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CLIMATE, WILDFIRES, WATER & HEALTH IN BARBADOS

CAN WE STOP THE BURN?

AUTHORS

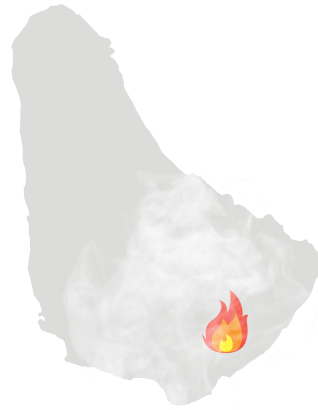
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A GRASSFIRE IN BARBADOS



POLICY ACTIONS

-  **Integrated wildfire hazard management** with biosecurity and climate change education, fire services, urban planning, emergency management, water management, roadworks, solid waste disposal management and environmental services
-  **Legislative changes to existing environmental & planning laws** on solid waste, energy, agricultural zoning, water and wastewater management and air pollution and emission levels.
-  **Economic policies to drive uptake of green bioenergy** at more favourable rates than PV, issuance of green credits or cash rebates for land management, carbon capture, biowaste conversion and water reclamation. This advances the progression of the National Energy Policy goals of being carbon neutral by 2030

INTRODUCTION

With the increasing drying and hotter climate trends predicted for the Caribbean, the importance of establishing wildfire monitoring and early warning systems (EWS) for Barbados and the Caribbean becomes increasing more critical. Natural and anthropogenic fires can play intricate roles in the structure and dynamics of many ecosystems (McWethy et al., 2013, Pausas and Keeley, 2019). Climate change and wildfires can have a reinforcing and synergistic relationship (Xu et al., 2020). Climate change-related rainfall anomalous intensity and distribution patterns can create droughts and increase their frequency in tropical and subtropical areas (Trenbeth, 2011). Wildfires can be fostered by existing climatic conditions in addition to other co-factors including waste management challenges, presence of fuels, ignition agents and human activity (Calviño-Cancela et al., 2017, Prestemon et al., 2002). Some climate conditions promoting fire activity include reduced rainfall, increasing and extreme temperatures, heat waves and windy conditions which may occur in relation to large-scale climate models such as the El Niño South Oscillation (ENSO) (Fang et al., 2021, Fasullo et al., 2018). Few studies examining wildfire variability in the Caribbean exist and more integrated research is strongly desired.

Collaboration with Barbados Water Authority on measures to facilitate water access for firefighting purposes during the dry season and low groundwater levels. A reduction in wildfire events has been observed from 2018-2020. Estimates of potable water demand and economic costs for firefighting were conducted enabling trending of water demands and economic costs with potential future considerations for firefighting, strategic reclaimed water reuse and distribution planning. Conclusions: The highest number of wildfires were observed in Southern Barbados, particularly the parish of St. Philip, which is known for its climatological dryness. This is the first ever series of studies providing evidence of climate links with wildfires and health in Barbados. It suggests that development of an early warning system for wildfires based on climate is possible but the inclusion of other potential anthropogenic co-factors such as solid waste management practices, burning of empty lots and arson may be useful.

RESULTS

Grassfires were the most prevalent wildfire type observed followed by rubbish fires, sugarcane fires. The trend over Barbados reveals a primary peak in February-March, coinciding with months of minimum rainfall (Figure 1).

- CLIMATE:** A significant association of rainfall, humidity and windspeed was observed for **rubbish fires** ($r^2= 0.62$), rainfall, humidity, and maximum temperature for **grassfires** ($r^2= 0.53$) and rainfall, humidity and windspeed for **sugarcane fires** ($r^2= 0.37$).
- LOCATION:** Positive annual trends in **southern and southeastern Barbados (Christ Church and St. Philip)** were statistically significant
- WATER:** Water demand increases in the dry season due to increased wildfire hazard risks with peak

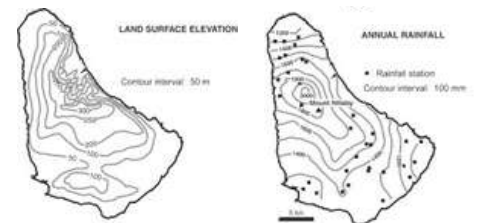


FIGURE 1 Map of Barbados with land surface elevation (left) and annual rainfall patterns (right)



