



Forest Fire Situation in Chile

Fire Environment, fire regimes and ecological role of fire in Chile

Chile, South America's longest country, with a length of 4,267 kilometres and a continental area of 756,945 square km (excluding the Chilean Antarctic Territory), has developed an important forestry sector in recent years. Forestry holds a significant position in the country economy. Forty-five percent of Chile's territory is subjected to forest fires. There are soils preferentially suited for forestry; and forests cover 20.8 percent of the country's area. The native forests occur mostly in the Andes Range, between the central and deep south. A vast commercial plantation area (2.1 million hectares) covers mainly the Coastal Range, where Monterey pine and Eucalyptus sp. plantations sustain 90 percent of the Chilean forest industry.

With a Mediterranean climate and a long dry season, Chile's single forest fire season normally occurs between October and April, with a period of maximum activity between December and February.

On average, some 5,200 forest fires are recorded each season, mainly in Region IV, approximately 500 kilometres north of Santiago, to Region X (city of Puerto Montt). Further north, vegetation is scarce or non-existent in the Atacama Desert. In the southern Regions XI and XII, Coyhaique and Punta Arenas cities, the abundant moisture and low population density (fewer than 0.7 inhabitants per square kilometer) protect the lush, thousand-year-old *Humid Temperate Native Forests* from fires.

Fires affect an average of 52,400 hectares each season, destroying mainly native vegetation (95.7 per cent). This vegetation is composed principally of pasturelands, scrubland, shrubs and, to a lesser degree, plantations. The average size of fires has dropped from 38.2 hectares in the 1960s and 1970s to around 9.1 hectares in the 1990s. There are fewer large fires: 87.1 percent of the fires are less than 5.0 hectares and 92.4 percent are under 10.0 hectares.



Figure 1. Fire in plantations of *Pinus radiata* (Monterey pine) and *Eucalyptus* sp. plantations.

Following Brown and other's fire regimes description, the damage in the old *Humid Temperate Native Forests* (*Nothofagus* sp. and other species) applies to the Understory fires and/or Mixed severity fire regime classes. In

the first one, the fires are generally non-lethal to the dominant vegetation and do not substantially change the structure of the dominant vegetation. In the second one, severity of fire either causes selective mortality in dominant vegetation, depending on different tree species susceptibility to fire, or varies between understory and stand replacement.

The fires in young Monterey pine and Eucalyptus sp. plantations, *Mediterranean Native Forests* (*Bosque Esclerófilo*), shrublands and grasslands apply to the **Stand replacement fire regime class**. Fires here kill aboveground parts of the dominant vegetation, changing the aboveground structure substantially. Approximately 80 percent or more of the aboveground dominant vegetation is either consumed or dies as a result of fires.

Finally, the **Non-fire regime class** is represented in *Humid Temperate Native Forests* in high elevations of the Andes Range, in wet sites and in the deep south of the country.

National definition of what constitutes a forest fire: Any fire which spreads in an uncontrolled manner, without limits, on wildlands and interface areas, which affects any kind of vegetation, structures, powerlines, railroads, facilities, etc.

Narrative summary of major wildfire impacts on people, property and natural resources that occurred historically

Since southern and deep southern colonization began in 1850, people have used fire to clear land for grazing and for agriculture. The impenetrable native forests, with their long rotations, were an obstruction to agricultural development. Clearing fires became forest fires, which lasted for days, months and, in some cases, for more than a year. The forests suffered as they were burned often. There was no technology, knowledge, means, or organization for fighting the fires. The main damage has been soil losses and fertility losses because of the erosion.



Figure 2. Fire effects in humid temperate native forests.

In the 20th Century, the fires still affected the central area native forests, changing the natural composition of species, damaging timber and influencing the economical status of the local people. Also, the wildfires caused fatalities, structure losses and affected the biodiversity, wildlife and the ecology in general. Interface fires also have been a problem, since they disturb normal life in the main Chilean cities of Valparaíso, Viña del Mar and Concepción.

