SUPPLEMENTARY APPENDIX

DATABASE OF MODEL VARIABLES

Land use and occupation

To map land use and occupation, the State Institute of Environment and Water Resources of Espírito Santo provided digital aerial photographs of the study area from 2013. Mapping was obtained by digitalization of the orthophoto at a scale of 1:35,000 and a spatial resolution of 1 m using the computer program *ArcGIS/ArcINFO* 10.2. Digitalization via the screen was performed by photo-interpretation techniques (visual interpretation of the images) at a scale of 1:1,500. In the case of doubt, maximum amplification of the visual field of the image was conducted at a scale of 1:5,000 for interpretation of the mapped variable and subsequent digitalization. To verify the mapped class, field visits were performed and points were collected with the *GPS Garmin 60 CSX* device.

The use and appropriation of natural resources in the region are observed in various forms. The areas surrounding the reserve have been cleared and occupied by monocultures of coffee, sugarcane, low-density livestock and fruit crops on large properties. The urban concentration in the city of Sooretama and residences in rural areas are factors driving the spatial distribution of people that compromise the integrity of the resources in the reserve. Four natural vegetation types exist: 1) High forest, which is dominated by large trees with a maximum height of 40 m; 2) Mussununga forest, which covers areas of high forest with smaller trees, generally with a maximum height of 20 m; 3) Flooded areas, with sections that are permanently flooded (marsh and swamp forest) or periodically flooded (riparian forest): in both cases, a water course always exists in the vicinity of or through these formations; and 4) Native grasslands, which are highlighted by the predominance of grasses and shrubs established in sandy soil. The soil is covered with litter and populations of bryophytes form peat in places without litter layer.

Proximity to roads

Mapped roads were classified into two categories: highways and rural roads. A highway was defined by paved roads with two or more lanes and two-way traffic, as represented in the study area by the BR-101, which runs in a north-south direction along nearly the entire brazilian east coast, and the BR-342, which connects the southeast region of the Bahia state to Sooretama in the Espirito Santo state and the northeast region of the Minas Gerais state. Rural roads were defined as unpaved roads and classified into main roads, secondary roads, access roads and internal roads. The main roads were considered to be roads with an acceptable standard of construction, a carriageway and an upper platform width of 5 m. Secondary roads were considered to be roads with the purpose of dividing the landscape. The access roads were considered to be roads that provide access to the interior of the landscape, and the internal roads were regarded as internal roads that run along the edge of the RNV.

To determine the variable proximity to the roads, a buffer was used to establish an area of influence for the roads at the beginning of a forest fire. The area of influence surrounding the roads was established on a scale of 25 to 150 m in accordance with Chuvieco & Congalton (1989) and Pew & Larsen (2001) and as a function of the increased displacement of vehicles and people. Thus, the main highways and roads were considered to have the greatest influence on the risk of fire, being used a buffer of 150 and 100 m, respectively. On the secondary roads, a 50 m buffer was employed; for the access roads and internal roads, a 25 m buffer was employed.

Thus, the proximity to residences was obtained by the euclidean distance, which describes the nearest straight-line distance between two points, from the centre of the origin cell of the image matrix to the centre of the neighbouring cell. On a plane, the distance between the points $D_{AB}(X_a, Y_a)$ and (X_b, Y_b) is given by the pythagorean theorem (Romero Calcerrada et al. 2010).

Slope

The slope map was obtained by a digital elevation model (DEM) from an ASTER raster radar image (Advanced Spaceborne Thermal Emission and Reflection Radiometer) with a spatial resolution of 30 m. Due to their importance in the direction of fire and an increase in flame propagation velocity, areas with steep slopes have a greater risk for potential forest fires than areas with gentle slopes (Brow & Davis 1973, Gaylor 1974).

Orientation of the relief

The map of relief orientation and the slope was obtained by a DEM. The orientation of the relief influences the conditions of humidity and the type of combustible material due to solar lighting conditions (Brow & Davis 1973). In the southern hemisphere, the majority of the sun's rays directly fall on north-facing surfaces and transmit more heat to this exposure. The west-facing surface receives the second-largest amount of energy, followed by the east-facing surface. The south-facing surface receives the least amount of heat. On flat terrain, the effect of solar radiation on the drying process of combustible material could be considered as a reference value (Soares et al. 2017).

Proximity to residences

According to Santos et al. (2006), the majority of the protected areas in Brazil are occasionally hit by forest fires, and the main causes of fire are characteristic of human action. This sense, spatial fire occurrence patterns are strongly associated with human access to the natural landscape.

To determine the proximity to residences, the area of influence of households was initially defined as a function of the population density in census limits indicated by the Brazilian Institute of Geography and Statistics from CENSUS 2010 (IBGE 2010). Population density (number of people per unit area), determined by Eq. 1, is the most common summary of the population distribution in a geographic space.

$$D_i = P_i / A_i \qquad (1)$$

where D_i is the population density per unit area i, P_i is the corresponding population and A_i is the land area of the unit (Deichmann 1996).

For each residence mapped in the study area, an area of influence was defined, and a 50 m buffer in this area was attributed to the population density class of < 1 hab/ha, which delimits the properties surrounding the RNV. Northwest of the RNV, in the community of Barra Seca and a municipality of Jaguaré, the area of influence of 250 m was attributed to the population density class of 110 hab/ha. Southwest of the RNV, the proximity to the urban area of the municipality of Sooretama renders a region of fire risk due to the "wildland - urban interface (WUI)". As it presents a greater population density, an area of influence of 500 m was defined for the sector with the population density class of 10 – 30 hab/ha and 1000 m for the sectors with > 30 hab/ha. After defining the areas of influence, the variable proximity to residences was obtained after applying the euclidean distance tool.

Table SI. **Programming command lines in Python in ArcGIS/ArcInfo 10.2 for spatialization in fuzzy logic of the influence of the relief orientation on the risk of fires.**

Command lines in Python

```
import arcpy  import sys, string, os,
arcgisscripting from arcpy import env
from arcpy.sa import *  gp =
arcgisscripting.create()  nm =
gp.GetParameterAsText(0)  dd =
gp.GetParameterAsText(1)  cb =
gp.GetParameterAsText(2)  las =
cb+"\\"+nm+'_seno'  def FS(r):

res = Con((Raster(r)==-1),0,Con((Raster(r)<=180) ,(1 / (1 + ((Raster(r) - 0) / 45)**2)),(1 / (1 +
((Raster(r) - 360) / 45)**2))))  res.save(las)  FS(dd)
mxd = arcpy.mapping.MapDocument("CURRENT")
df = arcpy.mapping.ListDataFrames(mxd,"*")[0] nl
= arcpy.mapping.Layer(las)
arcpy.mapping.AddLayer(df, nl,"TOP")
```