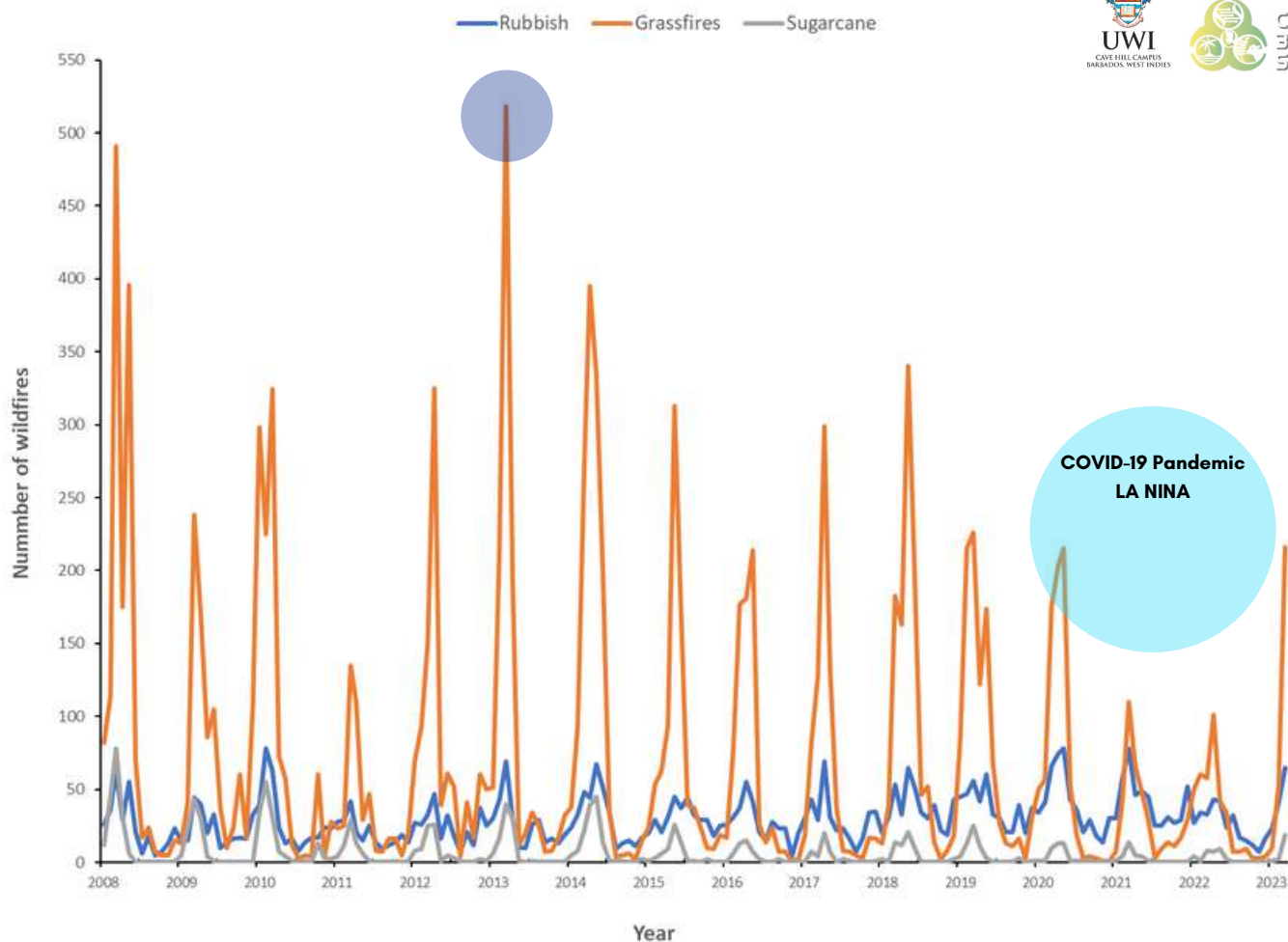


FIGURE 2. The numbers of wildfires (rubbish, grass, & sugarcane fires) by type in Barbados 2008-2020.



GRASSFIRES ACCOUNT FOR THE MOST WILDFIRES IN BARBADOS **EVERY YEAR**

2013 was the worst year for **grassfires** as it recorded the most grassfires in a **SINGLE MONTH** with **520 grassfires** in **MARCH 2013**. This was also the year of the largest **DENGUE FEVER EPIDEMIC** in Barbados.



RUBBISH FIRES ARE THE **SECOND MOST PREVALENT WILDFIRES** IN BARBADOS

During the **COVID-19 pandemic** there was an increase in **rubbish fires** during **2020** since there were lockdowns and reduced garbage collection frequency persons resorted to open burning to get rid of solid waste.

KEY RESULTS

CLIMATE CHANGE



RAINFALL INFLUENCES WILDFIRES IN BARBADOS

With **less rainfall** the more likely there will be wildfires particularly in **St. Philip and Christ Church**.



HUMIDITY INFLUENCES WILDFIRES IN BARBADOS

The **less humid** it is the **more likely** there will be wildfires predominantly in **Christ Church** and **St. Philip** areas

520

GRASSFIRES IN A SINGLE MONTH

The most grassfires ever recorded in a single month occurred in **2013**. There are **ONLY FIVE fire tenders** (firetrucks) operational on the island to service Barbados.

COUNTRY STATS

63%

OF ALL FIRES OCCUR IN
ST. MICHAEL, ST. PHILIP &
CHRIST CHURCH

At risk areas for all fire types including house, wildfires, rubbish fires etc. are concentrated in certain parishes.

~50%

OF ALL WILDFIRES
OCCUR IN ST. PHILIP &
CHRIST CHURCH ALONE

The risk of wildfires is predominantly high in Christ Church and St. Philip areas

OVERVIEW OF RESEARCH

Fires occur throughout Barbados however the frequency of fires appears to be higher in certain parishes such as **St. Michael, St. Philip and Christ Church** for **all fire types** and predominantly **Christ Church and St. Philip** for **wildfires**. **Rainfall** and **humidity** are the climate variables that influence wildfire events in Barbados.

COUNTRY STATS

HEALTH

82%

OF BARBADIAN RESIDENTS BELIEVE WILDFIRES ARE IGNITED BY HUMANS

This was statistically associated with monthly income of Barbadian residents!

76%

OF BARBADIAN RESIDENTS EXPERIENCED BUSINESS OR SCHOOL DISRUPTIONS FROM WILDFIRES

86%

OF BARBADIAN RESIDENTS SUPPORT NEW LEGISLATION TO TARGET WASTE MANAGEMENT & STOP OPEN BURNING OF GARBAGE

CLIMATE CHANGE

OVERVIEW OF RESEARCH

Wildfires have a **negative** impact on communities in Barbados. Disruptions from wildfires include closures of **schools** and **businesses**. The **most vulnerable** within communities such as **disabled persons** are particular at risk and should be prioritised. There is **very strong support** for **new legislation** targeting the proper **waste management** efforts in the island to **halt open burning** of garbage. This offers an opportunity for policy and legislation development to effect impactful and positive change.

