

**Miombo Network Meeting**  
**23<sup>rd</sup>- 25<sup>th</sup> July 2013**

**CHARACTERIZATION AND MAPPING OF FIRE REGIME IN THE  
NIASSA NATIONAL RESERVE DURING 2000 TO 2012:  
Preliminary results.**

By:

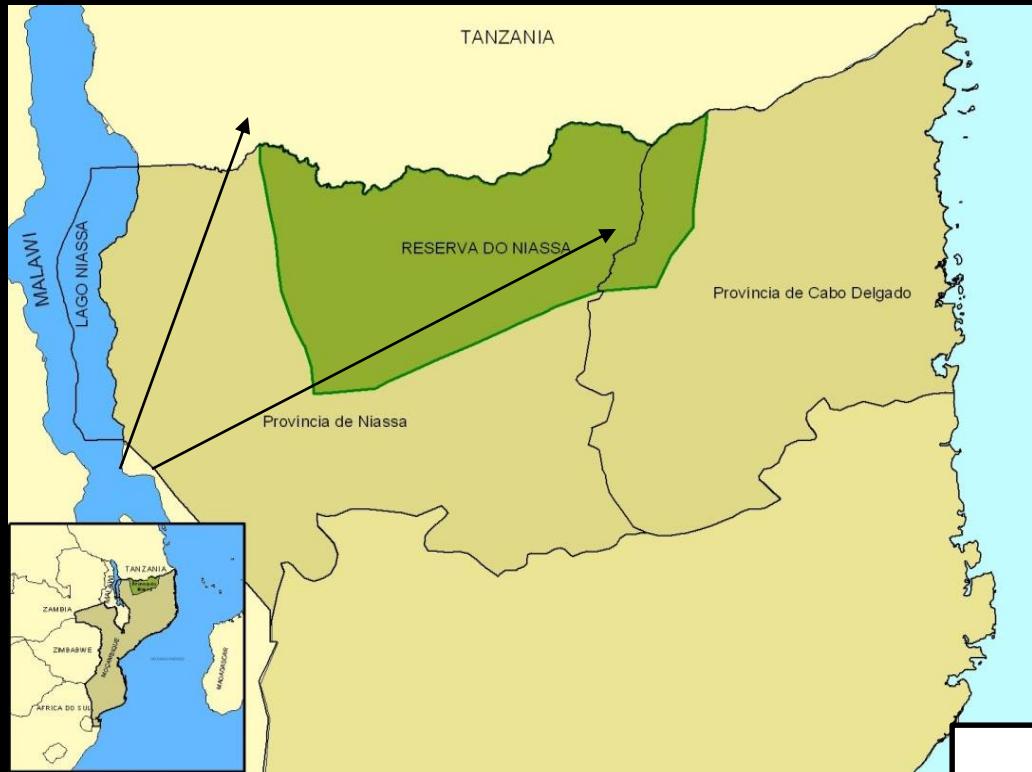
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# Outline

1. Introduction
2. Aim & Objective of the Study
3. Key Concepts
4. Methodology
5. Preliminary Results
6. Conclusions
7. Recommendations

# Study Site :Niassa Reserve



MAP: 800 mm  
MAT: 25°C

**Largest conservation area in  
Mozambique**

Surface:

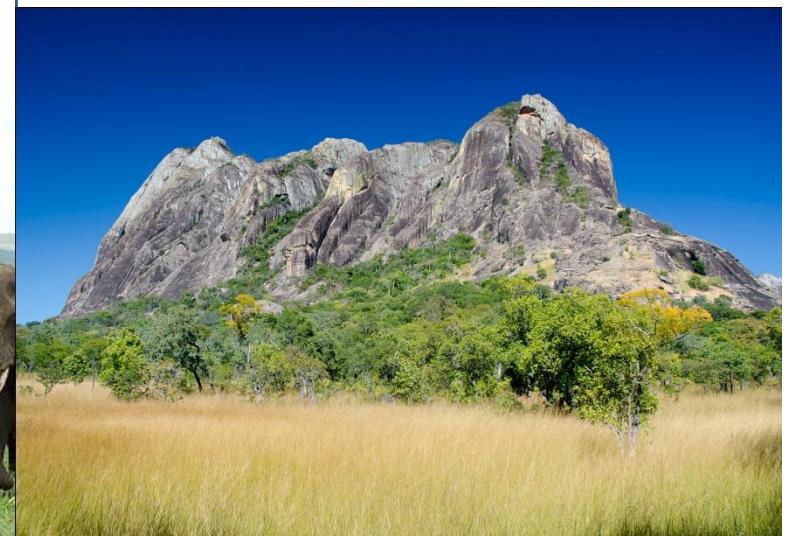
- 42 000 Kms<sup>2</sup>

# 1.1. Biological Diversity

- 800 Plant species which  $\frac{1}{2}$  are endemic
- Wild life
  - \_ Elephant: 20118
  - \_ Buffalo: 6833
  - \_ Hippopotamus: 1325
  - \_ 400 species of birds
  - \_ Endangered bird species:  
*(Rynchops flavirostris);*



Source: Craig (2009) & NNR Website



## Uncontrolled Burning



## Illegal Hunting



## Threats to Biological Diversity

### Human Settlements



-40 000 hab.

