



FIRE CONTROL AND TRADITIONAL FORESTRY IN PINE PLANTATIONS



Owen Donovan

'06 National Overseas Fellowship

Fellowship funded by the
Department of Education, Employment
and Workplace Relations
Commonwealth Government



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Chapter 1

Acknowledgements

1. Support

I would like to thank the following individuals and organisations who gave generously of their time and their expertise to assist, advise and guide me throughout the Fellowship program.

1.1 Awarding Body

International Specialised Skills Institute (ISS Institute)

Over twenty years ago Carolynne Bourne AM recognised the need to work holistically across occupations and industry sectors and build bridges along the way - filling skill deficiencies and skill shortages; valuing the trades as equal, but different to professional disciplines; using 'design' (problem solving) as a critical factor in all aspects of work; working in collaboration and enhancing communication (trades and professional); learning from the past and other contemporary cultures, then transposing those skills, knowledge and insights, where appropriate, into today's businesses.

In 1990 she met Sir James Gobbo AC, CVO who was seeking to address a critical need in Australia, namely the retention and enhancement of skills and knowledge of artisans and tradesmen and joined Sir James as the founding CEO of International Specialised Skills Institute (ISS Institute).

ISS Institute has successfully functioned as an independent, national organisation, committed to identifying skill deficiencies through market research and meeting associated need through its 'Overseas Skill Acquisition Plan (Fellowship Program)', education and training activities and consultancy services.

Based on experience and acute insights gained over nearly two decades, ISS Institute has developed extensive expertise in the development of the knowledge economy encompassing high level skills and knowledge underpinned by design and innovation across industries and their related occupations.

ISS Institute has an extensive record in assisting Government and non-Government organisations, firms, industry bodies, professional associations and education and training institutions to identify skills deficiencies and deliver practical solutions.

ISS Institute has been integral to the success of organisations and individuals seeking solutions with regard to optimising and enhancing existing abilities and establishing new directions and strategies for workplace practices.

A key initiative of ISS Institute is the 'Overseas Skills Acquisition Plan (Fellowship Program)'. The ISS Institute Fellowships are an exciting and unique opportunity for Australians to enhance their capabilities.

The Fellowship Program is the means by which skill and knowledge gaps are identified and verified, and then matched to overseas organisations where the skills can be acquired. Australians are presented with an opportunity to travel overseas, or for experts to travel to Australia. Importantly, Fellows must pass on what they have learnt through their Report and participate in a range of education and training activities and events such as workshops, lectures, seminars, forums, exhibitions and conferences.

The activities place these capabilities, plus insights (attitudinal change), into the minds and hands of those that use them - trades and professional people alike - the multiplier effect. Individuals gain; industry and businesses gain; the Australian community gains economically.

For further information contact Ms Carolynne Bourne AM, CEO

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Chapter 1

Acknowledgements

1.2 Fellowship Sponsors

Department of Education, Science and Training (DEST)

DEST provides national leadership and works in collaboration with the States and Territories, industry, other agencies and the community in support of the Government's objectives. DEST develops and implements policies that ensure the continuing relevance of education, science and training to contemporary needs and the growing requirement for lifelong learning. They also ensure high quality and value for money when delivering Government funded programs.

1.3 Fellowship Supporters

Department of Environment and Conservation (DEC)

In addition to DEST I would like to acknowledge the support of the Department of Environment and Conservation DEC (formerly known as Conservation and Land Management or CALM) for allowing me the time to undertake the Fellowship and compile this report.

Paul Brown, District Manager Swan Coastal Office.

Rick Sneeuwjagt, Manager DEC Fire.

Paul Jones, Manager Sustainable Forest Management Division In Australia.

Thanks especially to my wife Rebecca and children Evan and Rachel for releasing me across the world, to get my fix of pine forest experience, after putting up with twenty years of the one-eyed pine forester in Australia.

Thanks also to:

- Forest Products Commission
- Dave Guille, Operations Manager Plantations Branch.
- South West Fire Units
- Glynn Yates and Colin Giles.
- FESA (Fire and Emergency Service Authority.)
- Wayne Jones, Manager Perth North.

Chapter 2

About the Fellow

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Qualifications

Diploma in Conservation and Land Management 1988.

Over a career of more than twenty years Owen Donovan has gained experience in forest fire control in eucalyptus and pinus forests as well as grasslands, coastal heath and farmlands. He has also worked in eucalypt and pine harvesting with significant experience in the establishment of tree crops in low rainfall areas.

Owen joined the Department of Conservation and Land Management (formerly the Forests Department) in 1986 working in the crew at the Wanneroo, Gnangara and Yanchep depots. After graduating as a forest ranger in 1989 he spent six years working in Native forest harvesting in the Jarrah Forests of the Mundaring and Jarrahdale area. In 1995 He moved into tree crop establishment with the Forests Products Commission. This was part of a commercial landcare planting that saw over 10,000 hectares of mainly Pinus pinaster established on farms north and east of Perth. In 2004 he took up the position of Sustainable Forest Management coordinator in the Department Of Environment and Conservation Swan Coastal District. With all his time in forestry he has been actively involved in fire control and controlled burning in pine and eucalypt forests.

Having worked for twenty years in or around plantations, he has a keen interest in the protection and management of Pinus pinaster plantations and also a keen interest in the development of tree crops for lower rainfall areas were commercial tree crop can help combat Western Australia massive salinity problem.

Donovan is also involved in the continual improvement of his organisations' ability to tackle wild fires (focused on plantation areas). As fire is the single greatest threat to any tree crop, the better it can be attacked or the impact reduced, the greater the resource available for the grower to market.

Chapter 3

The Fellowship Program

3. Aim of the Fellowship

The purpose of the Fellowship was to undertake an overseas study program in Pine forest fire control in France, Spain and Portugal, to gain knowledge and observe methods used to combat wildfires in mainly pinus forests.

- 3.1** Obtain information on the suitability and effectiveness of the latest equipment available for pine forest fire control. From heavy machinery such as tracked machines through to 4WD trucks and hand tools.
- 3.2** Observe how other fire control organizations are structured to determine the most efficient command structure. Also assess how professional and volunteer organizations work together.
- 3.3** Find the most suitable P.P.E.(Personal Protective Equipment)for forest fire fighting. The essential safety items such as helmets, boots, protective clothing, smoke respirators, smoke goggles and gloves.
- 3.4** Assess how effective the training systems are that the European organizations use based around pine forest fires. Training for both professionals/staff and volunteer fire fighters.
- 3.5** Obtain information on the establishment and management of pine forests with the limited use of chemicals. Many plantation areas in Western Australia are also key Public drinking water sources. A reduction on pesticide use can only increase the acceptance of these plantation areas on such a valuable water source.
- 3.6** Observe forest-harvesting techniques to understand how the Europeans minimize waste from commercial operations.
- 3.7** Observe improvements in fire and forest control to improve the way we manage forests, by bringing this information back to Australia
- 3.8** Encourage European foresters to visit Australia to develop better lines of communication between like organisations (forester exchange program).

Chapter 4

The Australian Context

4.1 A brief description of the industry

The benefits to Australia in increasing or improving our training in plantation fire control are immense. Wild fire is the single biggest risk /threat to the viability of Australia's plantation industry. It is the one risk factor that cannot be fully planned or prepared for due to the unpredictable nature of fire. At some stage almost every forest is under risk from complete destruction due to wildfire. The training and equipment that either professional or volunteer fire fighters have access to makes the difference between insignificant fires or catastrophic loss of resource and in the worst case, loss of human life.

Fire control training, through either structured courses or on the job mentoring backed up with well maintained and appropriate equipment, makes for a the foundation of a competent fire fighting force. To coordinate and implement such a force requires a command structure that above all provides good communication, clear and direct operational control, for the deployment of men and machinery. While Australian fire crews and foresters have great experience and training with Eucalyptus forest fire control, plantation fire experience is generally limited as the great majority of fires occur in Eucalypt forest.

4.2 Peak Organisations. Key Representatives

Government

Department of Environment and Conservation DEC
 Fire and Emergency Service Authority of WA
 Bush Fire Brigade Division FESA
 Forest Products Commission FPC
 CSIRO
 CRC into Bushfire Control.
 Shire of Gin Gin
 City of Swan
 City of Wanneroo

Business

Integrated Tree Cropping ITC
 South West Fire Units
 Mercury Fire

Professional Associations

Institute of Foresters

In Australia there are many different organizations across the states that are involved in fire control. They can be broadly broken into three main streams based the type of fire they respond to: structural, grass and forest.

Professional Fire Fighters

These are the people that the general public think of when they hear the word fire fighter/ fireman. They are equipped with highly specialized vehicles (the red trucks) for building and structural fires and rescue (generally car accident rescue) and are all mainly centered in the major urban areas. These people are highly trained in structural fires therefore their vehicles

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are generally 2WD and not suitable for forest or grass fires. In WA this organization is the Fire and Rescue Services FRS (part of the Fire and Emergency Services Agency, FESA).

Volunteer Brigades

These brigades are typically landowners (farmers) based in Rural and semi rural areas that function to basically protect their own property or that of their neighbors. Their equipment can be farmer owned and basic units through to quite modern 4WD heavy fleet (especially closer to urban areas). The majority of their work and training is based around grass fires but can also include forest fires and some limited structural fires. In WA these crews are part of the FESA organization but in many states (such as Victoria and New South Wales) are part of the Country Fire Association (CFA).

Land Management Organisations

Each state has its own configuration of Government Department/s that manage state owned lands such as National Parks, State Forest, Plantation on State land and Nature Reserves. For twenty years in WA this has been the Department of Conservation and Land Management (CALM) formerly the Forest Department. These organizations have a large number of personnel to draw upon for fire control and often have large fleets of heavy machinery (bulldozers, front end loaders) and vehicles all 4WD and modified for forest use. Their people are all trained and experienced in forest fire control and grass fires but rarely in structural or rescue situations.

Fire fighting training for all these organizations is not available through any TAFE or University courses in WA.

At present forest fire training is only available through internal courses provided by the Dept of Department of Conservation and Land Management. The majority of forest fire training involves on the job training through mentoring and coaching from experienced staff.

Often the most effective method of training is through staff gaining experience in carrying out controlled burns. The experience in the use of the command structure and methods of lighting and fighting fire from controlled burns can then be applied at wildfires.

Chapter 5

Identifying the Skill Gap

The Skills / Knowledge Gaps

There are currently skills and knowledge gaps in Australian fire control in plantations. This is due partly to Australia putting almost all their efforts into fire control in eucalyptus forests (where the majority of fires occur).

All Australian forest managers dread the thought of fighting major pine fires due to intense fire behavior and difficulty of access. Almost all plantations are managed on a 'no planned fire regime', which gives fire fighters no real hands on training on how to deal with plantation fires.

This is compounded by Australian forest managers having no real tools to predict pine fire rates of spread as all research activities are carried out in Eucalypt forest areas e.g. Project VESTA (Eucalypt forest fire rates of spread trial between CALM and CSIRO in 2000).