#0001 | CBS 2023 POLICY BRIEF

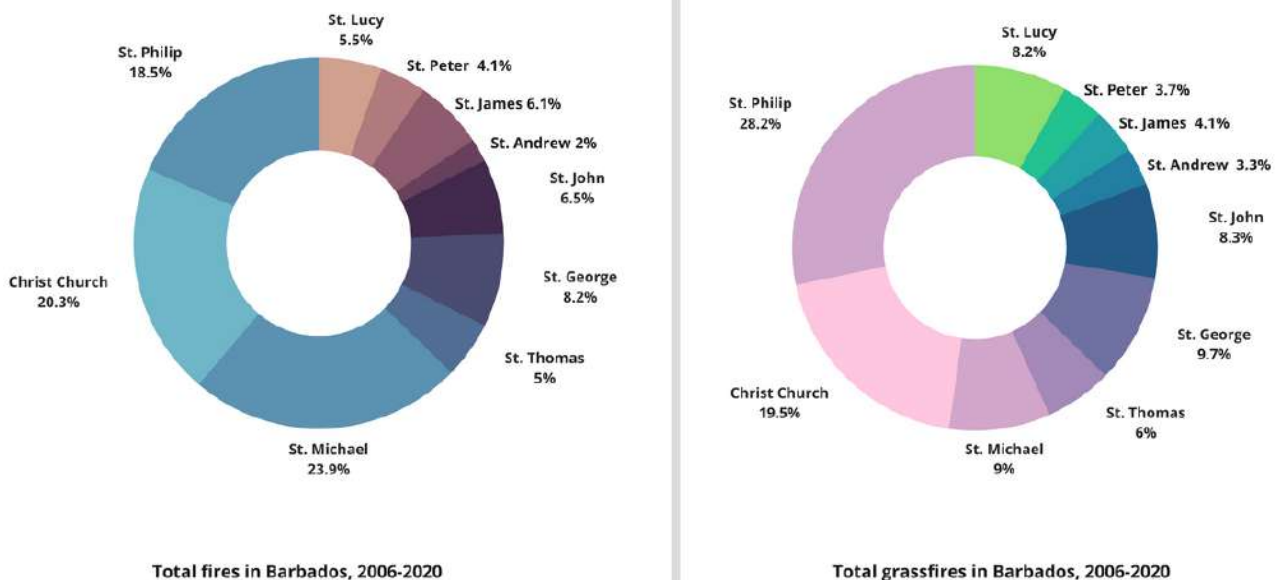
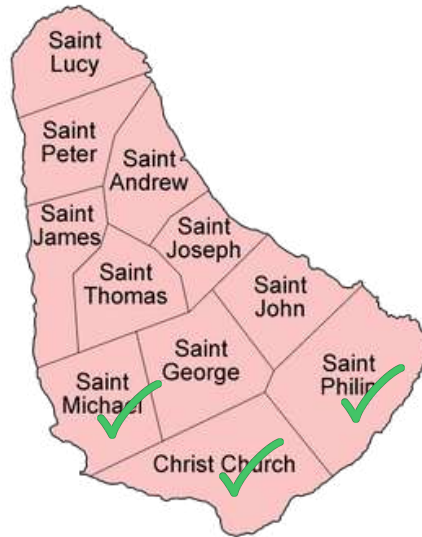


FIGURE 3. A map of Barbados highlighting the parishes with the highest wildfire activity (top). The total fires in Barbados from 2006-2020 (bottom left) and the total grassfires in Barbados from 2006-2020 (bottom right).

Fires occur throughout Barbados however the frequency of fires appears to be higher in certain parishes such as **St. Michael, St. Philip and Christ Church** for **all fire types** and predominantly **Christ Church and St. Philip** for **wildfires**.

RECOMMENDATION

Given that there are only 5 operational fire tenders at a given time on the island and the vast majority of wildfires occur in **2 parishes** which are serviced by Worthing (Ch. Ch.) and Four Roads (St. John) fire stations serious consideration should be given to opening a new fire station at **Six Roads (St. Philip)** to effectively service the needs of St. Philip which has the lionshare of wildfires and all other fires due in part to the dry nature (low rainfall) of this parish and increasing population density.

WATER & FIRE STATS

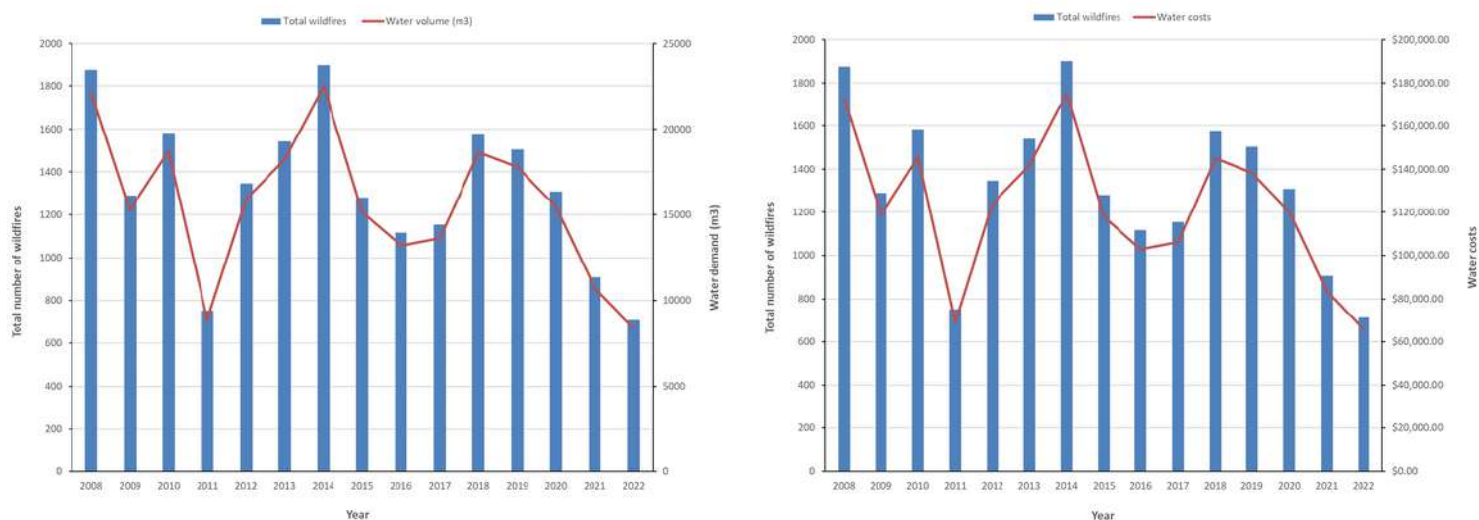


FIGURE 4. The total number of wildfires and the associated water demand in Barbados 2008-2022 (left). The total number of wildfires and associated potable water costs 2008-2022 (right).