-Shift Cultiv

-corridors of human activ

### Unsustainable Extraction



## 1.2. Why Study Fire Regime in NNR?

- Between 2000-2006: 13% burn ever year, 25% burn ever 2 years and only 7% not burn. (Ribeiro, 2007)
- The frequency and the return interval and fire seasonality influence the abundance and the distribution of plant species;
- Modification on fire regime threat less tolerant species

## **2.1 Aim of Study**

- **Enlarge the base knowledge for effective fire management**
- **Supply data for the evaluation of fire effects on the availability of forest resources to local communities.**

## 2.2 Study Objectives

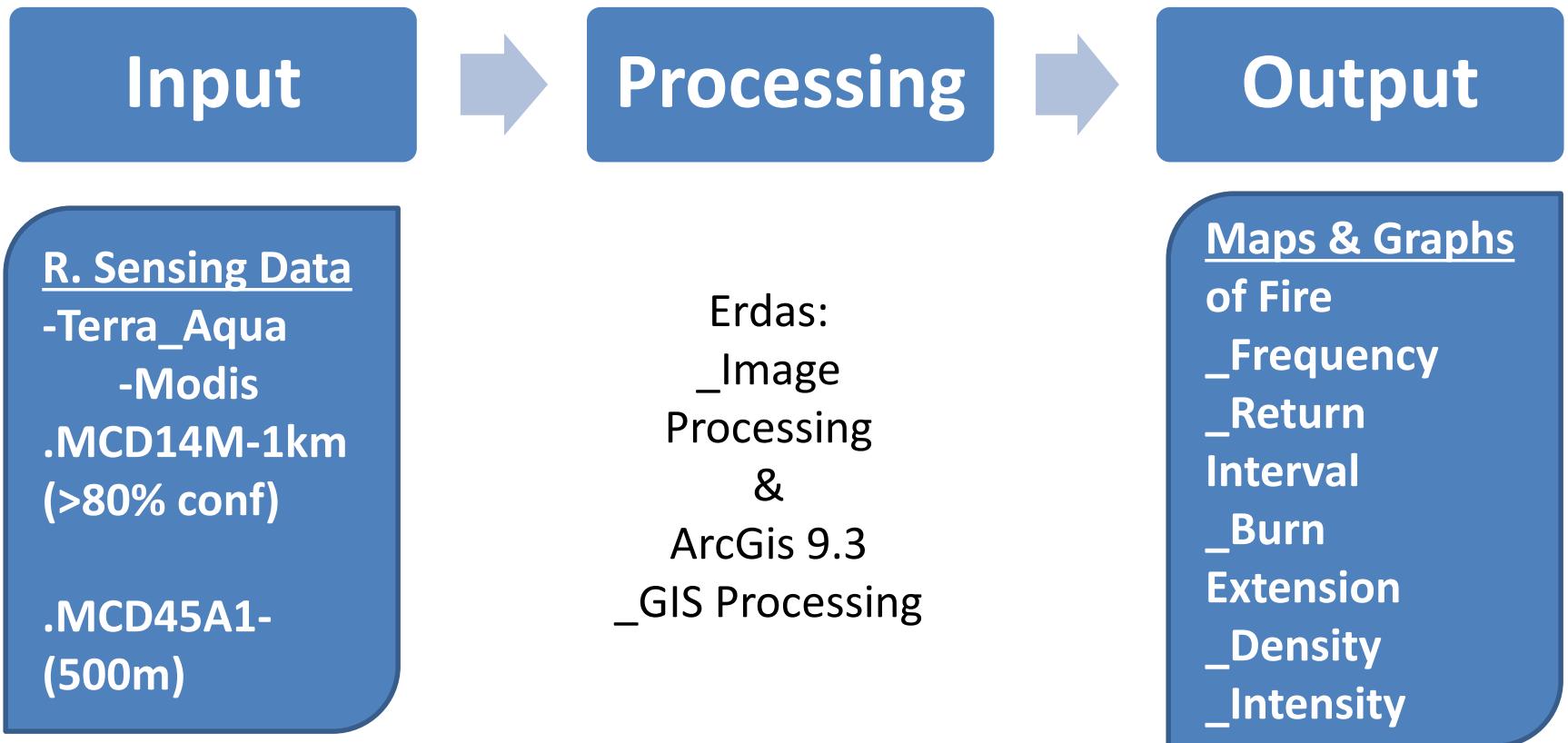
- **Map and characterize the fire regime in the Niassa National Reserve in term of:**
  - Frequency and Fire Return Interval
  - Burn Extension
  - Fire Seasonality
  - Fire Density and
  - Fire Intensity
- **Identify Factors that influence Fire Regime in NNR**

# 3. Key concepts

- **Fire Frequency:**
  - number of fires that occur within a given area and period of time
- **Fire Return Interval:**
  - Time between 2 successive fires in a designated area
- **Burn Extension:**
  - proportion of area burned
- **Fire Density:**
  - Nr of Active fire focus per Unit Area
- **Fire Intensity:**
  - Heat energy released in a fire line

# **4. Metodology**

## 4.1. Fire Regime Characterization



Match Fire Active & Burned Areas pixels using the Julian's day

## Overlay: Intercept

Fire Freq (MCD45A1)

Land Cover (Marzoli, 2007)

Eleph Dns.(Craig, 2009 )

T °C (Hijmans *et al*, 2005)

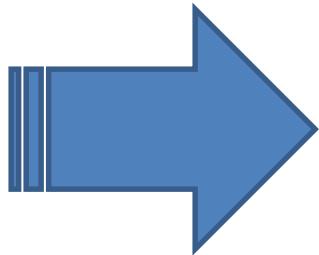
Prec (Hijmans *et al*, 2005)

Elevation

(<http://www.jspaceystems.or.jp/>)

Pop Dens (INE, 2007)

