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THE EVOLUTION OF PREVENTING AND FIGHTING FOREST FIRES IN THE SANTA CATARINA MILITARY FIRE DEPARTMENT - FROM EMANCIPATION TO THE CENTENARY

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Abstract: This study investigated the evolution of forest fire prevention and fighting carried out by the Santa Catarina Military Fire Brigade and discussed the future of the activity, considering the time frame of the emancipation of the CBMSC in 2003 and the approach of the Corporation's centenary in 2026. Three axes of evaluation were defined to measure this evolution: i) Human resources (training, quantity, training); ii) Doctrines and applied technologies (creation of a Coordination Office for the activity, evolution of techniques and implementation of new equipment) and iii) Institutional organization (opening of barracks, evolution of legislation, presence in advisory bodies and councils). Proposals under development at the CBMSC were presented, such as the creation of a Center of Excellence for the education and training of firefighters and brigadiers and the development of academic studies.

Keywords: Forest fires; Fire Brigade; Santa Catarina; Forest Protection.

INTRODUCTION

Forest fires are common events that have been occurring for millions of years. Some of their effects can be beneficial to the environment, as they help plants that need to burn to spread their seeds, kill diseases and insects that attack plants, among other things. However, the quantity and intensity of fires in recent years has skewed the effects to the negative side.

The Constitution of the State of Santa Catarina (SANTA CATARINA, 1989), in Article 108, item I, states that the Santa Catarina Military Fire Brigade (CBMSC) is responsible for: "I - carrying out services to prevent accidents or disasters, firefighting and search and rescue of people and property and pre-hospital care". Thus, throughout the state of Santa Catarina, the CBMSC keeps its operational staff ready to respond to all types of incidents that pose a risk to life and property, including forest firefighting.

Between the beginning of 2018 and June

2024, there were 24,293 incidents of fire in vegetation in which the corporation was involved (CBMSC, 2024). Most of these fires are small, require quick firefighting techniques and use simple tools and equipment. However, a smaller proportion become large forest fires, requiring firefighters to use more advanced techniques, as well as more robust materials and equipment to fight them effectively. Some operations can last for days, such as the fire in the Serra do Tabuleiro State Park in September 2019, which required the use of one hundred and eight firefighters, four water trucks, a helicopter and various other resources.

This work aims to measure the evolution of the CBMSC in Forest Fire Prevention and Combat, in the time frame from emancipation in 2003 to the present day, projecting growth prospects until the centenary in 2026.

MATERIAL AND METHODS

The CBMSC was officially created on September 26, 1926, within the organization chart of the then Public Force (now the Military Police) with the support of Governor Adolfo Konder. Since 2003, under its own management, the corporation has sought to evolve in all operational areas. It has the prerogative to respond to emergencies throughout Santa Catarina, so the area of the research is the state of Santa Catarina with its 95,730.7 km² and entirely inserted in the Atlantic Forest biome.

In order to meet the proposed objectives, three axes were defined which will serve as a guiding path for measuring the evolution of the CBMSC quantitatively and qualitatively. The axes are: i) Human resources (training, quantity, training); ii) Doctrines and applied technologies (creation of a Coordination Office for the activity, evolution of techniques and implementation of new equipment) and iii) Institutional organization (opening of new barracks, evolution of legislation, presence in advisory bodies and councils).

To obtain this information, we consulted the bulletins, files and reports published by the institution, through a search in the CBMSC library, as well as the e-193 incident management system. In addition, conversations were held with older firefighters in order to gain a better understanding of this evolution and, in a way, provide a historical overview of this area of activity within the CBMSC.

RESULTS AND DISCUSSION

As the institution responsible for carrying out a large part of the forest fire prevention and fighting activity in Santa Catarina, the CBMSC has a duty to continually strive for excellence and evolution in the services it provides. This section presents the results obtained and discusses each of the proposed areas.

HUMAN RESOURCES

Recognizing the importance of working to prevent and combat forest fires, the CBMSC works to train and educate its staff, raising the technical level of the corporation so that response to this type of occurrence is increasingly efficient and safe.

In this context, students on the officer and non-commissioned officer training courses have theoretical and practical lessons in forest firefighting. In addition, in 2008 the Forest Firefighting Course was created for graduates, with a view to updating the troops on theoretical and practical aspects, presenting the changes in the legal landscape, as well as new techniques, tools, equipment and accessories.

Given the increasingly aggressive impact of forest fires on the planet, as seen in the recent major fires in Portugal, Australia, the United States, Canada and Brazil, the focus on prevention is becoming increasingly important. With this in mind, in 2023 this operational course was renamed the "Forest Fire Prevention and Combat Course" (CPCIF).