WATER & FIRE



CENTRE FOR
BIOSECURITY
STUDIES

KEY CONCERNS & EXISTING GAPS

Barbados Fire Service & Barbados Water Authority

There is a vital importance of BWA service to firefighting efforts on the island. Over the sessions of training with the Barbados Fire Service a number of key insights were collected that would be beneficial to the BWA.

These included:

1) The inability of Barbados Fire Service to **locate and access fire hydrants** for the filling of fire tenders to response to fire events. This may be due to several reasons including:

- a) hydrants are paved over by **road works**
- b) hydrants on road reserve paved over by **property owners**
- c) **low water pressure** at certain hydrants (risk – slow response to fire event)
- d) hydrants after repaving of road are set **too low** which results in inability to access with Fire Service equipment
- e) **Debris in hydrants** (soil, silt, fine particles) can damage fire tender pumps. Also long flushing periods may or may not clear this problem up.
- f) Difficulty in **locating** functional hydrants at **night**. Some covers may be removed and the covers are not easily discernible at night. Suggestion of using roadmarking paint to make hydrants easier to identified.

2) Unable to **estimate potable water volumes collected for firefighting** – plans to measure this non-revenue water are in progress

3) Barbados Fire Service can assist with **hydrant marking and GIS location marking as they conduct weekly checks of hydrants** all over the island.

4) Barbados Fire Service can assist with **well locations** as they perform well rescues all over the island. This could aid in BWA's effort to map existing wells across the island.

5) **Pipe leak distribution mapping** by BWA is currently being developed and would be very beneficial for potential public health links for **mosquito-borne, water-borne and rodent-borne diseases** such as dengue, Zika, Chikungunya, leptospirosis, hantavirus fever, etc.