Road Euclid. Dist

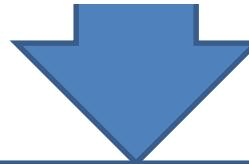


Map of Relationship:  
MODIS data + Surface  
+ Climate data



Logistic Regression\_Sas.9.0

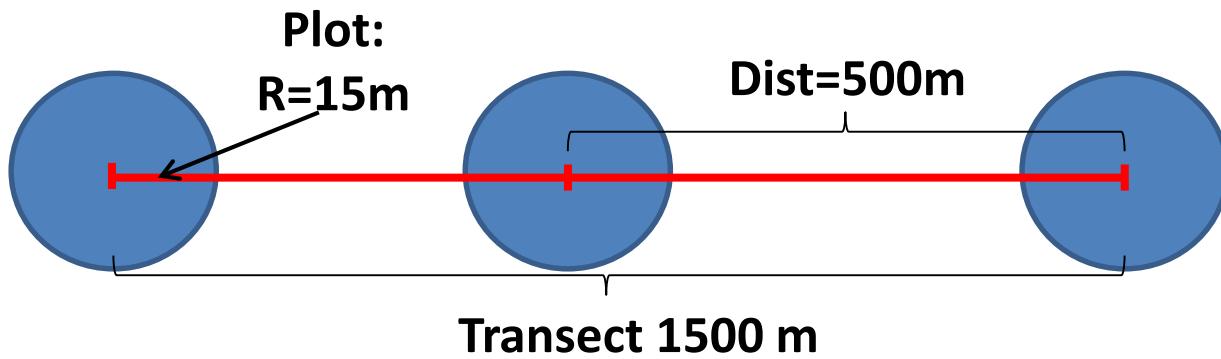
$$\text{Log} \left[ \frac{P_i}{1 - P_i} \right] = \alpha + \beta_1 X_{i1} + \dots + \beta_k X_{ik}$$



What Factors influences  
Fire Regime in NNR

# Accuracy Assessment

- **Field data Collection**
  - 108 plots geo-referenced & linked to the fire frequency's classes
  - Survey Signs of Vegetation Fire damages



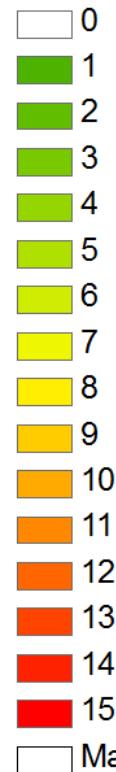
- Field data used as Reference to Accuracy assessment