In Europe, the French Forests Department and Fire department have invested greatly in fire research in pine forests to better predict fire intensity and rates of spread. This has enabled them to develop more effective methods of the best method to attack a fire and enabled them to develop state of the art fire fighting equipment and control methods.

The Portuguese are adept at sustainable forest management with minimal if any chemical inputs (a feat that we don't seem to be able to achieve in Australia). The Pine forest at Lieria (just north of Lisbon) has been continually managed and harvested for over 400 years. This forest area not only provides for forest products but functions as a popular recreation area. Utilization in this forest is also outstanding in that at the end of a rotation not only the trees are removed but stumps and all debris to produce fuel wood or charcoal.

Specific Skills Gaps are:

- Knowledge required in order for Australian forest firefighters to adopt the latest fire fighting equipment.
- Ability to assess pine forest fire research to find up to date fire behavioral information.
- Skills to facilitate greater utilization of forest resources, with methods such as alternative harvesting methods.
- Skills to assist in improved soil conservation, through reduced chemical inputs.

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The overseas program was purposefully designed to explore the identified skills and knowledge gaps and obtain the information necessary to return to Australia equipped with the knowledge and ideas in order to promote and improve Fire Control in pine plantations in Australia.

Program Content

The Fellowship enabled the fellow to visit a broad range of Organisations involved in fire control and forestry in vastly different terrain across three countries. The plan was to meet with as many key people involved in Forestry as possible and this was fulfilled as the contacts made had also arranged many formal and informal meetings on behalf of the fellow.

Meetings were held with many Department Chiefs and Land Managers and the following are the key people who clearly identified the main deficiencies that need addressing in Australia:

France

AFOCEL. Recherche appliquée pour le système forêt bois papier. France, Bordeaux, Domaine de Sivaillan-Les Lamberts, Molis en Médoc. www.afocel.fr
 Guillaume Chantre, Director Bordeaux station.
 Pierre Alazard, Senior Tree Breeder.
 Jean-Yves Fraysse, Forester in charge of Nursery and establishment research.
 Richard Emeyriate, Forester Exploitation.

AFOCEL is a research and study organisation in which the major objective is to improve the competitiveness of France's forestry sector and the supply security of its wood-using industries.

AFOCEL is privileged to be supported by the French pulp and paper industry to do research on one of its essential materials: wood; and is funded partly by industry and government.

AFOCEL's four fields of activity are:

Wood supply: harvesting forests, transportation and logistics, development of activities related to trees industrial wood and energy from biomass, economics and competitiveness.

Processes and Products: wood-process relationships

Forest: improving forests, biotechnology, sustainable management of forests

Territories: facilitating exchanges, forecasting

ARDFCI. Defense of Forest against Fire, France, Bordeaux, City centre. www.feudeforet.org
 Pierre Mace, Director ARDFCI.
 Julia Morin, Forest Engineer ARDFCI.

The Regional Association of Defense of the Forests against Fire, more commonly called ARDFCI AQUITANIAN. It is an association law 1901 which works to prevent the fire risk of forest on the Solid mass of the Moors of Gascogne.

ARDFCI has several key roles; To coordinate the programs of work suggested by the Authorized Property owners' syndicates (ASA) of DFCL, via the Departmental Unions.

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- To propose all studies, to constitute any ' think tank ' or any technical commission relating to the questions relating to a better protection of the forest solid masses and to the reinforcement of the action of DFCI about the departments concerned.
- To seek and collect finances for realising programs.
- To represent members based near regional, national and Community Authorities.

SDIS: Service Departmental d'Incendies et de Secours de la Gironde.
Lieutenant-colonel Dominique Bonjour, Chef du Groupement opération Prévision.
Captain Eloi le Mouillour. Fire Officer.

SDIS is the primary fire-fighting organisation in the Gironde area. SDIS respond to all urban and forest fire and also provide rescues for motor vehicle accidents and form part of an ambulance service in France. The organisation is based on a military structure and funded by the state. SDIS have over 1200 vehicles and 2000 professional fire fighters in the Gironde area. The Gironde District covers around 1 million hectares of farm and forest lands.

INRA: Institute National Research Association. France, Bordeaux, d'Arachon, INRA.
www.international.inra.fr
Jean-Micheal Carnus, Manager Forestry Research Bordeaux Station.
Christopher Ozirio, Director Atlantic Arc forestry group.

INRA is the French National research organisation similar to the CSIRO. INRA has 8,941 staff members, 14 research departments, 21 regional centers, strong scientific partnerships and a budget of €606 million (~\$1000 million AUD). INRA's results can be measured in terms of scientific publications, innovation and technology transfer, research training.

CAFSA: Cooperative Agricultural Forestry in the Sud Atlantic. Bordeaux, Cedex, France.
www.cafsa.fr
Henry Chaperon, Director.
Loic Cotton, Assistant Director Technique Charge Silviculture.

CAFSA is the principle grower cooperative for the pine forests in the Landes area. The organisation establishes around 12,000 hectares of forest a year and harvests approximately 45,000 hectares a year.

Spain

Santiago Perez Rubio, Chief of Forest Demarcation, Forest Engineer, Department of Environment, Valencia, Spain. Santiago Perez Rubio is a senior forester with the land management agency from Valencia and was a great host; providing translation services and functioning as a valuable guide and cultural advisor on my visit to Spain.

MATINSA. Maintenance de Infrastructure. Enrique Jardiel Poncela Madrid Spain.
Manuel Revuelta, Santa Cruz, Director Forestry Department.
Isidro Martin de Nicolas Garcia-Prado, Forest Engineer.

Matinsa is a major capital works company whose main business is the construction of roads, railways and major urban structures. The company is also involved in forestry activities such as fire control and forest silviculture throughout Spain.

Comunidad de Madrid (Bomberos), Parque central de Bomberos, Las Rozas, Madrid, Spain.

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Miguel Angel Beltran Gallardo, Chief of Forest Fire Control for Madrid (the State of Madrid).
Lourdes Alonso-Martirena Tornos, forester in charge of Bomberos fire Madrid.

The Comunidad de Madrid better known as Bomberos are the equivalent of the Australian fire fighters in red trucks. They are a mainly urban and rural fire fighting organisation who also control forest fire fighting in the state of Madrid (the forests department also has a large force that is primarily responsible for forest fire control and prevention).

Jose Antonio Suarez, Chief of Forests Department Fire Control for the state of Madrid.

The Forests Department for the state of Madrid employs over 400 staff for fire control (part of this force is employed through a contract with the Matinsa company).

INIA, Spanish National institute of Agricultural Research. Madrid Spain.

Ricardo Alia, Head of Forestry Research division. INIA is a national research organisation (similar to the CSIRO) The forestry division are currently DNA mapping several key pinus species to better identify difference between provenances.

Belen Vacas Vega, Forest Engineer in charge of Guadarrama State Forest, Madrid Region, Spain.

Portugal

Paulo Fernandes, Senior Fire control Researcher, University of Vila Real, Portugal. The University at Vila Real has a fire training module which offers the only structured course on the use of controlled burning in Portugal (and possibly in Europe).

Joao Melo Banderia Alliance Florestal, forester in charge of fire control. Porto Portugal.

Alliance Florestal (AFOCELCA) is a private forestry company that owns 200,000 hectares of mainly blue gum plantation in northern Portugal. The company employs its own fire fighting force to protect its assets.

Rita Matos Gomes Forester in charge. Forests Department Lieria Portugal. The Lieria Office of the forests department is responsible for managing 11,000 hectares of Pinus pinaster plantation that has been under a management plan system for over 250 years.

Susana Carneiro Forester with the Centro Pinus project, Oporto.

Centro Pinus: Association for the improvement of pine forests. Was created in 1998 by the main wood consumer industries, national forest authority and private landowners federation to solve the wood demand problem industry is facing.

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Findings

For ease of analysis, the following discussion has been organised around findings made in the three countries visited.

Cultural differences had the greatest impact on the differences between the methods of fire control in each country.

France

The areas visited in France were all within one hours drive of the city of Bordeaux which is approximately 400 kilometers south west of Paris.

Background

The Pine forest in the Bordeaux area is known as the Landes forest or Aquitaine-Gironde area and covers around one million hectares. The area is extremely flat and has a sandy soil that often has a water table at less than three meters from the surface.



Air photo of Landes forest

Some *Pinus pinaster* is thought to have existed in the Landes area thousands of years ago but the area only really became a “forest area” several hundred years ago when the French government started draining the swampy marshland areas, by bringing in Dutch drainage experts, and by encouraging the planting of pines in order to produce resin from the pine trees (*Pinus pinaster* is the best resin producing species of tree in southern Europe).

The draining of the Landes area and planting of pines has now established a major timber industry in the area as after WWII resin production declined due to the development of plastics.

Over 90% of the pine forest is privately owned with the average land holding being only 3 hectares. Most of the Public forest is along the coast strip and has been established to try and stop the advance of the coastal dune system (which in the 1700 and 1800’s was advancing inland and slowly overwhelming small villages).

In France, small communities often have an area of common land that is owned and managed by the local community (in Australia we would define this as a shire reserve). The community forest area in the Landes forest are classed as private but are often large areas of a hundred or more hectares. Occasionally they have very complicated boundaries as they may straddle a small village or town.

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The forest areas are protected by law from being cleared for farming or housing. This is best demonstrated by the variance in land value between forest and vineyard. The typical pine forest areas south of Bordeaux are worth around \$1500 AUD per hectare, a vineyard in the same area can be valued at around \$500,000 AUD per hectare.

The ARDFCI (Forest Fire prevention association)

The ARDFCI is a grower association whose role is to better develop more effective fire prevention strategies throughout the Landes pine forest.

Fire prevention strategies are developed by:

- Establishing and maintaining strategic fire breaks
- Emphasis on water point construction
- Preparation of maps for fire fighting
- The construction or maintenance of access roads
- Sourcing funding for the association
- Providing information to growers on minimum standards required for fire prevention activities.



ARDFCI Strategic fire break, Bordeaux



From left to right Author, Captain Eloi le Moullour, Julia Morin, ARDFCI local brigade reps

The ARDFCI is funded through a compulsory level of €3 Euro (about \$5 AUS) per hectare per annum from all forest owners. This levy is also topped up with additional funding from the government when it can be clearly demonstrated that additional funds are required to maintain fire prevention levels. The ARDFCI also provides a communication link from forest owner back through to government and to other organisations such as the fire department and forest harvesting companies. This link is quite important as in a forest fire situation the local Mayor is technically in command (regardless of their fire experience). The local Mayor will rely upon the local forest fire representative (basically a volunteer fire fighter as in the Australian brigade system) and the fire department representative to provide him with advice on how to fight the fire. It was explained that the Mayor is in charge as the French Political system is very reliant on having elected members actively involved in decision making in their patch! This seemed an odd initiative given that the local politician rarely has any knowledge or experience to make such decisions and in a fire situation time is critical. Often there is insufficient time to have a group discussion on tactics as decisions are needed to be made quickly and firmly for a command system to work.