WATER & FIRE RISK CONVERGENCE

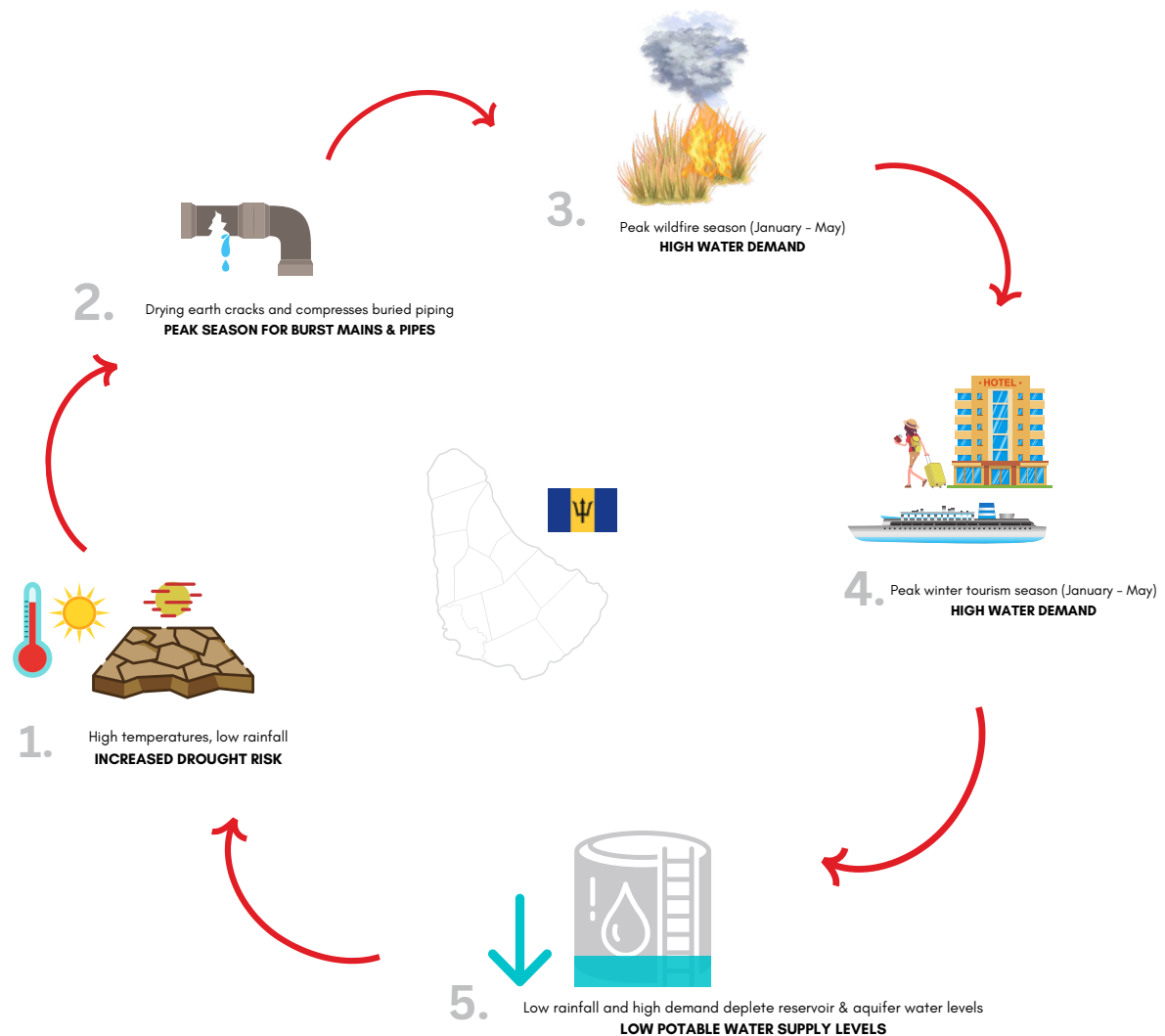


FIGURE 5. The convergence of water and wildfire risks in Barbados (January - May). **1. DROUGHT RISK** This period is the dry season in Barbados characterised by low rainfall, high winds and high temperatures which increase drought risk. **2. PEAK LEAK & BURSTS SEASON** Drying earth caused cracks in soil exerting compressive and shifting forces on buried water infrastructure (mains and pipes) increasing frequency of burst and leaks. **3. PEAK WILDFIRE SEASON** This period is also peak wildfire season due to dry conditions and dried biomass accumulation after the rainy season. **4. PEAK TOURIST SEASON** This is also the peak winter tourist season and water demand on the island increases significantly. **5. LOW WATER SUPPLY LEVELS** This all leads to low water supply levels in reservoirs and aquifers creating challenges for water distribution to customers.

WILDFIRE HAZARDS IN BARBADOS NEWS REPORTS 2023



FIRES WREAK HAVOC

Article by
Sheria Brathwaite

Published on
March 21, 2023

GRASS FIRES STRETCHING RESOURCES OF FIRE SERVICE

By Sheria Brathwaite

The recent uptick in grass fires has been putting the Barbados Fire Service under strain and Chief Fire Officer Errol Maynard is pleading with Barbadians to avoid starting fires. Meanwhile, the Barbados Union of Teachers (BUT) is urging the Ministry of Education to act more promptly in closing schools impacted by heavy smoke.



on March 20, 2023

EDITORS PICK, NEWS

More schools closed by grass fires



Article by sherrylynclarke@nationnews.com

Four more schools closed early on Monday as firefighters continue to battle grass fires across the island. Combermere School at Waterford, St Michael, was the first that had to close.



Spike in fires sends residents rushing for respiratory meds

Article by
Anesta Henry

Published on
March 22, 2023

By Anesta Henry

Pharmacies have recorded an increase in the sale of products to treat upper respiratory issues as Barbadians contend with smoke and ash from cane and grass fires that have been occurring across the country. President of the Barbados Pharmaceutical Society (BPS) Yolan Pantin told Barbados TODAY on Tuesday that in recent weeks, there has been an increase in the number of people going to pharmacies to purchase over-the-counter medications and have prescriptions filled, as they seek relief from sinus issues and allergic reactions. "Obviously, because of the situation we have been seeing more people passing through. It depends on what the doctor has written on the prescription and if they are looking for simple things like Histal, antihistamines, and maybe some nasal sprays, depending on how severely they are being affected by the present conditions. "They are coming with allergies, depending on how long they leave their symptoms, and some



CMO warns allergy, asthma sufferers to take extra precaution as fires continue

Article by
Anesta Henry

Published on
March 21, 2023

By Anesta Henry

"Asthmatics and persons who suffer from allergies and sinus complications have been advised to take all precautionary measures to protect themselves as the country continues to experience a series of cane and grass fires. Chief Medical Officer (CMO) Dr. The Most Honourable Kenneth George is also supporting the decision of the Ministry of Education to close affected schools to protect students and teachers from the potentially harmful inhalations. However, Dr George told Barbados TODAY that he had received no reports from polyclinics or the Queen Elizabeth Hospital (QEH) regarding an alarming increase in persons reporting to the facilities complaining of health issues due to the environmental hazard. "The major persons who would be affected are persons who have some form of allergy. And we know that asthma and sinusitis and sinus headaches and so forth fall into the allergy category and those are the people who should try to protect themselves the most. "The best way to protect yourself is to leave the area that is close to a site that is burning. We know that that may not always be easy, or it may be easier said than done. Therefore, individuals who can't get out of the situation, many of you may have masks in your houses because you would have used masks during the COVID pandemic. If you can't put on a mask, you have to try to lock your houses so that the influx of smoke will not affect you," he said. Dr George noted that smoke comprises chemicals which can lead to acute respiratory injury or a reaction that produces bronchial spasms, runny nose and itchy skin. In recent weeks, the Ministry of Education has had to summon parents and guardians to collect their children after the institutions had to be closed prematurely. Dr George said even though it may appear to the public that schools are being closed too frequently because of fires, "from a public health perspective, we need to make sure that people are protected. "We know that asthma kills one or two individuals every year. So it is better to be safe than sorry. I am supportive of the Ministry of Education deciding to close schools, particularly if staff and students are reporting that the environmental conditions are affecting their health. I haven't

KEY HEALTH NOTES

MOST
VULNERABLE

YOUNG CHILDREN



ASTHMA IS A SERIOUS HEALTH CHALLENGE IN BARBADOS

Barbados has one of the highest incidences of childhood asthma in the world.

DISABLED



WILDFIRES LIKELY WORSEN ASTHMA & OTHER RESPIRATORY PROBLEMS IN BARBADOS

The **SMOKE and ASH** from wildfires in combination with **SAHARA DUST** across the islands during the **DRY SEASON** pose a health threat by increasing air pollutants (particulate matter 2.5 or PM_{2.5}).

ELDERLY

7M

7 MILLION PERSONS DIE EVERY YEAR GLOBALLY DUE TO AIR POLLUTION

Air pollution leads to the death of 7 million persons every year across the globe according to World Health Organisation (WHO). Air pollution is the single most deadly environmental pollution threat.

