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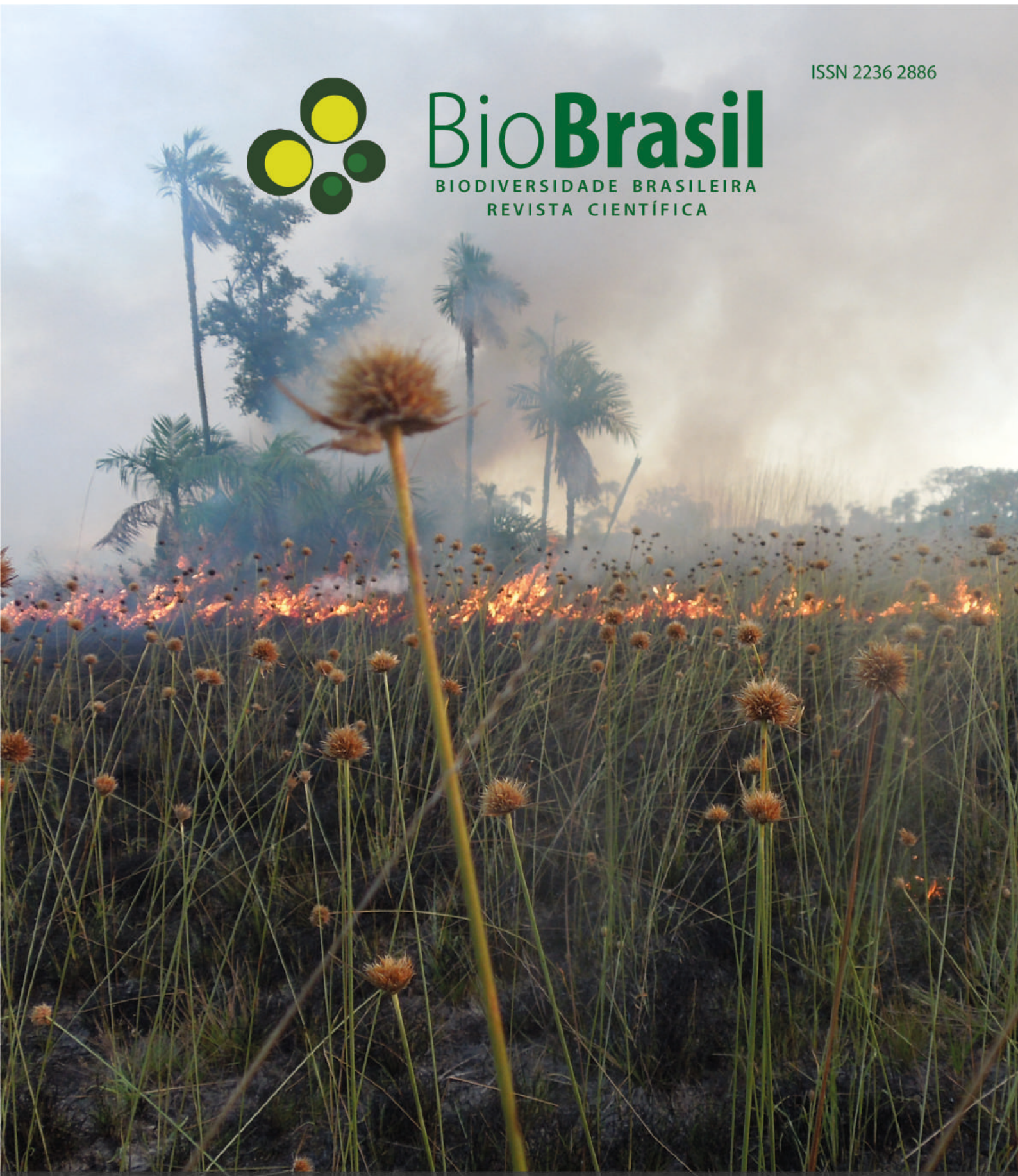

Special Issue:

7th International
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Editorial

7th International Wildland Fire Conference

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The 7th International Wildland Fire Conference was held for the first time in Latin America in 2019. Brazil was the host of the event that took place in Campo Grande, MS, from October 28 to November 1, after going all around of the world. The series of conferences, also known as Wildfire, celebrated its 30 years of existence in this edition, being called Wildfire+30. The first Conference was held in Boston, United States, in 1989 as a response of the international community to several wildfires that happened in many countries in the 80s. The first conference was a milestone for the establishment of the bases for global and transboundary cooperation on fire management, which were gradually improved in the following editions: 2nd edition in Vancouver, Canada (1997); 3rd in Sydney, Australia (2003); 4th in Seville, Spain (2007); 5th in Sun City, South Africa (2011); 6th in the city of Pyeongchang, South Korea (2015).

The strengthening of bilateral and multilateral cooperation agreements established between the conferences fostered the creation of the Global Wildland Fire Network and the Regional Wildland Fire Networks. Nowadays there are 15 Networks (14 Regional Networks and the Global Network) around the world that dialogue, cooperate and promote the exchange of knowledge, experiences and lessons learned, improving national and regional cooperative fire management capacities and strategies, networking and strengthening interoperability of cross-border cooperation and multisectoral actions in integrated fire management.

Wildfire+30 tackled Integrated Fire Management (IFM) as its main point of technical and scientific discussion. IFM approach seeks the integration of the traditional knowledge and practices in communities, the academic and research activities and the paradigm shift in public and private institutions in charge of fire, evolving from a zero-fire point of view to a to a policy considering fire as a management tool. Considering the idea of 'facing fire in a changing world', the technical debates at the conference sought to bring up strategies for 'reducing vulnerability of people and landscapes by IFM'.

The conference had five main subthemes (https://www.ibama.gov.br/wildfire2019-theme) for discussion. The role and contribution of civil society in the IFM (subtheme 1) permeated all debates, emphasizing the importance of traditional and indigenous knowledge for fire management. This issue is particularly important in Latin America, rich in traditional and indigenous peoples and populations with a centuries-old history of environmental conservation, respect for ecosystems and a dynamic knowledge about the use and role of fire in different landscapes.

Wildfire+30 highlighted and brought visibility to the role of women in integrated fire management. This issue still brings many challenges, but it has also advanced significantly thanks to the leadership of many brave women. The focus of the sessions related to this theme pointed out the challenges for women to jump into fire management, the ongoing advances and how we can improve even further, seeking balance, cooperation and integration of women and men aiming to minimize the damages of 'bad fire' and to promote 'good fire' for environmental conservation.

The role of private companies was also an important theme of the conference, aiming to show the opportunities for public-private partnerships as a possibility of strengthening the effectiveness of integrated fire management actions.

The IFM concepts for stabilizing fire affected landscapes and promoting resilient territories (subtheme 2), and for mitigating secondary impacts (subtheme 3), as well as the technological advances on prevention and fighting wildfires (subtheme 4) gave the scientific tone of the conference. In these subthemes were discussed: food security, environmental services, water security, atmospheric pollution, greenhouse gas emissions, human health and security, carbon credits, REDD+, recovery of areas affected by fire, remote sensing, fire propagation models, among other aspects of relevance to integrated fire management.

The integrated fire management was discussed as a key element in fire management policies (subtheme 5) for providing subsidies and innovations to the development of public policies based on identified and learned lessons. The lack of such policies can lead to disconnected actions of institutions and communities. It is through the development of coherent public policies that scientific, technical and community knowledge can be strengthened to promote global changes.

Special Issue: 7th International Wildland Fire Conference - Abstracts

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1. Role / Contribution of Civil Society in Integrated Fire Management (IFM)

1.1. IFM knowledge of indigenous and traditional communities
1.2. Role of women
1.3. Volunteering in integrated fire management
1.4. Role of the private sector (forestry & agriculture)
1.5. Role of NGOs
1.6. Role of academic and research sector

Patch Mosaic Burning: Traditional Knowledge Supporting Management Decision Making

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ABSTRACT – Patch mosaic burning is a practice performed by many traditional peoples and communities who use fire in the management of savanna landscapes around the world. However, in Brazil, for a long time, this ancestral practice was understood as an archaic and low-tech technique. An example of this is the case study at the Serra Geral do Tocantins Ecological Station (EESGT), where traditional community were treated as incendiaries by environmental managers. This perception neglected for more than a decade real opportunities to incorporate them into the territory conservation project. Therefore, only in 2012 to 2014, a commitment term between EESGT and quilombolas community, recognized and allowed the traditional use of fire for agricultural, pastoral and extractives practices. At this same period, the environmental agency was also transiting from a pyrophobic institutional management approach to an integrated fire management (IFM) approach, leading with news perceptions of the ecological and social role of fire in Jalapão and advocated the use of prescribed burns for fuel management and for pyrodiversity promotion. The practice of patch mosaic burning has also been adopted by managers in other tropical savannas protected areas around the world, such as Australia and South Africa, resulting in reductions of mega-fire occurrences. We conclude that actions to protect EESGT sociobiodiversity require a multidisciplinary, holistic and participatory management approach that seeks to understand the complexity of relationships between people, fire and protected areas.

***Keywords*:** mosaic burning, integrated fire management, prescribed burning, pyrodiversity, fire prevention.

Evaluation of traditional fire management in the Brazilian Cerrado

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ABSTRACT – Fire is a natural component of ecosystems and has been widely used by indigenous peoples in the management of tropical savannas. However, in recent decades, public policies aimed at the exclusion of fire have suppressed the use of burns and the related traditional knowledge has begun to be lost. Recently, traditional management has been valued again, being restored and applied as a strategy for protection against forest fires and management of natural resources by indigenous brigades hired by Ibama / Prevfogo. In the Brazilian Cerrado, this traditional knowledge recommends a concentrated fire regime between March and May, with some regional variations. Among the main management objectives was the increase in the amount of edible fruits and animals. The present work aims to evaluate if these objectives were achieved, after 03 years of implementation of this traditional regime in 16 Indigenous Lands. The evaluated fruits were Hancornia speciosa (mangaba), Byrsonima sp. (muricis), Anacardium occidentale (cajuí), Mouriri pusa (puçá), Caryocar brasiliense (pequi) and Pouteria ramiflora (veadeira). The animals evaluated were from the families Cervidae (deers), Canidae (wolves and foxes), Tinamidae (partridges) and Dasypodidae (armadillos); as well as the anteater (Myrmecophaga tridactyla), emu (Rhea americana), tapir (Tapirus terrestres) and seriema (Cariama cristata) species. The effects on the flora were evaluated by the proportion of reproductive individuals and the fruit yield per plant. The fauna effects were assessed by the frequency of traces. The traditionally managed areas (prescribed burns) were compared with areas hit by wildfires and areas subject to fire exclusion. In the managed areas, all plants showed better reproductive rates than the other treatments, except H. speciosa, which presented better results with the exclusion of fire. In relation to the animals, half of them preferred the managed areas and the other half preferred the areas excluded from fire. No animals or plants presented better results in areas affected by wildfires. The results show that traditional management was efficient to increase fruit and game production for the studied indigenous communities, validating the traditional use of fire for these purposes.

***Keywords*:** integrated fire management, prescribed burning, traditional knowledge, indigenous communities, natural resources, food security.

Evaluation of traditional fire management in an Amazonian savanna

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ABSTRACT – Lavrado is a savanna located in the Amazon biome. Its full extent is strongly impacted by wildfires and prescribed burns, but there are few scientific studies on the effects of these fire regimes on this unique ecosystem. Recently, the traditional knowledge about the use of fire in the Lavrado has been retrieved from the indigenous communities that inhabit the region and applied as a strategy to protect against forest fires and to manage natural resources. This knowledge recommends the use of burns in open vegetation areas between September and December, in order to reduce forest fuel and induce the reproduction of edible fruit species. This present work aims to evaluate the effects of this traditional regime on the fruit species Byrsonima coccolobifolia (murici), Byrsonima crassifiolia (mirixi), Byrsonima verbascifolia (orelha de burro) and on creeping species of the Myrtacea family, popularly know as araçás. The treatments evaluated were modal burns (September and October), late burns (November and December), wildfires (January to March) and fire exclusion. The evaluated parameters were the proportion of individuals in reproduction, loss of reproductive structures due to fire and fruit yield per plant. The obtained results indicate different responses to the applied regimes. B. verbascifolia showed good reproductive rates in all treatments that include fire, while B. coccolobifolia and Myrtaceae (araçás) responded better to early prescribed burns. B. crassiflolia presented better reproductive rates in fire exclusion, followed by modal burns, late burns and, lastly, wildfires. In general, there is a tendency for modal burns to have higher reproduction rates, less loss of reproductive structures and higher fruit productivity than late burns for most species. However, this burning period is too short and unstable to allow management throughout the region. In addition, the effects on reproduction were more variable than those observed in the Brazilian Cerrado. As observed in the flooded regions of Araguaia and Xingu, the flood pulse and saturated soil appear to promote greater complexity of fire response, which needs to be further studied to determine the optimal management in this type of ecosystem.

***Keywords*:** integrated fire management, prescribed burns, traditional knowledge, indigenous communities, lavrado roraimense, Amazon biome.

Focus Group as a tool for a participatory construction and development of Integrated Fire Management strategies

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ABSTRACT – Integrated Fire Management comprises a contemporary approach to fire management that combines sociocultural realities and ecosystems ecological needs with technological approaches to propose prescribed fires, thus preventing, monitoring and combating megafires. In this context, it is necessary to construct an integration between social actors related to the fire, as there are often divergences in perceptions and conflict regarding the fire use. The Focus Group is a strategy for collecting information from a focus theme that privileges a space for interaction between the group and the researcher / facilitator, which encourages participants to listen and share experiences. This study aimed to verify the experience of the Focus Group held in Carrancas, Minas Gerais, Brazil, in which are present different social actors aware of the occurrences and practices of fire management, in order to identify the difficulties and raise proposals about the fire use in natural areas management and conservation. Nine social actors participated, including traditional farmers, brigade members, people linked to tourism and public authorities. Participatory Rapid Diagnosis techniques were used, such as timeline, historical graph and participatory mapping, generating relaxation and involvement in activities. The dialogue made it possible to identify the traditional practice of controlled burning in rural ecosystems and the cultural changes that have contributed to the increase of megafires in recent years. The timeline and characterization of the largest fires, the survey of susceptible areas, and actions that should be prioritized for conservation of natural ecosystems were performed. The different fire scenarios (burnings and megafires) highlighted the different perceptions of social actors about their use, by the conflict between traditional farmers and brigade members, especially regarding fire management issues. The Focus Group proved to be effective in providing dialogue and greater interaction between social actors, reducing existing conflicts, generating reflection and subsidies to the construction of knowledge and management strategies, fire management and conservation of natural ecosystems.

***Keywords*:** fire ethnoecology, methodology, participatory actions

The native cashew tree of Roraima in the experience of Prevfogo in the Indigenous Lands of the "lavrado": to conserve and to use that ancestral wealth in that State whose own name derives from the Karib designation of the cashew – IOROI (Anacardium occidentale L.)

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ABSTRACT – The state of Roraima has the largest Amazonian savannah - the "lavrado", of about 61 thousand km², shared in part with Guyana. The region is inhabited by the Macuxi, Taurepang and Ingaricó ethnic groups (Karib linguistic trunk) and Wapichana (Aruak trunk), distributed in 27 Indigenous Lands. As is well known, savannas have fire as a factor of their own phyto-physiognomic formation. However, current human practices in agriculture and livestock have influenced the increase in fire cases. As they are repeated, the fires weaken the forested areas and provoke a growing savanization in this region and in its surroundings. In the work of Prevfogo / RR are involved six brigades - more than a hundred of brigadistas, selected and coming from the own communities. Over the years, it is remarkable how the use of prescribed burnings and burnings have shown a significant reduction in the need for combat during the most critical periods of the summer. Considering this indicator, the present experience of tree cultivation was carried out as a complementary strategy of MIF, focusing on cashew tree cultivation. The choice of this anacardiaceae was based on a previous study about the pre-Columbian occurrence in the region and its current natural geographic distribution in about 26 agglomerates called "native cajuais". In this “lavrado” environment, the species developed the typical characteristics of the "precocious dwarf cashew", developed by Embrapa in commercial clones from few plantations in the northeastern coast. Thus, the native cashews point out that here is a broad genetic base of this kind, whose conservation is essential for breeding programs. On the other hand, when looking at aspects of the recent history of the indigenous production system and the role of the cashew tree in it, the autonomous adoption of fruit tree plantations is noteworthy. It is urgent to propose initiatives involving research, academia and social organizations to establish action plans that contemplate the possibility of commercial cultivation. Given the vulnerability of the population and the ecosystem in the current reality, the perspective of yields derived from the cashew tree will lead to a new interpretation of the "lavrado", combining the use and conservation of this ancestral wealth. Income, on the other hand, will represent a better life for the families involved.

Keywords: 'Lavrado' of Roraima, traditional knowledge of fire, cashew tree.

The appreciation of the traditional knowledge of fire management as a tool for conflict management and strengthening of social participation in the Serra da Canastra National Park

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ABSTRACT – The fire, which is a socioenvironmental conflict factor in the Serra da Canastra National Park, was used, as an intervention proposal, as a theme for the approaching of conflicting actors. A meeting was held with residents of the Vão dos Cândidos community. A historical rescue was carried out, with knowledge accumulated over 200 years of management, and participatory planning of controlled burnings and firebreak by 2018. The approach did not aim to locating responsible for fires and information about the use of fire was sought. From the guiding questions "How," "For what?" And "When," they reported the use of fire in the region. The participation of neighbors in the burn was emphasized, which leads to the reinforcement of community ties. Residents reported that after the fire ban a conflict with the environmental agencies has started and that they considered fire fines unfair, since there is no interest from the residents in fires hitting their properties. The demand of fire use in August (peak of the drought period - late fire) after short rainfall period, which will ensure pasture regrowth during the end of the dry season (September) was highlighted. This information impacted the planning of the Protected Area (PA), which covered only the reversal of late fire for early and modal fire, and by that it should also predict a minimum area for late fire in order to meet the properties management. A intended future scenario was defined - what would need to be agreed upon for the community to be able to use fire, with authorization and planning, where the following subjects were highlighted: being able to put out fires without risk of being charged; use of fire according to legal norms and meeting agreements; prior communication to neighbors and ICMBio; protection of legal reserves and forest formations; choice of area being the owner's responsibility. A spoken map was produced with the location of the burning areas, where each interested party indicated the desired area. From this information a Community controlled burn authorization was issued. The proposal allowed to establish a minimum relationship of trust between both sides and to promote appreciation of the knowledge of traditional fire management. This is essential for restoring the use of fire and creating a sense of belonging regarding fire management at PA.

Keywords: controlled burn, community, fire management.

Exchange of knowledge about fires and burnings in search of integrated fire management in the IT Araribóia/MA and surroundings

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ABSTRACT – This work brings the experience of the Indigenous Land (IT) Araribóia and surrounding municipalities, as a way to minimize the environmental impacts caused by the high rate of fires that this area has presented, threatening the conservation of the Amazon rainforest and the survival of the indigenous people. Guajajara and the isolated Awa-Guajá peoples living in the protected area in question. This IT is located in the south of Maranhão, an area of 413 thousand hectares, with an estimated population of 13 thousand inhabitants (IBGE, 2012). In 2017, a territorial protection plan was prepared involving the State Coordination of the National Center for Forest Fire Prevention and Prevention (PREVFOGO) and the Environmental Education Center of the Brazilian Institute of Environment and Renewable Natural Resources (IBAMA) and several institutions: National Indian Foundation (FUNAI), National Institute of Colonization and Agrarian Reform (INCRA), Battalion Environmental Police (BPA), with local partnerships, such as: indigenous associations, rural unions, civil society and municipal governments. The objective was to sensitize indigenous and settlement community leaders with the formation of multipliers in the prevention and environmental education in the theme of burning and forest fires, encouraging the use of sustainable practices, conservation and sustainable use of natural resources and integrated fire management. The eight workshops took place in 2017 and 2018, involving 3 regions of TI Araribóia and its surrounding municipalities. 379 indigenous community leaders and land reform settlements participated. Participatory methodologies, group dynamics, spoken map, survey and visualization of problems and possible solutions were used from the construction of analysis and demonstration matrices for the implementation of agroforestry system. As already identified results, we have: elaboration of 41 action plans with themes related to the prevention and combat of forest fires, expansion of the articulation and communication between the involved institutions, increasing the level of effectiveness of the actions developed in the territory. Implementation of nurseries of forest species seedlings at TI Araribóia and planting in some spring areas. In addition to information received through informal reports from local residents about the decrease in fires in 2018.

Keywords: Indigenous people; settled; forest fires; methodologies participatory

Uruguay - Joint work of the private sector in the fire protection of implanted forests

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ABSTRACT – Uruguay is a country with a territorial area of 17 million hectares, of which 2.15 million are covered with forests. Of these, 850,000 hectares correspond to native forests and the rest (1.3 million), are implanted forests of Eucalyptus, Pinus and some Salicaceae, distributed over the territory, and owned by more than a hundred private companies. The area of implanted forests has increased greatly with the support of a policy of promotion of just over 30 years. Main destinations for the forests are cellulose production, and sawing for different purposes, but more than 95% export oriented. The plan described is the protection of such forests from wildfires, events that occur mainly in summer. The plan was designed, financed and executed privately, and implements fire prevention, detection and combat actions, affecting or threatening 1:200,000 hectares of forests. The accession to the plan is voluntary for members of the Society of Forest Producers, and its actions are based on strict protocols of action, covering all implanted forest areas. It encompasses prevention tasks through communication campaigns, detection of fire foci using airplanes and watch towers and, fire combat using helicopters and heli transported brigades, incorporating, if necessary, other means, property of the companies that hire the Plan. In the last five summers, more than 1,100 fire foci have been managed on average by the plan, reducing losses to less than 50 hectares per season. It can be concluded that it is a system adapted to the needs of those implementing it and the Uruguayan forestry sector and has achieved its objectives of protection, operational security framework, care of the environment and reasonable costs.