Narrative summary of major wildfire impacts on people, property and natural resources during the 1990s

In comparison with the 1980's, during the 1990's Chile increased its occurrence of fires by 13 percent, from an average of 4,800 to 5,530 fires per year. The average of 5,200 fires/year was surpassed and the level of over 6,000 fires was reached during the 1992-93, 1993-94 and 1998-99 fire seasons. Nevertheless, the average size of fires dropped from 11.3 to 9.1 hectares/fire, due to improved strategies, organizational methods and co-operation among the firefighting partners.

In terms of damage, several droughts during 1992, 1993, 1997 and 1998 caused enormous costs to Chile in terms of losses in environment, facilities and miscellaneous structures. The "El Niño Southern Oscillation" brought one of the most severe fire seasons at the end of the 1990's. During the 1997-1998 fire season, the fire behaviour was extreme in the deep south (Regions X and XI).

The fire problems moved during the 1998-1999 season to the central part of the country (Regions VI to IX) and caused the most difficult fire season in Chile's history (6,830 fires and 101,691 hectares burned). In this season, the "La Rufina" fire in Region VI burned 25,400 hectares, 14 houses, cattle and powerlines, among other losses.



Figure 3. CONAF and Army operations at "La Rufina" fire

During the 1990's, the environmental conditions also caused threats to fire crews. In 30 years, Chile has recorded 33 fatalities (firefighters, crew bosses, helitackers, pilots and, staff personnel); and 33 percent happened during the decade of the 1990s.

The local and urban border communities also have been at increased risk, because interface fires are more common than in the past. Urban development towards the forest in such cities as Concepción, Valparaíso, Viña del Mar, Santiago, Temuco and local condominiums within the wilderness areas has confronted people with fires. In addition, this new situation has increased the risk to fire personnel. The fires are more complex to fight, due to the mixture of different fuels and structures in the interface. Often this situation forces the overhead team to change the fire strategies to safeguard life and property.

During the late 1990s arson fires increased substantially in certain southern Regions, impacting Monterey pine plantations, people and private property.



Figure 4. Homes threatened by fires near Concepción

Fire management organization used in Chile

Fire Control is a governmental- by law- responsibility, carried out by the Corporacion Nacional Forestal (*CONAF*). *CONAF* is the country's Forestry Service, an organization created in 1970 and attached to the Ministry of Agriculture. It has the mission to “*Guarantee for society the sustainable use of forest ecosystems and efficient management of the National State-owned protected Wilderness Areas System, with a view to contributing to the improvement of quality of life for present and future generations*”. The fulfilment of this mission is achieved, among others, by protecting forest ecosystems from the action of harmful agents, such as wildfires.

CONAF carries out an organized Forest Fire Management Programme through actions of prevention, pre-suppression and suppression throughout the country. With the support of the United Nations, U.S. and Canadian agencies, Chilean specialists have been able to visit other countries and receive training with the most advanced technologies. In turn, Chileans hosted specialists from those countries. This exchange of specialists has been helpful in building a successful programme.

As the only government agency in the forestry sector, *CONAF* has implemented a single national standard in forest firefighting operations. This has been the first key to success.

The second key has been the active participation of the private forestry sector, which committed to protecting its own lands according to forestry regulations beginning in the 1980s. Sixty-eight per cent of Chile's land is in private hands, so this is a significant factor. Large and medium-sized firms, adopting and adapting the government's expertise, are implementing their own forest fire protection programmes.

Based on this momentum, *CONAF* has continued to protect the country's forest heritage, such as parks and forest reserves, directly and, more importantly, to do so in a secondary role with small and medium-sized firms.

Without doubt, it is this relationship between the two forest protection participants in Chile, which constitutes our third key to success in protecting forest resources.



Figure 5. Government-private sector helitack crew, near Lautaro.

Each season, *CONAF* and the forestry firms programme the operation of a total of 140 ground hand/engine crews, 24 helitack crews, in addition to such pre-suppression and co-ordination resources as 153 motorcycle prevention specialists, 25 dispatch centres and 241 lookout towers.