CURRENT RESEARCH

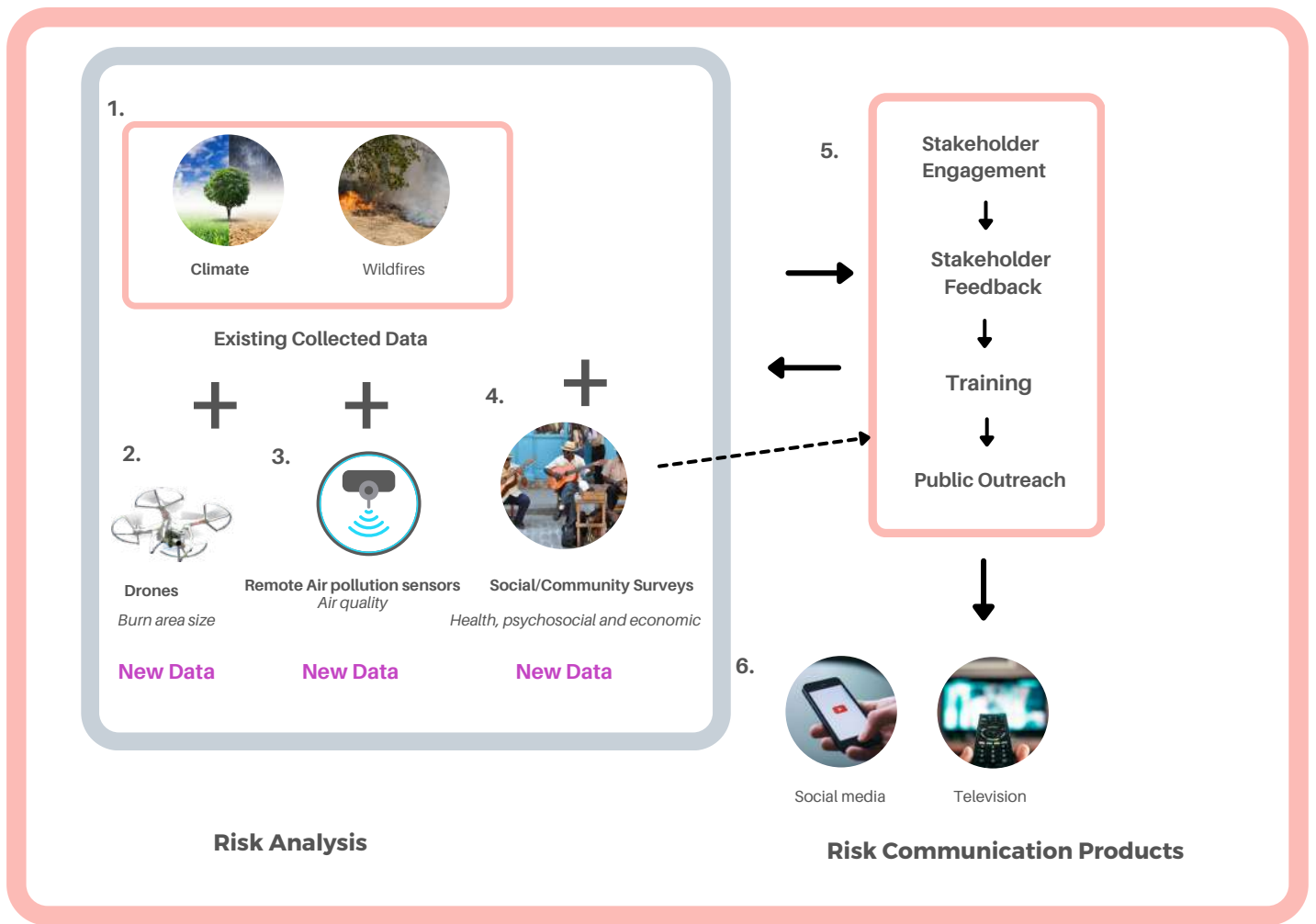


FIGURE 6. The data collection, risk analysis, stakeholder and communities engagement and design of risk communication products for wildfires in Barbados.



Current research at UWI in Barbados seeks to strengthen wildfire management by equipping the Barbados Fire Service with **drone technology** to collect **burn area size** data to calculate the size of each wildfire and to install **remote air pollution sensors** to monitor **air pollution** levels across Barbados. The first ever wildfire, climate and health survey was conducted in Barbados to understand the existing knowledge, attitudes (perceptions) and practices. This will help in developing adequate **risk communication products** for the national population about **wildfires, climate** and **health**.

DATA GATHERING



Barbados Fire Service (BFS)



Barbados Water Authority (BWA)



Barbados Meteorological Services

ALLIED OPERATIONS



Sanitation Service Authority (SSA)



Ministry of Transport, Works & Water Resources

COORDINATION



UWI



Department of
Emergency Management
(DEM)

LAW & POLICY



Office of The
Attorney General



Town and Country
Planning
Department



Ministry of Agriculture



Ministry of Health & Wellness

SOLUTIONS?