Keywords: implanted forests, prevention, detection and firefighting, companies

Voluntary Firefighter Crews at the Mantiqueira Conservation Units Mosaic

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ABSTRACT – The Mantiqueira´s mountain range, known as Serra da Mantiqueira, is considered by the scientific community as one of the irreplaceable areas for the biodiversity conservation (LE SAOUT et al, 2013). This mountain range is partially protected by two categories of protected area: "integral protection" and "sustainable use", created and managed by different governmental spheres, which compose the Mantiqueira Mosaic (Brazilian Ministry of the Environment - MMA Ordinance No. 351/2006) that currently has 17 Public Conservation Units (CUs) and 56 Private Natural Heritage Reserves (PNHRs). Complementary to the government agencies, civil society has always played an important role in the regional conservation, both by its historical engagement in movements to create new CUs, as well as by participating in those management councils. To train, equip and then, form voluntary firefighter crews is another example of the local society's engagement in the protection of Serra da Mantiqueira. It is an important tool to promote participatory management and increase social mobilization. In addition, the whole process mainly aimed to empower the owners and employees of the PNHRs, mountain guides, rural labor unions, city halls, farmers and organized civil society. At the end of the training course, voluntary firefighter crews are equipped with tools and personal protection equipment. In result, this proposal provides the society with trained and equipped firefighters squad in order to carry out the first attack, in case of wildfire. This paper presents data about the number of volunteers trained, in recent years, by the Chico Mendes Biodiversity Institute (ICMBio), through the volunteer program ruled by the Serra da Mantiqueira Environment Protected Area and Itatiaia National Park. The contingent of volunteers that have been trained or updated and equipped by ICMBio in the last 3 years, add up 89 new members, who are distributed in the municipalities of Aiuruoca, Cruzeiro, Delfim Moreira, Itamonte, Itatiaia, Marmelópolis and Resende, among the states of Minas Gerais, Rio de Janeiro and São Paulo, covering the Grande and Paraíba do Sul upper watershed. Despite the institutional effort, there are two main limiting factors to increase the number of volunteer firefighters: First is the difficulty to provide personal protective and combat equipment to volunteers. Second is the obligation to update personal and institutional documentation. It is noteworthy that the volunteers firefighters work in various CUs within the territory of Mantiqueira Mosaic.

Keywords: Serra da Mantiqueira; Conservation Units Mosaic; Volunteer Program; Forest Fires.

Together for the Community Against Fires

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ABSTRACT – The Santa Luzia Plant realized that the months of August and September are indicated as the months that suggest the lowest levels of rainfall, resulting in low humidity, which combined with improper practices of fire use by the local community ended up causing outbreaks of large fires. Nevertheless, the company's image was compromised, as after fires with unknown/criminal origins, Environmental Police inspections were followed by an Infringement Notice – even though there was no on-site operation and the fires were found to be criminal. As a result, the sector decided to carry out the campaign entitled "Together For The Community Against Fires" in partnership with the Municipality, the Fire Department, the concessionary responsible for the highways and the Rural Union, aiming to raise awareness by means of lectures in municipal and state schools, leaflets distributed in the highway 167 tolls and banners informing good practices, in order to prevent outbreaks of fire and the non-use of fire. This clarification process was necessary, since they believed that the burnings were intentionally practices of sugarcane cultivation. Therefore, it was necessary to clarify that the company was a victim of criminal action and that the practice is not part of sugarcane cultivation, once these fires cause productivity losses and fire-fighting costs. The results attained are the direct outcome of the minimization of fire outbreaks and information brought to the community, thus strengthening the company's image.

Keywords: civil society, private sector, agriculture, fire, prevention

The role of volunteering in the formation of the Cavalcante Brigade, GO

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ABSTRACT – This presentation address the history of BRIVAC's formation through the voluntary support of citizens of Cavalcante, GO and MIF, considering the appeal generated by the strong environmental, patrimonial and emergency impact of recurrent fire in our municipality. The residents of Cavalcante already have a historical relationship with fire, from their traditional use by the Kalungas communities, as well as through forest fires. From this relationship, the natural volunteers "brigade", sensitized to protect the more delicate vegetation from the fire in the 'Cerrado' and with the fragility of some people in relation to the uncontrolled fire, came together to help even without any technical knowledge in fire fighting operations and with little protection, risking their lives so that people would not lose their homes properties. In July 2014, the mountains that surround the city were affected by a great fire, necessitating extra help that united the already present 'PrevFogo/IBAMA, the Fire Department and the local Volunteers. In 2016, the population got together to buy a blowers (a specific tool for combat) that was needed by the Prevfogo, as well as the actions of the raised awareness. In the 2017, the entire 'Chapada' suffered the largest fire ever recorded, concentrating mostly on the PNCV - National Park Chapada dos veadeiros, and destroying more than 70 thousand hectares of native vegetation. On this occasion more than 200 volunteers were added to the fire combat. This action gave new perspective and it helped with the creation of a group of professional volunteers. In Cavalcante a contingent of 32 'brigades' was formed generating the creation of BRIVAC as formal result of the action of these volunteers, through the creation of a specific Department within the ACECE – Association of Conductors in Ecotourism, as good part of these volunteers are conductors in Ecotourism. In 2018, as result, practical stages were carried out with the prescribed firing directed by the MIF agent of Prevfogo and, as expected in that same year several fire outbreaks were recorded in the surroundings of Cavalcante and their efficiency. Volunteering remains strong, articulating awareness on the importance of MIF after what has happened and as expected, adaptations in the municipal legislation with guidelines regarding the fire and strengthening of management agents in the municipality.

Keywords: volunteering, integrated fire management, prescribed burning

The Indigenous Federal Brigades Program in Roraima: From Voluntary Brigades to Official Brigades and FUNAI-RR's Action in this Process

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ABSTRACT – This article deals with the experience of indigenous brigades in Roraima, where indigenous protagonism is an important factor in the process. Until 2012, PrevFogo/IBAMA in Roraima had only one Indigenous Brigade in Pacaraima, IL São Marcos, and four other non-indigenous. However, there were two volunteer brigades at Indigenous Reserve (IR) Raposa Serra do Sol, where indigenous people were trained by PrevFogo/IBAMA, with support from FUNAI, and there was strong pressure from the indigenous movement to get these brigades hired. Based on discussions around the Technical Cooperation Agreement (TCA) No. 41/2013 between FUNAI and IBAMA for the implementation of Federal Brigades in Indigenous Reserves, there was a closer dialogue between these institutions and indigenous communities, resulting in increased Indigenous Brigades, being installed in 2013 Brigades in four IRs and one in Settlement Project of The National Institute of Colonization and Agrarian Reform (INCRA). The following year, the Settlement Project brigade is dismembered and transferred to the IRs, totaling 6 PrevFogo brigades, all in Indigenous Lands: 2 at Raposa Serra do Sol TI (where before there were voluntary brigades), São Marcos, Araçá, Tabalascada, Serra da Moça. FUNAI-RR, through the Environmental and Territorial Management Service, keep up with the entire hiring process: publicizing the public notice, conducting the tests and since 2013 we have provided eating for all brigade trainings. Eventually we support combat. FUNAI's role in dialogue with communities is extremely important. Our challenge today is to provide a venue for Brigade headquarters. Four are installed in former FUNAI posts, which were extinguished in 2010, the other two work in facilities provided by the community itself, which value the work of the brigades. The brigade program in Roraima has been successful and has shown effective results, mainly through prevention activities focused on Integrated Fire Management (IFM), where interviews were conducted in the indigenous communities on traditional fire use, so that IFM practices can be appropriate to the local environmental and cultural reality. The brigade members, being indigenous, carry their traditional knowledge and use it in daily practices of prevention and combat, combined with the knowledge acquired in IBAMA trainings.

Keywords: Indigenous Brigade, Indigenous Lands, Environmental and Territorial Management, Roraima

Chiropractic assistance to firefighters from ICMBIO and IBAMA in Chapada dos Veadeiros - GO - Brazil

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ABSTRACT – In 2018, I performed a Chiropractic Sessions research—through ICMBIO's volunteer program—with ICMBIO and IBAMA PREVFOGO Firefighters from Chapada dos Veadeiros National Park in the state of Goiás totalizing 111 firefighters. The goal was to use Chiropractic to improve their Quality of Life and better adapt them to develop a higher performance in action (putting down forest fires). The Chiropractor is a health technician specialized in the spinal that is dedicated on minimizing and correcting spinal subluxations(blockages in the central nervous system) to help improve the functioning of the body as a whole (immunity and performance improvements, better adaptation to any kinds of stress). A worldwide validated, quality of life questionnaire (WHOQOL) was applied at the beginning and ending and the data was tabulated. The graphics show that, in general, the 4 domains evaluated in the WHOQOL questionnaire had a better result (physical, psychological, social relations and environment) after chiropractic ajustments.

Keywords: volunteer, firefighters, Quality of Life, chiropractic, health

Local knowledge and practices about fire use in wetlands management Argentina. A comparative study of fire regimes in two wetlands in Santa Fe province

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ABSTRACT – Wetlands are one of the most vulnerable ecosystems under current and future scenarios of climate change. Variation of rain distribution patterns, increase of extreme weather events (ENSO events, intense dry and rainy periods, heat waves), and changes in fire regimes (an increase of wildfire frequency and severity) are significant challenges for the design of wetlands management and conservation strategies. Moreover, this situation threatens rural wetlands communities' sustainability, along with their local knowledge and production systems. The wetlands of Paraná River delta and those of the Submeridionals Lowlands (Santa Fe province), are located in the central Argentinian region; here, the use of burnings is a common practice to manage grasslands to feed livestock. This traditional practice is deeply rooted among local rural communities, in spite of the legal prohibition enforced by authorities. This study focuses on analyzing fire practices and knowledge applied by local rural inhabitants. Which are the underlying rationales of burning? How do they choose the areas and time of the year to burn? How do they classify the grasslands? Which are the management and cattle range load applied in burning areas? We suggest that local knowledge and practices about fire management keep the relation to new processes of land transformation, such as cattle raising expansion, infrastructure development, conservation policies, and tourist valuation of local areas. In this way, we understand that local knowledge and practices originate through long regional historical processes, tightly related to land transformation and recent cattle development activities. Discussions about local knowledge historical perspectives concerning ecological aspects may allow finding alternative and sustainable ways of conservation. This new strategy will focus on enhancing transformative processes from previous fire suppression policies towards participative schemes that integrate rural communities, their living purposes and their production activities.

Keywords: fire, local knowledge, rural communities, wetlands conservation and management, grasslands, cattle raising, Argentina

Voluntary Brigades Work On Integrated Fire Management in Conservation Units

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ABSTRACT – In a current reality where environmental conservation has been related to the well-being of society as a whole and understood as an individual responsibility, voluntary work in wildfire prevention and control in protected areas is becoming more and more important. However, volunteers are not only active in prevention, control, development of new technologies, and data collection, but also disseminate a culture of protection and respect for nature which extrapolates the professional domain. Volunteer brigades involved in performing prescribed burns have significant knowledge of fire behavior and encourage civil society involvement, especially in the integrated fire management (IFM). The expertise of volunteers in preventing and fighting wildfires, coordinating teams that know the region where they operate, acting in different governance, climate realities, topographies and vegetation types can be useful tools to reduce the areas affected by high-severity fires through the IFM. Through trained volunteers, integrated fire management practices aim to minimize the costs of combat operations, stimulate research development, promote dialogue between scientific knowledge and empirical experiences, and improve the relationship between protected area managers and local communities. The prescribed burns have the potential to increase volunteer activity when compared to wildfires, as it is possible to schedule these planned actions. In addition, these activities promote high safety gains as prescribed burns tend to behave less intensely and more predictably than wildfires. The empowerment of civil society in implementing actions to conserve biodiversity in our protected areas increases the qualification of volunteer teams and reduces the vulnerability and discontinuity of activities, a situation to which government agencies are often subjected to customary budget cuts and, consequently, personnel, not always with good technical support for these tasks.

Keywords: Integrated fire management, civil society, voluntary brigade.

Indigenous firefighters: The important role of the Pemón indigenous brigades in the construction of intercultural fire management in Canaima National Park, Venezuela

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ABSTRACT – The Vegetation Wildfire Control Program (VWP) of the hydroelectric company CORPOELEC-EDELCA in Canaima National Park (CNP), has more than 35 years of continuous operation, undertaken by local native Pemón indigenous brigade members. Historically, the policies of the VWCP have aimed at fighting and suppressing fire, to protect the forests of the upper Caroní river basin (an area of 18,000 km2 that includes Gran Sabana Sector of CNP). This basin supports the hydroelectric Guri dam complex that provides 70% of the country's energy demand. Only 13% of the 2500-3000 fires that occur in the region each year are extinguished, despite constant and costly suppression efforts undertaken by these brigades. These suppressing fire policies, dictated by the senior management of CORPOELEC-EDELCA, have generated conflicts with Pemón indigenous communities. For the Indigenous peoples, fire is a central element of their cultural worldview used in their daily subsistence activities (sowing, hunting, fire prevention and protection of their forests). Increases in frequency and severity of vegetation fires due to climate change demand a rapid transformation of these suppression paradigms towards participatory and intercultural fire policies. The role of Pemón brigades is fundamental for the development of innovative institutions-communities' cooperation methodologies that promote spaces for co-management of fire in indigenous territories. This work summarizes the scope of workshops and interviews focused on the consultation and exploration of scenarios to integrate indigenous ancestral knowledge of fire management and the technical capabilities and experience of the VWCP. Participants agreed to a new model of integral fire management based on the inclusion of indigenous communities within participatory schemes. They pointed out that knowledge and practical exchange activities with the communities are beneficial for establishing direct contact with various indigenous groups (elders, captains, teachers, youngsters), understand and value indigenous cultural heritage (framed within the prevention program), and establishing cooperation agreements. Additionally, indigenous firefighters were recognized as critical stakeholders for the promotion and preservation of local wisdom, in a context where indigenous knowledge is going through a process of intense acculturation.

Keywords: Indigenous knowledge, fire, indigenous firefighter, integral fire management, Vegetation Wildfire Control Program, Canaima National Park.

The Social Map as a participative instrument to elaborate the Integrated Fire Management Plan of the Chapada dos Guimarães National Park

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ABSTRACT – Promoting the participation of surrounding communities and valuing their knowledge and cultural manifestations are objectives included in the Chapada dos Guimarães National Park Management Plan, wich extends to the fire management. This study presents how the "Social Map of popular knowledge related to fire" held in the São Jerônimo community contributed to the elaboration of the park's Integrated Fire Management Plan - PMIF 2019. Social mapping activities has followed the 'path' of fire in the daily life of the community since ancient times. The community has been experiencing recurrent wildfires in recent years due to water scarcity and local geographic formation, which turns fire combat more difficult. A mapping meeting and interviews with older residents allowed to identify spatially how their inhabitants dealt and deal with fire (habits), and how it interferes with their well-being and in nature (habitat). From the cartographies elaborated with and by the residents, it is possible to visualize fire as a fundamental dualogical social being in the daily life of the community. The bureaucracy to get controlled burning permits and the frequent incidence of wildfires, among other factors, contribute to the outbreak of social and environmental conflicts. By incorporating traditional knowledge into PMIF, we give audience and add value to the local culture. The stimulus to a dialogue based on the generating theme "fire" is the basis for a practical and reflective environmental education, settled in making and acting experiences, under the axiomatic perspective of values, ethics and political vision inherent in environmental education. Now, the park's management team is waiting for adequate climate conditions to implement prescribed fires in the Morro São Jerônimo region implementing the community suggestions listed in the Social Map. This process reflects an Ecology of Knowledge, which it is expected to build instruments that may contribute not only to environmental conservation and the reduction of incidence of wildfires in the region, but also to strengthen the community and identify possible public policies that reflect realities lived by the residents of São Jerônimo and the other communities around the Chapada dos Guimarães National Park.

***Keywords*:** Social Map, environmental education, fire integrated management, participative environmental management

Forest restoration activities with the indigenous community in Maranhão

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ABSTRACT – This study presents the activities related to the forest fire prevention process and the implementation of agroforestry systems in Indigenous Lands where there is the work of the Prevfogo indigenous brigades. This process began in 2017 at TI Araribóia, in Aldeia Jussaral, with the planting of native species in an area comprising the right bank of the Buriticupu River, which was in an advanced stage of environmental degradation caused by annual fires. About 200 seedlings of the species Jussara (popular name) were planted on the site, which was now monitored by indigenous brigade members. In 2018, there was continuity of activities to encourage the restoration of degraded areas through Environmental Education workshops, which culminated in the establishment of nurseries for the production of seedlings of native species in all Indigenous Lands that have the brigade program. in Maranhão. These nurseries were implemented through the state coordination of Prevfogo. The assessment of the development of these actions took place through on-site technical visits and monthly monitoring, with the partner of the brigade members and indigenous associations. As a result we have the continuity of the restoration of the riparian forests of the Buriticupu River, in the Araribóia TI, the beginning of restoration of springs in the Indigenous Lands: Governor, Porquinhos, Caru. In addition, informal reports on the reduction of hot flashes due to awareness of this issue among these populations. In this sense, it was found that the actions planned in conjunction with the local communities make it possible to improve the environment as a whole and raise awareness of the reduction in the number of forest fires and fires.

Keywords: forest recovery; awareness; seedling production.

Rescue of indigenous knowledge in the practice of Integrated Fire Management, TIs Xerente e Funil, Tocantínia, Tocantins, Brasil

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ABSTRACT – The Xerente Indigenous Communities, resident in the Xerente and Funil Indigenous Lands (TIs), located in the Cerrado biome, city of Tocantínia, Tocantins, Brazil, contribute to the Federal Brigades Program from Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis (IBAMA) and implemented by the National Center for Forest Fire Prevention and Fighting (PREVFOGO), which has as one of its main objectives to implement Integrated Fire Management in Indigenous Lands, both in preventing and fighting forest fires. The Program began in 2013 and the Xerente people with their knowledge and experience had a great influence on changing forest fire prevention strategies, since these fire were indeed severe and degraded their fauna and flora. The Indigenous people collaborated with the Xerente Indigenous Federal Brigade, which operates in the two aforementioned TIs. At the beginning of the Program's execution , there were some disagreements with the traditional knowledge, because during the Brigade Formation course, promoted by PREVFOGO/IBAMA, the Brigadistas were instructed not to let it burn, and that, all detected fire should be extinguished. Thus, there were a conflict between indigenous culture and the strategy adopted by the Brigade, as the Elders (older indigenous) did not accept this strategy and began to advise the Brigadists about the importance of using fire in the post-rain season, when vegetation is still damp, preventing the managed fire from becoming a forest fire and knowing where it would naturally go out. Meetings between PREVFOGO/IBAMA servants and Elders occurred and there they described the way their ancestors managed fire. The servants valued these popular wisdom and it was build a historical landmark of trust, participation, knowledge exchange and zeal for use of fire. Strategies to prevent major fires were jointly developed. Thus, there was a rescue of the use of fire by the Xerente People, through prescribed burns following the recommendations of the Elders, based on the themes: clearing fire for hunting, cleaning around the villages and farms, ensuring fruiting and escape route to animals. In this sense, every year there has been a reduction of major fires in the Xerente and Funil ITs.

Keywords: Brigade, Indigenous Land (TI), Integrated Fire Management, Indigenous and Traditional Knowledge.

Fire management by traditional comunities in Brazil

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ABSTRACT – Traditional ecological knowledge about fire management is internationally recognized as strategic to mitigate and to adapt to climate changes, conserve biodiversity and ecosystems services and to support the Integrated Fire Managenment. The objective of this study was to investigate the diversity of the uses of fire in Brazil, evaluating the wildfires causes and identifying possibilities of dialogue of knowledge about the problem. The results are based on a literature review and experiences with fire management in different regions and socio-cultural contexts in the country. The multiplicity and regularity of the uses of fire carried out by indigenous, quilombola and other traditional communities has productive but also symbolic motivations, involving collective and individual practices of landscape management at different scales. For many of these communities, the recurrence of wildfires started to become evident in the 2000s and is related to several interdependent factors. Climate change, associated with changes in environmental, political and economic conditions, increased sources of ignition and generated fuel load, which modifies the seasonality of the burns and the behavior of the fire. On the other hand, the recurrence of fires, combined with the gradual overcoming of the zero-fire paradigm, opened possibilities for dialogue between managers, researchers and traditional populations, providing a better understanding of the complexity and transformations of local uses and fire behaviors. Despite these changes, there is still a need for a dialogue between different stakeholders and scales of environmental governance in order to recognize and respect the dynamic and innovative nature of traditional fire management knowledge. In many regions, the anti-fire discourse is promoted by agribusiness actors, as part of a narrative contesting the territorial rights of traditional peoples and communities. In addition, the literature on the subject also shows a separation between an "objective science" and "traditional uses" of fire, incorporating only partially the traditional ecological knowledge in management decisions. The carrying out of joint activities of monitoring, planning and experiments related to fire can create learning situations where the different actors may contribute to develop adaptive strategies to cope with changing fire regimes.

Keywords: traditional ecological knowledge, integrated fire management, wildfires.

2. IFM Concepts for Promoting and Stabilizing Resilient Landscapes

2.1. Vulnerable natural ecosystems
2.2. Measures to protect the most vulnerable ecosystems from fire
2.3. Impact of fire on agriculture and food security
2.4. Landscape fire and environmental services
2.5. Landscape fire and water security
2.6. Impact of fire on biodiversity
2.7. Impact of fire on behavior of fauna
2.8. Post-fire damages due to extreme events (secondary damages after wildfire)
2.9. Recovery of areas degraded by fire
2.10. Protection of natural resources for disaster risk reduction

Low Flammability Plants Of The Cerrado For Green Fire Break

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ABSTRACT – Low flammability plants in green fires break can protect against forest fires as they make it difficult to spread fire. Green firebreaks should be strategically implemented in plans for the recovery of fire degraded areas, stoped the flame and services a refuge. Compared to black and traditional firebreaks, green barriers can reduce erosion, vegetation diseases and population. It should be implanted in risk areas and on the threatened edges of the most vulnerable ecosystems especially in the wild interface urban. For vegetation, flammability is the time required for the start of the flames, considering continuity, speed and percentage of burning. The initial temperature of the highest mass loss is the spontaneous ignition temperature. This is the rate of mass loss in the gas phase of combustion and is directly proportional to the flammability and spread of the fire. The objective of this work was to characterize the thermal behavior of low flammability cerrado plants in the Federal District. The survey was based on the search for relatively preserved plants adjacent to the vegetation consumed by intense fire in the typical cerrado. In August 2014, we collected the leaves of *Vochysia thyrsoidea*, *Palicourea rigida* and *Lavoisiera bergii* greens and *Echinolaena inflexa*, as a control, for it is a highly flammable grass. Combustion tests were performed with flame initiation application and tests of Thermogravimetric Analysis (ATG). Data were analyzed by analysis of variance in a completely randomized design. *P. rigida* shows the flame start time of 143s and the flame duration of 72s in combustion experiment and spontaneous ignition temperature (TIE) of 245 ° C in the ATG test. *V. thyrsoidea* presented flames after 117s with 89s duration and TIE of 236 ° C, and *L. bergi*-flame in 183s, duration 17s and TIE of 246 ° C. *E. inflexa* exhibited flames in the 70s, lasting 176s and TIE 261 ° C, significantly different from the others, with the highest combustion rate (2.1mg / min). This way, corroborating the previous results, *Vochysia thyrsoidea*, *Palicourea rigida* and *Lavoisiera bergii* described as low flammability species with results that separate in 67% of the control species and are therefore indicated for use in green barriers.