## **5. PRELIMINAR RESULTS**

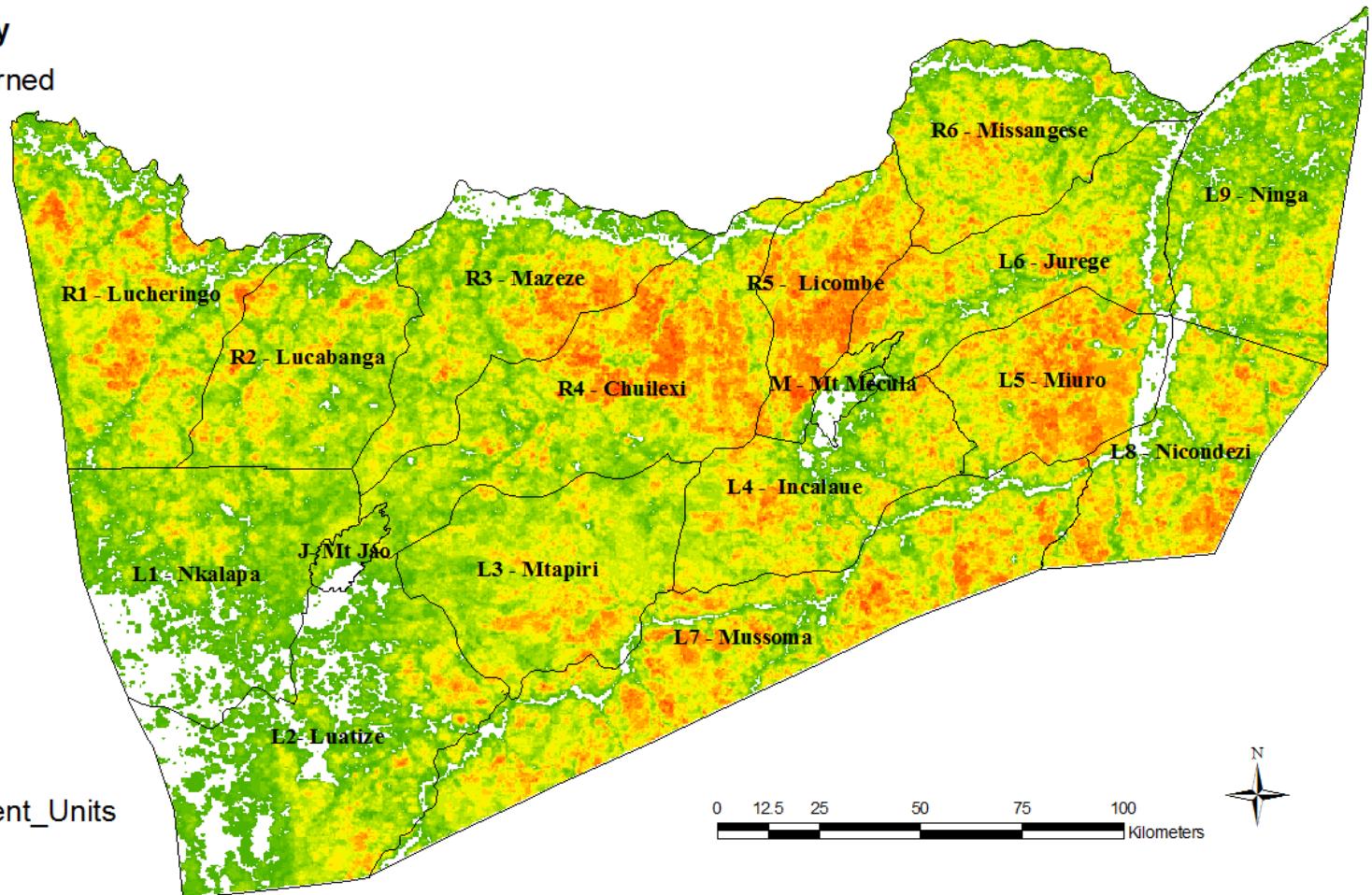
# 5.1 Fire Frequency

## Fire Frequency

Nr of Times Burned

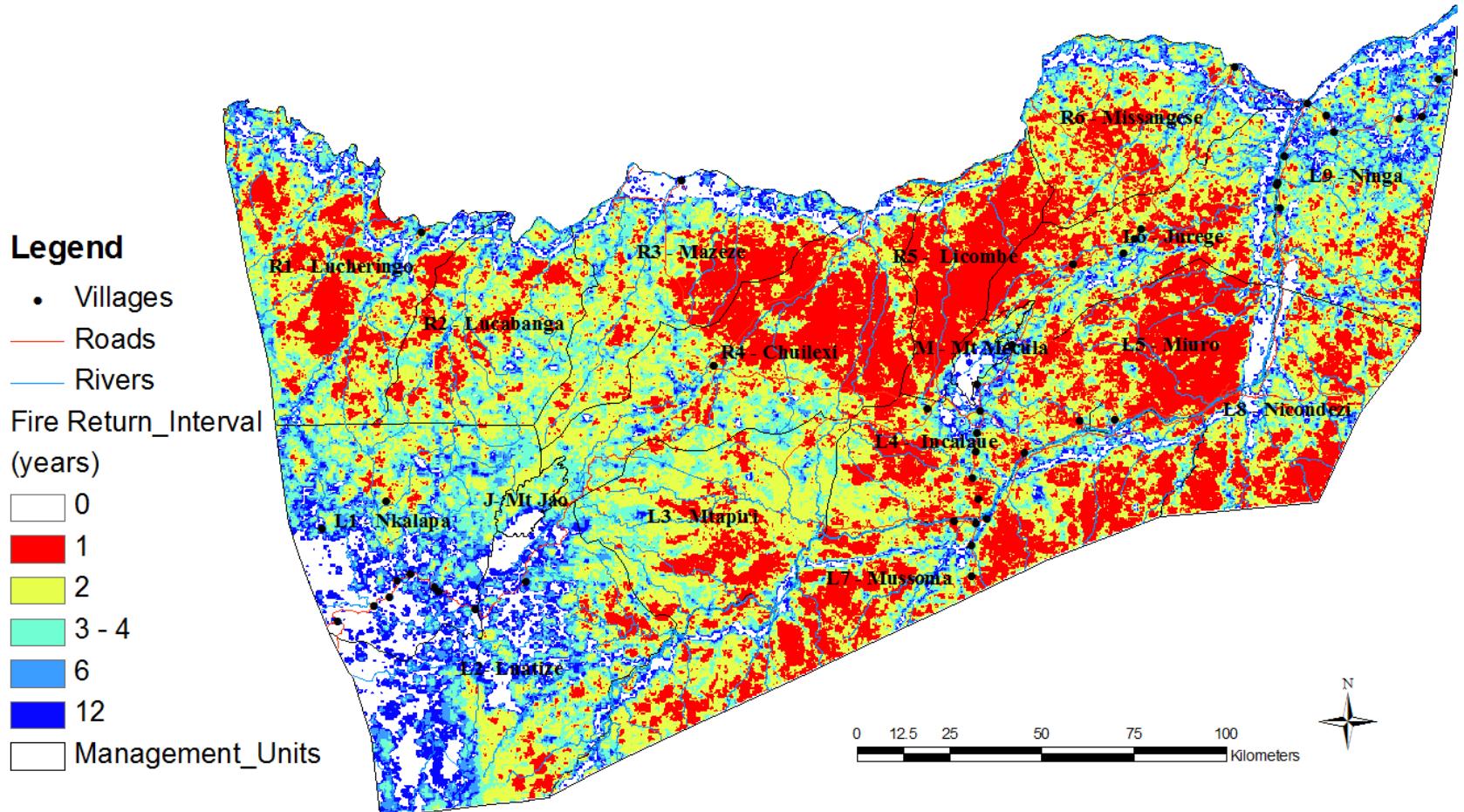


Management\_Units



The Mean Fire Frequency is 0.36 times/ years

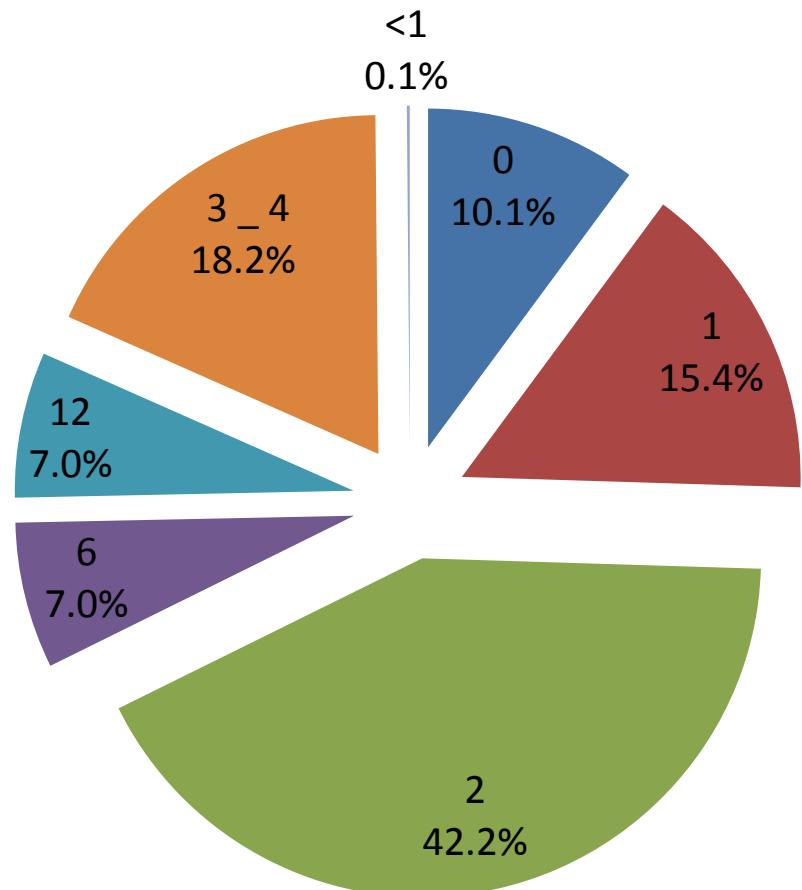
