



A BELIZEAN STORY

Fire, forests, and people

Community-based fire effects monitoring · Payne's Creek National Park, Belize

Funded by the UK Government through the Darwin Initiative



Conserving pine woodland biodiversity in Belize through community fire management

Designed to **assist the communities and protected area managers with fire monitoring techniques to evaluate best practices for fuel management** in this pine savanna ecosystem and adjacent broadleaf forest



In Belize fire is a good servant but a bad master

Severe fires decimate crops and destroyed homes



EMSR726 Wildfires in Belize

Emergency Response

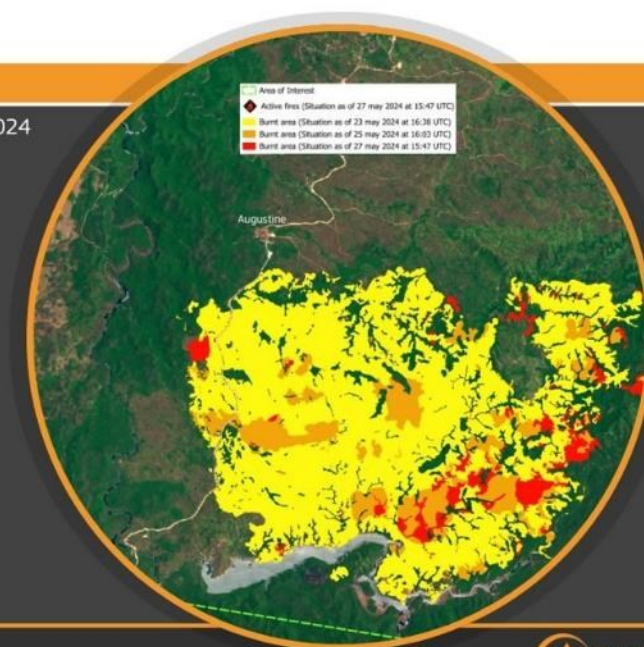
Event Date: 23 May 2024

Activation Timeline: 23 May - 13 June 2024

 ~350
people potentially
affected

 ~65,100 ha
burnt area detected

 ~52,100 ha
of forest affected



 PROGRAMME OF THE
EUROPEAN UNION  Copernicus
European Space Agency

 Emergency
Management

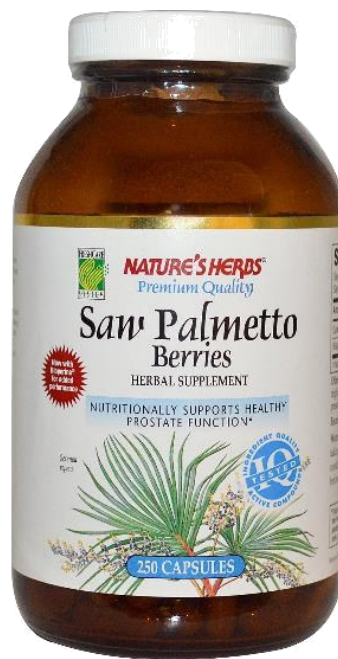
A Landscape built by fire













Payne's Creek National Park Fire Management Plan

Goal: 1) Use prescribed burns to replace damaging wildfires;
2) Restore uneven-aged stand structures of Caribbean Pine stands;
3) Enhance the nesting environment for the Yellow-headed parrot

Strategic action: Conduct prescribed burning operations and monitoring to evaluate reduction of fuel load and mitigate hardwood encroachment

Managers believed high intensity fire was necessary to remove shrubs competing with pines









Everything started here

Application of high intensity fires to remove shrubs did not appear to enhance seedling recruitment.

Low severity prescribed burns appeared to encourage recruitment.



Community members developed monitoring protocols with protected area managers and ecologists



Community members and rangers collect data on pines, palms and fire behavior

How does fire affect juvenile Caribbean Pine survival?

Fire Variables

Open



Shrubby



Densely wooded



Intensity (Char Ht.)	Moderate (1-3m)	Moderate (1-3m)	High (1-6m)
Heterogeneity	Low	High (patchy)	Low

Proportion Surviving (time t to t+1)

With fire	0.02	0.31	0.07
Without fire	0.40	0.38	0.29

How does fire season affect juvenile Caribbean Pine survival in different environments?