Keywords: Palicourea, Vochysia, Echinolaena, Lavoisiera, ignition, thermometry.

The occurrence of fire influences the tree stratum of the *Tabebuia aurea* monodominant stands "Paratudal" in the Pantanal of Miranda/MS?

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ABSTRACT – The Pantanal is located in the center of the South American continent, mainly in Brazil. The geomorphological complexity and waters of the rivers that descend to the Pantanal generate a seasonal flood cycle,that influences the organization of different landscapes with their phytophysiognomies and distribution of species. In these landscapes there are many types of monodominant stands, that are associated with diverse flood levels. The formation of *Tabebuia aurea* (Bignoniaceae) locally known as "Paratudal" is commonly associated with areas of higher flood, influence and occur in fire prone areas. Besides, this species is used by local communities as medicinal and source of wood. This study aims to analyze the impact of fire under different frequencies, in the tree community of *T. aurea.* Thirty-nine areas with fire frequencies between 2 to 9 years from 2003 to 2017, were selected through heat spots information and Landsat satellite images. We sampled all tree individuals with circumference at breast height equal or greater than 10 cm in four 25x25 m per area. We also measured the height of the watermark left by the last flooding in each tree. Preliminary GLM tests showed decreasing abundance and species richness in areas with higher fire frequency and higher flood levels, compared to lower fire frequency and lower inundation. We conclude that this interaction of fire and flood is probably related to the monodominance of *T. aurea.*

Keywords: Pantanal, phytophysiognomies, fire frequency, satellite images, environmental filters

Prescribed burning and fuel availability in wetlands of the Parana River, Argentina

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ABSTRACT – The Paraná River has a pulsatile hydrological regime alternating high and low waters. Normally the low water season is at the end of winter (August-September). In the flood plain there are islands formed by differentially deposited sediment, generating different topography, including a landscape pattern with: levees (higher), mid-slopes and lowlands of the islands, usually with water. In these lowlands the floating and rooted vegetation predominates, which accumulate biomass during the summer, commonly called "*canutillares*". Eventually they run out of water, due to downspouts of the river, and the exposed biomass stops growing due to winter temperatures, becoming high fuel loads. Among the anthropic disturbances in the Paraná Islands, the grazing of domestic cattle and burning to improve the quality of the fodder stand out. During the year 2008, factors that contributed to the propagation of igneous foci in the islands coincided, highlighting a historical downhill with winter cold that dried the vegetation, increasing the probability of fires. The objective was to carry out prescribed burns in wetlands and quantify the fuel available at the beginning of burning. In August 2018, in a "*canutillar*", without water for 120 days (down from Paraná), from the department Diamante (Entre Ríos, Argentina), a closure was made to avoid bovine grazing. The experimental design was randomized blocks with four (4) repetitions where the treatments are controlled burns and unburned controls. Before burning the fuel was quantified, cutting two (2) 0.25 m^2 subsamples on each plot, it was weighed in green and dried in an oven at 60 ° C to know the moisture content (% H) and dry matter (grMS * m^2) The normality of the data (Shapiro Wilks) was tested and an ANOVA ($p = 0.05$) was used with *Infostat*. The fuel values showed no significant differences between the burns and the controls (258 and 239 grMS * m^2, respectively), as well as H% (29 and 23%, respectively). High amounts of fuel favor burning in Paraná wetlands when favorable conditions exist. The observations will continue to know the productivity of the "*canutillares*" and the resilience after the disturbance.

Keywords: Prescribed fire, fuel load, wetlands, Paraná River Delta.

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Early prescribed fire in the Serra da Canastra National Park as a strategy to contain large fires within the Integrated Fire Management Plan

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ABSTRACT – The Serra da Canastra National Park has 200,000 hectares, with extensive continuous native wilderness areas, and historically is hit by large fires that mainly damage forest formations and wildlife. The accumulation of fuel due to the adoption of the zero-fire policy favored the occurrence of fires that, several times, reached more than 25,000 hectares per event. With the objective of creating mosaics of areas with different ages of burning, which can function as fire barriers and as protection of conservation targets (defined in the Integrated Fire Management Plan of the Protected Area), prescribed burns were made between January 16 and April 5, 2019 (rainy season) in the area of the Chapadão da Canastra. The choice of areas to be managed considered the area reached by fire in the previous year, the Fuel Accumulation Map produced from the Spectral Angle Mapper (SAM) of the Landsat Satellite 8, and the areas with the highest fire recurrence. The areas affected by lightning fires during the months of December/2018 and January/2019 (2,100 hectares) were also taken into account. All prescribed fires were preceded by a specific Burn Plan and completion of the Follow-up Form. Prescription parameters adopted, based on previous local experiences, were: temperature minimum 18 ° / maximum 28 °; relative humidity minimum 60% / maximum 100%; wind speed minimum - / maximum 10 km/h. A total of 5,464 hectares were managed. The controlled burns were performed at different times of the day, always within the prescribed parameters. Fire intensity (visual and sensory analysis) varied according to the area's fuel accumulation, which also influenced on the occurrence of natural extinction or need for combat. The activity has been accompanied by research from the Fluminense Federal University. As a result, the burnings fragmented the Chapadão da Canastra, hoping to facilitate the fighting and to prevent the spread of fires. In addition, firebreaks will be made. The prescribed fire had social support from the region, where the fire is historically used as a farming tool. It is necessary to increase scientific monitoring of the effects of prescribed fire for biodiversity conservation.

Keywords: prescribed fire, integrated fire management

Insect survey in the Vila Velha State Park, Brazil, in areas subject to fire action

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ABSTRACT – For the global understanding of the effects of fire on the environment it is necessary to analyze all the components associated with it, including insects as environmental indicators. Based on this premise, this study was carried out in Vila Velha State Park, southern region of Brazil, a 3,222.11 hectare integral protection conservation unit, created in 1953 to conserve native land, araucaria forest and arenaceous formations of scenic and scientific value. The objective of the study was to identify and compare the orders of insects found in a burned area in 2017. The collection and analysis period were 10 months, from June 2018 to March 2019, with collections every 30 days, with 15 traps of pitfall type in an area of 25 ha with predominance of grassy-woody steppe. For the calculation of the biological indexes, the data collected were processed in the ANAFAU program. The following orders were found: Blattodea, Coleoptera, Diptera, Hemiptera, Hymenoptera, Lepidoptera and Orthoptera. The Shannon-Weaner diversity index was 1.4179 (ranging from 1.0789 to 1.4019 in the monthly indexes) and the Equity index was 0.7914. The month of greatest abundance of the orders Hemiptera and Orthoptera was September (12 months after the passage of the fire), while Coleoptera, Blattodea, Diptera and Hymenoptera was December (15 months after the passage of fire); The order Lepidoptera showed dispersed abundance. The orders considered to be predominant were Diptera and Hymenoptera, due to the higher indexes of dominance (dominant and superdominant), abundance (very abundant and superabundant), frequency (very frequent and superfrequent) and constancy (constants). It can be concluded that the orders have specific times of greater occurrence and that the orders considered as environmental indicators are Diptera and Hymenoptera.

Keywords: Pitfall, Environmental indicators, Insecta

Recovering degraded área in Legal Reserve in the Rosely Nunes Settlement Project, Itaetê, Chapada Diamantina, Bahia, Brasil.

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ABSTRACT – The Rosely Nunes Settlement Project, created in june 1997, by the Instituto Nacional de Colonização e Reforma Agrária (INCRA), benefiting 160 families, is located in Itaetê city, Chapada Diamantina, Bahia, Brasil, in an area comprise by Caatiga Biome. The residents of this area have as main economic activity the rainfed familiar agriculture, having the fire as usual practice for cleaning plantation areas. To subsistence in drought times, the farmers search for other alternative income generation, including the tree suppression for commercialization, act performed years ago and repressed by the local social organization. One of these areas reached by this suppression, followed by fire use to cleaning the ground surface an late cultivation of annual agricultural crops, is being object of study in an experiment in recovering degraded area in legal reserve, cover an area of 1,1 hectare. The experiment starts in November 2016, arise from a join initiative through the partnership between the Brigada Federal de Assentamento Rosely Nunes, hired by Centro Nacional de Prevenção e Combate aos Incêndios Florestais (PREVFOGO), through IBAMA and Associação Comunitária do Assentamento Rosely Nunes. The Brigada Federal is constituted by local community residents, people from other settlement and nearest cities residents, which is hired annually in emergency character, during the six critical months (august to january). Inicialy, was adopted the isolation action and plantation of pioneer native species. In the following years was realized new thickening plantation, enrichment, cultural tracts: irrigation, crowning, mulch replacement. The experiment aims, recover the degraded area besides works as demonstrative area, pilot project, with a didactic use as empirical experience in Environmental Education actives to be developed with the settle people and other. After three years, the area is in a recuperation process, with replating of withered specimen and conduction of natural regeneration. In this sense, associating degraded area recovery experiences with behavioral changes in the available natural resources tract, and with the possibilities to repair mistakes committed in the past, providing balance the socioenvironmental, productive and economic needs.

Keywords: Fire, degraded area recovery, demonstrative área and ambiental education.

Quantification of fuel material in litter at *Eucalyptus* plantations in Aquidauana, MS

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ABSTRACT – The quantity and type of combustible material are fundamental components for the occurrence of a forest fire. In reforestation, fire is quite frightening, since there is a greater economic value associated with wood, as well as the continuous accumulation of litter on the soil surface, besides the fire itself being able to spread to adjacent areas, devastating natural areas and reducing forest biomass. Thus, the objective of this work was to quantify the amount of material accumulated in the forest floor of an eigth years old hybrid Eucalyptus 'Grancam' (*Eucalyptus grandis* x *Eucalyptus camaldulensis*) and Eucalyptus 'Urograndis' (*Eucalyptus urophilla* x *Eucalyptus grandis*), in the State University of Mato Grosso do Sul (UEMS), Aquidauana Campus. Five plots of 1m^2 were installed in a 3 ha plot where all material above the ground was collected systematically in April /19. The fuel material was separated according to its type (green or dry) and class (leaves, miscellany, and branches, with diameter <0.7 cm, 0.7 to 2.5 cm, 2.5 to 7.6 cm and> 7.6 cm) and then oven dried at 65°C for 72 hours. In each separate material the moisture content was determined. The experimental design was completely randomized in a 2x7 factorial design (Type x Class) in five replicates and the significant means were compared by the Scott-Knott test at 5% probability. No branches with a diameter greater than 2.5 cm were observed and the fuel material had a moisture content of 14.5%, with a higher average grade of branches (diameter of 0.7 to 2.5 cm). The total accumulation of dry fuel material in the area was 14.2 Mg.ha^{-1}. There was no difference between dry weight and green weight in the material, however in the classes, it was observed a greater green and dry weight of leaves, in relation to the others, where the bark class was less representative. Understanding the quantity and type of combustible material in forest typologies is essential for the eventual needs of actions to combat and prevent forest fires at different times of the year, serving as a protection measure for vulnerable ecosystems.

Keywords: Forest fire, Cerrado, humidity, branches, Eucalyptus.

Activities of the Paraíba Fire Department in the wild animal rescues impacted by burned

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ABSTRACT – In the area of performance of the Fire Department of Paraíba occurs the Caatinga, that is a biome of wide occurrence in the Northeast region that has a diversity of plants and animals with a high rate of endemism, able to adapt to climatic conditions of extreme temperature. However, despite its biological prominence, the region has been one of the most threatened biomes in the country, undergoing modifications for a long time, either by anthropic action by desertification and burned, either by the scarcity of effective actions for the conservation and protection. That way, vegetation fire reflects results relevant to the destruction of the fauna of the biomes, causing potential imbalance in ecosystems. In this sense, the present work is a descriptive study with the objective of characterizing the services performed by the unit of the 6º Batalhão do Corpo de Bombeiros Militar da Paraíba (6º BBM) in the rescue of the fauna of the Paraíba Caatinga and socio-educational actions in public schools. The reported results were the development of rescue activities for impacted fauna by fires in nine cities in the interior of Paraíba in the period from 2015 to 2018 and the execution of socio-educational actions to raise awareness for environmental preservation in ten schools in the region. In this way, it is concluded that the development of actions for the rescue of wild animals in areas impacted by forest fires and the development of socio-educational works are essential to collaborate with the environmental protection of areas preserved impacted by fire.

***Keywords*:** Military Fire Department; Caatinga; rescue of wild animals; conservation strategies.

Effects of fire and extreme drought events on forest integrity in the Xingu Indigenous Lands

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ABSTRACT – In the Amazon, large areas of forest in protected areas have become degraded over time, yet the drivers of these changes remain largely unknown. Specifically, we still know little about the relative contribution of anthropogenic and natural degradation pressures, such as the occurrence of fire and drought events on this process. To evaluate the effects of these factors on the integrity of forests in the Xingu Indigenous Territories (TIX), we quantified forest cover loss over the last 17 years (2001-2017). Using a generalized linear model (GLM), we evaluated the role of six different predictors: type of forest (upland or floodplain); number of times the area burned; population density; distance from villages; distance from major rivers; and the number of extreme drought events. Results showed that the area with forest structure in TIX droppedd 9.3% from 2001 to 2017, and half of this change occuring after 2015. All variables were important in explaining recent forest loss, but the number of times the area was burned, the number of extreme drought events and the type of forest were the main predictors. After three fire events, the likelihood of forest loss in a flooded area (70%) is 30% higher compared to an upland area (40%). Given the same number of fire events, areas that have not suffered with extreme droughts showed a 25% lower likelihood compared to areas with three drought events. Our results indicate that the forest type and population density in protected areas are important in explaining forest loss in indigenous lands, but changes in fire regime and the occurrence of extreme drought events are the main vectors of recent changes in forest cover.

Keywords: forest cover, fire, drought, upland forest, flooded forest.

The Social, Emotional And Economic Aspects As Secondary Damages Of The Forest Fire

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ABSTRACT – This study aims to exemplify the secondary damage caused by forest fires, in addition to analyzing the ability of a resilient ecosystem to restore its balance. In Brazil, for example, one of the regions most affected by the fire and, consequently, by its secondary damages is the Pantanal - a biome partially located in the cities of Corumbá, Ladario, Aquidauana and Miranda, in Mato Grosso Sul. Corumbá, already in early 2019, led the national ranking of fires, according to INPE - National Institute for Space Research. In 2018, there were 2,380 outbreaks of forest fires and in 2017, 7,446 outbreaks. When reporting a forest fire, we impulsively analyze physical parameters (vegetation, climate, relief, fire behavior, etc.), as well as technologies and systems for fire prevention and combat. Social, emotional and economic aspects play a secondary role, but no less important. Smoke and soot invade the cities, driving some social damage, such as: affected health (pulmonary infection, asthma and even cancer, due to inhalation, in addition to burning in the eyes, requiring masks as prevention); overcrowded hospitals; affected daily activities; schools with suspended classes; impaired vehicle traffic and navigation; homeless and homeless; shaken emotional; among others. Economic damages, in turn, arise as a "side effect" of these social damages, in addition to the need to hire specialized staff, provide fuel, food, first aid, vessels and aircraft, when necessary. If there is a fire in planted forests, the damage is very great: environmental, a pulp production chain is lost; and, economic, the rural producer's income is lost. Both atmospheric pollution and the reduction of biodiversity abruptly affect a resilient ecosystem that, as a consequence, brings incessant changes in the regime, forming a negative cycle. In this sense, the community cannot be seen as part of the problem because, despite the fact that more than 90% of fires are caused by human beings, this must be seen as part of the solution, since man promotes knowledge, information and forms of fire prevention and combat, so that this integration can achieve concrete results.

Keywords: secondary damage, forest fire, Pantanal, social aspects, emotional aspects, economic aspects.

The need for new environmental practices for the preservation of Natural Resources

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ABSTRACT – This study aims to collect statistical data related to the numbers of forest fires that occurred in the state of Mato Grosso do Sul in recent years, practiced by the population of Mato Grosso do Sul in observance of the lack of adoption of environmental education practices to reduce these numbers and consequent preservation of the environment. It can be seen in this context that in the four months of this year, there was an increase in fires to 239% related to the same months of the previous year, 57% of which occurred in the municipality of Corumbá, as a result of human failure. The concern with environmental problems and the need to promote new practices is mainly foreseen in the Federal Constitution of 1988, in item VI of article 225, in which it highlights the need to promote it at all levels of education, as well as to develop public awareness for the preservation of the environment. Therefore, being aware of the damage done to the environment, reflecting the lack of awareness and misuse of the environment in which one lives, is more than necessary and relevant for the current moment. The prevention of forest fires by means of educational projects and programs, using new practices, with the most diverse forms of communication with human beings, in addition to making them aware of their dependence on the natural resources that we obtain from their own land, bringing the application of new ideas of prevention into practice, as an example of rigorous inspection of the relevant legislation that already exists in the society of the region that lives with the scenario of the consequences of the Forest Fire.In this sense, we expect improvements in the actions of fire prevention and combat institutions, as well as of the population itself, covering all age groups, as well as a new political / educational vision on the issue that integrates the social, educational and ecological needs of the entire environment.

Keywords: environmental education, forest fires, new practices.

Integrated Fire Management Concepts for promoting and stabilizing resilient ecosystems

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ABSTRACT – Fire is a transforming and modeling element of natural environments, used by humans as a management tool for thousands of years. Its controlled use is indicated, and has been defended by specialists, for the borders of protected areas with native vegetation under anthropic pressure. The implement of fire management preventive actions, in opposition to the expensive efforts to eliminate it in preserved areas, corroborates to minimize the disastrous consequences of eventual fire. This is because a managed plant biomass is reduced and forms a mosaic of fuel discontinuity which, being mainly invasive alien species, alters fire regimes, combinations and ecosystem functions. Among different types of burning, controlled and prescribed burns stand out. These are characterized by the planned, monitored and controlled use of fire, carried out for conservation, research or management purposes, with predefined objectives in the Integrated Fire Management (IFM) plan. Its actions are related to the use of prescribed or controlled burning and forest fire prevention and control, with the purpose of reducing particulate matter and gas emissions, conserving biodiversity and minimizing the severity of future fires. This paper aims to analyze an experience of restoration of native forests of Serra do Rola Moça State Park (SRMSP) through natural regeneration and also the use of forest enrichment techniques, comparing the cost benefit of the methods. In order to achieve this experience, the IFM will be implemented in areas with high presence of invasive exotic grasses, defined the width of the native forest expansion bands and prescribed burns around this vegetation that will be selected via satellite imaging and conference in field of phytogeographic characteristics. In addition, there will be collection and dispersal of seeds from native vegetation, production and planting of seedlings and installation of ornithofauna attraction perches as forest enrichment techniques. Thus, from the results and records obtained, it is proposed to define a schedule for the continued action of those involved, seeking to enable greater resilience of these native forests of SRMSP and, thus, strengthen their natural regeneration.

Keywords: integrated fire management, prescribed burning, forest enrichment, forest restoration, natural regeneration.

Effects of the time of the year and fire history on severity in the Serra Geral do Tocantins ecological station

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ABSTRACT – The prescribed burning is one of the most important actions within an extensive network of planning of ecological, cultural, socioeconomic and technical factors that are contemplated in the Integrated and Adaptive Fire Management. In a prescribed burning, it is always necessary to reduce fire severity levels to preserve or restore the ecological balance of the area. In this study, the objective was to determine the influence of the time without burning of the area and the time at which the burns are performed on levels of fire severity at the Serra Geral do Tocantins Ecological Station. Were realized prescribed burnings in May, June, August, and September 2017 and in areas for two, three and four years without burning. For assessing the severity of fire were applied two methods: the method of Minimum Diameter of Burned Branches-MDBB, consisting in taking the measurements of the diameter of carbonized branches of 10 Rourea Induta bushes distributed in each plot, for a total of 48 plots, in order to evaluate the capacity of the incident fire to consume the woody fuel branches of the bushes; and the visual assessment of the level of fuel consumption at the surface of the ground. According to the two methods employed, the fire severity levels were higher in the firings carried out in September and in areas that had not been burned for three and four years. The results showed that the fuel load from the third year without burning associated with intense drying of the fuel material after a long dry season (September), subjected to low air relative humidity levels, made the fire that affected the environment increase their capacity of consumption of plant biomass. Besides, the traditional knowledge disseminated in the region, which states that the fuel two years ago without burning does not present high fire severity, was confirmed in this study. The burnings of May, June, August, and September in the areas of two years showed average values between 0.10 and 0.16 cm, being equal to each other ($p < 0.05$) and lower than areas of three and four years burned in September, which presented 0.26 and 0.23 cm respectively.

Keywords: forest fires, prescribed burning, fire ecology.

Fire prevention in vegetation in paleontological areas of the Rio do Peixe region – PB

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ABSTRACT – The interior region of the State of Paraíba, where the cities of Sousa and Uiraúna are part, have two Cretaceous basins that make up the Rio do Peixe, possessing a historical heritage with several dinosaur footprints. These basins are located in the Northeast of Brazil and its origins are related to the movements of failures occurring in the along the opening of the Atlantic Ocean. Therefore, the area of fossil footprints demarcated from greatest importance is distributed in the region of Passagem das Pedras, in the municipality of Sousa, where it currently houses a natural park denominated the Monumento Natural Vale dos Dinosaurs, with 40 hectares of area with ichnofossiliferous wealth. Otherwise, this area presents many threats of degradation through the anthropic action of fires by scarcity of effective actions for conservation and protection. In this sense, the present work aimed to carry out strategic planning for preservation against fire in vegetation in a paleontological and geological area of the Sousa and Uiraúna basins. The management of these activities was developed by the unit of the 6º Batalhão do Corpo de Bombeiros Militar da Paraíba (6th BBM), through the monitoring of important areas, demarcation, mapping, basin analysis and monitoring. In view of the above, the present work resulted in the creation strategies for preventing and combating fire in vegetation in demarcated geological sites. Through this work it is concluded that, using the necessary tools to conservation of paleontological heritage it is possible to achieve a reduction in destructive actions and degrading to these environments.