The manager of the ARDFCI Bordeaux office Pierre Mace and one of his foresters Julia Morin organised a presentation, so that the fellow could hear first hand the issues from the land owner representative, for a Shire just north of Bordeaux called Saint Aubin de Medoc. It was interesting to hear that on the other side of the world the issues were very similar,

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rubbish dumping and small landowners (hobby farmers) lighting fires that escape into forest areas.



Rubbish dumping in a fire control waterhole

SDIS, Bordeaux

The SDIS are the primary Fire Fighting organisation that cover the northern half of the Landes forest (called district 33) about one million hectares of forest and vineyard lands. They are also the fire fighters for the urban area of Bordeaux population 500,000 and all the villages and towns in district 33. They also provide an ambulance service although there is also a dedicated French ambulance service for more complicated medical emergencies.

The SDIS district 33 is a large fire fighting organization with 1700 full time fire fighters plus 330 support staff. They have an annual budget of €150 million (\$240 million AUD) as well as access to 180 SDIS heavy fire trucks (Heavy being 4WD with 3,500 liters of water).



Fire truck mounted on tracked machine to cross swampy lands

SDIS also have access to another 1000 vehicles and 5,000 volunteer fire fighters. The quality of these additional vehicles however was questionable with one volunteer truck perhaps qualifying as a museum piece. The quality of the volunteers was also variable as in the rural areas many of the 'young people' were in their fifties! SDIS statistics tell them that the worst part of their fire season is in Spring (March & April) when the winter has killed of a lot of the previous summers vegetation but access across low lying areas is very difficult or impossible with heavy trucks (see picture below). Spring is generally the season with

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the strongest winds and is the season when the fire department has its major fire events. Summer has the highest number of fires per month but generally fire size is small due to the prolific green vegetation. The fire season picks up again in Autumn as fuel levels build but winds are generally lighter so fire size is generally kept small.



GENERALITAT VALENCIANA
CONSELLERIA DE JUSTÍCIA I ADMINISTRACIONS PÚBLIQUES
 DIRECCIÓ GENERAL D'INTERIOR

AUTOBOMBA FORESTAL PESADA (BRP)



Personal diari:

Un conductor. La autobomba actúa conjuntamente con una brigada rural de emergencia a la que esta asignada.

Vehículo:

- Autobomba forestal pesada instalada sobre chasis todo terreno (Mercedes Unimog U 2150L, Pegaso 2223 o Pegaso 3046/10).
- Cabina simple o doble.
- Cisterna de 3.500 l.
- Bomba de incendios de presión combinada (8 Bar/40 Bar)

Dotación:

- Mangueras de aspiración (4 trams).
- Mangueras de 25 mm. de diametro (600 m.)
- Mangueras de 45 mm. de diametro (50 m.)
- Mangueras de 70 mm. de diametro (20 m.)
- Lanzas, bifurcaciones, reducciones, etc.
- Foco con trípode y otros accesorios.

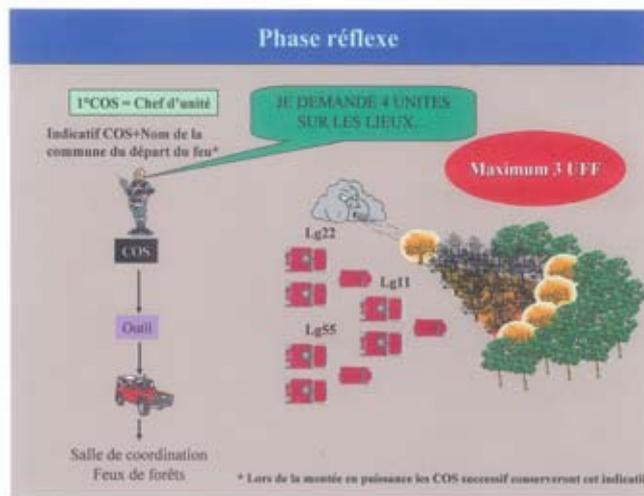
Specifications of standard 4WD fire truck

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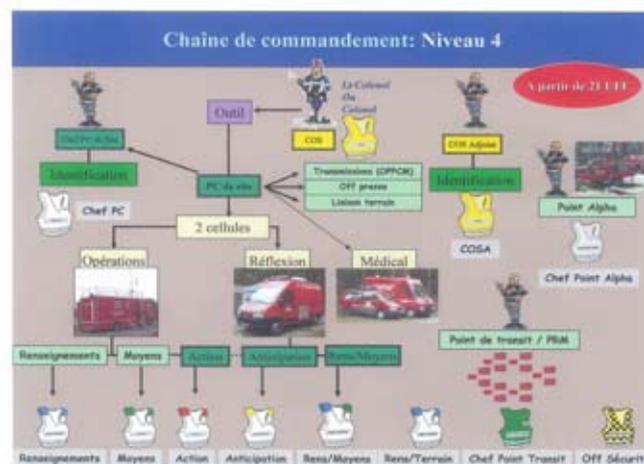
Incident Control System

The SDIS run with an incident control system based on the American Incident Control System or ICS. This seemed to be organised along the same basic principles as it is used in Australia (with the military type command structure). The main differences noted were the separation of planning and logistics roles from operations officer. The operations officer role is more out in the field and even when the operations officer is back at a control point he is often in a separate vehicle to the rest of the team so that he has fewer distractions. The following diagrams demonstrate how the French ICS structure moves from a simple level 1 (small fire) to a very large complicated level 4 incident (major fire with over 50 vehicles, 150 staff etc).

Simple French ICS diagram



Highly complex French ICS diagram



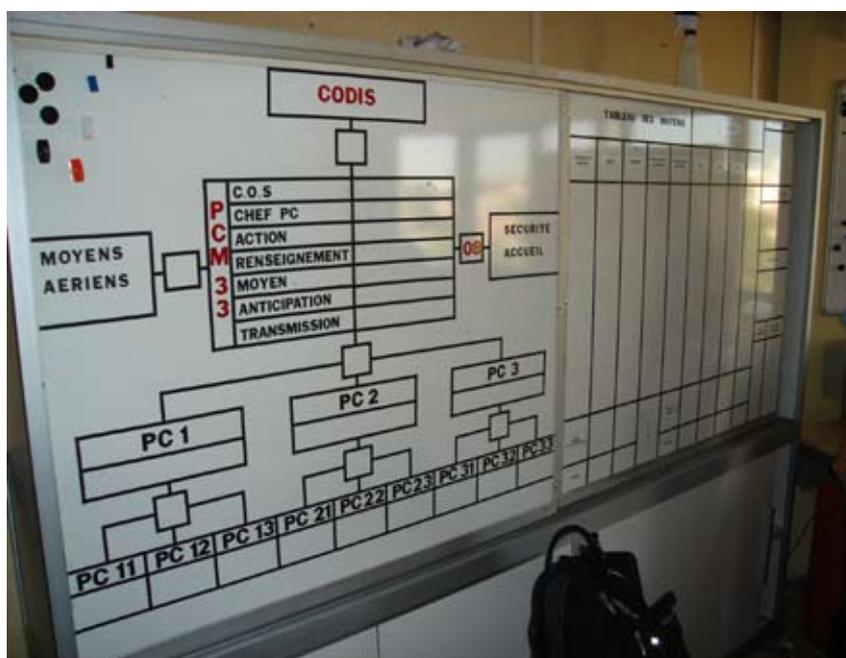
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Another observation worth noting in the French system is the fact they can draw on a large workforce and they generally only work in 8 hour shifts with change-overs in the morning and afternoon. All resources are kept track of, not only at the fire, but also in the central command centre, which keeps track of hours worked for each crew. The head office computer keeps track of hours worked and advises as to when change-overs are required (fatigue management). The ICS command team work on a staggered shift change through the day which may overlap the crew changes in the field. This is to ensure that when the crew change-over occurs there is still a consistent ICS team in place.

A further difference identified in the French system is that the career or professional fire fighters are there to attack and extinguish running fire but then will leave the mop up and patrolling to the local volunteers. If they are at a major fire (say over 100 hectares) a professional crew may also assist with mop up and patrol but generally this is left to volunteers.

The picture below is of a simple yet effective structure layout that was permanently displayed on the central command board for the SDIS office. It clearly shows the main ICS positions, who they report to and who reports to their position.



ICS control board at the SDIS regional office. Photo 7

An opportunity for exchange:

While at the SDIS office the fellow gave a brief presentation on the way in which CALM fire undertakes wildfire control and the way in which we carry out controlled burning in pine plantations. This sparked much interest as the SDIS has recently started to carry out research burns to assess the effectiveness of controlled burning in natural grassland in the Landes forest.

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Owen Donovan accepting gifts from Captain Eloi le Moullour and Lieutenant Colonel Dominique Bonjour

Equipment

The most significant observation made with regard to equipment was cab access. French fire trucks (including standard models) have a door above the passenger seat which can be opened so the passenger can stand on the seat to operate a fire hose (once the seat has been folded down to expose a checker plate footing). This allows the trucks to be effectively run with only two men. One driver who has the pumper controls on the dashboard and an operator on the hose who can attack the fire from the cab. This makes communication easier, saves space as the truck does not need a work area on the tray and provides a safer area for the hose operator as if the truck is caught in fire he can sit down in the cab and close the roof door.

All French trucks also have a water pump driven by a Power Take Off (PTO) pump running through the transfer case. This saves the weight of having a second motor and is possibly more reliable (truck motor versus separate pumper motor). Many of the trucks did carry a small backup portable petrol pump that could be used to transfer water out of a creek or be connected to the truck if the truck engine failed.



French fire truck with roof manhole. Photo 9

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Another innovation that the French fire fighters were using, was an electric submersible pump to draw water from shallow wells. The unit pictured below was capable of delivering up to 20,000 litres an hour and can be set up by one person. Wells were being placed in strategic places through the forest (by the ARDFCI contractors) to reduce turnaround times at fires.

The French fire service also has a much smaller relay pump that is designed for shallow water areas. This smaller relay pump was light, simple and looked relatively easy for two people to set up in a shallow dam or creek. There was also a much larger trailer mounted version which was powered by a 6 cylinder car motor. In terms of appropriateness for Western Australia, it is doubtful that enough forest water sources would be available to meet the pumps output. However, such a system may be more appropriate for other regions within Australia.



*Trailer mounted
bore draughting pump*



Shallow water relay pump



Large capacity water transfer pump

AFOCEL

AFOCEL is a commercial research organisation that is funded partly by the paper and pulp industry and partly by government. The organisation provides a best practice example of operational research. All members of the organisation were strongly committed to improving the way in which forestry is carried out in the Landes forest. The operational trials the group was implementing seemed to be in conjunction with growers, harvesters or buyers of timber. The organisation is also very efficient at communicating its' findings to ensure they are adopted in the field.

Nursery

While AFOCEL does not manage a nursery it does have a FORLITE (grower owned cooperative) nursery across the road from its office. Jean Yves François from AFOCEL has been involved with improving nursery practices in cooperation with the FORELITE nursery for the past ten years. Jean Yves Frances hosted a tour of the nursery which supplies around 10 million pinus pinaster seedlings, almost 1 million Pinus teada and a small amount of other species every year.