The ground units are typically composed of 8 to 20 completely equipped and trained professional firefighters who operate manual tools, fire equipment and mechanised equipment (portable chain saws and motor pumps) with high safety standards. They are transported in light and medium vehicles (4x4 vans, minibuses, buses and trucks) and tanker trucks; and applies Class A suppressant foam.



Figure 6. Typical initial attack ground crews

In Air Attack, during each fire season, a large fleet of powerful initial attack resources is operated. Twenty-two light airtankers, *PZL*, *M-18 Dromaders*, *Air-Tractors (AT602/802)* and *Turbo Thrushes*, work together with large airtankers such as the *Canadair CL-215* and the *SP-2H Neptune*.

Also 25 helicopters, such as Aerospatiale, SA 316B/SA-315B, Bell 206 B, L-III, 204/205-A-1/, 407/, 222/209 and Ecureuil AS-350s, work in Helitack equipped with Bambi-buckets, Helitanks and elite personnel. This air-mobile approach has demonstrated outstanding results and efficiency in containing and controlling a large number of fires in the country.

During the 1999-2000 fire season, Chile will begin to operate its first Hispanic female Helitack crew.



Figure 7. Some of the air attack fleet ready for fires

Table 1. Wildfire Database: Numbers of fires and area burned during the period 1990-1999.

Year	Total No. of Fires on Forest, Other Wooded Land, & Other Land	Total Area Burned on Forest, Other Wooded Land, & Other Land ha	Area of Forest Burned ha	Area of Other Wooded Land Burned ha	Human Causes (*) No.	Natural Causes (*) No.	Unknown Causes (*) No.
1990	4,114	25,545	7,308	18,237	3,649	n/reg.	465
1991	5,193	50,273	13,578	36,695	4,695	n/reg.	498
1992	4,786	24,224	3,807	20,417	4,370	n/reg.	416
1993	6,114	49,981	16,343	33,638	5,588	n/reg.	526
1994	6,210	65,606	21,052	44,554	5,719	n/reg.	491
1995	5,354	26,174	7,588	18,586	4,915	n/reg.	439
1996	5,886	40,082	19,083	20,999	5,392	n/reg.	494
1997	5,487	43,595	20,150	23,445	5,311	n/reg.	176
1998	5,329	90,888	64,147	26,741	5,057	n/reg.	272
1999	6,830	101,691	50,898	50,793	6,359	n/reg.	471

Note: Total number of fires and area burned in Chile between 1990 and 1999 on forest, other wooded land and other land. The data cover each fire season, i.e. 1990 corresponds to the 1989/1990 fire season. n./reg. = not registered.

(*) Only 9.1 percent of the fire-causes are investigated.

Most fires are caused by human activities. Lightning or other natural causes are insignificant or not registered. People's carelessness while passing near forest or shrub areas causes 30.7 percent. Carelessness while using fire in forestry and agricultural activities is significant, with 10.7 percent. Intentional activities cause 36.1 percent, recreation sports and children playing with fire cause 9.4 percent, other activities and other causes 4.1 percent and unknown causes account for 9.0 percent.

The wildfire database is managed by computer and paper records. The fire database will be available in CONAF's website: www.conaf.cl at the end of year 2000).

Overall average annual number of fires: 5,200 fires

Overall average annual fire size: 10.3 hectares

Average annual number of fires in the 1990s: 5,530 fires

Average annual fire size in the 1990s: 9.14 hectares

Use of prescribed fire to achieve resource management objectives

In Chile, the use of fire (average of 300,000 hectares /year) has contributed to the development of the country, but it also has damaged natural resources, either intentionally or not. The initial objective was to make some areas suitable for agriculture and livestock raising. However, the global results have been negative for the country.