Keywords: conservation and protection; vegetation fire; geological sites; Valley of Dinosaurs

Effect of fire and ecological restoration in gallery forests in the Quilombola Kalunga Territory and the Chapada dos Veadeiros National Park, GO

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ABSTRACT – The actions derived from an integrated fire management (IFM), implemented since 2014 in protected areas in Brazil, particularly in the Cerrado, seek to reduce the area affected by wildfires and to protect fire-sensitive vegetation types. The occurrence of wildfires in riparian gallery forests and wetlands (*veredas*) can significantly threaten the conservation of these ecosystems as well as their efficiency in the protection of water resources and the provisioning of other ecological services. Wildfires in these vegetation types cause the mortality of palms and trees, causing compositional and structural changes, such as the opening of the canopy. The Chapada dos Veadeiros National Park and the Quilombola Kalunga Territory have seen wildfires take place since 2012, which occasionally affected gallery forests. The goals of this study were (i) to map the areas sensitive to wildfire, specifically gallery forests and *veredas*, (ii) to monitor natural regeneration in these areas, and (iii) to test different techniques to control invasive species and to restore the vegetation. Eighteen 10x20-m plots were installed, in which the process of natural regeneration taking place and the need for a restoration intervention were characterized. Gallery forests showed a high mortality rate of trees, resulting in a low tree density, with one individual per 105 m^2 (95 ind/ha). The soil was predominantly coverd by a few invasive species, such as *Melinis minutiflora* and *Andropogon gayanus* (up to 26% cover). Moreover, the loss of the vegetation promoted soil leaching and erosion. Therefore, the proposed restoration actions include: (i) protecting the terrain contour lines using branches, (ii) direct seeding of forest species from the local pool, and (iii) tree staking for the rapid growth of the vegetation and covering of the soil, as well as to facilitate natural regeneration. Once we understand the processes involved in the recovery of these forests, informational materials covering the restoration techniques used in this project will be produced using an accessible language, so that they can potentially be used by the local communities in affected fire-sensitive areas. Technical materials will also be produced and shared with the managers of protected areas involved in restoration efforts and IFM.

Keywords: direct seeding; staking; facilitation of natural regeneration; wildfire.

Influence Of Prescribed Burning On Biological Attributes Of The Soil In Natural Pasture From Pantanal

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ABSTRACT – Natural pastures are an indispensable natural resource for the Pantanal. They form the basis of the feeding of beef cattle and herbivores, being renewed by the alternation of flood and drought period. Controlled burning, as a pasture management practice, is employed in the Pantanal in a selective and localized manner, trying to eliminate or contain the expansion of undesirable species and promote the regrowth of low acceptability fodder plants. In this regard, soil fauna can be used to assess the degree of modification an area is undergoing due to its rapid response to environmental change. Thus, the objective of this work was to evaluate the effect of the prescribed burning on the soil fauna in natural pasture of the Nhecolândia sub-region of Pantanal. The study was conducted in September and October 2018 on natural pasture composed mainly by *Aristida* sp., a coarse fodder of high areas and low fertile sandy soils. Pitfall traps were installed to capture epigeic fauna in pasture areas as follows: I - control area (no burning and n = 5); II - area that would be burned adjacent to control (before burning and n = 5); III - control area after the burning (n = 5) and IV - area adjacent to control after burning (n = 5). In total 1652 individuals were found distributed in 14 groups. Data from the four treatments were subjected to analysis of variance followed by Tukey test. Next, because data from treatments I, II and III, were not subjected to burning (n = 15), they were grouped and the Student's t test against treatment IV (after fire and n = 5) was conducted. Tukey test indicated that only treatment I and IV were significantly different from each other ($p < 0.05$), with the latter presenting less diversity. The t-test between the group without burning against the group with burning showed a reduction in diversity ($p<0.01$; average diversity without burning 1.19; average diversity with burning 0.68). There was also a change in species composition; while treatments before burning presented a predominance of Colembolla, treatments after prescribed burning showed dominance of Coleoptera.

Keywords: soil invertebrates, fire effect, soil fauna richness, diversity.

Paraguaçu Waters: Microbasin Ecologic restaurantion from Córrego Ibicoara, Mucugê, Chapada Diamantina, Bahia, Brasil.

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ABSTRACT – The Ibicoara Stream Microbasin, localized between Ibicoara and Mucugê cities, Chapada Diamantina, Bahia, Brasil, belongs to the Alto Paraguaçu Hidrographyc Basin, which is the object of study from Águas do Paraguaçu Project. The aim of the Project is to reverse the environmental degradation process in priority areas of Atlantic Forest's Biome, through ecologic restoration actions in 30 hectares with Fazenda Ibicoara Community. It is an iniciative of the Public Prosecution Service of the State of Bahia, with the financial support of the José Silveira Foundation, execution by Instituto de Permacultura da Bahia – IPB, in partnership with Brigada Federal de Assentamento Diamantina, from Centro Nacional de Prevenção e Combate aos Incêndios Florestais – PREVFOGO/IBAMA, that offers support with speeches, arceiro negro reparation and confection, and a partnership also with Instituto Chico Mendes de Conservação da Biodiversidade – ICMBio in actions related to arceiro negro implantation and preventive hunting supervision. The 42 rural properties, from 35 families involved in the Project, composes the Fazenda Ibicoara Comunity. These areas, mainly the nearest to southwest portion of the Chapada Diamantina National Park, suffered deforestation, forest fires in Atlantic Forest remnants and an alternative land use. The ecologic restoration process began in 2016, with the Fazenda Ibicoara Community involvement, from awareness raising to the other stages as: Elaboration of 42 participative restoration plans from degraded areas; withdrawal of the degradation factors; actions to improve the landscape permeability, as living fence planting, afforestation of coffee plantation and Sistema Agroflorestal (SAF) implantation; regional native species plantations with distinct techniques, in forest fragmented and deforested areas; ecologic restoration maintenance and monitoring, and, capacitation throughout lectures, courses and field classes. Were implemented 21 restoration techniques for degraded areas, using 110 regional species and 40.000 plant seedlings with a 5% mortality rate in October 2018. Since 2016, there has been local community integration, result attributed to the Project, which has been connecting forest, people and business.

Keywords: Microbasin, environmental degradation and ecologic restoration.

Synergism of climatic variables and forest burns in the State of Acre

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ABSTRACT – We aimed to understand the role of precipitation and temperature in the incidence of forest burns in the State of Acre, Brazil. In the last 40 years forest burns became more frequent, occurring each four-five years in different parts of the Amazon basin. Spatial and temporal distribution of forest burns is commonly associated with extreme dry caused by anomalous increase of temperature of ocean surface. In the Southern and Southwestern Amazon, where State of Acre is located, two recent extreme dry events (2005 and 2010) is associated with increase of temperature of tropical ocean surface in the Northern Atlantic. Herein, we selected consecutive number of days without rain (P↓) and number of days with maximum temperature above 35ºC (T↑35°C) to investigate potential relation with total annual cumulative area of forest burn scars in the municipality of Rio Branco between 1984 and 2018. Climate data were gathered from rain stations within study area. Years of incidence of extreme dry in the State of Acre were registered in 2005, 2010 and 2016, totalizing 526,289 ha, which correspond to 98% of mapped burns. These years match with periods of more than 40 days consecutively without rain and more than 38 days with maximum temperature above 35ºC daily. Moreover, strongest recorded El Niño took place in 2016, which caused 66 days with T↑35°C. During 2017 and 2018 more than 30 days with T↑ 35°C and P↓ were registered, contributing to the incidence of forest burn of 895 and 262 ha, respectively. In the first 20 years of monitoring, when it begun, large forest burns occurred each 10 years (1987 and 1998). Then, in the last decade, the frequency of severe forest burns increased to each five years (2005, 2010 and 2016). Overall, average interval between massive forest burns occurred in 1984 and 2018 was 7.25 years. We believe that increasing frequency of extreme climate events and forest burns is likely leading to a new fire regime, a climate "new normal", virtually boosting incidence of forest burns within the region in near future.

Keywords: Amazonia, temperature, extreme dry.

Community Forest Brigades and their implementation as part of a new vision in the integrated fire management in the Bolivarian Republic of Venezuela

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ABSTRACT – Venezuela is located in the Neotropical area of the planet, a region where climate change scenarios involve a worsening of drought and an increase in temperatures, with the consequent increase in the season and severity of vegetation fires. Additionally, the occurrence of socio-productive activities based on the use of fire in or around many National Parks is a constant fact. Thus, the use of fire in these areas cannot be replaced in the short or medium term, even in those conservation areas, since their indigenous inhabitants make use of fire as part of their cultural legacy. Given the vulnerability of the ecosystems of the National Park System, which includes fire-sensitive vegetation such as forests, new challenges arise, forcing the replacement of formerly established suppression and combat models and developing new, more effective fire management strategies nationwide.From 2010, several initiatives promoted the incorporation of Integrated Fire Management practices (IFM) into new management policies of the Forest Fire Department. These policies include the inclusion of community members, their traditional knowledge and practices about fire management, and scientific criteria, as to achieve an effective reduction of the area affected by fires. This strategy involved the promotion, organization, training and equipment of Community Forest Brigades that integrate voluntarily to the National Risk Management System. This strategy has had a positive impact on the reduction of the forest area affected by fire while contributing to strengthening the culture of self-protection in remote rural communities. The training process and the experience accumulated in Waraira Repano National Park (La Costa Mountain Range, Capital Region), Mochima National Park (Northeast coastal Region), El Guácharo National Park (La Costa Mountain Range, Eastern Chain), and especially in Canaima National Park (Guayana Shield - South Region), have set the foundations for the promotion of a national strategy. The bases of this intercultural strategy include rural communities as central characters in the formulation and development of Local Fire Management Plans in the whole country.

Keywords: self-protection, local community management, community fire risk management, integrated fire management, community forest brigades.

3. Contribution of IFM to Mitigate Secondary Impacts

3.1. Impacts on atmosphere and climate
3.2. Vegetation fire and smoke pollution warning and advisory systems
3.3. Climate change and integrated fire management
3.4. Carbon credits, carbon sequestration, REDD+
3.5. Risk mitigation
3.6. Prescribed burning for fuel (fire hazard) and wildfire disaster risk reduction
3.7. Impacts on human health and security

Good practices in Eletronorte's Public Management aimed to reduce the number of disconnections of Transmission Lines caused by forest fires.

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ABSTRACT – Forest fires are responsible for recurrent disconnection of Eletronorte's Transmission Lines. When there is a fire on the Transmission Line, the system automatically shuts down, since the equipment has a heat sensor. Therefore, beyond the environmental impact, the fires compromise the electric energy supply and promote financial loss. In 2017, Eletronorte paid R$ 4,220,058.21 to the National Electric Energy Agency as penalty for energy unavailability. Thus, in order to reduce those damages, in 2018 the Company added some new guidelines to its Transmission Lines management protocol. Previously, each regional branch was responsible for its own management. As from 2018, a united and systemic coordination began. A single hired company is responsible for the easement lanes cleaning, that starts simultaneously on all Transmission Lines by the end of the rainy season in May. Eletronorte also started using its own equipment to increase the mowed area in places not covered by the out hired company's contract. There is a new detailed field inspection every June, in order to help mapping the risky areas. The results is a clear reduction of shutdowns by forest fires: 2016/ 82; 2017/135; 2018/19. The penalty paid for unavailable Transmission Line time was reduced to R$ 17,098.23 in 2018. Perhaps Eletronorte needs more time to assess the real effectiveness of the new actions. However, based on the available data, the current guidelines for the Transmission Lines management protocol are suffice and may need some improvement in the future.

Keywords: forest fire, transmission lines, disconnection, management, improvement

Integrated Fire Management: Preliminary results and trends in Federal Protected Areas

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ABSTRACT – The fire management went through a ripening process. Initially, the exclusion of fire was the strategy of environmental preservation, but it resulted in accumulation of biomass fuel and severe fires. It sought to integrate fire with ecological and socioeconomic needs, an alternative rather than excluding the fire for conservation called by the Integrated Fire Management (IFM). In Brazil, this approach has been applied since 2012 with significant changes in governmental and community acceptance. Therefore, this paper reports the outcomes of the IFM in Federal Protected Areas (PAs). In 2014, only the *Serra Geral do Tocantins* Ecological Station and *Chapada das Mesas* National Park worked from the perspective of IFM. In 2017, 53 PAs planned their actions through the elaboration of Fire Management Plans (IFMP). Today, almost 200 PAs made their IFMP, of which, 44% have hired fire brigade. The hiring of specialized personnel was favored by Law No. 13,668/2018 which extends the contract term from 6 months to 3 years. The hiring of almost 1,200 wildland firefighters, mainly members of the local population, values the traditional and regional knowledge and contributes with the income linked to conservation. With the increasing consolidation of the IFM, there is a constant generation and exchange of knowledge and experiences between managers and institutions, boosting the development of techniques such as the fuel load mapping. The dissemination of knowledge occurs through exchanges and training cycles of public federal servers, firefighters and volunteers/community, training about 2,500 people/year. That generated many strategies for the reduction of fires, such as in the *Serra da Canastra* National Park, which started authorizing controlled burnings for producers, reducing recurrent tensions between managers and community; and the *Campos Amazônicos* National Park, with prescribed burnings (PBs). Those actions contributed for the reduction of 51% and 90% of burned area (2010/2018), respectively, protection of sensitive vegetation, springs/*veredas*, threatened species and reduction of GHG emissions. Another 25 PAs performed PBs in 2018 and 40 intend to execute them in 2019. The IFM is becoming consolidated. However it is still necessary to continue learning from the results to fit the best strategy for each area.

Keywords: Federal Protected Areas and Integrated Fire Management.

Guidelines for environmental health surveillance with respect to air pollution related to fires and effects on human health

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ABSTRACT – The issue of fires in Brazil ranges from environmental damage and losses to regional economys to harmful effects on human health. In much of the country is commonly used in some agricultural practices. Their different kinds of biomass emit various pollutants and quite varying concentrations. The content of the smoke from the fires is not homogeneous, and the health effects are not, as well. The purpose of this paper is to support the state and municipal managers regarding the performance in environmental health surveillance activities for air pollution related to fires and effects on human health. Air pollution is a major environmental health problem currently, being associated with various deleterious effects on human health. According to the Unified Health System (SUS), the degradation of air quality directly affects costs and overloads the public health system, representing an increase in emergency care and hospital admissions for respiratory and cardiovascular diseases. Circulatory diseases were the leading cause of death (27.6%) in the country in 2016, while respiratory diseases were the third leading cause of hospitalization (10, 3%) and the third leading cause of death (12, 1%) in 20 17. Since part of the total hospitalization and deaths might be attributed to exposure to smoke from biomass burning, fire prevention measures and integrated fire management are required to improve health statistics, as well as reducing the demand and burden of SUS. The Draft Law of the National Integrated Fire Management Policy foresees the involvment of diverse social players, based on the strengthening of intra and interinstitutional joint. Thus, environmental health surveillance encourages actions capable of diminishing impacts of fires on human health aimed at the well-being and health protection, considering to that, articulations necessary to approach the problem in the country. Therefore, some of these actions include tracking, monitoring, data analysis on heat sources and health data in order to producing and sharing information to population, managers and stakeholders.

Keywords: air pollution, environmental health surveillance, fires.

Determinant factors of fire recurrence in Cerrado: focus in vegetation recuperation and aids for protected areas management

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ABSTRACT – The occurrence and propagation of fire is determined by several factors such as meteorological conditions, seasonality, topography and accumulation of biomass fuel. However, the anthropic influence has generated a negative impact despite the natural fire history in the Cerrado. This study aimed to investigate the temporal and spatial patterns of fire in two federal protected areas: *Serra Geral do Tocantins* Ecological Station (Esec) and *Nascentes do Rio Parnaíba* National Park (Parna), from 2010 to 2017, in order to identify determining factors of fire occurrence and obtain data to assist the fire management in these areas. Remote sensing was used for burned area (BA) delineation, frequency evaluation and distribution. Linear models were applied to indicate which factor - monthly precipitation (MP), number of days without rain (NDR), vegetation type (Normalized Difference Vegetation Index – NDVI) and the interaction between NDRxNDVI - is most related to annual BA. NDVI values were obtained before passage of the fire to represent the fire hazard potential. The coefficients of determination (R^2) for BAxNDR and BAxMP were 0.438 and 0.424 for Esec, and 0.371 and 0.353 for Parna. The BAxNDVI ratio for Esec presented a R^2=0.040, while NDRxNDVI and BA resulted in a R^2=0.214. For Parna, the R^2 were 0.080 and 0.092 for BAxNDVI and BAxNDRxNDVI. These values indicate rainfall as the most determinant factor for the occurrence of fires in these Cerrado areas. The fact that vegetation has presented a lower relation with BA or, in other words, has explained just a little of fire occurrence, can be caused by the predominant sandy, with a few nutrients and high percolation type of soil; as well as the distribution of phytophysognomies and relief. The data obtained in this study may help in the definition of improved fire management tactics, allowing prediction of the appropriate conditions for prescribing burns, as well as indicating situations of danger especially related to the accumulation of biomass fuel, helping to combat wildfires. Although, it is still necessary to incorporate other factors into the analyzes.

Keywords: biomass, burned area, rain regime, fire frequency.

Start and spread of forest fire: A Case Study in the Federal Conservation Unit Serra de Santa Barbara, Mato Grosso state, Brazil

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ABSTRACT – Spatial patterns of start of forest fires define the structure of the spatial pattern of fires which may have different sizes and levels of severity generating a mosaic of burned areas. The aim of our study was to analyze the Serra de Santa Barbara a Federal Conservation Unit composed of transition areas between the Amazonia, Cerrado and Pantanal biomes with an area of 120,092 hectares, located in Pontes and Lacerda and Porto Esperidião municipalities in Mato Grosso state, Brazil. In 2018, the Federal unit had seven days of burningresulting in 8% of the Conservation unit burned. In this context, the start and spread of forest fire were analyzed using data from burn outbreaks (obtained from the Instituto Nacional de Pesquisas Espaciais (INPE); boundaries of protected areas Instituto Chico Mendes (CMBio); description of protected areas in the Conservation Units Register (obtained by CNUC - MMA); responsible for the State Conservation Units (obtained by SEMA / MT) and LandSat 8 satellite images (obtained by the OLI sensor, composition RGB654). By analyzing the data, We found that the start of the fire was around 9:03 am (07/22/2018) spreading on the main front as an elongated elliptical shape, characteristic of flat terrain with wind. The fire finished at 20h03min (24/07/2018) with a distance of 1 km from the left flank to the right. Our results indicated that the fire burned the humid vegetation, with low air temperature and high relative humidity. Most of the fire propagation was nocturnal and when the fire spread it converged due to the uphill formations and to the solar radiation effects at sunrise together with the atmospheric convection process caused by thermal inversion. Understanding the start and spread of forest fire allows us to evaluate evidences of fire points and in the adjacent areas allowing a better assessment of the causes of the fire start.

Keywords: transition area, fire ignition, night fire, forest fire, topography.

Assessment of the perception of fire risk through abandonment training in a rural school unit at a fundamental level

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ABSTRACT – The District of Novo Mato Grosso is a rural community with approximately 800 inhabitants, located in the municipality of Nova Ubiratã / distant MT 570 km from Cuiabá, capital of Mato Grosso, Brazil. Due to regional economic activity the community is admittedly an environment susceptible to the occurrence of fires. The Getúlio Vargas Municipal Rural School, composed of 80 elementary students and 8 teachers, located in this district, was the object of study, due to the fact that the academic community will be a multiplier in actions to prevent local fires. As a result, this study carried out by the Forest and Burned Fire Control Program, which is part of the Environmental Management of BR-242 / MT, in its educational aspect, aimed at training the school community through awareness and awareness of fire prevention, and later the Area Abandonment Training. As a methodological strategy, first, an emergency map and escape route according to NBR 9077/2001 were elaborated through an exploratory analysis of the building, fire safety preventive and architectural plans; secondly, the perception and behavior of teachers and students in relation to the risk of occurrence of fire in the school were evaluated through the application of pre and post training questionnaires; and third, there was training with fire simulation for area abandonment. Considering the main results, it was concluded that: there was an improvement in the perception of teachers and students regarding the risk of fire in the school; and with the simulation of fire and the abandonment of the area, the school community involved proceeded in a correct way to abandon the established area, avoiding panic in an oriented and safe manner as they were directed, demonstrating that it is possible to abandon the school in less than 1 minute. As future training in the school environment, it is recommended to include the theme of fire prevention in the Pedagogical Project; as well as the elaboration of the Emergency Plan, with regular training and simulations in addition to the adequacy of the school building regarding the requirements of the Fire Department, mainly in relation to basic safety requirements.

Keywords: rural community, Novo Mato Grosso district, Nova Ubiratã/ MT municipality, escape route, fire simulation.

4. Technological Advances on Prevention and Fighting Wildfires

4.1. Technological advances on prevention and fighting landscape fires
4.2. Remote sensing; monitoring; fire detection
4.3. Use of drones
4.4. Use of chemical retardants
4.5. Fire propagation modeling
4.6. Observation and modelling of smog pollution from vegetation fire
4.7. Tools to support the management of large fires
4.8. Peat fire fighting
4.9. Warning apps
4.10. Early warning system

Use of PlanetScope Images in the burned areas monitoring program in parks and protected areas the IBRAM-PROMAQ

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ABSTRACT – The Monitoring Program of Burned Areas in the Parks and Conservation Units (UC's) under the management of the Environmental Brasilia Institute - IBRAM (PROMAQ, Federal District) is an annual program, started in 2010, with the aim of quantifying outbreaks of forest fires and measure the areas burned in Parks and UC's. The survey of the burned areas takes place remotely, using PlanetScope. This survey is done on a monthly basis, during the period from January to May and from October to December and fortnightly from June to September. Then, for each area is filled specific form. With basis in this record is done the georeferencing **of the areas affected by forest fires. In the year 2018, were monitored 76 parks and UC u**nder management of IBRAM. Of this total, were recorded and mapped areas burned in 55, being filled 505 records, totaling a burnt area mapped 1,715.46 acres. In the year 2018, despite an increase in the number of forest fires records, when compared with previous years, there was a decrease in the burned area, making it the year with the lowest number of area burned since beginning of PROMAQ. The increase in the number of records can be explained by the use of PlanetScope high resolution images, which presented a significant evolution in the survey of the burned areas, areas previously inaccessible that now are monitored. Another factor to be considered is the temporality of analysis of images, from 30 to 15 days and may make differentiation of burned areas adjoining, which often was not possible in the field, i.e., a burned area could be considered as only a record, when in fact it could be formed by several outbreaks of different fires. In spite of the increase of the number of records it was observed that there was a decrease in the amount of already burned areas due, among other factors, to the change in rainfall when compared with previous years. Another possible explanation for the decrease in the amount of burned areas, is the fact the IBRAM have hired 100 professionals specialized in fighting forest fires, among brigades, brigades and squadron chiefs, which were distributed in Parks and UC's under the management of IBRAM.