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Pinus pinaster seedlings, in the FORELITE nursery north of Bordeaux



Over head view showing the high germination rate per tray and seedling uniformity

The pine planting season spans around 9 months (spring, autumn and winter). This clearly shows how different the climate is in the Landes forest to Western Australia where we experience a two-month planting window.

Seedlings are sown in the Forelite nursery year round to ensure that on leaving the nursery they attain the minimum specification required by growers. It was obvious from inspecting the plants that were being dispatched to the field that the nursery was producing a very high quality seedling that showed good vigor, health and root system.

Jean Yves François explained that over the years the nursery has had occasional problems with growing seedlings (such as poor germination, uneven growth and problems with the growing medium) but has developed practices that ensure thorough constant monitoring, seedlings to standard at dispatch.

One other nursery innovation was the seedling tray loading system where a dozen or more individual trays are kept on a rack that can be loaded onto trucks via a forklift or hiab. This reduces the handling and damage to seedlings, minimizes the opportunity for fungal attack, due to good air circulation and reduces manual handling of trays.

Weed Control



Pinus pinaster growth affected by grass competition

Forestry operations in the Landes area have strict controls on the type of chemicals that

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can be applied broad scale. As a general rule herbicides are rarely used as weed control at planting is carried out through mechanical means. Occasionally sites have a thick matt of a native grass that does require an application of Roundup herbicide.

After establishment, weed control appeared to only be used to obtain access through a plantation for fire control. Tree growth was apparently not greatly affected by the proliferation of Bracken fern, Blackberry and Gorse bush. The picture below is of a three year old plantation where the trees were only just starting to break through the weed growth.



Three year old plantation with typical weed growth



Under growth in an un-managed pine plantation weed growth



Pinus pinaster stand in the Landes forest plantation

The lack of weed control continued through the plantation life with even mature closed stands having a thick undergrowth of blackberry and gorse bush. Occasionally before a pruning or harvesting operation inter-rows would be slashed or chopper rolled (French chopper roller) to open up access and enable easier access for fire control. Without this weed control many stands would be difficult to near impossible to access on foot especially where blackberry was thick.

Tree Breeding

Pierre Alazard is the senior tree breeder with the AFOCEL group in Bordeaux and has been working on breeding an improved *Pinus pinaster* for over twenty years. Tree breeding is a very slow job as it can take 5 to 7 years from planting to see the first results of your work. The time lag from making an improvement to seeing a noticeable difference in tree growth and form can take over a decade.

The Landes strain of *Pinus pinaster* is quite different in form to the other main strains: Portuguese, Corsican, Moroccan and Spanish. Australian trials of the Landes strain have

always shown it to have poor form (especially butt sweep) but with good vigor. In the Landes forest it was hard to find a single tree let alone stand that had straight stems.

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That is why the tree breeding of pinaster in the Landes area is so impressive, as people like Pierre Alazard have managed to breed a crooked tree straight. Pierre Alazard showed me 3rd Generation pinaster stands which were a significant improvement on unimproved pinaster but the greatest improvement gained has been through hybrid of the best of the Landes strain with the Corsican strain.



Owen Donovan amongst Landes-Corsican hybrid Pinus pinaster



Hybrid pinaster and seed orchard pinaster showing 1999 storm damage

This Landes-Corsican hybrid is such an improvement on typical pinaster it almost looks like another tree species. Improvements in tree growth are usually measured in % increase in growth or straightness but the best measure to assess how effective tree breeding has been in the Landes forest is the statistic that in the past twenty years improved genetics has added another 2.5 million tons to the annual harvest (equivalent to a \$140 million dollar increase in wood products) from the same land base. AFOCEL believe that the current improvement in genetics will over the next twenty five years add up to 15 million tons per annum or up to \$900 million dollars to the wood supply chain!

A further observation with regard to the hybrid pinaster was that it appeared to have a much more robust root system as it had suffered almost no damage from the catastrophic storm of 1999 that had damaged or destroyed almost 100,000 hectares of the Landes forest. The following picture shows the butt sweep caused by the storm on one row with the adjacent row of hybrid pinaster virtually unaffected.

Harvesting

AFOCEL foresters have been working with industry to identify the most effective machine harvesting equipment for the Landes pinaster forest. Today approximately 65% of harvesting is carried out by machines (in Australian plantations this figure would be closer to 98% carried out by machines).

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Machine harvester in the Landes forest



Example of 14 year old stand with minimal edge tree effect

The harvesting machines appear similar to those used in Australia, as they have excavator tracked bases (Caterpillar, Kato or Komatsu) with LAKO or Val met harvesting heads. In comparison, Australian machinery is constructed on a larger and stronger scale with Warratah heads. These are more effective given that Australian plantation timbers seem to have heavier branching.

Edge tree effect was very small even on major fire breaks and drainage lines which is unusual to see in pine plantations (edge trees were possibly only 20% larger than internal rows). Given that the trees have abundant soil moisture and nutrition the fellow can only speculate that there is a difference between the effect the sun has on edge trees in France and Australia (as in Australian plantations edge trees are often 50 to 100 % larger than the internal rows).

While with CAFSA the fellow met with a harvesting contractor and Frederic Gay, a District forester from the Smurfit company office at Arachon. Smurfit is one of the largest sawmilling /Pulp Company's in the region, their Arachon pulp mill alone has a one million ton intake. Timber is bought as a standing volume (with a volume per tree calculation). This is different to the Australian method where volumes are generally based on cubic metres per hectare basis. The French system of purchasing wood or forest assessment seemed to be based around the average volume per tree e.g. 0.7 cubic meters per tree or 1.2 cubic meters per tree.

From this volume assessment the mill then provides the grower with a quote based on the quality of wood and accessibility of stand. It is then up to the mill to decide on what product the timber is used for.

One unusual point about the harvesting method in the Landes forest is the contractor's tender vehicles were all vans. Fuel and oils were inside the van behind the driver's compartment. While this provided added security for the tools and parts being carried it also meant that any fuel spills would soon be picked up in the driver's cab.

CAFSA

CAFSA is a large-scale Forestry Company and is unique in so far that it is a cooperative owned by forest growers. The average private forest in the Landes area is only 5 hectares per property. There are over 100,000 forest owners that make up the Landes pine forest. CAFSA is the overall cooperative that has several divisions or associated companies such

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as FORELITE, which is the tree nursery division and S.DIGIT, which is the inventory and mapping division.

CAFSA establishes up to 12,000 hectares of mainly pinus pinaster ever year in the Landes area. This equates to planting over 15 million trees per annum. CAFSA owns most of the machinery used to carry out site preparation and all planting is carried out by hand. Where possible the company tries to carry out works on as many properties as possible in one area, so that there is a larger uniform stand (thus improving the economy of scale).



Pierre Alazard with a CAFSA mull board plough used for site preparation



CAFSA site just planted to Pinus pinaster

The company's BFSA division acts as the middleman buying wood of growers arranging the harvesting and transport then selling it to the sawmills. While the company does own a large volume of equipment they generally employ contractors who have their own machines for harvesting operations.

North east of Bordeaux CAFSA established a new seed orchard on a rich loamy clay that would normally be planted with vines. The site was chosen as the seed orchard because it was far enough from the plantation stands of pinaster to be free from contamination. The site had been used for a second generation seed orchard which had been completely removed to allow a third generation seed orchard to be planted on the site. It was interesting to note that the land value of this site was around \$2,500 per hectare, whereas across the road, the vineyard land was worth up to \$500,000 per hectare!



CAFSA tractor and cultivator preparing seed orchard site north east of Bordeaux

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INRA

INRA is the French national research organisation. The fellow met with Jean-Micheal Carnus and Christophe Orazio the team that heads the International European Cultivated Forest Institute. It took the two weeks in Bordeaux to ascertain how the financial side of forestry works in France. The following is the fellows' understanding (some of which could have been lost in translation).

Forest growers often develop an association to lobby the government for funding. The ARDFCI is one such example of an ongoing association but one was also set up after the big storm of 1999 which offered loans to forest owners so they could re-establish their plantations. This in a subtle way is French government subsidizing forestry operations. Although without protection and subsidization it is quite likely that a lot of the Landes forest would have been removed for housing, farming etc and the French timber industry would be just importing more rainforest timber to meet local demand.

An opportunity for exchange:

INRA are also developing a complete history of *Pinus pinaster* and requested Donovan to add a piece on what had been done with this European species in Western Australia. Their interest is in the major advances that have been made in the breeding of *pinaster* in WA and the under pine controlled burning which is unique to the WA pine forests.

Spain

Background

In fire control and forestry terms, crossing the border from France to Spain, was like crossing into a different continent. Unlike the flat fertile fields of south west France the Spanish countryside is often very similar to Australia with long rolling plains of dry open farming country with forestry lands mainly occurring on the rockier hilly slopes.

Spain has had a massive re-afforestation program that has re-established over 1,000,000 hectares of forest/plantation (this was started after world war two and completed in the 1950's. The aim of the re- afforestation was often to reduce erosion on steep slopes and to turn abandoned grazing lands into managed forests. The *pinus* plantation areas visited were all in hilly to mountainous areas and were often intermingled with other species such as *Pinus pinea*, *Pinus nigra* (on higher altitudes) and *Pinus sylvestris* in more alpine mountainous sites.

In many areas there seemed to be no definite boundary between what was planted and a natural stand of trees. This is now causing problems in that planted forests are often locked up from harvesting as they were established 30 or 50 years ago (before the current generation were born) and today the untrained eye sees these man made forests as natural stands. Problems arise as these stands were often over crowded and unhealthy and desperately in need of thinning (but are now locked up in conservation parks).

A further consideration in Spain is each Provenance/state/region such as Madrid or Galicia is an autonomous region that has its own police force and forests department. Spain is truly several countries in one, as crossing the border from one state to the next you can see a dramatic change in the way the land is managed, especially in forest management. The most dramatic example is north of the city of Madrid where all the forest was in a natural park, then on the next hill the forest was in the state of Castilla Leon the forest was being harvested and managed. Apparently the reason for this was that Madrid is a wealthy region and does not need the income from forestry where as Castalia is a poor region and

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therefore must have its forest earning an income to cover fire control and access costs.

Fire Control

The fellow was extremely fortunate in Madrid to meet with a forester colleague Santiago Perez Rubio, who had organised for the fellow to see some spectacular forests and to attend meetings with many senior managers of public and private companies.

The first company visited was the Matinsa organization; a company that is responsible for major infrastructure works throughout Spain (similar to Australia's Multiplex group). The fellow was introduced to a forest engineer (Manuel) who is the manager of the company's recent push in forest fire control and forest establishment. Working for Manuel was a forest engineer Isidro Martinez who left no stone unturned for the next week in showing Donovan everything there is to know about the Madrid region.