The use of fire has created conditions to have many fires burning thousands of hectares of forest. Due to these results, many laws have been enacted to control and regulate the use of fire in forestry and agricultural activities; and severe penalties have been established for infractions. In addition, these laws have defined suppression responsibilities and the private forest owner's protection obligations. The principle legislation starts with the Penal Code (1874), followed by the "Forest Law" (1931) and the Supreme Decree 276 (1980). This last law stated the concept of "*controlled burning off*" to eliminate vegetation in a direct way, limited to a previously specified area, a specific day in the fire season and in compliance with stated technical rules to keep fire under control (firebreaks, burning methods, personnel support, etc).



Figure 8. Prescribed burning in Region VIII

In 1990, the concept of "prescribed burning off" was introduced for special counties that contained high risk and dangerous areas. These counties could develop hazard reduction burn plans that were signed by a forester.

Today the current policies and practices of the main forest companies are to reduce the use of fire as much as possible, limiting it to those circumstances where there are no other options. Alternative practices of using mechanical methods (chippers/biting machines, etc.) are carried out, being more acceptable by local communities. Improving the controlled application of prescribed fires and transferring this knowledge to small landowners that use fire is the main goal of CONAF for the 2000s.

Public policies affecting wildfire impacts

The 1976, 1979 and 1982 laws describe *CONAF*'s functions. The enforcement and control of all regulations that rule these matters, besides the investigation of wildfire causes, is carried out by the *Carabineros de Chile* Forest Police. In addition, *CONAF* protects small forest owners who have not enough capacity to protect their own holdings; and *CONAF* assists medium and large private companies in fire protection through various forms of coordination, support and participation. To assure the fulfilment of this policy, *CONAF* has set up fire dispatching and firefighting priorities throughout Chile.

On the other hand, according to the Decree Law 701 regulations, private forest owners must submit a wildfire protection plan for their property; including prevention, pre-suppression and suppression activities, which are reviewed and controlled by specialists from *CONAF*.

Besides the prescribed fire policies, *CONAF*'s goals for 2000 are focused on improving local Government participation in prevention and suppression activities. Communities will be encouraged to adopt specific protection programmes to incorporate more technology in their operations and to safeguard human lives.



Figure 9. Fire prevention technology transfer day in Region IX.

Sustainable land use practices used in Chile to reduce wildfire hazards and wildfire risks.

Law rules all forest management activities on forestland in Chile. The private owners must submit and follow a *Forest Management Plan* completed by a forester for their property, including forest regulation and protection activities. In these practices, inside and perimeter firebreak construction is considered. Also, the owners must have an annual maintenance programme for firebreaks.

In Monterey pine and Eucalyptus sp. plantations, where pruning, thinning and harvesting are conducted, slash is managed to reduce the fuel load.

Perhaps the most important land use practice to reduce wildfire risks is the one that reduces the use of uncontrolled fire in forestry and agricultural practices.

As in other countries, the development of green firebreak programmes that introduce less flammable species are in progress, which will help agro-silvicultural programmes for small owners.

Community involvement in fire management activities

The local community involvement in fire actions is one of *CONAF*'s main goals, because people cause almost 100 percent of fires.

The communities actively participate in special *Prevention Programmes* throughout fire-prone areas of the country. There are *Recreational Journeys* with sports activities (soccer games), fire prevention painting festivals, "traditional Indian folk presentations" (music, dance and songs) and focus group workshops with neighborhood committees. *CONAF*'s prevention specialists (anthropologists, elementary/high school teachers and foresters) work as facilitators to help people solve on-site fire problems.



Figure 10. *CONAF*'s prevention officer working with the future.

Using the county network programmes, local communities make their own firebreaks in high-risk interface areas every fire season.

Finally, following a *CONAF* on-site theatre example where the shows are set up in high occurrence fire zones, local communities now have their own plays for their neighbourhoods.

Reference

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IFFN/GFMC contribution submitted by:

Patricio I. Sanhueza Bravo
Jefe Nacional Operaciones/Manejo del Fuego
Chief, National Fire Prevention Program
Fire Management Department
National Forestry Cooperation CONAF
Av. Bulnes 285 of.201
Santiago
CHILE

Fax: +56-2-699-4605
Tel: +56-2-390-0180 / 390-0181
e-mail: psanhuez@conaf.cl