***Keywords*:** forest fire Monitoring, remote sensing, PlanetScope, Federal District.

Geospatial Transmission Management System - GGT

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ABSTRACT – This study aims to present the Geospatial Transmission Management System as a way to monitor the burning and forest fires that occur under power transmission lines. Burns contributes very severely to forced shutdowns, becoming during 2017 the main cause of this type of event. The agents of the electric sector are required by Aneel Normative Resolution 669/2015 at least once a year to inspect the safety bands, wich are bands where the size has been defined in the respective operating licenses by the competent environmental agency. Despite that, shutdown events with consequent blackouts are recurrent during the dry season in Central Brazil, from July to November of each year. This planned maintenance is precisely to ensure system security and prevent fire shutdowns. That is why, in 2017, an Agreement was signed between Aneel and the Inpe. The system uses geospatial technologies in satellite imagery to monitor safety bands. The Normalized Difference Vegetation Index (NDVI) index detects maintenance by the difference in values between images on T1 and T2. The lower the value, the greater the certainty that the company performed the maintenance. Experts in the field have developed research using this index satisfactorily, which allows the development of expertise in the field of fire monitoring research. Preliminary published results demonstrate that the developed methodology is adequate to detect changes in the landscape and to prevent future forest fires and burns and to prevent disconnections.

***Keywords*:** fire monitoring, safety lanes, GGT.

Embedded systems technologies applied to environmental impacts assessment on forest firefight

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ABSTRACT – Embedded systems are electronic devices with a high amount of automation and combine hardware and software to perform specific tasks. In the PROMETEU project (headquartered at the University of Brasília), aiming the environmental impacts assessment of forest fires and firefighting, we develop three families of embedded: SAPHIRA 3, PROMETEU and OBÁ. The SAPHIRA 3 family started on a functional prototype in 2014 and evolved into mobile systems for collecting atmospheric data (eg, carbon monoxide and particulate matter) and terrestrial (eg, iconography and flame temperature analysis). Due the presence of GPS modules, it produces maps on a detailed scale for the study of fire and its fighting. SAPHIRA 3 collects large amounts of data and has real-time and post-processing capabilities in decision making. Thus, for example, we can program the capture of a photograph as for a given condition, such as a standard value for carbon monoxide or flame detection. However, the SAPHIRA 3 family spend a high amount of energy and need a heavy energy cell or a permanent power supply. It has been used in AT-802F aircraft of the Fire Department of the Federal District (Brasília/Brazil), with a capacity to launch 3,000 liters of water. In this case, the data collected presents the atmospheric conditions above the forest fire, as well as the conditions that collaborate and compromise the effectiveness of aerial firefighting. The SAPHIRA 3 family, when attached to the backs (coastal pump) of the brigadiers has its autonomy limited to few hours. So, we develop the OBÁ family, with less processing capacity, but able to map labor conditions (atmospheric pollution and basic weather data) and chemicals scars generated by the use of chemical fire retardants. The last family, PROMETEU, has smaller dimensions and weight for it use coupling into drones (RPA - Remoted Piloted Aircrafts), monitoring or controlling cameras and devices (sensors and cameras) for thermal infrared (IR) and near-infrared (NIR) spectral bands in the assessment of the terrestrial thermal patterns and in the vegetation analysis.
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***Keywords*:** Instrumentation, environmental impact assessment, labor ecology

Operational conditions of aerial forest firefighting: efficiency and effectiveness

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ABSTRACT – The present work is a segment of a larger project named PROMETEU and aims to contribute to study the effectiveness and efficiency of aerial firefighting in the *Cerrado* Biome (Brazil). The study area was the Federal District (Brazil) and data collect was performed by the probe SAPHIRA 3v.3, coupled in a airtanker (water bomber) aircraft (Airtractor AT-802F, with 3000 liters of water capacity). Data were collected every 2 seconds, comprising information on geographical coordinates, speeds, altitudes and various kinematic data. The accuracy of the passes over the fire lines was assessed by orthogonal photographs taken by a RGB camera and the water release point was determined by the altitude and barometric oscillations. Another set of data came from Landsat 8 satellite images (end of the dry season), in which the fire scars of forest fire were identified. The distances between the scar borders and the water launching point were used to classify the operation in efficiency classes: high if below 100m, moderate if between 100 and 300m and low if above 300m. Air combat effectiveness was high in 46.4% of cases, moderate in 42.9% and low in 10.7%. The results show the importance of aerial combat and also reveals that the findings must be analyzed in the companion of several factors, including coordination with the team on the ground (local firefighters), vegetation factors (biomass and humidity), meteorological (wind direction and speed) and topographic/topological (relief and obstacles), since these factors interfere with the effectiveness of the operation. The aircraft tracking also showed that 22% of the time was spending in taxiing (moving in aerodrome with low speed), a fact associated with the operation based at Brasília International Airport, where there is interference from other segments of aviation (military, civil, general, commercial, executive, etc.). This value compromises the efficiency and effectiveness of the operation, as it increases the operational cost and the response time of the operation. These data are useful to justify the adoption of operational bases at alternative aerodromes, already in use. Acknowledgments: FAPDF (proc 0193.001387 / 2016) and CNPq (proc 442722 / 2018-4).

Keywords: aerial combat, local sensing, effectiveness, efficiency

Evaluation of the efficiency of a long term retardant in laboratory

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ABSTRACT – Fire retardants are chemical agents used to reduce or eliminate combustion of a flammable material, widely used to prevent and combat forest fires in countries such as United States, Spain and Australia. In Brazil its use is incipient and needs advances in the research and regulatory sectors. This work aimed to evaluate different concentrations of a long term retardant on development phase, using the Effective efficiency index (IEE) methodology. The tests were conducted in a combustion chamber at the Forest Fires Laboratory in the Universidade Federal do Paraná (UFPR). The experiment consisted of 4 treatments (concentrations of 5, 10, 15 and 20%) and water in 5 repetitions each. The fuel material used was tifton hay (Cynodon spp.) in proportion of 1.0 kg / m², forming a layer 8.0 cm thick on a surface of 150.0 cm long by 75.0 cm width (parcel). The product was applied in the final third of the parcel. The plots were burned lengthwise and, as the fire spread, the flame height (hc in cm) and the fire propagation velocity (r, in ms-1) were recorded every 10.0 cm of advance. The data were submitted to ANOVA statistical analysis and cluster analysis, performed using the software Statgraphics Centurion. The fire behavior parameters were: hc: 64.0 cm and r: 0.0070 m.s-1 as reference values, hc: 28.0 cm and r: 0.0026 m.s-1 for 5% concentration; hc: 21.2 cm and r: 0.0019 m.s-1 for 10% concentration; hc: 16.8 cm and r: 0.0023 m.s-1 to 15% concentration and hc: 29.0 cm and r: 0.0028 m.s-1 to 20%; hc: 30, 3 cm and r: 0,0031 m.s-1 for water. There was a statistically significant difference between treatments and, through cluster analysis, it was possible to observe two groupings: a) 5 and 20%; and b) 10 and 15%. However, according to the IEE the efficiency rates for each concentration were: 5%: 43,35; 10%: 49.29; 15%: 50.84; 20%: 42.76 and 30,87 for water. According to the assumptions of the IEE method, the only approved concentration, with restrictions on use, was 15%, while the others were disapproved.

Keywords: fire retardants, fires, efficiency index.

Normalized Difference Vegetation Index (NDVI) and Vegetation Condition (VCI) of the Tadarimana Indigenous Land to Identify Susceptible Areas to Forest Fire

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ABSTRACT – Forests fires can occur in a natural way in the dry season, aggravated by anthropic practices. Remote sensing and geoprocessing techniques demarcate and spatialize land surface data making possible the study and monitoring this areas. It's intended to subsidize managers of environmental and civil defense agencies, in terms of methodological routine, aiming to set preventive and reactive actions, in terms of combating fires in the Tadarimana Indigenous Land (TIT), in Rondonópolis, Mato Grosso, Brazil. August 27, 2017, a forest fire occurred in the TIT, which consumed 5,203,493 hectares of native vegetation, causing several damages to the local biodiversity. This episode was the motivating element of the research. Seven scenes from the Landsat-8 satellite were utilized, understanding the months from april to november 2017. To characterize the aspects of vegetation vigor and vulnerability to fire, was used the Normalized Difference Vegetation Index (NDVI), considering the minimum and maximum values of NDVI. Rainfall and heat spot source data provided by the Instituto Nacional de Pesquisas Espaciais (INPE) were also used in the analysis. Was generate NDVI maps with bands 4 (Red) and 5 (NIR), circling the official limits of TIT and its surroundings (1000 m buffer). For the months of april and november, the average rainfall was 0.807 and 0.817 mm respectively. In july and august the values decreased by 0.645 and 0.591mm. In september there was the lowest NDVI value (0.48), which can range from -1 to +1. Around TI, the month of april presented NDVI value of 0.716. Two hot spots dated august 27 were identified inside the TIT and not around it (1000 m buffer). From this results, it's possible to determine the beginning of a critical period to intensify the environmental monitoring at TIT before the occurrence of fires. For example, august 2017, with a minimum NDVI values of -0.749, most critical fires prevention actions could be implemented.

Keywords: forest fire, vegetation index, remote sensing.

Evaluation of potential specie for use in safety curtains for forest fire prevention

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ABSTRACT – In urban-rural interfaces, the threat of forest fires to properties, human life, as well as biodiversity is worrying, so different techniques have been developed to mitigate or prevent possible damage. One of these is the use of safety curtains, which are plantings in strips of species with less flammability than the main cultivation, in order to reduce or prevent the spread of fire and may also have overall conservation benefits. Its use has been recommended worldwide, but there are still few tests performed regarding its use. This study aimed to evaluate the flammability of Ocotea porosa (Imbuia) specie to compose safety curtains. Fifty replications of epiradiator burns (250 to 350 ° C) were performed with 1g of freshly collected mature leaves (up to 2 hours after collection). The ignition frequency (FI) in percentage, the ignition time (TI) in seconds, the combustion duration (DC) in seconds, the combustion index (IC) determined by the flame height in centimeters and, Finally and the flammability (VI) value, established through FI and IT, were analyzed. The results showed the following values: FI = 96%, TI = 32.5s, DC = 17.9s IC = 4 (high) and VI = 2 (moderately flammable). It can be concluded that Ocotea porosa has potential to compose safety curtains, however, calorimetric and combustibility analyzes are recommended in order to reinforce the results of the present study.

Keywords: preventive forestry, forest protection, green barriers.

Flammability of urban ornamental species for use in green firebreaks

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ABSTRACT – Wildfire promotes disruption to ecosystems, and one of the preventive measures taken to reduce their effects is green firebreak. This measure consists of plantations along strips and in different strata with low-flammability species, which act as a physical barrier reducing or preventing the passage of fire. The characterization of species that may make up these green firebreak is basic and essential studies for the adequacy of preventive measures, capable of meeting other sectors such as the landscaping. Therefore, this work aimed to evaluate the flammability of two urban ornamental species: *Eugenia uniflora* L. and *Persea gratissima* Gaertn F. for use in green firebreaks. The experiment was conducted at the Protection Forestry Laboratory of the Federal University of Paraná, Brazil. Flammability was tested by controlled burning in an epiradiator, with a temperature ranging from 320 to 390 ° C, using 1 gram of freshly collected mature thin material (<0.7 centimeters in diameter). Fifty repetitions per species were performed, being: ignition time, combustion duration, flame height, and ignition frequency. From the mean of these variables, the flammability and intensity values were obtained for both species. Also, the green mass of a fraction of the plant material was determined and, after remaining in the greenhouse for 48 hours at 75 ° C, the dry mass estimated for getting moisture content. According to the tests performed, it was found *E. uniflora* showed the highest ignition frequency (37) compared to *P. gratissima* (28). This may be correlated with a lower moisture content found in the fuel material of the first species (87.10%) compared to the second (150.91%). Both presented high combustion intensity, with an average flame length greater than 12 centimeters. However, based on the frequency and timing of ignition (average 28 seconds for *E. uniflora* and 35.4 seconds for *P. gratissima*), both were considered weakly flammable, thus presenting, in addition to ornamental quality, potential for use in green firebreaks.

Keywords: protection forestry; wildfire; green barriers.

Wildfire Recurrence at Quilombola Kalunga Territory (GO)

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ABSTRACT – Kalunga Historical Site and Cultural Heritage was stablished by the law n°11.409/GO and regularized as Territory in federal scope in 2009. Its total area comprises three Goiás municipalities: Monte Alegre de Goiás, Teresina de Goiás e Cavalcante. Likewise, remnants of quilombola communities, which are "social groups that developed unique characteristics of land occupation, social, productive and religious organization throughout Brazilian historical formation" (LIMA,2012, p. 1), inhabit it. Due to being a protected area with restricted use, there is a significant amount of remnant vegetation, with large natural fuel disponibility. The practices of burning fields, among other community-owned fire uses, considerably potentialize the wildifre occurence, what makes the understanding of the wildfire phenomenom, its dynamics and main occurence and spreading causes in Kalunga Territory necessary. Studies which seeks the interaction of social aspects with the physical characteristics of the examined area's vegetation to mitigate and pre-empt environmental impacts are of paramount importance, focusing on geotechnology use for planning and fire fighting. The present Territory has expressive biologically, scenically, economically and socially relevant areas, which gives it a huge importance to the society and, mainly, to the traditional communities whose cultures are inserted within this environment. Therefore, it is sought to realize a(n) study/analysis about the occurence and recurrence of wildfires at the Quilombola Kalunga Territtory from Goiás between 2009 and 2019. For such purpose, there is going to be made a literature review on this theme, use of geotechnological tools and informations disposed at the "wildfire data bank" of the National Space Survey Institute (INPE), such as burnt outbreaks and burnt areas. These data are going to be supplemented with medium and high quality satellite images. This article is part of the "Development of the wildfire risk predictive model to the Quilombola Kalunga Territory (GO)" project, resulted by a partnership between CNPq and Prevfogo-Ibama. It is sought to assist the present fires diagnosis at the Territory and help with its management. Besides, the obtained results will contribute with environmental sensibility actions in Territory communtities.

Keywords: wildfire, burnt outbreaks, geotechnologies, management, Cerrado.

Ocotea puberula fire behavior for potential use in safety curtains in preventing forest fires

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ABSTRACT – The safety curtain is a silvicultural technique for the prevention of forest fires, which aims to prevent and/or reduce the spread of fire, consisting of a planting of species less flammable than the main cultivation. This study aimed to evaluate the behavior of the fire of *Ocotea puberula* (Canela Guaicá) to indicate its use in safety curtains, using *Pinus taeda* L. as a control (species considered flammable). The entire experiment was carried out in a combustion chamber at the Forest Fire Laboratory of the Federal University of Paraná, in Curitiba, Brazil. For the experimental burns in the combustion chamber, fine plant material (< 0.7 cm) removed from the treetops was used, which remained 48 hours in greenhouse (75° C). For each species, four replicates were performed with plots of 1 m² with fuel material load of 1 kg.m-2. The factors were analyzed: moisture content of the material (%), fire propagation velocity (m.s-1), flame height (m) and fire intensity (kcal.m1.s-1). These data were submitted to statistical analysis (ANOVA) and Tukey test, through software R. All variables of fire behavior showed a significant difference between the tested species. The means of propagation velocity, flame height and fire intensity differed between the two species, and *P. taeda* presented higher values than *O. puberula* for the tested variables, indicating that the tested species is less flammable than the control species, and this species presents potential characteristics for use as safety curtains, requiring complementary tests to prove the efficiency of this species to compose safety curtains.

Keywords: preventive forestry, forest fire.

Detection and analysis of heat focus associated with soil use in the Munim River watershed

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ABSTRACT – Forest fires are mostly caused by anthropogenic actions and have a devastating potential in the environment. The Munim River Watershed has experienced strong economic growth linked to the exploitation of natural resources. This research aimed to identify hot flashes in the Munim River Watershed and associate them with land use. For land use analysis, scenes 220/62 and 220/63 were used. Through the use of ArcMap 10.5 software, different digital image processing practices were carried out, which can be described in three main steps: Preprocessing, Highlighting and classification, where the defined classes were: dense vegetation, thin vegetation, exposed soil, clouds, and, water bodies. The data obtained for the analysis of heat sources in the Munim River Watershed region were obtained on the electronic platform of the National Institute for Space Research (INPE) on the period from 2008 to 2018 based on data of satellites by NOAA, GOES, AQUA, NPP METOP, MSG, and TERRA series. Among the years analyzed, 2011 was the year with the lowest number of hot spots, a total of 2,114, whereas 2015 stood out with the highest number of hot spots, totaling 14,048. By combining the hot spots with land use in the year 2015, it was evidenced that most of them were identified in areas classified as thin vegetation with 41.95% and in areas of exposed soil with 39.76% and in smaller amounts in areas of dense vegetation with 16.99% of allocated points. The cities of Chapadinha, Afonso Cunha, Coelho Neto, Buriti, São Benedito do Rio Preto and Urbano Santos were the ones that indicated the largest number of hot spots, being classified as Very High, High and Medium intensity. In the years 2009 and 2011 the lowest focus intensities were identified in the Munim River Watershed, being quantified at 2,690 and 2,114, respectively.

***Keywords*:** use of the soil, natural resources, heat spots

Vegetation index behavior (EVI) in burnt areas at Chapada dos Veadeiros National Park – PNCV/GO

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ABSTRACT – Wildfires are some of Cerrado characteristics, having an important function on vegetation maintainment, although they also promotes negative environmental impacts. Seeking to understand the vegetation's behavior with wildfires, this study aims to analyse the vegetation index / Enhanced vegetation index in burnt areas between 2006 and 2010, and the relation between these burnt areas with morphopedological compartments within the PNCV territory, including its 10 km damping area. For the EVI analysis Landsat images from the study period were used, totalizing 115 EVI cutouts. The morphopedological compartmentation is resulted from a comparative analysis and associated to the physical variables: geology, geomorphology, hipsometry, declivity and soils. The procedures were executed in GIS, used to intersect and associate the themes, resulting in I, II, III and IV morphopedological compartments. It was observed, with EVI data, that the large wildfires precedent results to the difference between the EVIs from burnt and not burnt areas were closer to zero, tending to positive values, what might mean that the areas which suffered wildfires were with a similar vegetation to the areas which didn't suffer or even with bigger green leaf areas, proving the use of this biomass to the fire spread. This pattern is also evident on the results obtained after the huge fires, with more negative results, what displays that the burnt areas could be recent marks, or with regenerating vegetation. The III and IV compartments were the most striked ones by wildfires. About 76% of compartment IV area was burned during the studying period, whilst compartment III burned area reached 57%. These compartments are formed by areas whose altitude, relief and natural vegetation variations are larger. The morphopedological compartmentation might be one of the tools for the choice of priority areas to wildfire prevention, and the EVI discloses the vegetation as one of the main factors to fire spreading, highlighting the significance of management in these areas.

***Keywords*:** wildfires, enhanced vegetaion index and morphopedological compartments.

IGNITE: a tool for adaptive fire management and biodiversity conservation in the Cerrado

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ABSTRACT – Fire has shaped plant evolution and biogeochemical cycles for millions of years in savanna ecosystems. Despite this, fire suppression practices are still prevalent in the Brazilian savannas and generally result in fire regimes incompatible with biodiversity conservation goals. Recently, managers and researchers have discussed and implemented fire management alternatives including more adaptive and integrated approaches. In adaptive management, decisions are made as part of an ongoing process of review and evaluation of results to improve understanding of system responses to implemented practices and adjust them if necessary. Implementing an adaptive approach into fire management requires the ability to deal with uncertainty, consider multiple management options at the same time, overcome institutional barriers, apply innovative monitoring approaches, resolve management conflicts and improve the poor interaction between scientists, managers and local people. Of course, fire management practices raise relevant issues such as: What spatial and temporal patterns of fire are needed to sustain ecosystem conservation values and biodiversity, and how can such regimes be properly implemented and monitored? To answer these questions and assist managers in decision making process, we are developing a management software which is called IGNITE, a free tool, planned and structured specifically for fire management in the Brazilian Cerrado. The IGNITE should lead managers through three modules: fire management planning, execution and monitoring. At each step, users should add qualitative information and enter spatial data such as the land cover mapping and areas affected by wildfires and prescribed burns in previous years. The software aims to identify areas susceptible to inappropriate fire regimes, helping to guide management decisions. In addition, by proposing targets, indicators and protocols for research and monitoring we hope to consolidate the adaptive fire management and encourage managers and researchers to engage more deeply in the process. The IGNITE has the potential to reduce scientific uncertainties and enable, in medium and long term, the building of a database for biodiversity conservation in the Cerrado.

***Keywords*:** adaptive fire management, management software, Cerrado

UAV use for prescribed after-burn mapping in Itatiaia National Park

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ABSTRACT – This research was conducted in the Campos de Altitude located in Itatiaia National Park (INP). The vegetation is composed of grass and shrub strata characteristic of this type of phytophysiognomy, with the presence of endemic species of the area. Historically, since it is an area with the highest concentration of major fires, as of 2017, the conservation unit performs management actions aimed at increasing the knowledge of the ecological role of fire in the Campos de Altitude. The aim of this study was to perform a detailed classification of the scar left in the soil after prescribed burning, evaluating the effectiveness of the burning. The images were obtained on March 31, 2017, after two days of the prescribed burn, using an RGB sensor coupled to an unmanned aerial vehicle (UAV). After processing and orthomosaic generation, an image of the entire area with 8 cm of spatial resolution was obtained. Orthomosaic classification was made by object-based analysis. The algorithm used for segmentation was edge-based segmentation, the defined parameters were scale and merge, with values of 60 and 80, respectively. The land cover classes used in the classification were: vegetation, burnt vegetation, rocky outcrops, and water. The classification algorithm used was the Support Vector Machine (SVM). Accuracy was assessed using a confusion matrix and Kappa index. The SVM algorithm was found to be effective in the classification of high-spatial-resolution images, with an overall accuracy of 94.5% and a Kappa index of 0.92. For the burnt vegetation class, the user's and producer's accuracy was 87.9% and 94%, respectively. The mapping indicated that the prescribed burning was effective, achieving its objectives (reduction of combustible material and fragmentation of it in the landscape, in an area susceptible to fire). It was also observed that because it is a fire characterized by low intensity, an area of arboreal vegetation and areas of swamps within the area were not affected by fire.