Open
Wet Season



Shrubby
Wet Season



Open
Dry Season



Shrubby
Dry Season



Proportion Surviving
(time t to $t+1$)

0.00

0.40

0.05

0.06



Landscape heterogeneity increases survival of *Pinus caribaea* var. *hondurensis* juveniles in a frequently burned, humid savanna

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Abstract

We characterized Caribbean pine (*Pinus caribaea* var. *hondurensis*) seedling and juvenile survival in lowland Belizean savannas with respect to environment and fire regimes. Plants in open and densely wooded environments had lower survival after fire. We hypothesize that facilitative or correlative mechanisms might promote positive relationships between shrubs and pine survival.

Abstract in Spanish is available with online material.

KEYWORDS

Belize, Caribbean pine, demography, fire intensity, survival

ORIGINAL ARTICLE

Large Trees Are Most Influential for Long-Term Persistence of Caribbean Pine (*Pinus caribaea* var. *hondurensis*) Populations in Lowland Belize Savannas

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Keywords: Belize | demography | fire regime | grassland | matrix model | pine savanna | population dynamics

Palabras Clave: Belice | demografía | dinámica de poblaciones | régimen de fuego | pastizal | modelo matricial | sabana de pinos

ABSTRACT

Caribbean pine (*Pinus caribaea* var. *hondurensis*) is the dominant canopy tree in lowland savannas of Central America and naturally experiences frequent fire. Previous research showed differential survival of juvenile pines between open, grass-dominated environments and shrub-dominated savanna environments. To date, however, no studies have modeled the population dynamics of natural stands. We studied Caribbean pine population dynamics in coastal Belize to establish a baseline and determine the relative importance of size-based stages and vital rates to population growth. We collected field data on pines from 2017 to 2021 in open and shrubby environments and grouped individuals into three size-based stage classes. We calculated transition probabilities among stages for two 2-year time intervals (2017–2019, 2019–2021) based on growth and survival and on reproduction, adding them to yield a single matrix for each environment and time interval. These transition matrices were then averaged for each environment, and mean matrices were used to calculate the population growth rates (lambda). We compared these population growth rates with those estimated from simulations using mixed modeling of vital rates, where the time interval was modeled as a random effect. We explored elasticity values for each transition in the mean matrices. Lambda was lower in open than in shrubby savanna environments in both analyses. Population growth rates were most sensitive to the growth and survival of pole and large trees in both savanna environments. Although the elasticity of seedling and juvenile trees was relatively low, these stages are naturally important in both environments, especially after major disturbances such as hurricanes.

RESUMEN

El pino caribeño (*Pinus caribaea* var. *hondurensis*) es la especie dominante del dosel en las sabanas de tierras bajas de América Central y, de forma natural, sufre frecuentes incendios. Investigaciones previas han demostrado que la supervivencia de los pinos jóvenes varía entre entornos abiertos dominados por pastos y sabanas arbustivas. Sin embargo, hasta la fecha, no se ha modelado la dinámica poblacional de los rodales naturales. Este estudio analiza la dinámica poblacional del pino caribeño en la costa de Belice para establecer una línea base y determinar la importancia relativa de las etapas de desarrollo basadas en el tamaño y las tasas vitales para el crecimiento poblacional. Para ello, se recopilaban datos de campo sobre pinos entre 2017 y 2021 en entornos



Terrestrial Lidar Predicts Dry Fuel Weight in Pine Savannas

Chad Anderson, Fanny Tricone, Scott Pokswinski, Sam Hillman, Rick Anderson, Mario Muschamp

Palm



Pine



Open

Dense



New Questions: What are the effects of fire in broad leaf ecosystems of Belize Maya Forest



“My research suggests, and others attest, that external actors aiming to influence environmental management will only have local impact through sustained engagement and personal relationships that go beyond written outputs.”

Fire Trace
Plans and Practices of Conservation and
Development in Belize's Coastal Savanna, 1920 to
Present
Cathy Smith, 2019



We thought this project was about understanding fire.
In the end, it was about understanding the people and the ecosystems on which they depend.
The best fire science begins by listening.