The Matinsa company currently have a contract with the forests department to undertake all the fire control work to the north and east of Madrid an area of about 500,000 hectares but contains a large urban and rural area so the area of forest to protect was maybe around 100,000 hectares (with about another 100,000 hectares of scrublands). The forest area, to the south and west of Madrid, was managed by another forest fire contractor. Total value per annum for both companies for the fire control only service was around \$30 million AUD. The first site visited with Matinsa was their fire station about an hour north of Madrid. While the company was responsible for the day to day running of all the men, machinery and infrastructure for fire control, the assets remained the government's. In fact the employees were paid by Matinsa, but were government employees as they were guaranteed their positions regardless of what company held the contract.

Apparently in many areas of Spain the government bureaucracy is often so large and slow that to achieve results contracts are let for company's to basically manage the day to day running of government staff? The fellow was informed that if the forest fire fighters needed a new GPS or fire unit it would take weeks or months to purchase one through the government system, whereas the Matinsa company could as a private company obtain it within a day or two.

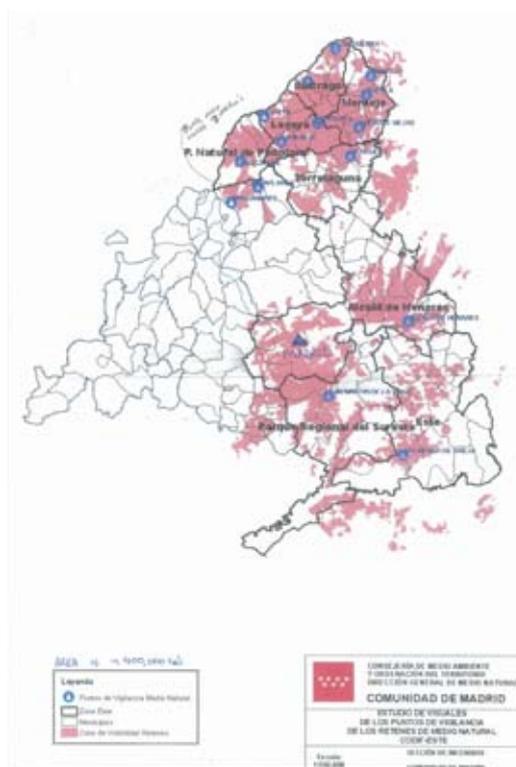
Matinsa employed around 250 staff in the peak of the fire season spread across 15 work centres. It also managed a fleet of heavy duty 4WD trucks, light fleet and a helicopter base jumping crew. Matinsa was also responsible for manning a dozen fire towers in the Madrid area.

While the Matinsa Company mans its own fire towers (to detect forest fires) the professional fire fighters (Bomberos) also man a network of fire towers which are placed to detect mainly urban and rural fires. There was a complete lack of cooperation between the two agencies as in places the two organisations had fire towers only several hundred meters apart and in one instance there were two tower men manning one tower?

Fire towers were numerous in the area due to the overlap by both organisations. In the Madrid State, it is estimated that there were over 30 fire towers. While there was some difficult terrain a similar area of 800,000 hectares in Australia would be lucky to have 6 fire towers. One fire tower north of Madrid had a visible area of only 7,000 hectares due to difficult terrain. One notable difference with Spanish fire towers was they are often manned 24 hours a day. There was a great emphasis on early detection and a rapid response to contain fires. This was best demonstrated by the fact that the majority of the Matinsa managed area was within 15 minutes of any helicopter base and usually within 15 minutes from any one fire station.

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Map showing seen area from Matinsa fire towers over approximately 400,000 hectares of Madrid region

Equipment

The Matinsa Company's fleet of trucks and light units were similar in design to the French forest fire fighters. With one exception being the medium fast attacks the company had purchased which were Spanish made Hummers (also known as American Humm-V's). These 4WD dual cab utilities could comfortably carry 4 people (as all in the vehicle sat in air seats) They also comfortably carried a 800 litre fire fighter in the tray with additional hand tools.

Having seen Hummers before, Donovan had dismissed them as being a gimmicky vehicle and not practical for forest work. However, this opinion changed after being taken around the training track by Isidro Martinez at the Matinsa depot and convinced that these 4WD vehicles had much greater clearance and capabilities than any of the Toyota/Nissan vehicles currently used in Australia. The only draw back with the vehicle was its \$90,000 cost, close to double the Japanese competitor.

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Matinsa, Spanish made hummer fast attack



Matinsa, Standard Mercedes Benz Heavy Duty

The majority of the fast attacks in the Matinsa fleet were 4WD Nissan Navara dual cab utes with 400 litre high pressure fire fighters (as a slip on unit). These were very similar in set up to units used in Australia apart from the pump units being very high pressure/low volume. The local foresters claimed that the use of high pressure low volume meant these units water lasted three times longer than a low pressure unit? The only drawback with the units was they couldn't draft water from creeks or dams. Apart from this drawback the unit appeared to throw water further and deliver a more effective jet of water up to 25 metres (with little drift).

One major difference in these units was the pump was set up similar to a hydraulic pump with an electronic cut off to ensure that the pump could not be run dry. A more elaborate filter system was also required to ensure the water was clean. The petrol motor powering the pump was the same 5.5 horsepower Honda used in Australian units.



The Heavy Duties or 4WD trucks that Matinsa used were also equipped with high pressure low volume pumps. The standard heavy duty was very similar to those used in France, a Mercedes Benz 4WD truck with around 3,500 liters of water and a PTO driven pumper. An auxiliary pump was also carried for drafting water from dams or rivers and as a backup if the truck was to break down. There were dual controls for the PTO driven pump, one on the back of the truck the other near the driver in the cab.

Due to the high pressure water system the main hose used on the trucks was a 25mm lay flat in rolls of around 30 meters. Each truck could carry up to 600 metres of this 25mm hose and a small amount of 50 mm lay flat. Due to the high pressure water a completely different nozzle was used which was similar to a machine gun with an on off trigger in the rear hand grip with the front hand grip having a twisting action to change the nozzle from fan to jet. This attachment appeared to be very well made and was comfortable to use.

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Demonstration of high pressure PTO driven unit

Hand Tools

The basic tool for forest fire fighting in Spain appears to be called a Batefuegos (meaning fire flap). This hand tool is basically a mud flap on the end of a stick and is apparently very effective for flapping out small fires. While these devices appeared comical, Donovan observed that every truck and car carried a few of these Batefuegos.



Santiago Perez Rubio with a Batefuegos, fire fighters mud flap



Explosive charge of water and foam

One other uniquely Spanish invention observed was at the Matinsa depot was a round plastic container that held about 2 litres of water and foam that also contained an explosive charge! The idea being that the container is rolled or dropped in front of the head fire, when the charge is ignited the container explodes and a radius of foam is spread for several metres. However, the fire fighters present did not like using the charge as they said it spread shrapnel too far and was too risky to use.

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Air Support

Part of the five year Matinsa contract is to maintain a helicopter base jumping crew for attacking fires in the mountain areas north of Madrid. The Matinsa helicopter base was about one hour north of Madrid at the foot of the mountain range.

The helicopter was on contract to Matinsa for fire control for five months of the year and 150 flying hours. If there is an extended season and more hours are flown, the company must negotiate with the government to increase funding or cease the helicopter contract.

The helicopter was set up with a pilot and co-pilot plus one forester and 9 fire fighters. On activation the helicopter drops in the forester and crew then fills its 1,800 liter collapsible belly tank with water to provide support for the ground crew. The forester on the ground directs the helicopters drops, while the crew use hand tools to extinguish the fire.

Thanks to Manuel and Isidro the fellow was fortunate enough to have a flight in the helicopter over the forest and mountain areas directly north of Madrid. From the helicopter platform the difficult terrain that the helicopter fire crew face when they are dropped into north of Madrid can be appreciated. While the mountain areas were steep and had almost no road access, they did appear to be at such a high altitude that they were often in a milder climate than the forested area several hundred meters lower in the landscape.

Bases for fire fighting helicopters were all spread around the Madrid province to ensure that the response time to any possible fire was kept within 15 minutes of any helicopter. This added cost of running several small bases was believed to be worth while due to the rapid response time to key areas. If all helicopters were based at say the Madrid airport response time to the outlining areas could be as much as 25 minutes.



Matinsa helicopter at Helibravo base north of Madrid



View of Pinus pinaster forest from MATINSA helicopter north of Madrid

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Forestry

Approximately one hour north of Madrid is the largest single commercial stand of pinaster available for commercial harvesting (in the Province of Madrid). This forest is around three thousand hectares of relatively mature forest that was originally planted in 1907 and has been commercially harvested under a 15 year management plan that determines acceptable volumes and areas to be harvested. The forest is well documented as a man made plantation but due to its closeness to the Capital of Madrid it has now become politically less acceptable to have harvesting operation in the forest.



60 year old Pinus pinaster plantation north of Madrid



Tree marking with an axe near Madrid

The plantation has multiple users such as recreation, fishermen, hunters and grazing by local farmers. Harvesting the trees is seen as detrimental to the water quality coming out of the plantation (while cattle graze on the edge of the dam's high water mark). This was one of many cases in Spain where timber production was not the primary product or use of a forest. Often recreation was seen as more important. On this site it appeared that the foresters needed to educate the public that the harvesting operation was needed to maintain forest health and for fire control purposes.

The management plan allowed the cutting of 4,000 tons per annum but due to green pressures only 1,500 tons was actually cut. This returned about \$37,000 per annum to the community (as the land was common lands owned by the local shire). This meant that 85% of revenue went to the local shire and the remainder was spent on forest works. Due to the small volume of harvesting the return back to the forest would be insufficient to maintain the recreational facilities in the area, let alone cover the cost of wildfire prevention over 3,000 hectares.

Even though the forest had a management plan to determine areas to be harvested and replanted there appeared to be no set silvicultural prescription for the thinning of the forest. Tree marking for harvesting was still carried out by axe and appeared to be based on aesthetics rather than stocking rate or basal area.

There was also very little emphasis on obtaining maximum production from the forest. Utilization from harvesting operations was very good as it was everywhere in Europe but again there was little pressure or desire to push the stand to maximum production. This was evident by the lack of tree breeding in the stock used. Tree form was absolutely atrocious with very poor stem form and very slow growth rates. This was not due to the site as the soil was quite deep and rainfall adequate at around 700mm.

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Poor Pinus pinaster tree form near Madrid

Another point of interest from this forest was that some transport of timber to roadside was still carried out by donkey! In the year 2006 within sight of the capital of Spain with 7 million inhabitants, in a developed country, donkeys were still used to move logs! Apparently this is partly due to the very strict conditions on soil disturbance by harvesting. Animals have been proven to have less soil damage than machines and are often used on steep slope sites?

Bomberos



Bomberos operational Headquarters Madrid

The Bomberos of Spain are the urban fire and rescue department who also carry out some ambulance services. The fellow was fortunate to be given a tour of their Madrid headquarters by Miguel Angel Beltran Gallardo who also gave a presentation on some of the fire statistics for the area of Madrid. The Madrid Provenance covers 800,000 hectares and has 7 million inhabitants.