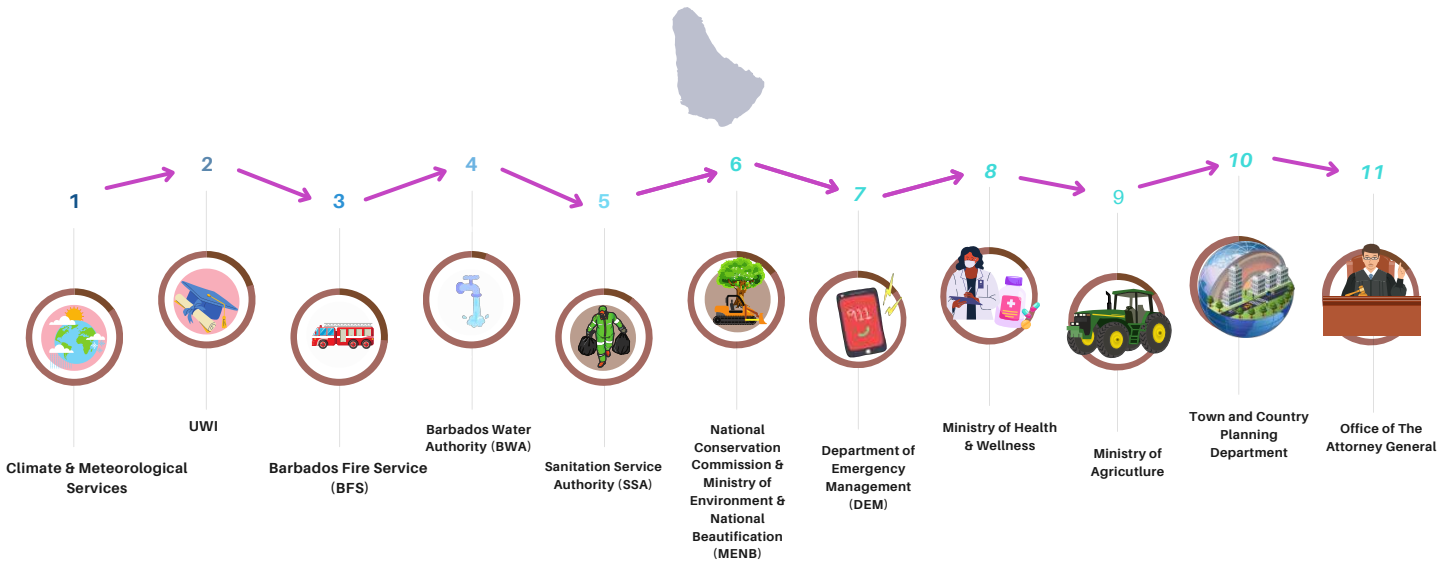


National Conservation Commission &
Ministry of Environment & National
Beautification (MENB)

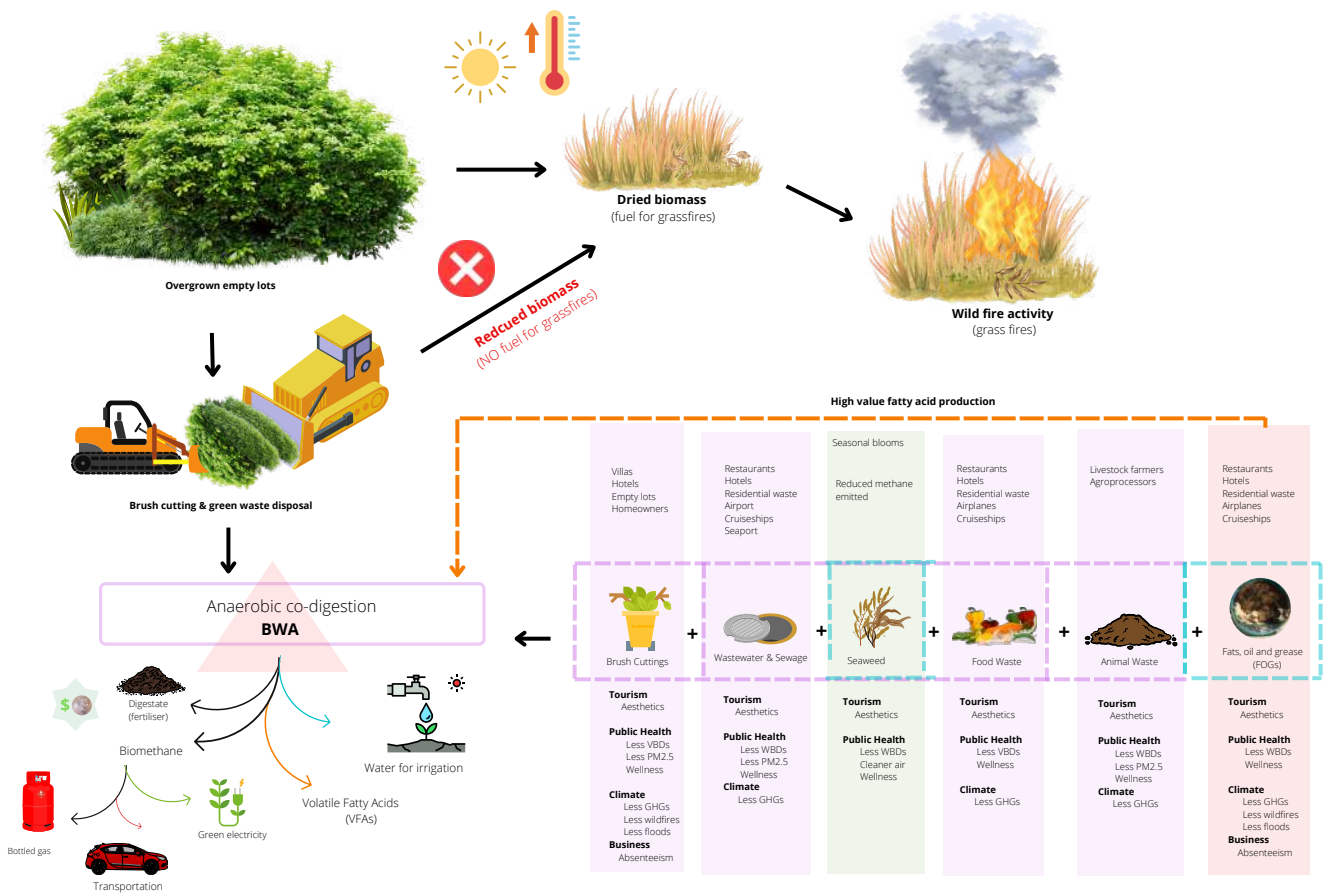
RECOMMENDATION

Wildfires are a multifaceted problem radiating into several different sectors including **education, business** and **public health**. They require an **integrated** and **coordinated** approach to tackle them. The national legislation and policy frameworks need examination to facilitate better **land use management, public health, enforcement, urban planning, waste management** and greater awareness for the population.