## 5.2. Fire Return Interval



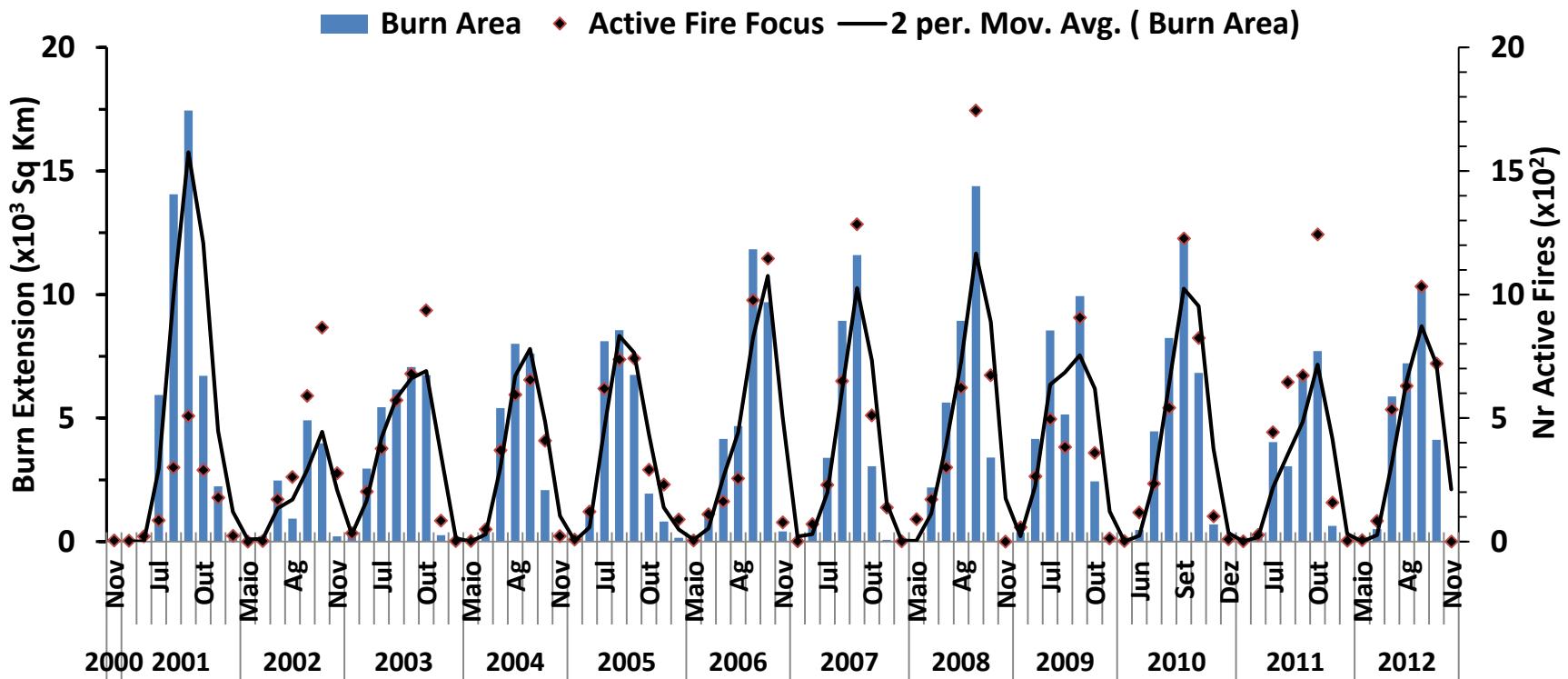
MFRI indicate that fire occur in a particular site, every 3.29 years

## 5.3. Burn Area Extension

FRI (Years)	Burn Area (Sq Km)
0	4245.25
<1	58.77
1	6437.76
2	17689.06
3 _ 4	7640.54
6	2924.76
12	2915.19
Total	41911.34