The total number of non urban fires average at 350 per year with 50% of detection through the 000 phone calls, 30% detected by fire towers and 20% by other means. Average response time is 15 minutes from detection to first arriving unit. The Bomberos employ 1300 full time firemen with an additional 350 seasonals for summer. Staff are based at 18 permanent stations and 16 temporary summer sites. The majority of the Bomberos equipment (and it is supposed training) is for urban fire and rescue.

One strange fact was fires <1 hectare are recorded as "Connato" or not a forest fire? Any fire larger than 1 hectare is recorded as "Incendio" or as a forest fire. The other oddity with the definition was a 100 hectares scrub fire was classified as a forest fire due to its size not the vegetation it was burning in!

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Standard light unit for Bomberos in Madrid.

In the Madrid provenance a forest fire of over ten hectares was deemed news worthy and usually attracted politicians and a media frenzy. This is starkly different to what makes the news in Australia! (Where a forest fire of a 1,000 hectares is rarely a news bulletin) The Bombero's base was also a helicopter base having one air ambulance, one air command helicopter and one helicopter with a bambi bucket. The Bomberos also employed several forest engineers to provide advice on forest fire fighting at major fires. This factor meant that at any forest fire there could be Bombero's working alongside a forest engineer from their own organisation.



Bomberos air base Madrid with Air ambulance, command and fire fighting helicopters.

Again all the fire fighting trucks and utes were equipped with high pressure low volume units. As with most of the forest department trucks the Bomberos trucks water pumps were all PTO driven. In discussions with the Bomberos staff it was apparent that there is very little use of earthmoving machinery at any fire incident. Mineral earth breaks which are the standard for almost all fire control in Australia are absent in Spain! Very occasionally a bulldozer is used at a fire near Madrid. This seemed to be because that they are expensive (not compared to a helicopter) and slow to arrive. Due to the high number of fire fighting trucks available there has been a culture of just chasing fire with water. In Australia we have an insignificant amount of fire trucks in comparison and so have to use machines to reduce our water usage.

A further site of interest at the Bomberos base was the protective clothing warehouse. A tour of the facility highlighted the heavy clothing used by the urban fire fighters. This is possibly the easiest way to spot the difference between urban and forest fire fighters as the standard forest fire fighter usually needs nothing more than a cotton shirt and jeans as compared to the thick woolen jacket and trousers of the urban fire fighter. The one outstanding piece of clothing is the safety helmet which is a full face golden "star wars" unit worth about \$1,000 AUD. While the helmet may not be practical for forest fire fighting, it would certainly be appropriate in house fire situations.

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Bomberos fire uniform and "star wars" helmet.

Emergency Centre Madrid

Isidro Martinez from Matinsa had pre-arranged a visit to the Madrid emergency call centre. In Spain the general emergency number is 112 and the call centre in Madrid takes all Police, Fire and Ambulance emergency calls. Entering the building was a little daunting as there was very tight security and no bags were allowed. Donovan had to produce his passport and sign in before being scanned for weapons and led into the main building. Security was very tight at this complex as it functions as the nerve centre for all emergency management and coordination for Madrid.

The main operations room housed approximately one hundred people answering all the emergency calls for the region which comprises some 7 million people. The Bomberos duty manager has a team of over a dozen staff who not only answered emergency calls but also dispatched all the fire units to any emergency. The Duty Manager's role was to assess the requirements of men and machinery required for an incident, while retaining a presence at all bases for other emergencies.

This operational structure is the fundamental difference between forest and urban fire control agencies. Urban agencies have to maintain crews at all bases to be available for life threatening emergencies (eg car crash or house fire in their region). Forest agencies however can throw all resources at any one incident and if need be re-deploy them to any other fire that occurs, based on the level of risk posed. As the forest agencies don't need to keep as large reserves at any base, more outside crews can be dispatched to major fires. Alongside the Bomberos were a handful of forestry staff who carried out similar roles for the Forest Department (although at major fires the Bomberos were the lead agency and in control of any incident). While this centralized system appeared to be very effective at monitoring the location and identity of any units in attendance, it seemed to lack the control and experience that is obtained by local districts managing fires in their own patch. It is impossible for a duty controller to fully understand and interpret a fire situation when they

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are in a concrete air-conditioned cocoon a hundred kilometers away. Regardless of how good the information flow is, the closer the controller is to the fire, the better their interpretation is as to how to deal with the situation.

INIA and COCA

INIA is the Institute of National Research in Agriculture for Spain (agriculture including forestry). Ricardo Alia is the head of the forest tree genetics unit at the INIA Madrid campus and Donovan was very appreciative that he made time available to undertake a tour of the Pine resin forest at Coca (about a two hour drive north of Madrid near Segovia). In the Coca area there are approximately 20,000 hectares of *Pinus pinaster* plantation (including a small area of *Pinus pinea*) that is grown only for its resin production. Timber is cut out of this plantation but only for the purpose of producing resin.



Traditional resin tapping of Pinus pinaster at Coca

Resin from *Pinus pinaster* has been tapped (the process of bleeding the resin from the tree trunk) for centuries in the Coca area and was the main source of the town's wealth up until around world war two when plastics began to replace traditional resin markets.

There are only a few *Pinus* species that are commercially tapped for resin around the world. The following are a few of the major commercial species and their country of origin. *Pinus elliottii*: Brazil, Argentina and South Africa. *Pinus Massoniana* and *Pinus kesia*: Peoples republic of China. *Pinus pinaster*: Portugal and Spain. *Pinus roxburghii*: India.

Resin is broken down to produce Rosin which is a clear glassy solid with a byproduct being turpentine. The most important uses of Rosin are in the manufacture of surface coatings, adhesives, printing inks, synthetic rubber, soaps and detergents. The turpentine's distilled from Resin are used widely as a fragrance (such as the "norsca fresh" pine scent) or as a flavour and in resin manufacture.

1.2 million tons of Rosin is produced annually world wide. China is the world's biggest

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producer. With regard to Australia, Donovan has been unable to locate any record of resin being tapped from Australian plantations. This may be possibly due to our comparatively high labor costs compared with China and Brazil, and the fact that most of our pine plantations were developed after World War two.

It is interesting to note that Portugal is Europe's biggest producer of Resin as the *Pinus pinaster* stands in the warm climate are considered highly productive; although production has fallen from over 100,000 tons per annum in the 1980's to less than 30,000 tons per annum in the mid 1990's. Spain and France also have large areas of *Pinus pinaster* but have not had the same level of resin production possibly due to higher labour costs.

The resin produced in the Coca area was being sold in its raw form for between one to two dollars per kilogram, with the average tree producing 5 kilograms per year. As the average stand (mid rotation) held 100 to 150 trees per hectare this equated to 500 kilograms a year or \$500 to \$1,000 AUD per hectare per year.

The return from resin was around ten times the possible return from the timber of any tree grown on this site! Some of the staff in Ricardo Alias group at INRA demonstrated that with some genetic improvement it was possible to double the rate of resin production per tree. Evidence that resin had been important to this region was found in 700 year old stone carvings in a nearby church, which clearly show pine needles and pine cones.



Stone carvings of Pinus pinaster needles and cones in a medieval church near Coca



Resin Factory at Coca.

Ricardo Alia also showed some trial work on resin tapping where instead of the usual knife cut through the bark to let the resin drip into a ceramic cup, plastic hose and bags were being used to obtain the resin without contamination. Part of the trial was to see if the rate of production could be increased with reduced labor as the Spanish have to compete with China's very cheap resin production. The trial looked promising as it appeared this new method caused less damage to the tree but produced just as much resin as the old method.



New method of resin extraction.

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The Coca resin processing factory was also visited, unfortunately being a Sunday it was closed but the following picture suggests that resin was being used at an industrial scale.

Several hundred metres from the resin factory is a college that specializes in agricultural sciences. One of its programs is the training of forestry technicians. Forest engineers in Spain complete a 4 to 6 year degree at university and forest technicians complete a two to three year (equivalent to a diploma) course at technical colleges. The impressive part of the forestry school at Coca is the castle that it is housed in. The school is even called "El Castillo"



Forestry school at Coca

6.2.3 Portugal

Portugal is the home of *Pinus pinaster*. The country is only 200 kilometers from east to west and 600 kilometers north to south (about twice the size of Tasmania). Yet this small country has approximately one million hectares of *Pinus pinaster* forest/plantation and over 700,000 hectares of *Eucalyptus Globulus* (Tasmanian Blue gum) plantations. The northern half of the country is a mountainous region almost entirely covered in forest, apart from some small subsistence agricultural lands along valley floors. Portugal has a climate similar to Victoria with warm summers and cold winters. Mountainous areas often receive snow. Although the coastal strip has a milder climate with warmer winters and a milder summer due to frequent ocean mist.

Some of the forests in Portugal were protected by the crown as far back as the 1400's. As the country golden era was founded on its exploration of the new world many forest areas were protected by law and managed to provide high quality timber for ship building. The areas visited in Portugal were all North of the Capital Lisbon and apart from Villa Real all relatively close to the coastal plain.

Donovan undertook a 7 hour trip to visit the town of Villa Real which is approximately 300 kilometers north east of Lisbon. The Spanish countryside is similar to Australia with rolling plains of open cropping and grazing lands and on crossing the border into Portugal there was a dramatic change, which was that for the 400 or more kilometers traveling through this green forested country a recently burnt patch of forest was always in sight! (This patch stretching from one hectare to several thousand hectares). From every town and highway it was possible to see the scars of wildfires through the pine and eucalypt forests. In some areas all that could be seen for thousands of hectares was burnt forest or recently harvested forest (due to fire damage).

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Forestry

Portucel Viana Mill at Estrada north Portugal. Photo 48

One of the first sites visited with Paulo Fernandes from the University of Villa Real was the Portucel Viana Kraft Paper Mill at Estrada on the Northern border of Portugal. This mill uses mainly *Pinus pinaster* but also eucalyptus to produce Kraft Paper which is basically the brown paper used to make cardboard packaging. The mill's general manager was Armando Brochado and the engineer in charge of the chemical process Delfim Trancoso. The following are a few of the basic volume facts on the Mill:

- Total intake 800,000 tons per annum.
- Green log intake 400,000 tons.
- Other mill waste 400,000 tons.
- Green logs can be up to 300 days old!
- Mill produces up to 30 megawatts of electricity through burning forest waste.

This Mill sources most of its wood from Portugal but at times will import up to 30% of its needs from Brazil or even Bordeaux if the price is right.



Delfim Trancoso and the author alongside 300 day old wood stockpiled at the Portucel mill.

At present the mill's greatest problem is the majority of harvested wood is obtained from fire salvage operations. The mill management was well aware that the *Pinus pinaster* forests could not sustain the current rate of loss per annum to wild fires. Its' eucalyptus intake was less affected by fire as the blue gum plantations coppiced well after fire.