***Keywords*:** prescribed burning, Support Vector Machine, classification, INP

Occurrence and recurrence of forest fires in Itatiaia National Park between 2008 and 2016

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ABSTRACT – Some ecosystems are adapted to fire disturbances, but as fires become recurrent in the same area, fire can cause drastic landscape changes resulting in loss of biodiversity. Thus, this study aimed to evaluate the occurrence and recurrence of forest fires for a period of 8 years in the interior and in the buffer zone of Itatiaia National Park (INP). The polygons of the burned areas were extracted from the INP Fire Report database. Since 2008, reporting polygons have been collected using GPS devices. Each polygon that delimits a burned area represents one occurrence. Therefore, the total number of occurrences in each year is represented by the number of polygons this year. The total area burned between 2008 and 2016 was 3435.64 hectares, corresponding to 4.3% of the study area. In this period, 354 occurrences were verified, and 2014 had 51 occurrences, the largest number found in the study. However, 2014 was not the year with the largest area hit by fire. The largest burned area occurred in 2010, with 1573,86 hectares. This fact can be explained by a single occurrence that reached 1255.11 hectares in the Campos de Altitude of Itatiaia upland. Inside the INP, areas with up to 5 fire recurrences that can be classified as anthropic fields and related to livestock use were verified. In the buffer zone, up to 6 recurrences were found, especially the lower part of the park and the areas near the rural communities of the municipality of Itamonte. The map of fire recurrence plus the survey of the causes of forest fires and the socioeconomic needs of fire use provides important subsidies for the planning and execution of specific strategies aimed at the protection and management of protected areas.

***Keywords*:** INP, burned area, GIS

Characterization of severity in fires that occurred in 2015 at the Chapada Diamantina National Park

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ABSTRACT – The Chapada Diamantina National Park (PNCD) is an integral protection unit, in which the rupestrian field vegetation prevails, a savanna type, which suffers recurrent fires. For the management of this environment, it is essential to analyze the severity, which can be defined as the magnitude of the change caused in the ecosystem by fire, due to the fire consuming the vegetation leaving the soil bare. Remote Sensing provides feasible approaches to describe fire patterns in different ecosystems, considering that satellite images are often used to outline fire perimeters and characterize the degree of severity. This study aims to assess the degree of fire severity that occurred at the PNDC in 2015, using the dNBR and RdNBR spectral indices. For the evaluation of post-fire effects for the selected areas, images of the Operational Land Imager (OLI) sensor were used onboard the Landsat-8 satellite. Four images of the OLI sensor were chosen in 2015, the pre-fire image of 28 August and the post-fire images of 25 September, 14 December and 30 December. For the pre-processing step the digital numbers were scaled to radiance values and after the conversion the images were corrected atmospheric, the method used for the atmospheric correction was FLAASH. The data obtained were pre-processed and properly prepared for the calculation of spectral indices and the results were classified according to the severity levels indicated by Key and Benson (2006) For the three analyzed fires, the dNBR index identified about 50% of the burned areas for the class Moderate low severity, with values between +270 to +439, for the RdNBR index, approximately 80% of the areas burned for the high severity class was identified, with values between +660 to +1300. It is concluded that the use of the multitemporal index dNBR and the relative index RdNBR are important tools for the classification of the burned area in the study area, as well as, supporting the development of actions aimed at fire prevention in the PNCD area considering the degrees of severity already experienced in that environment.

Keywords**:** *vegetation fire, digital image processing, Landsat-8 sensor OLI, índice espectral*

Spatial and temporal dynamics of the use of fire in the Atlantic Forest of Sergipe

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ABSTRACT – The monitoring of fire hotspots is an important tool for environmental management and evaluation, allowing us to understand the dynamics and trends of fire use. In Brazil, INPE detects hotspots by images generated by optical sensors, capable of capturing electromagnetic radiation in the thermal average range of 4μm. The aim of this study is to analyze the spatial and temporal distribution of the hotspots detected in the years 2016 and 2017 by the VIIRS sensor (NPP-375 platform) in the area covered by the Atlantic Forest biome in the state of Sergipe, based on vector data from the Atlas of Forest Remnants of 2016 produced by SOS Atlantic Forest, as well as in areas destined to Rural Settlements managed by Incra. The vectors of the hotspots were obtained in the Fire Database of CPTEC/INPE, while the vectors of rural settlements were obtained in of Incra and the National System of the Rural Environmental Registry. The best capacity for refinement and detection of hotspots motivated the choice of platform NPP-375. From the intersection of vector layers at GIS, the incidence of 2,187 hotspots was identified in the study area, of which only 260 are associated with phytophysionomys of the Atlantic Forest biome: Forest 186, Sandy coastal plain vegetation (Restinga) 61 and Mangrove 13. Of the 186 hotspots recorded in forest area, 17 focus on the Legal Reserve of Rural Settlements. The hotspots were detected with greater intensity in the dry season, however this condition is not only associated with moisture and the rainfall reduction, but also to the cycle of crops that use fire as a form of management, as is the case with sugarcane. It is noteworthy that the occurrence of 1,873 hotspots beds coincided with the peak of sugarcane harvesting in Sergipe that occurs between November and March. The state of Sergipe lacks government actions that promote alternative techniques to the use of fire in the harvesting of sugarcane, as well as preventive actions and fire fighting in Rural Settlements.

***Keywords*:** burned area, hotspots, sugarcane

Development of a prototype with wireless sensors for detection of forest fires

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ABSTRACT – Each year, in several countries of the world, large expanses of forest are lost due to the fires, causing impacts social and economic. A strategy designed to lessen or even prevent the occurrence of forest fires is the implementation of detection and prevention systems in forest areas. In this sense, as for the detection systems, can be highlighted more traditional media, like conventional observation towers and ground patrol; or even, through monitoring of automatic cameras installed in the towers, satellite monitoring, air patrol and more recently, in some countries, wireless sensor networks, distributed in the area to be monitored. Studies show that there are advantages and disadvantages in many different means of detection, since your operating cost, efficiency and your coverage area. In this context, the present work aims to develop and evaluate the performance of a system of wireless sensors, adaptable and that integrates the different devices and technologies, with the aim of detecting forest fires. For the development of the prototype are being considered the sensors of smoke, relative air humidity and temperature. The prototype developed as a product of this project will have direct connection to cell phones, tablets or laptops, through the submission of data to a cloud, through the shield device to ethernet connected to an Arduino board. The wireless sensor system will be programmed to send beeps alert when a fire is detected, allowing a real-time experience, with access to the data collected by the sensors. With the validation tests of the prototype in an area considered at risk, in the Serra das Confusões National Park, located in the State of Piauí in the Northeast region of Brazil, is expected to validate the efficiency of prototype for detection of forest fires, as well as a better combat management on the part of managers and actuators in the operation. The importance of this project is evidenced by the technological innovation in the field of forest protection and the possibility of new alternatives of control systems that are viable economically.

***Keywords*:** forest protection, Arduino, technological innovation

Fire patterns in the Brazilian Cerrado: an approach comparing different input datasets in the fire risk modelling

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ABSTRACT – Emissions from vegetation fires are relevant in the atmosphere-biosphere interaction. Nevertheless, fire is still intensely used as a tool in land management, modifying natural fire patterns in fire-prone ecosystems. The Brazilian Cerrado has shown increased anthropogenic fire ignitions, especially due to deforestation that removed ~50% of its original cover and unusual droughts. Fire risk (FR) models using meteorological and vegetation parameters have been used to estimate fire patterns at biome level. The aim of this study was to evaluate the performance of INPE's FR model using different climate and land cover (LC) datasets (versions 0 and 1) to estimate FR patterns in the Cerrado. Meteorological datasets from CoSch and MCD12Q1-IGBP V006 land cover data represent v0 while v1 is composed by IMERG and Mapbiomas v3.0 datasets. The analyses were performed in the wet (W: November-March) and dry (D: May-September) seasons from 2015 to 2018 at 1km of spatial resolution. The versions were compared using the seasonal predominance of FR (PFR) and evaluated in five categories: "minimum", FR<=0.15; "low", 0.15<FR<=0.40; "medium", 0.40<FR<=0.70; "high", 0.70<FR<=0.95 and "critical", 0.95<FR<=1.0. The main fire pattern differences between v0 and v1 were observed in D, when the PFR remains "high" during all season according to v0, while v1classifies "critical" PFR from July to September. In W, differences were not observed, except for November, classified as "low" PFR by v0 and "minimum" PFR in v1. These differences can be related to the higher LC spatial resolution and definition of vegetation types in v1 such as woody savannas; v1 is based on Landsat medium resolution spectral images (~30m) while v0 uses MODIS low resolution (~500m). Concerning precipitation, the information has a higher spatial consistency using 10 km of spatial resolution in v1 while v0 uses 25 km of spatial resolution. With new Mapbiomas editions and revisions released every year, INPE's FR will be updated accordingly, allowing a realistic temporal modeling of the vegetation; including terrain data in this condition will allow a new FR product at 30m resolution for protected areas – our next goal.

***Keywords*:** Fire modelling; fire season; savannas; Brazil; land use

Evaluation of heat spots occurence in Kalunga Quilombola Territory in Goiás temporal series

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ABSTRACT – Wildfire occurence modeling has huge importance on environmental conservation and in the stablishment of environmental education, fiscalization and fire fighting actions. The elaboration of computational models which represent the occurence of wildfires ought to have a data and information set about these events. Currently, an important set of satelitte orbitals, equipped with surface temperature variation sensors, have been used by National Space Survey Institute (INPE) in order to monitor heat spots throughout South America. These sensors provide moderate spatial resolution data (1 km to 8 km), yet with high temporal resolution, until 30 minutes. These data are available for free at INPE fire database (www.inpe.br/bdqueimadas). For the project's elaboration, wildfire data were accessed on a wildfire database website, for the years between 2009 and 2017. Then, through a computation program of Geographical Information System (QGIS), the wildfire data were spatially integrated to the Kalunga Quilombola territory map. After the wildfire data spatial integration, these were analysed in monthly temporal resolution using an electronical computational program table. Then, the production of temporal series graphs were started for posterior analysis, whose tendencies were being verified, as well as the seasonal patterns. It was possible to observe that the temporal series has an expressive randomity degree with years which had large fire occurence and years with minor occurence, probably due to climate anomalies such as "El Niño". However, there is a clear seasonal pattern with a wildfire increase in June/July, an expressive increase in September and October, which are drier months. This data and information set are going to be used as an aid in spatial and temporal modeling for wildfire occurence in Kalunga Quilombola territory.

***Keywords*:** fire monitoring, fire computational modeling, geographical information system

Temporal analysis of vegetation cover variation by fire action in Lábrea (AM)

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ABSTRACT – The present work aimed to analyze and quantify the areas of fire occurrence and the consequences of its action on vegetation, in the territory of Lábrea, southern region of the Amazonas state. Operational Land Imager (OLI) sensor scenes were used aboard the Landsat 8 satellite, from August and September of 2014 and 2015. These scenes were treated using remote sensing techniques, divided into two stages: (1) pre -processing (radiometric calibration, atmospheric correction, reflectance conversion and noise removal); (2) post-processing (vegetation index generation: Normalized Difference Vegetation Index - NDVI, Normalized Burn Index - NBR, image composition, interpretation, mapping, quantification and spectral behavior of vegetation). Heat source data from the Instituto Nacional de Pesquisas Espaciais (INPE) burn monitoring program were also used. The results demonstrated the high increase of hot spots in 2015, compared to 2014. The location with the highest concentration of hot spots was in the Assentamento Monte project. The use of NDVI and NBR vegetation indices showed the potential in the identification and mapping of burned areas. Comparison of hot spots with areas of effective burn demonstrated the inaccuracy of the location of the burn monitoring sensors. The total estimated burned areas in two different areas of the Lábrea municipality (AM) were 1,174.37 ha and 12,761.26 ha in August and September 2014, respectively, and 22,403.86 ha and 23,320.71 ha in August and September 2015, respectively. Through the spectral behavior of the vegetation it was noticed that the alteration of the surface reflectance after a burn, reflecting larger amount of energy in the red and blue bands. The results show that the largest amount of heat spots and burnt areas are in settlement project areas, and that the NBR vegetation index has the greatest potential to distinguish burnt areas from other vegetation types. The spectral response of the surface changes with burning events in which the red band showed higher sensitivity.

***Keywords*:** remote sensing, vegetation index, burning, spotlights heat

Quantification of burnt areas as a fundamental parameter for the estimation of spatial and temporal patterns of fire incidence in Canaima National Park (Venezuela)

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ABSTRACT – Canaima National Park (30.000 km2, CNP), inhabited by Pemón indigenous peoples, is considered an important protected area due to its biological and cultural uniqueness. High levels of fire incidence, along forest fire vulnerability represent a threat to both ecosystems and human wellbeing. The purpose of this research was to estimate spatial and temporal patterns of fire occurrence in CNP, through burned areas quantification, during 2014-2015 and 2015-2016 periods, using Landsat-8/OLI satellite data (spatial resolution: 30 m). Detection and quantification of burned areas required: 1) visual interpretation of fire scars appearing in 252 images, and 2) QGIS (version 2.18.3) application, to estimate total burnt area and vegetation type affected by the fire. Results indicated that the total burnt area was 64200 ha and 106000 ha during the 2014-2015 and 2015-2016 periods, respectively. These figures represent 2.2% and 3.7 % of total CNP area, while they represent 5.62% and 9.26% of Eastern CNP territory, an area of CNP were grassy savannas are dominant. From the first to the second-year fire incidence increased by 64%. This increase relates to the occurrence during 2015-2016 of one of the most severe ("very strong") ENSO episodes recorded nicknamed as Godzilla. During January 2016, at the highest level of ENSO, no rain was recorded in CNP, and 45,000 ha burned, which represents 43% of all burned area during that year (Oct 2015-Aug 2016). Although savannas were the most affected areas, forests were very affected in 2015-2016, when fire extended towards these ecosystems when the occurrence of dry extreme atmospheric conditions increased forest vulnerability to fire. The methods used during this research allowed us for the first time to determine –with a high level of confidence- the magnitude of fire activity within CNP. This work represents a fundamental advance in the process of identifying vulnerable areas and defining fire management plans in CNP.

***Keywords*:** burned area; spatial and temporal fire incidence patterns; remote sensing, ENSO episodes, Canaima National Park.

Remote sensing time series to assess fire recurrence patterns over Campos Amazônicos National Park

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ABSTRACT – Fire is one of the major factors in the dynamics of terrestrial ecosystems, and its monitoring and assessment is very relevant for the understanding of ecological processes and human impacts at different scales. In this context, this work analyzes the fire incidence in the savannah enclave of Campos Amazônicos National Park (CANP), in the period 2000-2018, relating fire recurrence patterns with the current spatial distribution of tree cover physiognomies. Landsat multitemporal series were used to update the burned area mapping (2017 and 2018) through semi-automatic processes accompanied by visual supervision, complementing the burned area database that has been developed over the last years. Additionally, Landsat Tree Cover Continuous Field product was used to relate the different classes of fire recurrence and surface type. Over the past 19 years, 1.13 million hectares burned have been mapped, a total of 2.6 times the total size of the CANP enclave. Areas affected by fire between 2 and 4 times stand out, occupying 37.49% of the enclave, and correspond to areas with predominance of physiognomies with medium-low and low percentage of tree cover. It was also observed that in areas with frequency higher than 4 fires there is a decrease in the tree cover percentage between the years 2000-2015, highlighting the prominent role of fire in maintaining the open phytosiognomies. Current research lines are focused on the analysis of fire experimental plots, using remote sensing data and fieldwork information to understand the relationships between fire and vegetation in the study area, providing information for the optimization of fire management strategies of CANP.

***Keywords*:** burned areas, Landsat series, savannah enclave, Amazon

Spectral response of temperature and vegetation in regions with an incidence of hotspots in a river basin, case study

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ABSTRACT – Fires significantly alter the vegetation cover, directly influencing the temperature of the soil surface, with vegetation being a natural regulator of the temperature of the environment. Thus, the objective was to evaluate in areas with higher incidence of hotspots the relationship between soil temperature and the Normalized Difference Vegetation Index (NDVI) of the Itapecuru River watershed, State of Maranhão. The study area is located in the centre-east of the state of Maranhão, between the coordinates 2° 51' to 6° 56' S and 43° 2' to 43° 58' W and an area of 52,972.1 km². The data used in relation to hotspots were obtained from the platform of the Burning Program - INPE, the NOAA-12 and ATSR satellites. To calculate the NDVI and soil temperature, scenes from the Landsat satellite, TM/5 sensor were used, with band 4 (near infrared) and band 3 (red) for the NDVI results and band 6 for the calculation of the soil surface temperature. During the period from August 1, 2000 to October 31, 2000, 794 hotspots were detected in the basin area, being distributed: 336, 314, 154, 76 and 32 hotspots in areas of 25,488.804 km², 22,622.331 km², 2,162.415 km², 2,236.902 km² and 461.648 km², respectively. The NDVI of the total area was calculated and ranged from 0.976 (high vegetation index) to -0.896 (low vegetation index). In 39.28% of the total area, the highest vegetation indices were registered, with values between 0.976 and 0.47. While in 0.4058%, the lowest indexes were found, between -0.184 and -0,896. In relation to temperature, values ranging from 10ºC to 15ºC were found for lower temperatures and 26ºC to 39ºC for higher temperatures, corresponding to 0.8462% and 38.631%, respectively, of the total area, highlighting temperatures between 22.2 and 26.3ºC in 53.25% of the basin area. A high visual similarity between temperature and NDVI was observed, i.e., in areas with lower vegetative index (-0.184 to -0.896) the highest temperatures (26.4 °C to 39 °C) were observed. It was found that the temperature of the soil surface is directly related to the vegetation of the environment.

***Keywords*:** burning; deforestation; fire risk.

Procedures in the use of drones to validate the fire detection by satellites

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ABSTRACT – Forest fires annually destroy extensive areas of vegetation, causing great environmental and economic damages. Many products derived from satellite observations have been used to monitor fire events. In Brazil, the Queimadas Program from INPE develops applications for the daily operational monitoring of hot spots detected by satellites. These detections are obtained with measurements from different sensors, which require specific algorithms and calibration parameters. The use of thermal sensor coupled to drone allows obtaining parameters with adequate spatial resolution. However, there are still no defined routines for obtaining these measures. The aim of this work is to propose a procedures protocol for the use of thermal sensor coupled to drone in experiments for validate the detection of hot spots by satellites. Based on our field experiences it is first necessary to have support from brigadiers, to instruct the teams with safety procedures to carry out the experiments. Secondly, i) to request authorization for the drone flights, in the SARPAS / DECEA system; ii) to check the weather conditions (cloud cover, wind speed and direction, etc.); iii) to determine the size of the burned area, which is inversely proportional to the spatial resolution of the satellite sensor studied; iv) to define the height of the drone's positioning, depending on the dimension of the chosen area and the sensor's field of view, and; v) to determine the sequence of the drone activation time, the start of the burning and the satellite imagery over the location. Finally, it is necessary to obtain quality thermal measures: i) to start the fire in advance for arrive to high temperatures during satellite imaging in the place of interest; ii) to consider the time to stabilize the drone and start acquiring the thermal data, before and after the peak of the satellite passage, and; iii) after the satellite has passed, to use the drone for measure the surrounding temperature (radius = ~ 200m), obtaining a temperature reference in the surrounding areas. This protocol aims to standardize the experiments, improving the detection algorithms and providing improvements in the products presented in the Queimadas Program database.

***Keywords*:** Thermal sensor; experimental burning; validation; fire; drone; calibration

Diagnosis of potential species for the composition of fuelbreaks in Brazil

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ABSTRACT – In forest fire occurrence, one of the used techniques to prevent and reduces the damages in forest cultive are the fuelbreaks. It is a structure constituted of less inflammable species what dificult the fire propagation. The aim of this study was to conduct a research about potential species for use as fuelbreaks in Brazil. For this, was identified studies about flammability tests in species, using forest species frequently cultivated – e.g. *Pinus* – as reference. Three studies were observed on this theme, which approached three methodologies: i) identification, by photo, of species less effect in areas with fire occurrence. ii) burning test and evaluation of fire behave (combustibility). iii) epiradiator use (flammability). Through the analysis of moisture content and volatile material, in addition to the delay time for ignition founded (method i). Four low flammability species were diagnosed the *Vochysia thyrsoidea*, *Palicourea rigida* and *Lavoseiera bergii*, when compared with *Echinolaena inflexa*. The direct burning (method ii) totaled eight species analyzed, standing out as species *Mimosa caesalpiniaefolia* and *Hibuscus* as successful in fire control, because they have a good development even in a drought region. Regarding flammability (method iii), seventeen species was studied and the test had showed that *Bougainvillea glabra*, *Ligustrum lucidum*, *Psidium beefianum*, *Schinus terebinthifolius*, *Ocotea puberula*, *Araucaria angustifolia*, *Cupania vernalis* and *Luehea divaricate* have propagation or degradation potential to make fire. However, by the same method, as the species *Magnolia grandiflora* and *Jasminum* demonstrated an extreme flammability, thus they are not indicated to a composition of safety curtains. In despite of the low flammability of the mentioned species, additional tests are still necessary to confirm the potential of these uses in safety curtains. There was some difficulty in using data in some regions of Brazil, or in more research related to the theme; showing that the study and respect of species are used for a security curtain composition in a country is scalable and timely.

***Keywords*:** forest fires, flammability, fuelbreaks

Impacts of the deployment of the BR 242 highway in the heat sources from satellite images of Nova Ubiratã, Mato Grosso State, Brazil

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ABSTRACT – In the state of Mato Grosso, Brazil, the highway named as BR-242 plays an important role in the outflow of agricultural production in the region, tending to increase the traffic with the expected construction of eight bridges to be complete in the year of 2019. Regard the forest fires and hot spots, there is a controversy if the increase of road access raises the frequency of man-made fires or is reduced by providing access to their suppression and control, are implications on the road effects for fire management. Therefore, the aim of this study was to identify the influence on the spatial patterns represented by the hot spots detected in the lateral bands of the BR-242 highway in an area of the road, about 156 km in the municipality of Nova Ubiratã. The data detected were obtained by the Database Program of the Instituto Nacional de Pesquisas Espaciais (INPE), from the dry season from May to October between 2015 to 2018. The data was analyzed, we also partitioned the distance in three classes along the BR-242 corridor as: 0 - 5 km, 5 - 10 km and 10 - 15 km, left and right side of the highway. When analyzing the variation of the heat sources, in the class 0 - 5 km presented a variation of 42% to 77%, approximately twice as much variation when compared with other classes. The class 5 - 10 km was 11% to 44%, and in the class of 10 - 15 km, variation was 11% to 28%. Probably all of these outbreaks come from clearing agricultural practice in the highway lateral bands, in addition to cleanings, can be derived from highway traffic. In this sense, measures to protect the areas near the highways are necessary to improve the safety of the drivers, evaluating the role of human presence in suppressing forest fires in the vicinity of the highway.