NATIONAL COORDINATION - WILDFIRE HAZARDS



WILDFIRE PROBLEM AND SOLUTION FRAMING - BARBADOS





RECOMMENDATION

Wildfire hazards can be reduced utilising a systematic approach that tackles simultaneously national issues of **land use management, public health management, spatial & urban planning, waste management** with greater awareness and enforcement for the population. Reducing the volume of green biomass (vegetation) limits the available dried biomass that can act as 'fuel' during the dry season when wildfires are peaking. **Green biomass** can be converted to economic value through **anaerobic co-digestion** to produce **biomethane, carbon dioxide** and **hydrogen sulphide**. Biomethane can be purified and utilised as a renewable green fuel for **cooking, transportation, electricity generation** and to produce **animal feeds** via biotechnology. **Carbon dioxide** can be used in **beverages, medical gas, green extraction** from fauna and flora to make new **pharmaceuticals, flavours, fragrances, nutraceuticals**, sustainable and . The use of a **circular economy** is one approach that can be very useful and productive for **small island developing states (SIDS)** like Barbados. This aids with the creation of a **sustainable way of life, climate resilience** and **sustainable development**.

SOCIAL FACTORS & DYNAMICS

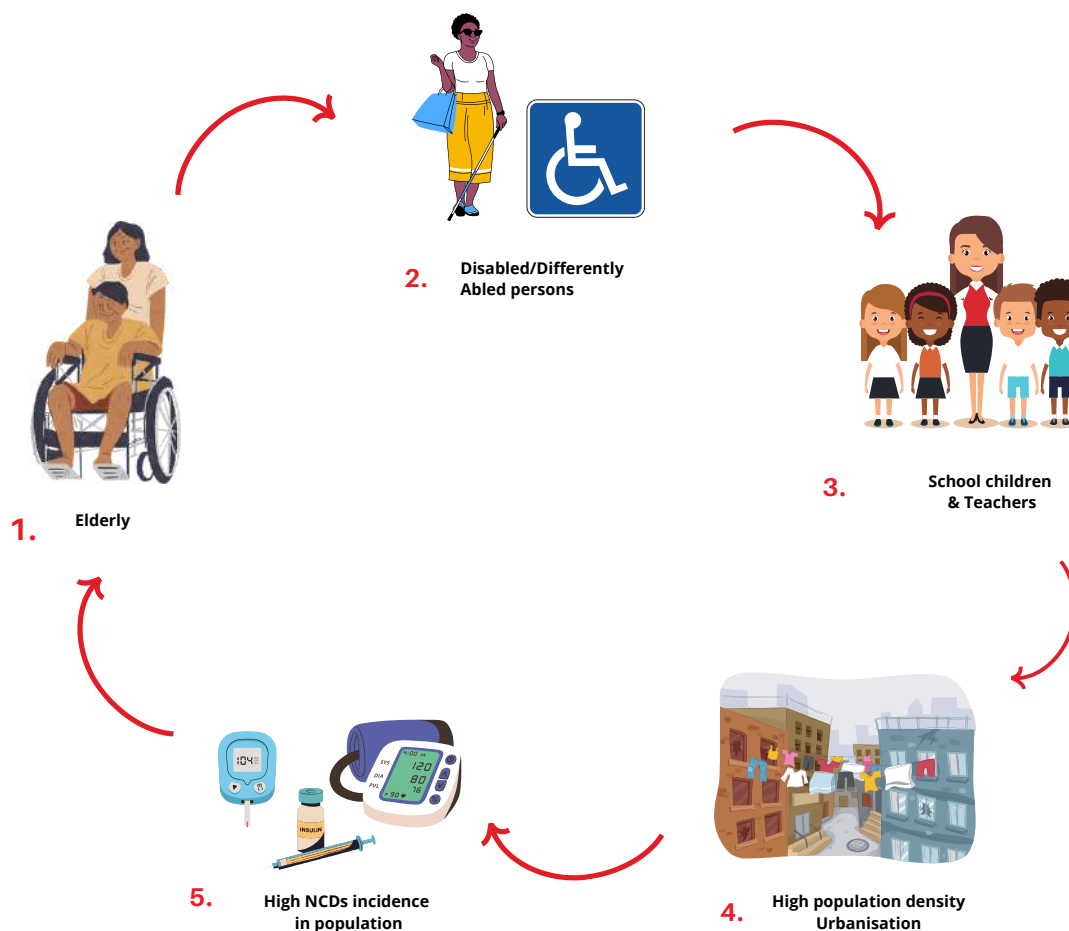
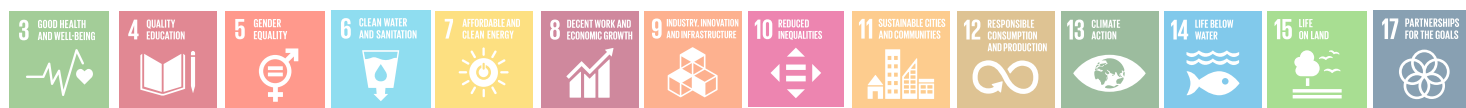


FIGURE 7. The diverse social impacts and social dynamics of wildfires, climate, and health in Barbados.



RECOMMENDATION

Wildfire hazards pose several challenges for **hazard and disaster management** practitioners. This is complicated by the existing social issues that are inherent within each country context. The vulnerable in the community are at high risk for smoke inhalation and respiratory distress from wildfire smoke. These include the **disabled, elderly, school children and school teachers**, those living in **densely populated areas** (high waste volume generation) and **chronic non-communicable disease (NCD) sufferers**. The impacts on education due to school disruption illustrates the varied ways in which climate change affects Barbados and other SIDS.

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