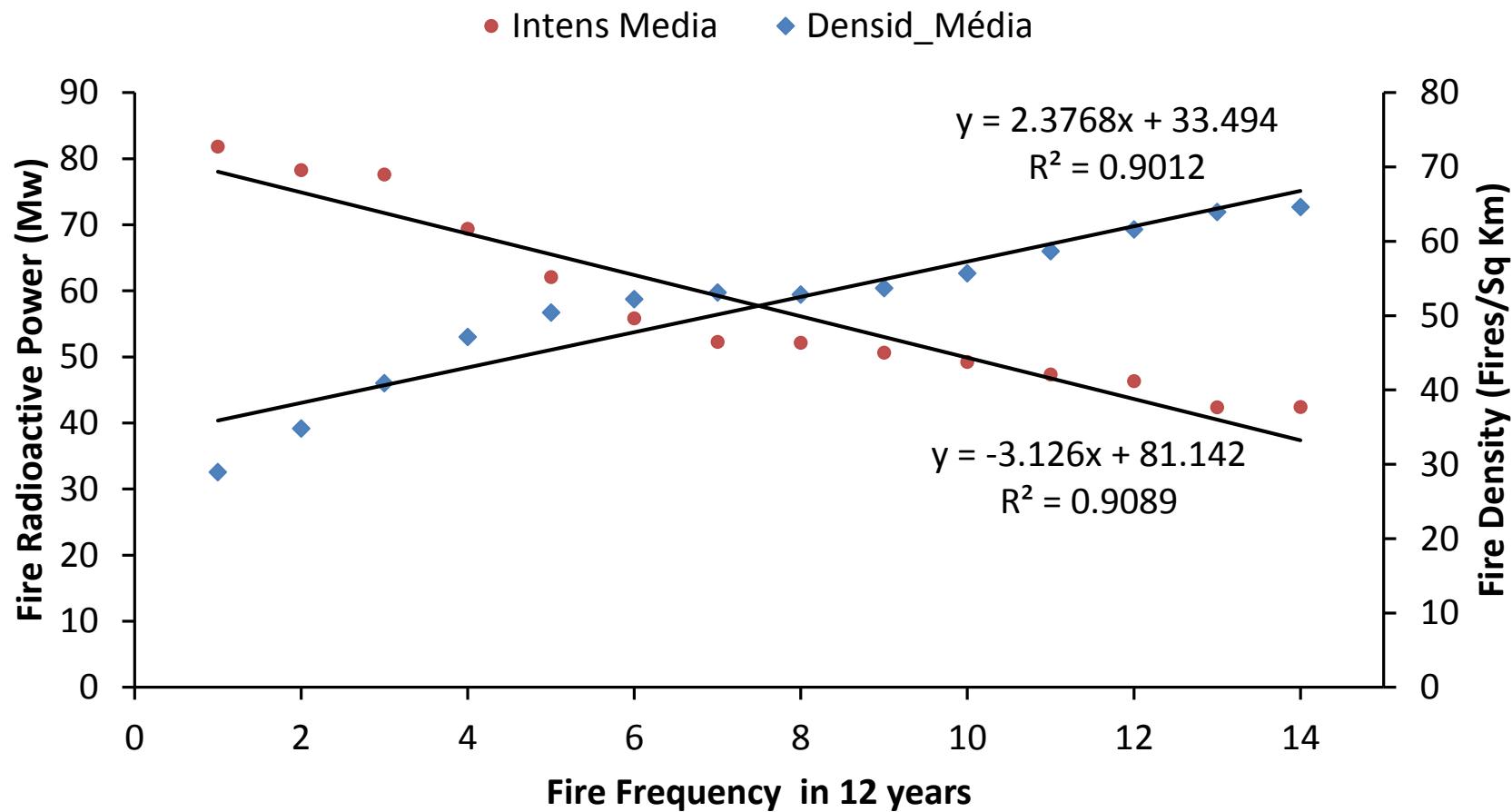


## 5.4. Fire Seasonality

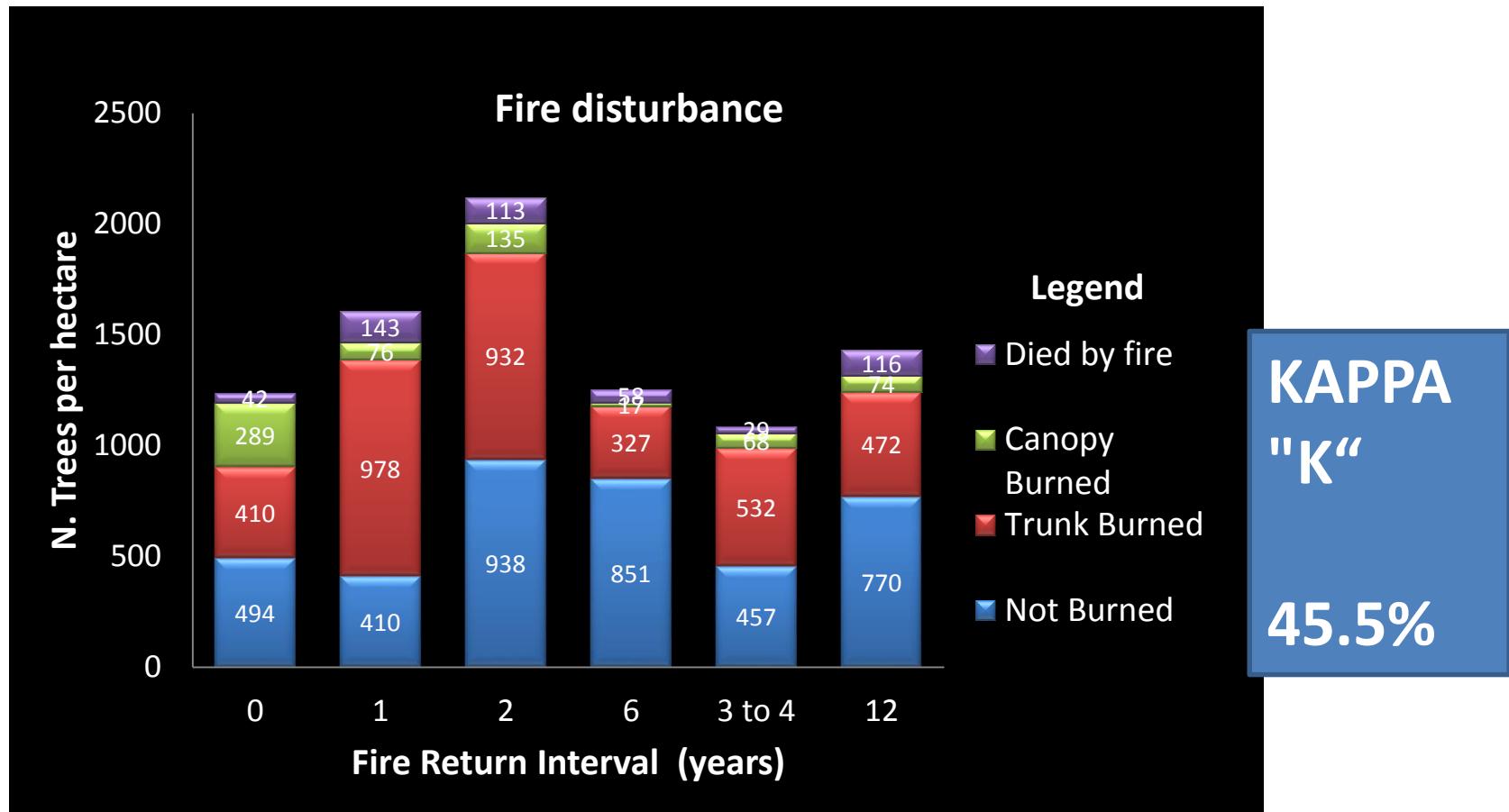


Wet: Dec-April    Early Dry: May-July    Late Dry: Aug\_ Nov.