***Keywords*:** environmental impacts, infrastructure, forest fires

Evaluation of heat sources in settlement project in the municipality of Nova Ubiratã, Mato Grosso state

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ABSTRACT – The Nova Ubiratã municipality is considered the 3rd largest grain producer in the State of Mato Grosso, Brazil, with more than 600 thousand hectares dedicated to soybean, corn, cotton and other crops. Before the agribusiness, from the 90's, the federal agency named as Instituto Nacional de Colonização e Reforma Agrária (INCRA)) installed federal settlements (PAs) known as: Piratininga, Santa Terezinha II, Boa Esperança I, II and III and Cedro Rosa, with a total area of 77238 ha and 915 settled families in 2017. The diagnosis of hot spots in the PAs was the beginning of a proposal of Integrated Fire Management (MIF) plan, and its success depends on the size of the PAs, geographic location and isolation, human density and environmental activities/pressures, capacity (firefighters, equipment), local fire brigade training and community support. In this context, this study aimed to analyze the heat sources obtained by remote sensing in the federal settlements (PAs) in relation to the territorial extension of the municipality of Nova Ubiratã, in the period of the dry season between May and October, in the years 2015 to 2018. For this purpose, we downloaded data from the Instituto Nacional de Pesquisas Espaciais (INPE), heat sources detected by the AQUA/MODIS ¨Satellite of reference¨ with a spatial resolution of 1 km, we carried out spatial. Our results indicated that in the dry season the PAs with 6% of the rural area of the municipality contributed with up to 28% of the total of hot spots detected in the municipality between the years 2015 to 2018. We concluded that the hot spots in the federal settlements and in the municipality results from the use of fire for pasture and agricultural management. Our finding can assist the management of government projects to promote operational actions of monitoring, prevention, firefighting and in the provision of areas prone to fire hazard.

***Keywords*:** fires, hot spots, soil management, MODIS product, farmer

Analysis of the heat sources detected by MODIS and VIIRS satellites in central western Amazonia

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ABSTRACT – Forest fires are characterized as environmental disasters and depending on its gravity they destroy the entire forests causing ecosystem losses. The quality of the detection of heat sources in the satellite is relevant to verify the sources of fires and to assess the area to be reached, especially in areas of hard to reach such as those in the Brazilian Amazonia. This study was carried out in the municipality of Nova Ubiratã, Mato Grosso state and we aim to analyze the heat spots detected by two satellites between the months of may and october (dry season) from 2015 to 2018. The identification and quantification of the active heat sources were analyzed from the Database of the Instituto Nacional de Pesquisas Espaciais (INPE), detected by the AQUA satellites ¨Satellite Reference¨ Moderate Resolution Imaging Spectroradiometer (MODIS) with resolution of 1 km and Suomi-NPP (S-NPP) and Visible Infrared Imager Radiometer Suite (VIIRS) sensor with resolution of 375 m Outbreak data were analyzed. Our results indicated that the number of heat sources detected by the S-NPP overestimated the AQUA in 13.83%, while the VIIRS detected 8.410 outbreaks, the MODIS sensor recorded 1.057 outbreaks. In addition to the fact that the S-NPP is a third generation satellite, the difference is due to the higher spatial resolution of 375m of VIIRS with conditions to detect hot spots, while the spatial resolution of MODIS is 1 km. We think that the interpretation of the data monitored by different satellites and sensors is fundamental for the effective decision-making of the fire analyst for fire management by forest fire prevention and control institutions.

***Keywords*:** AQUA, satellite monitoring, Nova Ubiratã, reference satellite, S-NPP

The fate of burned areas in the Mato Grosso and Pará Brazilian Amazon States

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ABSTRACT – Given the regional complexity and dynamic, Amazônia has been targeted by permanent monitoring systems since the 1980s. PRODES (Monitoring Brazilian Amazon Forest by Satellite), created in 1988, delivers the yearly deforestation rate assessment, mapping the occurrence of clear-cutting. As other human-caused forest disturbances, such as from fire and selective timber harvesting, became common throughout Amazonia, a new and complementary system was created. In 2004, a warning system, called DETER (Near-Real-time Deforestation Detection), was designed to deliver daily warnings to guide environmental enforcement. DETER maps the occurrence of clear-cutting and the long-term and gradual reduction of canopy cover due to forest fire and unsustainable logging, known as forest degradation. Considering that fire-driven deforestation is the major source of carbon emissions from Amazonia, we analyze whether the fate of the burned forest is the clear-cut. To do this, we used data for the 08/01/2017 to 07/31/2018 period and compared the DETER class "burn-scarred vegetation" with the PRODES class "clear-cut". We selected Mato Grosso and Pará states, hotspots of deforestation in the Amazon region. The Pará state had both the highest burn-scarred vegetation (9105 Km²) and clear-cutting areas (2590Km²) compared with Mato Grosso, which displays 8020,27 Km² and 1339 Km², respectively. The burned area was then intersected with the clear-cut map. The result shows that 1% (94,4 Km²) and 1,6% (129 Km²) of the detected burned vegetation were converted to cleared land in the Para and Mato Grosso, respectively. A forest fire can alter radically forest structure and easily lead it into clear-cut. Also, deforestation has long been associated with fire, and thus it was expected to find a higher proportion of burned areas converted to cleared land. We hypothetized that, in the analyzed period, DETER has detected mainly scars of a low-intensity forest fire. Besides, we hypothetized that there is a regime of recurrent antropogenic interventions in the forest before total vegetation removal. Thus, if apropriated surveillance actions are taken is possible avoiding that this process results in clearings.

***Keywords*:** forest degradation, remote sensing, land cover changes monitoring, Amazon region

Fire Risk in Vegetation Contiguous to Highways of Access to the Industrial and Port Complex of Pecém/Ceará-Brazil: Case Study

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ABSTRACT – The risk of fire is related to the amount of ignition agents available from human sources and from natural causes of fire. The literature also indicates a significant relationship between the occurrence of fires and the distance from the nearest road. Thus, fires, particularly those near highways, can generate traffic disturbances, causing changes in demand and capacity, reducing average speed and, consequently, generating undesirable delays for road users, as well as contributing to causing disasters related to the transportation of passengers and cargo. This paper presents a study on the risk of fires in vegetation in areas adjacent to the main access roads to the industrial and port complex of Pecém, roads for the flow of raw materials and products. The study considered stretches of the federal highways BR-222 and BR-020 and the state highways CE-085 and the former highway CE-422, currently called CE-155, within the limits of the municipalities of São Gonçalo do Amarante and Caucaia, both belonging to the Metropolitan Region of Fortaleza, State of Ceará, Northern Coast of the Northeast. In the region there is a varied mosaic of landscapes according to local geoecological and climatological factors. There is a shortage of rainfall, low air and soil humidity, strong sunlight, high levels of evaporation and temperature, and vulnerability to climate change. Statistics were analyzed for records of hotspots identified by the processing of satellite images. To validate the foci, atmospheric data from ground meteorological stations and records of occurrences of the Military Fire Department of Ceará were analyzed. The analyses showed that forest fires and more than 70% of hotspots are identified in the period between the months of September and December. The study made it possible to map the areas with the highest incidence of fires, which require greater attention from the local community and from forest fire fighting institutions. These results are essential subsidies for the institutions responsible for preventing and fighting fires in vegetation, preventing and mitigating natural and technological disasters, and for the private sector to prepare Mutual Assistance Plans in the event of emergencies.

***Keywords*:** Forest Fires, Road Transport, Remote Sensing, Civil Defense

Detection of agricultural fires in the State of Acre with GEE and QGIS

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ABSTRACT – Herein we aimed to test four supervised classifiers to map forest scars caused by agricultural burning activities, and also evaluate time-quality ratio accuracy. In the last decade, while deforestation rates decreased, the number of thermal hotspots increased through Amazonia. Monitoring forest burnings is important to identify and map location and trend of active burnings in real-time. However, such procedure is usually based on detection of isolated thermal hotspots on the surface, which do not allow evaluation of the size of areas affected by fire. As cloud image processing evolves and provides new tools, as Google Earth Engine (GEE), it became possible to detect and monitoring areas impacted by fire in fast and agile ways. Nevertheless, testing the efficiency of algorithms to balance commission and omission errors in the final product is pivotal. Thus, we tested four supervised classifiers (maximum likelihood, decision tree learning (CART), random forest, and minimum distance) in physical and cloud environments by the use of QGIS and GEE, respectively. We evaluate time spent (minutes) in each classification of the Landsat 8´s scene 005/066, within a computer with the following configuration: Intel Core i7 processor, graphic card NVIDIA, 8Gb memory RAM ddr3. We considered four classes: forest, deforestation, burnings, and bodies of water; with 20 samples for each class. Time spent with QGIS was 90 minutes: 40 minutes to download images, 13 minutes sampling the classes, and 37 minutes to obtain outputs after application of algorithm. With GEE, time spent was 27 minutes: six minutes to sampling, one minute to apply algorithm, and 20 minutes to download classification. Minimum distance was the algorithm with best performance due to minor commission and confusion errors for bodies of water and deforestation classes. Cloud image processing is a large step for digital satellite image processing routine, as it saves time and offers several classification algorithms simultaneously. Products of monitoring forest burnings are an important source of information for decision makers, supervision, and agricultural practices, as well as, inclusion in platforms as TerraMA2.

***Keywords*:** supervised classifiers, Google Earth Engine, QGIS

Preliminary study on the incidence of hot spots in Protected Areas – GEF Terrestre

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ABSTRACT – The GEF-Terrestre is a Federal Government project, aligned with the principles of the Convention on Biological Diversity and the United Nations Framework Convention on Climate Change, which aims to promote the conservation, recovery and management of biodiversity in the Caatinga, Pampa and Pantanal biomes, for through the strengthening of the management of 28 Conservation Units (UCs). One of the lines of action of the GEF-Terrestre is the integrated fire management (MIF) in at least one UC of each biome targeted by the project. In this sense, the objective of this work was to carry out a preliminary study on the incidence of hot spots in the project's UCs in the 2014-2018 period. For this purpose, data from hot spots (reference satellite MODIS / Aqua-Tarde), provided by the National Institute for Space Research (INPE), were used as indicators of burnt areas detected from images obtained by space sensors. Using the QGIS application (3.4.5) the data of hot spots were crossed with the areas covered by the UCs and their surroundings (10 km distance), generating information related to the spatio-temporal distribution of the hot spots. The preliminary results showed that in the UCs there is a higher incidence of hot spots in the surroundings (2.505) than inside them (1.787). Likewise, it should be noted that of the total of the UCs selected by the project (28), eleven (11) UCs did not present any occurrence of hot spots during the study period. Finally, we conclude the need to carry out more in-depth studies using medium spatial resolution satellite images (such as the Landsat and Sentinel 2 satellites) in the units highlighted in this study, in order to assess the dynamics of fire in the studied UCs.

***Keywords*:** biodiversity; fire management; burnt areas; monitoring; management

Location, temporal tendency between 2003 e 2018 and relationship with deforestation

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ABSTRACT – In Amazon, the areas known as "Arc of deforestation" concentrate much of the Brazilian wildfires. The deforestation and forest degradation by fires are two of the processess that cause most of Brazilian greenhouse gas emissions. Although the estimates of emissions from deforestation are better known, those resulting from forest degradation are less accurate as it depends on monitoring the later trajectory of areas affected by fires. Understanding this temporal and spatial dynamics is a key issue for public policy actions and for better estimating greenhouse emissions.

The objective of this study was to evaluate the Amazon sites where the active fires concentrated between 2003 and 2018, the changes in these areas of fire concentration and the relationship of wildfires and deforestation. We used MODIS active fires dataset (afternoon data of AQUA satellite). We quantified the annual frequency of active fires in each cell of a squared grid (side = 0.5o) to highlight areas of concentration and analyzed the tendency for increase or decrease in each cell using the Pearson Correlation. To identify land use and land cover we used data produced by MapBiomas (http://mapbiomas.org/).

The concentration of active fires was associated with economic (expansion of the agricultural frontier), climatic processes (new areas of the Amazon started to burn), and detection of active fires (suggesting that the detectin probability is not evenly distributed among the vegetation types). The temporal dynamics seems to be associated with economic processes, especially with the advance of the agricultural frontier and the consolidation of grain production in areas that have been deforested for a longer time. The Amazon agricultural frontier concentrates most of the active fires and there is a tendency of "migration" of the fires to the north, following the agricultural frontier. We found tendency of reduction fire counts in the consolidated deforestation areas across entire Deforestation Arc and a tendency of increase in more preserved forest cover areas near agricultural frontier. When evaluated on a detail scale, the active fires tend to be located in forested areas, close to deforested patches.

***Keywords*:** forest fires, active fires, MODIS, Amazon

5. Integrated Fire Management as Key Element of Fire Management Policies

5.1. Experiences from the regions (Global Wildland Fire Network): National
5.2. Experiences from the regions (Global Wildland Fire Network): Cross-boundary
5.3. International cooperation and humanitarian aid in wildfire situations
5.4. Fire management in the international agendas: Sustainable Development Goals, the Paris Agreement and the Sendai Framework for Disaster Risk Reduction; climate financing mechanisms
5.5. Are landscape fires an emergency problem or a land management issue?
5.6. Interface fires
5.7. Management of information at social media
5.8. CPolicies: how to adapt or develop policies to the extreme fires we are facing nowadays and in future
5.9. Lessons identified and lessons learned
5.10. Emotional impacts of fire
5.11. Visions for the future

Wildland Fires Statistics In The Canton Santa Ana, Province Of Manabí, Ecuador, In The Period 2012 – 2018

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ABSTRACT – The analysis of wildland fires statistics provides essential information for the development of effective fire management programs in the communities. These analyzes allow to define where, when and why fires occur. The objective of this work was to analyze the wildland fires statistics in the Canton of Santa Ana, province of Manabí, Ecuador, during the period 2012 - January 2018. Before this period, there are no statistics of this type of fires in the Fire Department of Santa Ana, institution that provided this information. In the area under study, weeds and crop residues predominate, mainly corn, and some pastures. The analysis was made considering the occurrences of fires in a spatiotemporal context (years, months, days of the week and type of vegetation affected). Statistical analyzes were performed with the SPSS v.22 (Statistical Package for the Social Sciences), working with a significance level of 0.05. In the analyzed period, 91 occurrences were reported, corresponding to 2016 the highest percentage (38.46%) which represents 35 fires, followed by 2017 with 16. Between September and January, 87.91% of the total occurrences were registered, which is associated to the time of greater use of fire by the peasants to clean the land and with little rainfall. The largest number of fires were reported in weeds. No statistically significant difference was found for the occurrences according to the days of the week ($p = 0.763$) and the hours in which occurrences were reported ($p = 0.139$) according to the Kruskal-Wallis statistical test. It could be concluded that more than half of the fires occurred in the Ayacucho Parish, associated with the greater number of areas of agricultural crops. It was also found that the logs lack important information to make these analyzes with the required quality. Among these information may be mentioned: burned area, coordinates, causes, conditions of danger, type of fire, means used in the extinction and data on vegetation, which have been included in a proposed fire report.

Keywords: Forest fires, fire prevention, historical behavior, forest protection, vegetation fire records.

Integrated Fire Management For Preventing Mega-Fires Occurrences In Estação Ecológica Serra Geral Do Tocantins, Jalapão, Brazil

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ABSTRACT – This research describes the evolution of fire management at Serra Geral do Tocantins Ecological Station (SGTEE) and how it influences mega fires occurrences in this protected area. The method of work involved bibliographic review, documentary analysis and personal experience, since all authors work at EESGT. Two fire management approaches were identified in the protected area: one focused on fire exclusion (2001 to 2012) and the other on fire management (2014 - current). We noticed that the period of fire exclusion led to fuel accumulation and continuity favoring large wildfires occurrences. Mega fires events were registered in 2010, 2012 and 2014 burning, respectively, 80.000, 107.000 and 88.000 hectares. The SGTEE faced the challenge of formally changing management paradigms by assuming that adaptive and integrated fire management can ensure the effective protection of its socio-biodiversity. Since 2015, when fire use has been expanded through prescribed burns and participatory management agreements with traditional communities, no mega fires have been recorded at PA (the largest event recorded in 2018 was only 3.000 hectares). The current experience of fire management in the SGTEE reveals that it is possible to revert scenarios of recurrence of mega fires at the late dry season, common in the Cerrado, and transform socio-environmental conflicts into opportunities for knowledge integration and participatory management. It also inspire the revision of traditional paradigms in the conservation of Brazilian biodiversity in savannas protected areas.

Keywords: mega-fires; integrated fire management; protected areas; Cerrado; fire management; wildfire prevention.

Conflicts of fire in Parks: Integrated Fire Management as a mediation tool

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ABSTRACT – The fire use in natural ecosystems management is a major source of conflict between protected area management and local communities. These conflicts influence the incidence of accidental fires by unauthorized and unplanned fires, and also of arson as retaliation for conservation, significantly affecting biodiversity. The Brazilian state of Minas Gerais has a heterogeneous vegetation, with landscapes inserted in the Atlantic Forest, Caatinga and in the most representative Cerrado domain, in which fire is a natural element. In this context, this study aimed to identify the State Parks of Minas Gerais that have the fire use as a conflict, as well as its causes, in order to discuss how Integrated Fire Management can contribute to alleviate them. For this, we used structured questionnaires sent to the Parks managers, which were analyzed quantitatively through a conflict matrix built from the values obtained in the data collection, which allowed to verify the frequency and the conflict degree of importance. The results showed that all Parks sampled (14) have conflicts with fire, however, 71% (10) consider it strong or very strong, 21% (3) is very weak and only one unit considered of medium importance. The conflicts are related to the following causes, hierarchically: agriculture, land regularization, urban expansion and real estate speculation, restrictive legislation and tourism, and mining. In the context of the results obtained, to establish Integrated Fire Management can contribute to alleviate these conflicts and favor socio-biodiversity, especially in parks where agricultural activities stand out. This strategy is characterized as a participatory and intercultural governance process that brings together different sectors of society, favoring mediation and better management tools in agreement with local communities and the environmental agency. It differs from public fire control policies that prioritize their restriction and suppression, and do not prioritize traditional ecological knowledge and practices.

Keywords: wildfire, socioeconomic activities, protected area

Occurrences of vegetation fires in Curitiba-PR wildland-urban interface, from 2011 to 2015

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ABSTRACT – Vegetation fires cause direct and indirect damage to flora, fauna, soil and humans. With the increasing urbanization of the earth's surface, vegetation is increasingly dividing its space with anthropic occupations, thus increasing the wildland-urban interface. The knowledge of the spatial distribution of occurrences of vegetation fires in a locality enables managers to develop and implement a policy to prevent and combat fires. The objective of this study was to spatialize the occurrences of vegetation fires in the city of Curitiba, Paraná, from 2011 to 2015, relating with the monitoring map for the coverage and land use in Brazil in 2016. Data regarding the fires were obtained of the Occurrence Registration and Statistics System SysBM-CCB, version 3.31 of the Paraná State Military Fire Department. The monitoring map for the coverage and land use was obtained from the Brazilian Institute of Geography and Statistics (IBGE). After consistency of the data, the validity of 1,255 occurrences was verified, and from this total it was observed that 208 fires (16.6%) occurred on the highways, offering a danger to the visibility of vehicle traffic. For the mapping of occurrences in the map provided by IBGE, 997 occurrences of the total obtained (79.4%) were considered because they presented specific information for their location. Of this total, 905 occurrences (90.8%) were observed in areas of the municipality classified by the IBGE as "artificial areas", characterized as areas with predominance of non-agricultural anthropic surfaces. The other occurrences were distributed in the classifications "mosaic of occupations in forest area", "forest vegetation", "country vegetation" and "mosaic of occupations in country area", occupying respectively 76 (7.6%), nine (0.9 %), five (0.5%) and two occurrences (0.2%). From the results obtained, it can be concluded that in Curitiba the predominance of fires occurs in anthropic areas, being necessary to direct public policies of fire prevention to the public of these areas.

Keywords: fire statistic, fire distribution, fire

Intercultural Fire Management in the Meseta Comiteca Tojolabal, Chiapas, Mexico.

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ABSTRACT – In Mexico, forest fires cause significant losses of natural resources in various ecosystems. Chiapas is among the 10 Mexican states with the highest recorded number of wildfires on the last decades. The Region "Meseta Comiteca Tojolabal" encompasses seven municipalities with an area of 7,243.35 km^2, where plateaus, hills, and mountains in the northern portion dominate 80% of its terrain. The distribution of human settlements is associated to the presence of water sources as streams used for irrigated agriculture, livestock, and other uses. Recently, ecotourism has become an important income for a significant part of the population. Governmental institutions consider the traditional vision of the farmer and his cultivation practices ("swidden") as the main cause of environmental deterioration; such that they have tried to demotivate this practice by promoting modernization of agriculture throughout the use of technological innovations. The objective of this study is to propose an Intercultural Fire Management strategy where communities and governmental institutions responsible for wildfire management join efforts and work together in a regional cultural context. The methodology consists in a comprehensive analysis of the role that play the actors based on the proposal known as "Mapping of Key Actors of Tapella" (2007). The proposal not only involves drawing a list of possible actors in a territory, but knowing their actions and objectives of why they are in the territory and their perspective in the near future. The interviews are complemented with participant observations.

Keywords: Intercultural Management, fire, territory.

Integration of the South Mato Grosso Indigenous Peoples in the Policy of Fire Control and Prevention and Territorial Mismanagement

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ABSTRACT – The research aims to collect data on fire indices in the Indigenous Lands of the state of Mato Grosso do Sul, in order to conclude that the culture of fire still persists in the indigenous environment, making it possible to foster policies of integration of fire management by these peoples in order to reduce the impacts of fires on the biomes. In the state of Mato Grosso do Sul, in the municipalities of Dourados and Caarapó, there is a predominant formation of Cerrado ecosystems and traces of Atlantic Forest. The dry winter climate combined with poor territorial management makes the cerrado biome propitious to fires. This research was carried out based on the analysis of the INPE Burning Database, in the Dourados and Caarapó Indigenous Lands in the state of Mato Grosso do Sul, on the dates from March 29, 2018 to March 30, 2019. In the period of one year, an intense cluster of fire outbreaks was observed in the areas of Indigenous Lands, located in both municipalities. The research resulted in the finding that in these indigenous areas there was a higher concentration of fire outbreaks, noting that the use of fire by these peoples offers more advantages to the environment than risk and degradation. Fire has been used by indigenous peoples for a long time for a variety of ecological, social and spiritual purposes. But the indiscriminate use of fires has been attributed to the Indians, who, by the way, are longest on Brazilian soil. In fact, the "white man" takes advantage of the indigenous peoples' technique of fire to blame them for the fires, in order to cover up the fact that the biggest problem is the territorial mismanagement of the ecosystems. The municipalities of Dourados and Caarapó are examples that the urban advance on the environment has indiscriminately driven the fires. From this point on, the public authorities must promote firefighting programs integrating the indigenous peoples who have traditional knowledge of fire management, in order to increase safety and minimize the socio-environmental damage caused by the growing urban advance on the environment.