The CPCIF is a course organized and taught by the corporation itself, which has evol-

ved with the emergence of new knowledge and technologies. The CPCIF aims to train students in the following subjects: basic fire theory; propagation and behaviour; organization and safety rules; equipment, tools and accessories; firefighting methods; prevention; environmental legislation; forest firefighting operations. In addition, subjects relating to Santa Catarina's forest cover, rescuing wild animals and investigating the causes of fires are covered. This set of lessons is taught over 90 hours and involves theoretical and practical lessons for up to 24 students.

Since 2008, 288 firefighters have been trained, more than a hundred of whom were members of the CBMSC Task Forces. All of these graduates return to their original barracks, share the knowledge they have acquired and become a reference point for their colleagues in dealing with vegetation fires.

DOCTRINES AND APPLIED TECHNOLOGIES

After the concern with training human resources, another axis for the evolution of Forest Fire Prevention and Fighting (PCIF) is the creation and advancement of the doctrine adopted and the use of new technologies.

Parizotto (2006) defended his master's thesis at the Federal University of Paraná with the title "O Controle dos Incêndios Florestais Pelo CBMSC: Diagnóstico e Sugestões Para o Seu Aprimoramento" (Forest Fire Control by the CBMSC: Diagnosis and Suggestions for Improvement), becoming a pioneer in proposing a doctrine for the PCIF at the CBMSC. In January 2012, the Forest Firefighting Coordination Office was set up, made up of five officers who began to organize knowledge, organize courses, promote the dissemination of good practices and serve as a technical and advisory reference for the CBMSC Command. The Coordination currently has 21 members, 6 of whom are officers and 15 squares, to improve the PCIF in the CBMSC, through courses, trai-

ning, the production of technical material and the testing of new equipment and technologies.

In terms of taking preventive and predictive action, the CBMSC initially used the Monte Alegre Formula to measure the likelihood of forest fires and to prepare teams in advance. It is worth highlighting the conclusion of the Command and Staff Course by De Souza (2013), entitled “Fire Danger Index in Municipalities in the State of Santa Catarina”.

With experience in various types of disasters, including forest fires, the Task Forces (FT) were created in 2011. They consist of organized personnel on standby in the CBMSC’s 15 battalions. The aim is that when a disaster strikes and the response capacity of the local teams is exceeded, the nearest FT teams will respond. The teams have specific training in disaster areas and operate autonomously (they bring tents, food and equipment with them) so that they don’t become a logistical burden for those who receive them (who are already overloaded).

With the evolution and spread of satellite technology, the CBMSC started using information provided by EPAGRI/CIRAM and also FIRMS/NASA. With a view to its centenary in 2026, the CBMSC has begun tests with startups that use satellite sensing (bringing together around 70 factors) to predict fire outbreaks.

As a point of organizational and doctrinal evolution, it is worth noting the creation of the e-193 system in 2007, which made it possible to record incidents in a digital and standardized system in the state. The system allows statistical information to be extracted from occurrences such as response time, travel time, among other data, and thus improves the doctrine of team deployment. In 2019, *Analytics* was implemented, bringing the concept of *Business Intelligence* to analyze incidents. Before 2007, this was done manually on paper in each barracks, making it extremely difficult to get a proper overview of the problem at state level. The CBMSC has also invested in training military personnel in georeferencing

using GIS software, such as QGIS, for better planning and execution of operations.

From 2003 to the present day, many innovations have been implemented to optimize the work of forest firefighters, including the PickUp Kit, blowers, chemical retardants, RPA (remotely piloted aircraft), among others. For the future, with a view to the centenary and beyond, the CBMC has already started testing technologies using satellite images and sensing to predict forest fires. This technology assesses more than 70 factors (humidity, slope of the terrain, type of vegetation, among others) to determine the likelihood of a fire. Although they are already in use by the CBMSC, the RPAs will make great strides in fighting forest fires. The latest models have on-board thermal cameras, making it possible to find the hottest spots along the fire line. In the future, they will be able to carry out autonomous scans to improve the situational awareness of teams in the field.