## 5.5. Fire Density and Fire Intensity



## 5.6. Accuracy Assessment



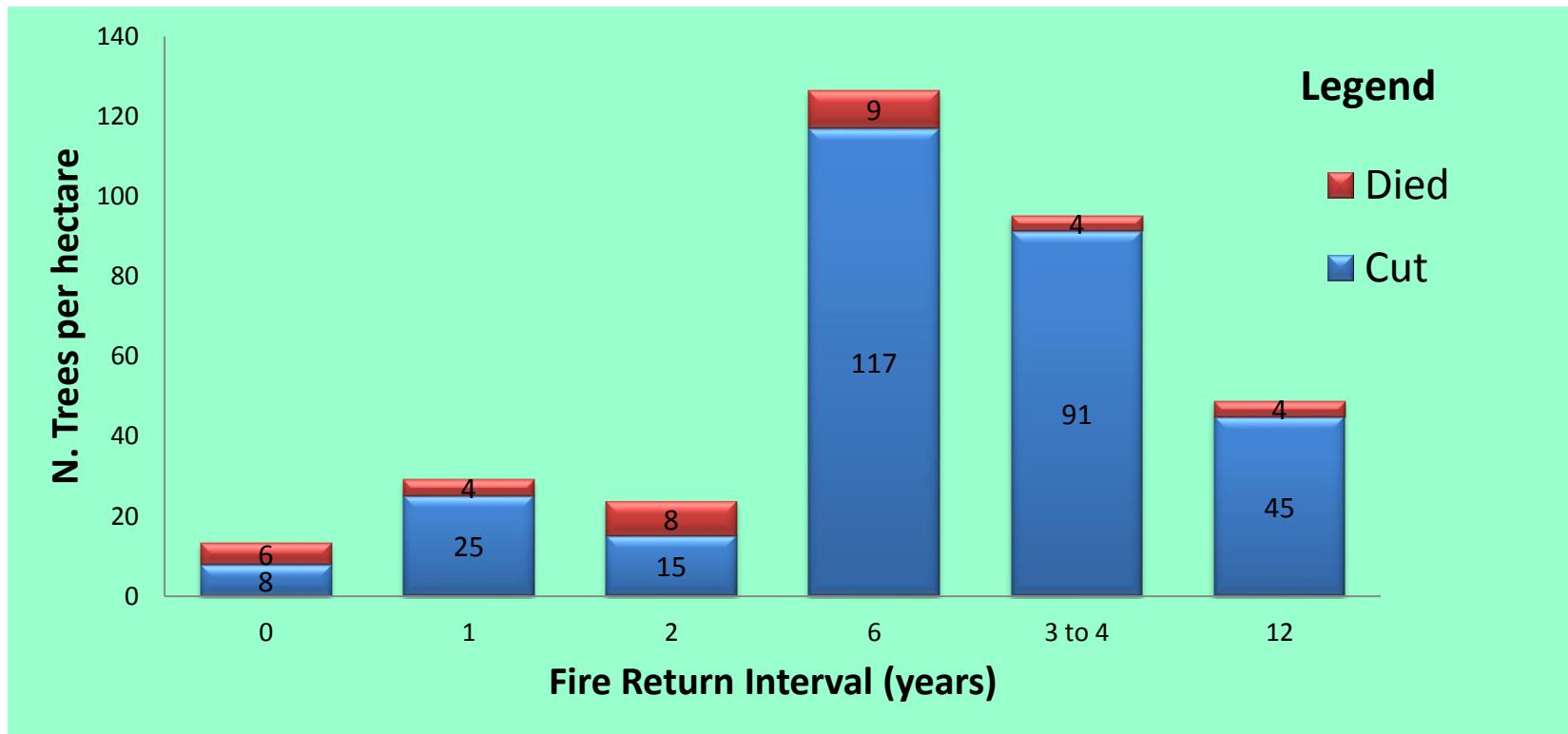
There are moderate agreement between Modis Fire Frequency Map and Reference data

