Mitigation Plan

Management of Job Hazard Mitigation Actions

In Spain, the management of Job Hazard Mitigation Actions (JHMAs) has to follow Law 31/1995. In doing so, Gran Canaria Forest service has opted by a mixed system. It has its own JHMA service for safety, hygiene, and health monitoring. And, it has contracted an external service for ergonomics and psycho-sociology. Before, contracting University of Lleida (this authors) there was not a specific training in JHMA in wildland fire management. Therefore, decisions were taken following Spanish Ministry of the Environment recommendations. This lack of specific training has allowed an easy field to discomfort and there have been many formal workers complains regarding low involvement in JHMA of Forest Service. This conflict do not allow for an efficient accomplishment of either fuel management or fire control actions. This conflict has been partially resolved by appointing a Human Resources Supervisor within the Forest Service. Main modifications taken are:
- to establish an administrative supervisor (within Environmental Protection Officers) that chairs in non-command actions (i.e., managing equipments)
- to change from seasonal contracts to full year contracts. This means a better investing on training, personal protection equipment, …

Personal Protection Equipment among different workers

This chapter is under revision, not yet finished. (see http://www.etsea2.udl.es/~UFF/2_courses/pages/wfmmd.htm)

Specific Workers Training Plan

We propose 3 different levels of specific training and additional education (see http://www.etsea2.udl.es/~UFF/2_courses/pages/wfmmd.htm)

Specific Workers Health Monitoring Plan

There is an internal Health Monitoring Service for the whole Gran Canaria Cabildo Insular employees. However, it has not been addressed that workers in suppression actions and also is demanding forestry operations do require a more detailed health monitoring that other workers (i.e., a one visit a year fits all policy is not adequate). Therefore, we propose these improvements: Health Monitoring would be implemented before contract date, and later annually but right after fire seasons ends up (November) to be able to detect any significant weakening in the workers' health conditions. For more details, see http://www.etsea2.udl.es/~UFF/2_courses/pages/wfmmd.htm)

Additional measures in Job Hazard Mitigation for prescribed burning operations and suppression fire use

When should Workers Health Monitoring be refreshed?

When working conditions change significantly, we have to do a renewed JHM assessment. We suggest that a new JHM assessment should be carry out:
- Whenever worker changes from suppression work to fuel management and vice versa.
- Whenever worker changes from its bio-geographic area (i.e., when moved to help in another island).
- Worker changes from day shift to day/night shift.
- Today, a new JHM assessment is required in whenever this changes happens to occur

When do we reach "imminent hazard red signal"?

In this case, legislation states that we must make a new job hazard assessment. In non-suppression actions, this "imminent hazard red signal" is reached when the safety conditions determined by the engineer in charge do change (disappear). In a prescribed burn, this happens when we moved out of the prescription window that has to be written with JHM actions properly considered. In that situation, any worker or any Environment Protection Officer may stop the burning process (following Spanish Law 31/1995).
In suppression actions this is more complex.

Conclusions

In a first assessment, we consider that the level of worker's job hazard (i.e., only one "very severe level" and ten "severe" items regarding JH issues). Some major tasks such as lookout or fire analyst are not defined in full detail.
Main changes suggested (to be implemented in less than a year time) are:
- To clarify responsibilities among job-types

This has been done satisfactorily. There is a new fire crews' layout after addressing the recommendations by Pous and Molina (2006).

- To inform each worker about specific job hazard and main tasks to mitigate them. This has been accomplished by means of a specific training course and latter work on specific mitigation tasks.
- To inform each worker about Basic Life Support (BLS). This has been done satisfactorily.
- To establish Standard Work Procedures (i.e., prescribed burning under tree cover, backfiring operations) These SWP should define imminent risk situations and escape process.
- To add a specific chapter on JHM in all Forest Fire Prescribed Burn Plan. This has to include: SWPs, Personal Protection Equipment, escaping routs … This has been done satisfactorily.
- To establish a system of data collection to ensure that all pertinent information on incidents, near-hits and accidents are register.
- To improve Personal Protection Equipment- PPE (i.e., a new generation fire-shelter for all combat crew member, flares to escape entrapments, ergonomic water canteen). This has been done satisfactorily in some items.
- To improve PPE replacements, maintenance, and cleaning
- To improve fuel transport and handling. This has been done satisfactorily.
- To improve the communication system to cover the whole island, in a reliable manner, and allowing emergency calls. There is already a project to address this issue soon.
- To locate a GPS device in every combat vehicle. There is already a project to address this issue soon.
- To set up an automatic net of remote weather stations to represent all climatic zones in the island. This has been done satisfactorily.
- To provide a portable weather station to all combat crews. This has been done satisfactorily.

There is a need of certification (education and training) to participate in actions using fire (both prescribed burning and suppression fires). There should be three different levels of certification (crew member, crew leader and engineer)

It is necessary a specific Spanish National regulation in backfiring operations. Lastly, in firing operations (both prescribed fires and backing fires) we strongly recommend that a properly certified worker is present to control that safety issues are fulfilled in the sense of "safety officer" in USA (Fischer, 1987; Moos y Kvitzau, 1988). If this worker is not available, this task has to be assumed by either the fire boss or the fire analyst.

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