Following the example of international institutes, the CBMSC is seeking to improve its research into forest fires. Plans are currently underway to build a Center of Excellence in Forest Fire Prevention and Combat. This structure will be a complex for training troops and the community, with the possibility of using it at any time of the year, even when the weather conditions are not favorable. Currently, in order to put students in a real training situation, the CBMSC depends on third parties providing areas for burning, as well as having suitable burning conditions, which is quite difficult considering the state’s climate. Previously, in 2018, the Forest Fire Studies Laboratory (LEIF) was built in Xanxerê, with a range of equipment, including a burning table for testing plant fuels and different inclinations. This environment was used to train firefighters and professionals involved in the area. LEIF currently has a mobile structure in Lages and will be integrated into the Center of Excellence.



Figure 1. Future facilities of the Center of Excellence.



Figure 2: Experiment on the firing table at LEIF

INSTITUTIONAL ORGANIZATION

The last axis refers to Institutional Organization and describes the corporation's organic advances in terms of greater distribution throughout the state, organization of the services provided, greater influence in state and federal councils and bodies, as well as increased relevance in society, especially with socio-educational campaigns.

Initially, it should be noted that the CBMSC, after its emancipation, worked to increase the number of barracks and their coverage in the state. This has considerably reduced the response time to incidents. In particular, when it comes to forest fires, the sooner the fight is started, the less it will spread and the less damage it will cause. Thus, in 2003, the Corporation had 53 barracks, until the expansion to

the current 144 municipalities that have Military Firefighter Organizations, which corresponds to 90% of Santa Catarina's population living in a city with an active barracks, the highest rate among the states of Brazil.

As for the services provided, in addition to firefighting itself, it is important to highlight the importance of fire investigation. This is an important phase in the operational cycle of firefighting activities, as it is the phase in which the causes and consequences are verified, as well as whether all the prevention and firefighting actions have been carried out correctly or whether there have been failures that need to be corrected.

In Brazil, most forest fires are not investigated. There are no parameters for assessing the causes of fires and it is difficult to understand whether prevention actually works. At the CBMSC, expertise in building fires is mandatory, and the corporation is working to implement the same measure for vegetation fires. This is done by training troops to carry out forensics on forest fires, but also by adopting technology, especially with the help of satellite imaging and monitoring tools, which help to detect fires quickly and monitor their progress

In the institutional sphere, at state level, an important milestone was the appointment in 2008 of military firefighters to CONSEMA - the State Environment Council. Participation in the council is fruitful because the CBMSC provides the vision of the institution that acts in emergencies to safeguard biomes. When the previous stages of protection fail, the CBMSC takes action, whether it's containing dangerous products on a highway or fighting forest fires.

At the federal level, the CBMSC has been a member of the National Council of Military Fire Brigades of Brazil (LIGABOM) since 2019, and more specifically of the Forest Fire Management Committee - CONAGIF. Many fruits have been generated from this involvement, including the participation of the CB-

MSC in firefighting operations in the Pantanal and Cerrado in the states of Mato Grosso do Sul and Mato Grosso in 2020 and 2021, in fires in Canada in 2023, as well as the training and exchange of military personnel in the National Force (approximately 40 firefighters from the state served in other states with the National Force). It should also be noted that this exchange promotes the exchange of knowledge and doctrines, further improving firefighting techniques in Santa Catarina.

Finally, the CBMSC is implementing an institutional policy to bring the community closer together and raise awareness of how to prevent and combat forest fires. In some specific cases, local communities and biomes are greatly affected by forest fires, which also affect the people who live and work there. For this reason, we are looking to train volunteers who are willing to act as community representatives in prevention and, when the fire still occurs, to take part in the firefighting actions as a fire brigade, helping the CBMSC and reducing the response time to a fire incident.

CONCLUSIONS

The CBMSC has had its own management for approximately 21 years and great progress has already been made. An analysis of the three axes - *human resources, doctrines and applied technologies* and *institutional organization* - shows the commitment to training, innovation and strategic expansion.

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As far as human resources are concerned, the CBMSC encourages the training of its personnel through training and specialization courses, as well as the production of academic work. In this regard, the creation of a Forest Fire Coordination Office brings together firefighters interested in the area, which allows for the improvement of doctrines and technologies applied in the corporation's operational work - in addition to the founding of LEIF and the proposal for a Center of Excellence in forest fires, in collaboration with academic institutions in order to further raise the CBMSC's standard of excellence.

Finally, the institutional presence in advisory bodies and councils, as well as the installation of units strategically distributed throughout the territory, have strengthened representation, responsiveness and adaptation to the demands presented by the current climate scenario.

Given the above, the goal is to reach the Corporation's centenary by placing it as a benchmark in Forest Fire Prevention and Combat in Latin America, projecting a future of continuous improvement and innovation in environmental protection and public safety in Santa Catarina.

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