In Australia at present there is a lot of interest and talk about producing energy from forest waste yet this plant already produced 30 megawatts per annum. Delfim Trancoso said the mill could accept more forest waste to produce electricity although the market price for this waste wood meant that there was no profit to the grower in delivering it to the mill (therefore little incentive).



Roll of Kraft Paper hot of the drying press.

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Forest Genetics

In Portugal the majority of all forested lands are privately owned and often on small land holdings of less than 5 hectares. This has created a generation of forest owners who do not live on their land and apparently in many cases rarely ever see their own forest. A significant amount of the forest estate is in a poorly managed state with very little silviculture by owners to improve forest health or growth. This is apparently due to many forest owners moving to urban areas as they retire and the next generation having little ties to rural life.



Paulo Fernandes and Susana Carneiro at the Valenca seed orchard.

Susana Carneiro is the forester in charge of genetic improvement, for a project called PINUS. The genetic improvement project is called Centro PINUS (created in 1998) and aims to improve pine forest productivity by:

- Improving management by communicating best practices.
- Supporting pine breeding program-PINUS project.

The Pinus project was developed by the main pine wood consumers of Portugal, the forest department and the forest growers association. The main aim behind the project was to try and solve the wood demand problems that industry is facing (shortage of local wood). The following are a few facts that the forest industry are facing in Portugal (from a Centro Pinus brochure):

- Pinus forest area has reduced from 1.35 million hectares in 1978 to less than .97 million hectares in 1997.
- Average growth has fallen from 7.2 m³/ha/year in 1982 to 5.9m³/ha/year in 1997.
- In 2002 only 200 hectares was planted with improved genetic stock, by 2006 this had increased to 3000 hectares.

The projects improved genetic stock has a 17% gain in volume and 21% in stem form on routine Pinus pinaster stock.

The current level of seed production from Orchard seed (improved stock) is sufficient for planting 3,000 hectares a year. With a million hectares estate there should be around 15,000

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hectares of replanting a year (based on a fifty year rotation) so it is apparent that only a small proportion of replanting is with improved stock.

Susana Carneiro and Paulo Fernandes took Donovan to one of the seed orchards established near Valenca in 2000. While the orchard had good establishment and fair growth Donovan stressed to them that it lacked presentation. Donovan believes the best way to sell new genetics is to make sure that sites that are to showcase improved stock, need to look like they are the best.

While the area of Pine estate has been steadily falling for over 30 years the area of *Eucalyptus globulus* has been increasing. Apparently landowners often preferred eucalyptus to pine as there was less management for the same return. Eucalyptus also had the advantage of re-sprouting or suckering after fire whereas pine required more expensive replanting.

Fire Control



Desperate measures in fire control.



High Pressure fire unit in action, Villa Real.

Portugal often makes it onto the Australian news with reports of massive bushfires and within a day it became self evident! On a bad day in Northern Portugal the fire services may have to deal with up to 150 deliberately lit fires (apparently Galicia in Spain is similar). There appears to be some cultural problem where a fair proportion of the community has little regard for impact of fire on the environment. One of the other reasons Portugal has so many forest fires is they have no mop up standard! Mineral earth fire breaks are rarely constructed. Unburnt pockets are just mopped up with water along existing firebreaks or roads. It is possible for the fire services to return to the same fire up to 20 times due to poor mopping up!

To compound the problem there are four fire fighting services working across almost all land tenures, with little communication or respect between organisations. The main organisations are as follows.

Bombeiros

As in Spain the urban fire control agency in Portugal has a massive fleet of trucks and utes that are well equipped for urban and forest fires. The difference in Portugal is that only a proportion of the Bombeiros are full time employees. The majority are called volunteers and are kept on for the peak fire season (at which time over 4,000 staff work for this organisation). It is not understood why they were called volunteers as they were paid for their time?

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Donovan toured the Bombeiros' base in Villa Real which had all the equipment needed for a town of about 40,000 people although I was very surprised by the high ratio of very young volunteers to seasoned full time employees.

Sapadores Florestais

The Sapadores Florestais basically function as a form of forest department. It seems that many years ago the forest department was wound down to just a service agency (as most of the forests are privately owned). Over the past decade the forests department has started to employ more field crews to carry out silviculture works on contract for local shires. At present in the peak of summer the Sapadores Florestais crews number 700 and respond to forest fires.



Sapadores Florestais fire crew near Villa Real.

The advantage the Sapadores have over the Bombeiros is that they work in the forest areas through the week so are familiar with the firebreaks and vegetation types (Bombeiros are generally based in urban centers). The Sapadores can be characterised as a no-nonsense, can-do group of people with greater experience than a volunteer core!

Unfortunately the Sapadores seem to lack equipment, only having dual cab utes with slip on fire units and also seemed to lack a cohesive command structure that you would normally be found in a forest department (partly due to their employer usually being the local shire). Their strength lay in their awareness of the standards required to mop a fire up but due to a complete lack of any machinery were unable to undertake this task at larger fires (their only form of machinery was hand tools!).

Private Companies - AFOCELCA

The third fire fighting organisation visited was part of a private forest grower company: AFOCELCA. This company owned or had leases over 200,000 hectares of pine and eucalypt forest in Portugal. Due to the increasing loss of estate every year to wild fire, in a desperate move the company had formed its own fire fighting force.



AFOCELCA fire crew at their base south of Villa Real.



AFOCELCA fire truck.

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The base was located deep in one of their private forests. The company employs around 400 seasonal fire fighters who also carry out some forest silviculture works. This one company also contracts three helicopters each summer (50% of their fire budget was spent on just running the three helicopters). The helicopter crew was impressive as they were all fit and young but also had a few experienced hands in their crew. It was obvious from the morale of the group that they worked well as a team with their helicopter pilot. As in Spain, they were airlifted to fight a fire with hand tools with the helicopter then dropping water to support the crews work. Several of the crew were fire fighters who worked for six months in South America (Chile) and six months a year in Portugal. Sadly some Chilean fire fighters had been killed at a major forest fire in Portugal in the peak of summer.

As with the Sapadores, the AFOCELCA crews were aware of the required mop up standards but had less than state of the art trucks and utes to tackle forest fires. They also had no access to machinery to tackle large forest fires and relied solely on hand tools.

GYPS

The fourth organisation involved in the industry was the Gyp fire crew and although they were not visited Donovan learnt that they were formed a few years ago by the government due to increasing pressure to combat the forest fire problem. The Gyps are part of the Portuguese military, something along the lines of an SAS unit. They are a force of 200 men with several helicopters spread through the forest area. Apparently they are an extremely fit and highly disciplined group and are very effective at combating fires early after detection. Gyp crews hand over the fire and mop up works, once Bombeiros or other crews attend the fire and return to their base.

A chance meeting.

While staying at the hotel Villa Real, Donovan had a chance meeting with two Australians who were working as water bomber pilots with the Villa Real Bombeiros. The pilots were based out of Villa Real with two more Australians at the next air base and another DEC water bomber pilot at an air base near Lisbon.



Dunn's aviation dromadiar water bomber, at the Villa Real airport.

The Australian air contingent from Dunn's aviation had left Australia to help with the fire effort in Portugal. This turned out to be a bonus as it provided the opportunity to hear first hand how different the air side of fire fighting is in Portugal. The pilots were only a small part of the fleet of aircraft and helicopters in use. Everything from small helicopters with 1,000 litre capacity to a Russian plane with a 12,000 litre capacity was in use. Discussion identified a series of problems for these pilots:

- No air command platform. No coordinated air attack at fires.
- Almost no communication between air and ground forces.

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- A lack of sharing of resources across district/regional boundaries
- Air safety sadly lacking due to the multiple nationalities of pilots (Russian, Spanish, Portuguese and English speaking pilots).
- The large Russian plane was a waste of fuel and water as it was too big for the job.

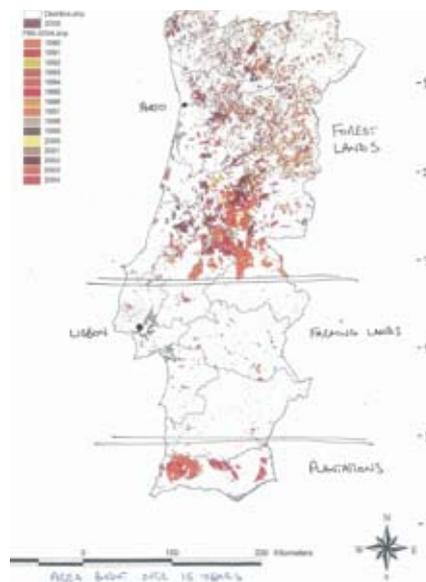
The pilots also commented that due to poor mop up standards they may return up to 20 times to the same fire. This was mainly due to almost no fire being tracked with a machine. They even commented that it would be very rare to see any type of machine at a forest fire.

There were however, several good points identified about the way the Portuguese ran their air operations are as follows:

- The air force is spread through forest air strips in logical central points (also had some well equipped runways).
- The Gyps were seen as a very effective first attack force.
- Private AFOCELCA air attack was very effective.
- The fire service had a quick response time from detection to deploying aircraft.

The most concerning part of the air fire fighting force was the lack of overall air command. The pilots reported that at one major fire there was up to 15 aircraft all trying to find an open piece of sky to get their load of water in. The hazard of mid air collision was compounded by the Russian jet water bomber flying around the fire at high speeds with very little manoeuvrability.

The overall impression left was that the entire forest fire fighting effort in Portugal was not a coordinated effort and lacked effective suppression and mop up standards. It was depressing to see the following map showing the burnt forest area over the past 15 years. It appears that unless there is a dramatic change in fire control there will be very little forest left within the next fifteen years.



Map of burnt forest area over the past 15 years.

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Lieria National Forest

The Lieria National Forest is located on the Atlantic coast only one hour's drive (at Portuguese road speed) north of Lisbon. The forest receives around 800mm of rainfall a year and is based on deep coastal sands. This forest is the oldest Portuguese state forest and has been a managed forest as far back as the XIII century. This forest was first established by the Portuguese King Afonsa III and protected by later kings as it was an important source of timber for ship building and to prevent the coastal dunes from moving into more fertile farming lands inland.

The primary species for this dune rehabilitation is *Pinus pinaster*. Within sight of the beach the pinus pinaster was the height of weeds such as pig face. This is mainly due to the strong north westerly winds which keep all vegetation at ground level. Further inland the pinus pinaster regains the form of a tree and was up to 35 meters in top height. The forest covers around 11,000 hectares of sandy soils but several years ago 3,000 hectares was destroyed in one wild fire. In the early 1800's the forest had its first true management plan drawn up which formalized compartment boundaries, annual harvest yields and silviculture. The forest is managed under an 80 year rotation and little appears to have changed in its management over the past few hundred years.

One interesting weed in the pine forest was eucalyptus globulus, introduced about a hundred years ago and now firmly established in a few creek lines. At one river crossing the Tasmanian blue gums were over 40 meters tall and it was hard to believe this was not Manjimup or the Dandenong ranges.



Eucalyptus globulus in the Lieria forest.



Pinus pinaster seed tree in Lieria forest.