Keywords: indigenous lands, urban advancement over ecosystems, fire fighting program, fire management techniques, territorial management.

Perspectives on Integrated Fire Management in Brazilian public policies

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ABSTRACT – The aim of this paper is to present a methodology for Integrated Fire Management (IFM) seeking prevention, control and suppression of forest fires in Conservation Units with integral protection in Minas Gerais through the proposition of a pilot-project in State Park of Serra do Rola Moça. IFM is a strategy used for different objectives, such as, restoration of endemic vegetation, landscape transformation, wildlife maintenance and fire prevention. The implementation of IFM in Brazil is recent, with its first experiences in three Federal Conservation Units in the North region. This paper is composed of two stages. The first stage encompasses data production and collection from 2019 through 2021, in the Conservation Unit *with* integral protection of State Park of Serra do Rola Moça in which the following steps will be followed: meteorological data will go through systematization, data collection on areas more frequently affected by fires will be gathered and forest strata of greater relevance will be identified, in order to establish the polygons for prescribed burning. The meteorological data will be obtained through the automatic station of the National Institute for Meteorology (INMET*)* located at the Park's Integrated Center. The Fire incidence analysis will occur through investigation of time and place data for each occurrence, its burnt area and perimeter available in the Forest Fires Occurrences Reports (ROIs).The forest diagnosis will be performed using satellite imageprocessing, by means of the false color system NDVI, using the software Spring and later on Quantum GIS for vectorization of the identified areas. Second stage concerns implementation. To achieve this, field work for characterization and validation of pre-established polygons will be conducted initially observing the factors of topography and fuel, to assess the feasibility of the procedure and to establish the burn mosaic. With this, we aim to establish a methodological procedure to support the development of regulation norms to implement IFM in Conservation Units with integral protection in Minas Gerais in accordance with the current legislation.

Keywords: fire integrated management, prescribed burning, methodological procedures, regulation, legislation.

Risk Management Assessment against the threat and disasters caused by forest fires. An application case for the Wildland Urban Interface of Valparaíso, Chile

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ABSTRACT – The growth of the cities has contributed to the generation of processes and dynamics linked to the transition between urban and rural-forest ecosystems, thereby enhancing the emergence of Wildland Urban Interface (WUI) spaces (Herrero-Corral, 2012), as well as problems associated with the generation of forest fires; therefore, only focusing in fostering an increase investment on emergency measures may result in more harmful and burdensome fires in the future (Mutch, Lee & Perkins, 1998). In this sense, it is essential to have a comprehensive view on risk and its management-linked to the factors that generate conditions of vulnerability-, so the purpose of this study was to evaluate the performance of Risk Management (RM) during The 2014-2018 period, through its specific application for the city of Valparaíso, Chile and its WUI areas, taking as reference the catastrophic fire of 2014, classified as the largest urban fire in the country's history. To elaborate this evaluation, a methodological approach using indicators to obtain the Risk Management Index (RMI) considering four public policy components: risk identification, risk reduction, disaster management and governance and financial protection (risk transfer) was used. The results obtained evidenced the existence of previous risk conditions and a constant increase in vulnerability as a social construction process. In this sense, the performance level of the RM in the city in 2018 is due to an emerging or emerging adaptive response (obtaining an RMI of **2.31** over a maximum value 5), which is closely linked to the underlying factors that generate it, such as the existence and prevalence of irregular settlements and built environments not adapted to the behavior of forest fires, environmental degradation, insufficient or outdated territorial planning, and limited community capacities that do not adequately consider the DRM. Conditions which, in sum, are reflected in the limited public policies related to risk reduction and in terms of risk transfer, favoring the recurrence and increase of the effects on the city's WUI.

Keywords: WUI, RMI, risk management evaluation, public policies, land use planning.

Dependence on the use of fire by rural actors to the land management in the Amazon

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ABSTRACT – Although most forest fire occurrences in the Amazon is associated to human activities, the understanding of the influence of rural actors (small, medium and large landholders) is still poorly explored in the literature. This research objective was to investigate the dependence on the use of fire by rural actors and which are the implications of this practice on forest areas and carbon emissions. The study area includes 89% of Amazon biome, in the Brazilian territory. The product of burned area was derived from the mapping of the product MODIS/MOD09, for the period between June and November 2015. We analysed 384,456 rural private properties that were declared in the Rural Environmental Registry (CAR). According to the number of fiscal modules (FM), each rural property (RP) was classified as small (RP ≤ 4FM), medium (4FM > RP ≤15) or large (RP > 15FM). Burning scars were registered in 10% of analysed properties, considering all types of land use/cover, except forest areas. Small and large properties represented 80% (n=32,453) and 7% (n=13,787) of the total, respectively. In respect to burning scars in forest areas, 342,635 ha were affected by fire resulting in the emission of 0.0107 Pg C. Small properties contributed with ~ 30% of the total of this burned area and carbon loss, being equivalent to 18% of area of forests (618,495 ha) situated in these properties. On the other hand, large properties contributed with ~50% of the total of burned areas in forests and carbon emissions, corresponding to only 2% of the forest area inside these properties (7,947,336 ha). The inverse relationship between the use of fire and the size of the property can be determined by the availability of financial resources to land management. Hence, it is possible to infer a higher dependence on this practice by small landholders. However, this condition does not imply necessarily in a higher impact on forest areas and carbon emissions. Our estimates showed that large landholders have an expressive contribution to forest degradation. This stratification by rural actors is important to improve the definition and implementation of forest management and fire control measures.

Keywords: Forest Code, SICAR, family farming, environmental legislation.

Perception of the positive and negative impacts of fire

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ABSTRACT – The objective of this research was to demonstrate the perception of the human being in relation to forest fires. Mankind has become a great sphere of reflection, where it always seeks new answers to broad questions. The perception of human beings in the relationship that forest fires have with global warming is of paramount importance. The research was conducted in the period from March 12 to 15, 2019, through the application of a questionnaire on the Google forms platform, where it had as criteria 1 (one) right of objective response of "yes" or "no", with only 10 questions. The results of the 31 (thirty-one) forms were obtained: The female gender presented a higher number of interviewed 64.5%, compared to 35.5% of the male gender. In relation to the level of schooling 48.4% of interviewed have completed high school, 41.9% have completed higher education and 9.7% responded to complete elementary school. When questioned about the difference of a fire to a burnt, 67.7% affirmed that they knew the difference and 32.3% participants answered not to know. Questioned if they already witnessed a forest fire, they said yes 32.3%, and affirmed that they did not 67.7%. If it was already guided by some organ (Federal, State, Municipal) on combating forest fire, 29% of respondents said yes, and 71% replied that they did not. When approached if they believe that there is a law against fires, they responded that yes 96.8%, and affirmed that not 3.2%. Regarding the importance of knowing fire-fighting practices 100% of respondents answered yes. When asked about the function of IBAMA, they answered yes 93.5%, and the other 6.5% who do not know the purpose of the organ. Asked if they give importance to the environment, 100% of interviewed answered yes. Finally, if they believe in global warming, they responded that yes 90.3%, compared to 6.5% who responded that they did not, besides those who responded do not know what is totaling the remaining 3.2%. The interviewed demonstrated to obtain basic knowledge about forest fires, even with some negative points, most of them demonstrated positive perceptions of the proposed theme. In this context, we can perceive the importance of public policies in the practices of forest fire fighting with society.

Keywords: Forest fires, from, climate change, Google forms.

Integrated management of fire in Ilha Grande National Park, Brazil

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ABSTRACT – Ilha Grande National Park - PNIG, located in Atlantic Forest biome and designated as Ramsar site, inserted in Brazilian territory, has a history of large fires in periods of 3 to 5 years. Although conservation unit - CU is in a semideciduous seasonal forest region, which is a fire-sensitive physiognomy occurs, the predominance of the pioneer vegetation of Influence Fluoride Lacustre, so-called floodplains, in more than 80% of its area. After decades of combat attempts, most often frustrated, and with recognition so much of management, community (fishermen, beekeepers, islanders), of which: Large fires in critical and uncontrolled times tend to cause greater damage and be difficult to combat and control; The floodplain vegetation has a visible resilience going into regrowth shortly after the passage of the flames; Fires with more than 30,000 ha (around 60% of the unit) have already been recorder in only one event. Considering the factors mentioned above, all combat difficulties, characteristics of flammability and rapid recovery of lowplains versus the sensitivity of semideciduous forest, we chose to adopt integrated fire management (MIF), which has for main management objectives avoid large fires and protect more sensitive environments and reduce the biomass of pioneer vegetation with Fluoride Lacustre Influence for flames do not enter the restingas and riparian forest composed of Semideciduous seasonal forest that are sensitive and has as much slower response than pioneers. To achieve these objectives, prescribed burns are being planned, initiated in 2018 and continued in 2019, in search of a more effective response to fires. Thus, the management of fire in CU life to the preservation of the ecosystem with prescribed burnings in times with climatic characteristics conducive to forest preservation and easy propagation in lowland. This approach, due to the complexity of fires in the park area, is being developed with the support of several partners and dialogue with the users of the territory, public authorities and brought to the knowledge of the scientific community so that they can be initiated research on the relationship with fauna, flora, soils and gas emission, which help park management find the best conservation results in fire management.

Keywords: Fire Management, Prescribed Burning, National Park, Atlantic Forest, Floodplain.

Analysis of the Brigade Program in Pernambuco in the Context of the Importance of Integrated Fire Management Actions.

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ABSTRACT – This paper proposes an analysis of the Brigade program in the state of Pernambuco in the context of the importance of integrated fire management actions for the conservation of the Pernambuco semi-arid caatinga, through the study of the environmental education actions developed, as well as data of heat sources from National Space Research Institute (INPE) and scar burning of satellite imagery for the priority areas of the Ibama Brigades in Pernambuco, from 2014 to 2018. Caatinga covers approximately 735,000 km², including the states of Piauí, Ceará, Rio Grande do Norte, Paraiba, Pernambuco, Alagoas, Sergipe, Bahia and the northeast part of Minas Gerais. The sustainable use of the biodiversity of this biome is fundamental for environmental conservation and improvement of the Caatinga populations' socioeconomic conditions. The exploitation of Caatinga's forest resources contributes to the degradation of the environment, especially through the permanent use of fire as a production tool in family agriculture. The environmental impact of burning involves loss of soil fertility and destruction of local biodiversity, favoring greater vulnerability of this ecosystem to climate change processes. The use of fire in rural settlements, carried out without control mechanisms, increases the risk of forest fires, raising the total burned areas in Caatinga in Pernambuco. In order to minimize the environmental impact caused by the use of fire in the caatinga, it is essential that the population that inhabits the caatinga be inserted in a process of awareness and training, able to prevent and reverse the impacts suffered by this biome in recent decades. Exploratory, with an inductive method, the research stems from a methodology centered on the literature review and data from INPE about the PREVFOGO IBAMA Brigades of the state of Pernambuco. As a result, it is expected that the program of Brigades implements integrated fire management as an appropriate strategy to address the challenges of fire use in the context of family farming and traditional populations in the priority areas of the Brigades in Pernambuco, with the reduction of hot spots and burned area, as well as empowering communities in alternatives to the use of fire.

Keywords: public policy; brigade program; monitoring integrated fire management; caatinga.

Program Amazon without Fire Brazil: contribution of international cooperation to national strategies and policies

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ABSTRACT – The Program Amazon without Fire Brazil (PASF-Br) was an initiative of the Brazilian government in partnership with the Italian government carried out from 1999 to 2008. Taking into account the many fire-prone areas spread along the arc of deforestation, the program aimed to reduce the incidence of wildfires in the Brazilian Amazon and to improve the living conditions of rural communities. Government agencies, civil Society organizations and rural communities from 34 municipalities in the states of Acre, Mato Grosso and Para took part f PASF-Br. The strategies adopted included: a) development of Municipal/Community Fire Prevention Protocols; b) implementation of demonstration units (DU); c) environmental education; d) training on fire prevention and fighting; e) capacity building by addressing the training of multipliers; f) implementation of action by the multipliers. The results showed an increase in the aware and engagement of local communities related to the reduction of fire-use for rural purposes, decreasing the wildfires locally. The families that implemented the DU had an increase in family income. This outcome together with the multipliers' performance promoted the expansion of the program's area of operation, leading rural community members initially not involved in the program, to seek the adoption of the program's strategies. PASF-Br influenced national strategies and policies. The National Center for Prevention and Fighting Wildfires - Prevfogo adopted the strategies of the program. In addition, the new forest code of Brazil, in its article 40, establishes that the replacement of fire-use in rural areas should be considered. The successful outcomes of the program in Brazil lead to Bolivia and Ecuador to establish trilateral cooperations with Brazil and Italy to develop the same program. The Pasf-Bolivia was completed in 2017 and the Pasf-Ecuador is in progress. Clearly, this program has identified that international cooperation is an important mechanism for improving national strategies. The actions proposed by the program are in line with the scope of the integrated fire management approach, as they provide a broader dialogue between the various stakeholders and propose the replacement of fire-use in an ecosystem, the Amazon, not adapted to this natural element.

Keywords: Amazon without Fire, alternative techniques to fire-use, demonstration units.

Analysis of FUNAI's Integrated Fire Management activities from the perspective of the Illicit Acts Prevention Coordination

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ABSTRACT – This study aims to analyze the activities related to forest fire prevention and support carried out by the Indian National Foundation - FUNAI between 2015 and 2018 within the scope of Programs developed by the Illicit Acts Prevention Coordination - COPI of the Territorial Protection Directorate - DPT of FUNAI (eg Fire Prevention Group - GPI), as well as the Technical Cooperation Agreement - ACT Prevfogo / Ibama and FUNAI. In this context, we will analyze what the public policy of the Integrated Fire Management - MIF was like before and after the partnership between Prevfogo / Ibama and FUNAI, and how the ACT has contributed to modify the vision about the MIF and the traditional usage of fire, both "in" and "out" FUNAI. "In" FUNAI, through a new institutional look at fire which was previously seen only from the socio-cultural aspect of Indigenous communities and not as an important element in forest fire prevention actions, with annual activities of MIF in Indigenous Lands, or as an element of territorial protection, as the Indigenous Federal Brigades - BRIFs constantly act within the territories. And "out " of FUNAI (institutions and society) under the possibility of a new look at the traditional use of fire by Indigenous communities that had been previously seen by institutions and society only in the negative aspect and not as an activity to prevent large forest fires. The ACT allowed FUNAI to expose to external actors (institutions and society) the importance of traditional fire usage for Indigenous communities as a socio-cultural instrument. This usage was until then fought and was not integrated into Public Policy. Therefore, we consider the partnership provided by the ACT positive, both to modify the intra-institutional and interinstitutional views on the MIF, and to deconstruct the prejudice of institutions and society against traditional fire usage by Indigenous communities by rescuing this usage among the communities and especially by inserting the vision of Indigenous communities in the Federal Government's MIF public policies.

Keywords: Traditional Usage of Fire, Technical Cooperation Agreement, Indigenous Communities, Public Policies.

Prevention, Control and Monitoring of Fires in the Brazilian Cerrado

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ABSTRACT – The Brazilian Cerrado covers 24% of the national territory. It is home of a diversity of phytophysiognomies that shelters about 5% of the world's biodiversity. The Cerrado is an ecosystem that have been shaped by a long history of fire, caused by lightning or human ignition. The people who lived and still live there have used fire for thousands of years influencing the ecosystem. In the scenario of climate change and land-use change that modify the fire regime, leading to increase intense degradation processes, the Brazilian government has been supporting initiatives for conservation and sustainable use of the biome. In 2011, the implementation of the Brazil-Germany Cooperation Project for prevention, control and monitoring of fire in the Cerrado, called as Cerrado-Jalapão Project, began. Federal and state government agencies and the local communities were involved in the project. The focus of Prevfogo/Ibama in the project was the indigenous lands in the states of Tocantins and Mato Grosso. The activities included (1) acquisition of equipment and vehicles adapted for fighting fire operations; (2) environmental education processes; (3) training and implementation of the integrated fire management (IFM) approach. As results of the project: the response capacity of Prevfogo to fire events was improved; a better efficiency and effectiveness of the brigades were achieved; a closer cooperation with the local communities was developed, increasing the local capacity for fire management. Three indigenous lands were initially pilot areas for the IFM approach. Nowadays, IFM is applied in 26 indigenous lands, including 43 ethnic groups and an area of circa 10 million hectares with preventive and protective actions against fire damages. The Cerrado-Jalapão Project has also made a very valuable contribution to the paradigm shift underway in the country: from a zero-fire policy to a policy considering fire as a management tool. A bill that institutes the National Policy for Integrated Fire Management (bill number 11.276/2018) is under way in the National Congress. The document highlights the potential contribution of international cooperation in the improvement of efficiency and effectiveness of national strategies.

Keywords: Cerrado, savannah, integrated fire management, indigenous land, public policies.

Advances and challenges in the implementation of a comprehensive fire management policy in the Bolivarian Republic of Venezuela

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ABSTRACT – The National Park System (NPS) of the Bolivarian Republic of Venezuela comprehends 43 National Parks, 37 Natural Monuments and 65 Recreation Parks, which represent 23% of the national territory. This system preserves the springs of 80% of the water basins that supply water to the population, including the Caroní river basin, which generates 70% of the country's electricity. Climate change scenarios mean an increase in temperatures, a worsening of drought higher severity of vegetation fires, and extended fire seasons. Fire vulnerability of NPS ecosystems, which includes fire-sensitive vegetation such as cloud and evergreen forests and high Andean wetlands as well as the rural-urban interface, has posed new challenges. We were forced to rethink beyond formerly established fire suppression and combat models and develop new and more effective fire management strategies nationwide. Since 2014, Integrated Fire Management (IFM) initiatives were considered as part of new management policies promoted by the National Forest Fire Department. This process started with the inclusion of community members, their local traditional knowledge of fire management, and scientific findings, to reduce effectively the annually burnt area, especially in locations with fire-sensitive vegetation. Likewise, since April 2009, an ambitious human talent reinforcement plan began its implementation, through "Special Training Plans" offered by National Experimental University of Security, to reach the goal of 10,000 new firefighters troop's formed at the national level, under the principles of the IFM. Additionally, it has already been envisaged the need to strengthen multimodal warning systems, fire monitoring by remote sensors, early detection and first response to forest fires, inter-agency coordination of a shared logistic support network and the development of a permanent evaluation and adjustment mechanism. Of plans, protocols and procedures with leading and equitable participation of researchers, local communities and officials under the principles of intercultural, joint effort and mutual respect of all its members.

Keywords: Integrated Fire Management, Forest fire management policies, forest firefighters, significant fire reduction, National Park System (NPS), Venezuela.

Shaping landscapes, remaking knowledges: practices, myths and fire management in Xingu Indigenous Territory (MT, Brazil)

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ABSTRACT – Since 2017 the 16 indigenous communities that inhabit 4 contiguous Indian Reserves at the headwaters of the Xingu River decided to call the entirety of their territories by the name Xingu Indigenous Territory (in portuguese, *Território Indígena do Xingu*, TIX). This 2,8-million-acre reserve is an important part of a corridor that links protected areas along the Xingu River basin. The TIX concentrates an enormous socio-environmental diversity, but it is suffering from the climate changes and the hard impacts of the surrounding area occupation based on extensive monocultures. In the past, few decades, wildfires had become increasingly frequent in the territory and its populations observed important changes in the forest's humidity and in the natural signs that guide their management practices. Fire has always been a diversity-generating tool, but it became dangerous, impacting crucial environmental resources. As many old men from different ethnic groups in the TIX usually say, "the fire became angry, big, strong and started to run faster". This paper aims to describe how TIX's peoples are creating a dialogue between traditional knowledge and new techniques for the use of fire, in order to restore environmental balance. Xinguans are seeking to understand these new environmental signs and engaging themselves on new practices of fire management. In this context, the Socio-environmental Institute (in Portuguese, *Instituto Socioambiental*, ISA) carried out projects to encourage and support indigenous adaptative experiences, techniques and strategies for fire prevention. It also promoted meetings in indigenous villages to reinforce communities' agreements on wise use of fire and its management, based on local forms of social organization. We argue that the only way to achieve these goals is ensuring the participation of TIX's populations on these processes as protagonists. The diversity of landscapes and ways of managing environments contributes to the wise use of fire, which ignites the life in territories, forests and its people.

Keywords: fire policies; indigenous fire management; Xingu indigenous territory (TIX).

Bananal Island in flames: the Karaja people and the fire management in their territory

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ABSTRACT – Bananal Island endures large wildfires every year. The most affected are the indigenous people of both the Karajá and the Javaé populations (self identified as the *Inỹ*), who live on the island ever since immemorial times spread along three Indigenous Lands. This action research has taken place on the Indigenous Land Araguaia Park, in the Fontoura Village, in which there are about 800 inhabitants. Since 2015 the Brazilian Institute of the Environment and Renewable Natural Resources (Ibama)/Prevfogo in a partnership with the National Indian Foundation (Funai) execute the Integrated Wildfire Management (MIF) on the island. So that the MIF succeeds the engagement of the indigenous people is critical in every single step. Currently the volunteer firefighters are the Karajá people, which assures their participation on the planning and execution of the prescribed burning. One of the challenges is to engage the community beyond the volunteer firefighters group once all of them benefit from the territory. The goal of this action research was to amplify the understanding of the Karajá people about the MIF to qualify their participation to the same extent that I have sought information about the traditional usage of fire by the *Inỹ*. I have produced the video "Mifando a Ilha", which brings the indigenous knowledge, from the elders and the volunteer firefighters, besides the government agents. The video was used in activities in the village in order to deepen the debate about the use of fire throughout history and in current times. The Karajá have separated the types of fire among those they have caused anciently (for the purposes of dealing with their crops and for communication while fishing), the ones that are happening currently (MIF, keeping wild animals away, opening paths and collecting honey) and the "fire from the others", which is the burn of pasture areas so that the regrowth of grass feed the cattle. Almost the totality of the cattle on the island belongs to non-indigenous people, who use the native pasture under the payment of a monthly fee. The categorization of the types of fire made by the *Inỹ* reveals that they understand some occurrences of fire as positive and others as negative. The fire that affects the use of the territory by the Karajá could, under careful work, become the fire that favors biodiversity and the sustainable use of the territory. Thus, the fire would turn from villain to mediator of the socio-environmental conflicts on the Bananal Island.

Keywords: Karajá, Bananal Island, Integrated Fire Management, traditional knowledge.