# 5.7. Factors influences Fire Regime in NNR

Table1: Sumary of statistical Analyses

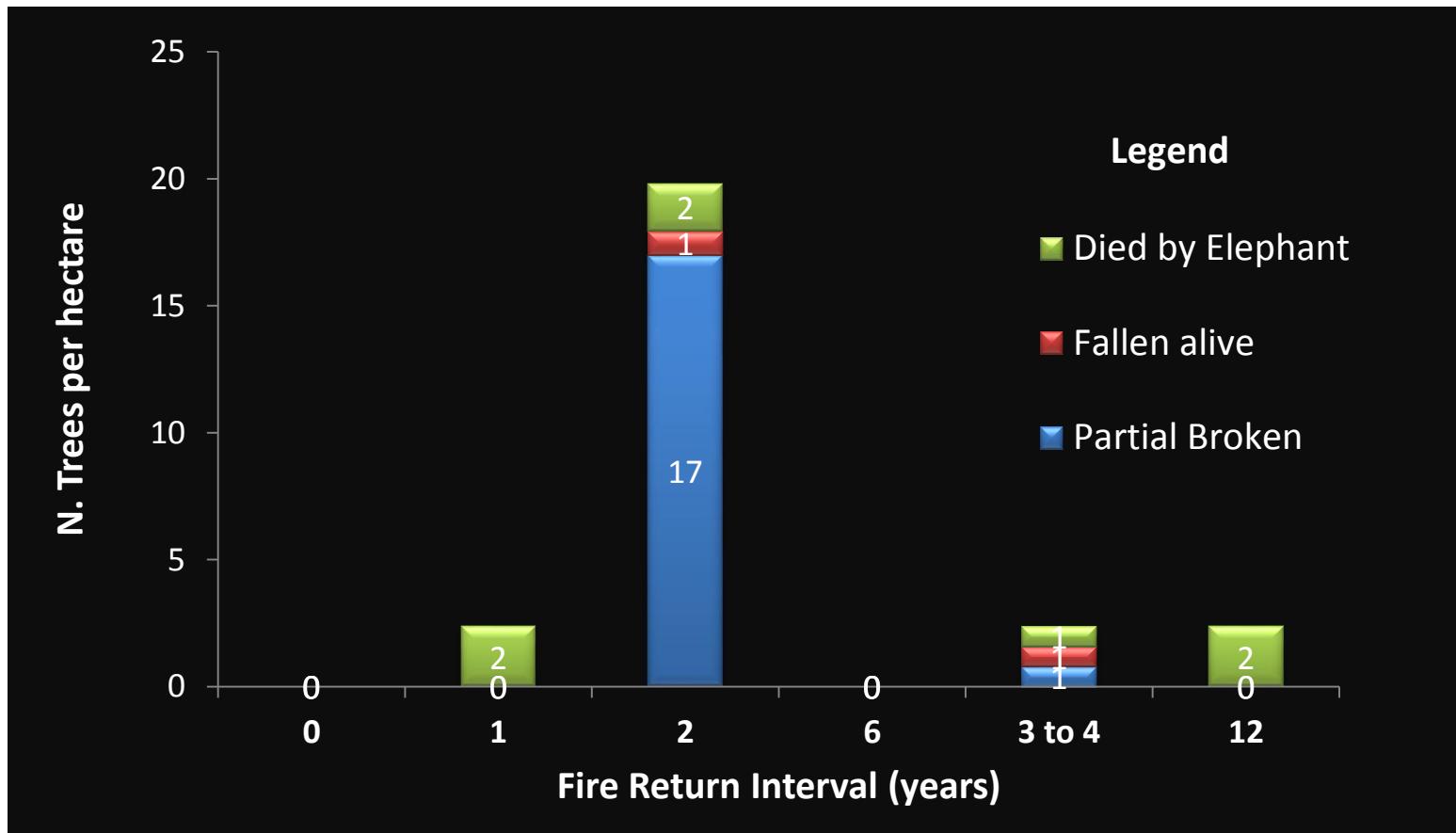
Parameter	DF	Estimate	Stand Error	Wald Chi-square	Pr > ChiSq	Odd Ratio
Intercept	1	-7.2936	0.3734	381.4501	< .0001	-
Vegetation	1	0.313	0.0960	<b>41921.1</b>	< .0001	-
Dist_Rua	1	0.0221	0.000315	<b>4904.7</b>	< .0001	1.022
Dens_Eleph	1	1.2512	0.021	<b>3545.2</b>	< .0001	3.494
Elevation	1	-0.00341	0.000085	1619.9	< .0001	0.997
Precipitation	1	0.00416	0.00012	1189.6	< .0001	1.004
Temperature	11	0.2081	0,0126	274.2	< .0001	1.231
Dens_Pop	1	-0.00831	0.000739	<b>126.5</b>	< .0001	0.992

## 5.7.1 Human Disturbance & Fire Regime in NNR



The Less frequent burned areas concentrate high number of trees damaged by Human

## 5.7.1 Elephant Disturbance & Fire Regime in NNR



The Most frequent burned areas concentrate high number of trees damaged by Elephant

## 6. Conclusion

- Central-North, East and Northwest area of the NNR burn more frequently than other areas in the reserve.
- The Mean Fire Return Interval (MFRI) is 3.29 corresponds to fire frequency of  $0.36 \text{ years}^{-1}$ .
- The fire seasonality in the NNR is related to the annual rain distribution within the area.

## 6. Conclusion

- Fire Frequency in NNR is highly determined by Vegetation, Distance from the Roads and Elephant Density less defined by Population density.

# Acknowledgment





# THANK YOU