The Lieria forest is the origin of the improved genetic material that was used to establish the West Australian *Pinus pinaster* plantations. The lierian strain was selected as it had superior form and growth for Western Australian conditions over any other pinaster. In the 1960's Dick Perry one of the original foresters from the Western Australian forests department spent 18 months working in the Lieria forest selecting plus trees for the pinaster improvement project. Unfortunately this work was carried out a generation ago so there were no foresters in the Lieria office who knew where these plus trees were. Many had also been killed in the recent large forest fire.

It was a shame to see that since a plus tree selection in this forest had been carried out that there had been little improvement in the way the forest was managed. While the forest was still tended and maintained there appeared to have been little improvement in growth per hectare or rotation age in over 40 years. The Forests Department seemed to be an

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organisation with such little funding that it could only just maintain historic practices, as there was no extra funding available to carry out improvement works (or possibly a cultural resistance to change). Additionally, there was no funding available to use fertilizers to increase tree growth.

Lieria forest area post fire ready for replanting.



The forest area was still managed on an 80 year rotation when the same species in France or Australia on this productive a site, would have a rotation length of maybe 40 years. Part of the long rotation length was due to the establishment of seeds rather than seedlings which meant early growth was very slow. At around age three to five a slasher was used to create rows amongst the field of pine seedlings. No scrub control was carried out (weed control was not a major issue as the sands did not support many grassy weeds). Within this context stocking rates were highly variable.

Three year old Pinus pinaster plantation in Lieria forest.



One practice still used in the Pinus pinaster forest was the extraction of resin. As in Spain resin collection was carried out in many stands although in Portugal it seemed to be concentrated close to clear felling. The foresters used a term that translated to 'resin to death' which normally occurred for three years leading up to the clear fell harvest.

Resin collection Portuguese style.



Controlled Burning

The one shining light of hope Donovan held for fire control and forestry in Portugal was to see a small band of foresters and researchers trying to reintroduce controlled burning into their forested lands.

Donovan was fortunate to meet with Paulo Fernandes from the University of Villa Real who has researched the impact that controlled fire can have on wildfires for many years. Paulo has also conducted training programs in the use of controlled fire to try and educate/provide experience to the next generation of foresters.

This is a mighty task as Portugal along with Spain and France appear to be locked into a

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NO PLANNED burning regime where all and sundry believe that all fires are bad for the forest. This seemed a strange policy as the Mediterranean forests occur in landscapes that over time have developed with fire. Many species such as Pinus and Quercus (oaks) can withstand low intensity fire due to their thick bark. Low intensity fire also seems to recycle nutrients tied up in leaf litter as these dry forests lack the climate that northern Europe has to break down leaf litter (as in England and Germany).



Burnt forest south of Villa Real.

The common belief appeared to be any fire would stress trees, remove nutrients from the soil, damage surface roots and kill off micro fauna and generally reduce tree health. This belief was based on the effects of wildfire on forests, which due to their high intensity can have adverse affects on forest health.

Fernandes took Donovan on a site visit to see the results of a research burn under some mature pinaster and how the reduced fuel level had saved the stand from a wildfire. Fernandes was preaching to the converted as Donovan had seen many such examples in WA, with controlled burning being the norm in eucalypt forest and some pine plantations.

In summary it appears that through all three countries, controlled burning was often used to reduce fuel loadings to better manage wildfires a generation ago. Some time after WWII possibly with the wide spread use of faster and bigger 4WD trucks a policy of no planned burning became entrenched through forestry and fire departments.

Photo 65 identifies the effects of fire in Portugal which are having a large impact on the community and the forest resource.

Donovan believes that if communication between the organisations can be improved and controlled burning can be implemented, that fire losses will be reduced and that these countries will still have forests to protect.



Wildfire damage north of Lisbon.



Paulo Fernandes controlled burning trail with wildfire damage in background.

The following are recommendations to Government, Industry, the Business sector, Professional Associations, Education and Training Providers, our Community, and the ISS Institute.

The following observations encapsulate the information that was gained throughout the course of the Fellowship program:

- The modification of a Department of Environment and Conservation (DEC) fire truck to allow through the roof access. This would also include setting up the pumper control panel in the cab of a truck. If this method of “in the cab” fire fighting proves effective it could greatly reduce the risk to a truck crew when caught in a dead man zone situation. If successful this could be applied Australia wide and not only in Western Australia and DEC. The cost to modify a truck in such a way is likely to be \$5,000 to \$6,000.
- DEC fire could manufacture a bore pump similar to the French trailer mounted unit that is capable of pumping water from existing monitoring bores on the coastal plain. This bore has the potential to deliver water in remote areas without the capital expense of constructing a dam. This is suited to coastal plain areas (with a water table within 30 meters) from Esperance to Geraldton. Again this could be applied Australia wide once trialed by DEC in WA.
- That the DEC supports the exchange of foresters from France, Spain and Portugal. These three countries have possibly the most similar species and climate conditions to southern Australia. Yet Australia and especially WA is one of the few places in the world that use controlled burning to better manage wildfire. At present southern Europe still has a no burn forest policy which does not seem to be sustainable. (A good case for WA and Australia setting the standard in training, reinforced by the opportunity to benchmark during the visits to these locations.) A WA fire agency needs to trial a high-pressure low volume slip on fire unit ASAP to assess its suitability to our forest and fire conditions. One such unit will cost around \$12,000 (about double the cost of a normal fire fighting unit). The trialing of one such unit could revolutionize the way we develop future new fire fighting units in Australia.

7.1 Government

Government should continue supporting forest based fire fighting organisations in order to keep them separate from urban fire fighting organisations as the two groups are tackling a different beast! This does not mean they cannot work together but the difference should be acknowledged as significant.

One of the main differences is to recognize the core tasks of each organisation at a fire. Urban fire fighting organisations often do attend “bush fires” although their main aim is to be available to respond to accidents and emergencies that threaten human life. It is of little consequence to urban fire fighters whether 1 hectare or 100 hectare of forest is burnt so long as they are able to respond immediately to higher priorities such as motor vehicle accidents or structural fires where generally there are more lives at risk and a need to respond quickly means the difference between life and death.

Forest fire fighters priority is also Life, Property and Environment but as most work in the forest and fully understand its value are more interested in minimizing the fire’s size than falling back to protect the next house. This is not to say that land management organisations fire crews will sit by and watch houses burn! It is just a matter of doing the same job from a different point of view and a different set of priorities. Due to the different roles

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each organisation has developed different equipment to suit their environment. The main difference in equipment are the type of trucks used, 4 Wheel drive versus two wheel drive and the urban fire fighters reliance on a fire hydrant network, for the delivery of very high volumes of water. The forest fire fighter also have much lighter protective clothing as they can frequently carry out shifts up to 24 hours long. Urban fire protective clothing tends to be much heavier (to protect from radiant heat) the work is often more intense over shorter periods of 8 to 12 hours.

7.2 Business

Australian businesses should closely watch the development of new specialized fire equipment in southern Europe. While there is a small language barrier to overcome, the developments in Europe are leading the world due to their large investment in research.

Additionally, Donovan doesn't believe that at present Australian companies do realize that some of the current equipment that is used in Australia for forest fire suppression is the best in the world. With a small outlay, is it possible that large markets could be opened up in Europe or the USA for a relatively small Australian investment?

7.3 Professional Associations

Institute of Foresters (IFA). The IFA could support the exchange of foresters between southern Europe and Australia. The exchange of foresters between the two regions would help Australia keep up with the latest technology and trends while allowing Australia to increase the Southern Europeans' knowledge of controlled burning. This could provide a valuable opportunity for knowledge transfer.

7.4 Education and Training / Knowledge Transfer

Donovan will be available to discuss his findings with the Industry Skills Council regarding further enhancement of Training Packages and development of new ones where appropriate.

As outlined above there is a significant difference between the training requirements of urban and forest fire fighters with each group using different machinery/equipment to fight a 'different beast'. Training in fire control tends to be very organisation specific. This may be more due to the cultural differences between organisations rather than different training needs. Across all organisations the basic training requirements of safety, command structure and the planning of strategies should be very similar.

An area lacking in the curriculum of Australian fire fighting organisations at present are units based around Pine forest fire fighting. As this type of forest is of a different structure to natural eucalyptus forest it would be worthwhile exploring the adoption of training packages used by the French, Spanish and Portuguese forest departments.

"Basic training" in fighting fires in these forest types is unlikely to be of benefit but higher level training on the tactics, methods and command structure in use should be of benefit. These skills are usually only found in highly experienced personnel. These are the skills used to command resources to battle the fire.

It is highly likely that the French fire service which is of similar structure to Australian organisations has a training package that can be translated to develop improved skills

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for Australian fire fighters. The French fire organisations also appeared to be very well organised and professional in their duty. This further enforces the strong and clear structure to their organisation - a symptom of a sound training base.

The Portuguese University UTAD in collaboration with their forests department also have an intensive 4 week fire training package (all based on pine forest fire control) which has detailed training on fire intensity and methods of attack, fire spotting calculations and rates of spread prediction. As the course is based around classroom and field based scenarios it is the base line for training Foresters in prescribed and wild fire management. The Portuguese also appear to have a high level of research into pine fire behavior (possibly due to the higher likelihood of wild fire in comparison to Spain and France?)

Donovan's personal belief is that forest fire control is best learnt through mentoring. Mentoring is required to pass on local knowledge of fire behaviour in different fuels (forest types). Mentoring is also beneficial in passing on knowledge of fire behaviour with local weather conditions and wildfire prediction.

His department has some structured fire training where the learning leads to the completion of a nationally recognized award (units of competence and or short courses). Many of the DEC training courses are recognized by the Training accreditation council of Western Australia e.g. the DEC prescribed fire training module is PUAFIR406A Development of prescribed burn plans.

The adoption of training packages from these other organisations into the Australian curriculum can only improve the skills and knowledge of Australian fire fighters. The challenge is to sift through all the options to find the best package and translate it for Australian conditions.

7.5 Community

Forest fire fighting agencies need to raise their profile across Australia. Everyone is aware of the firemen who drive the red trucks and save cats from trees. The media love the image of the volunteer fire fighter and rightly so as they are out there risking a lot and rarely receiving anything in return but a little media glory. If forest fire organisations do not lift their profile then they may go the way of similar European organisations and wither and die out!

Raising the profile of forest fire organisations in the media will help lift community awareness of other forest issues as well. It is also some of the only public education work, that will hit main stream media, that doesn't just make foresters look close to environmental terrorists for harvesting trees.

7.6 How ISS Institute can be involved

Donovan believes that further fellowships would be a fantastic opportunity as he believes that it usually takes a few voices to make changes happen. Fellowships to explore the fire methodology in other areas of southern Europe or North Africa would be of benefit to Australia. This would also provide a better opportunity to showcase the use of controlled fire in Australia to like climate areas.

A Fellowship to investigate the use of forest waste for power generation would also be timely as Australia presently has very limited use of forest waste and a growing need for greenhouse friendly energy.

Chapter 8

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