Managing ecosystem services from Tropical forests (Chile)
8-12 de mayo 2017-Santiago Chile.

Fire risk model for informed desitions to prevent forest fires in dry forest in Costa Rica

Mauricio Vega-Araya
LabTEc-Universidad Nacional, Costa Rica.

May 10, 2017

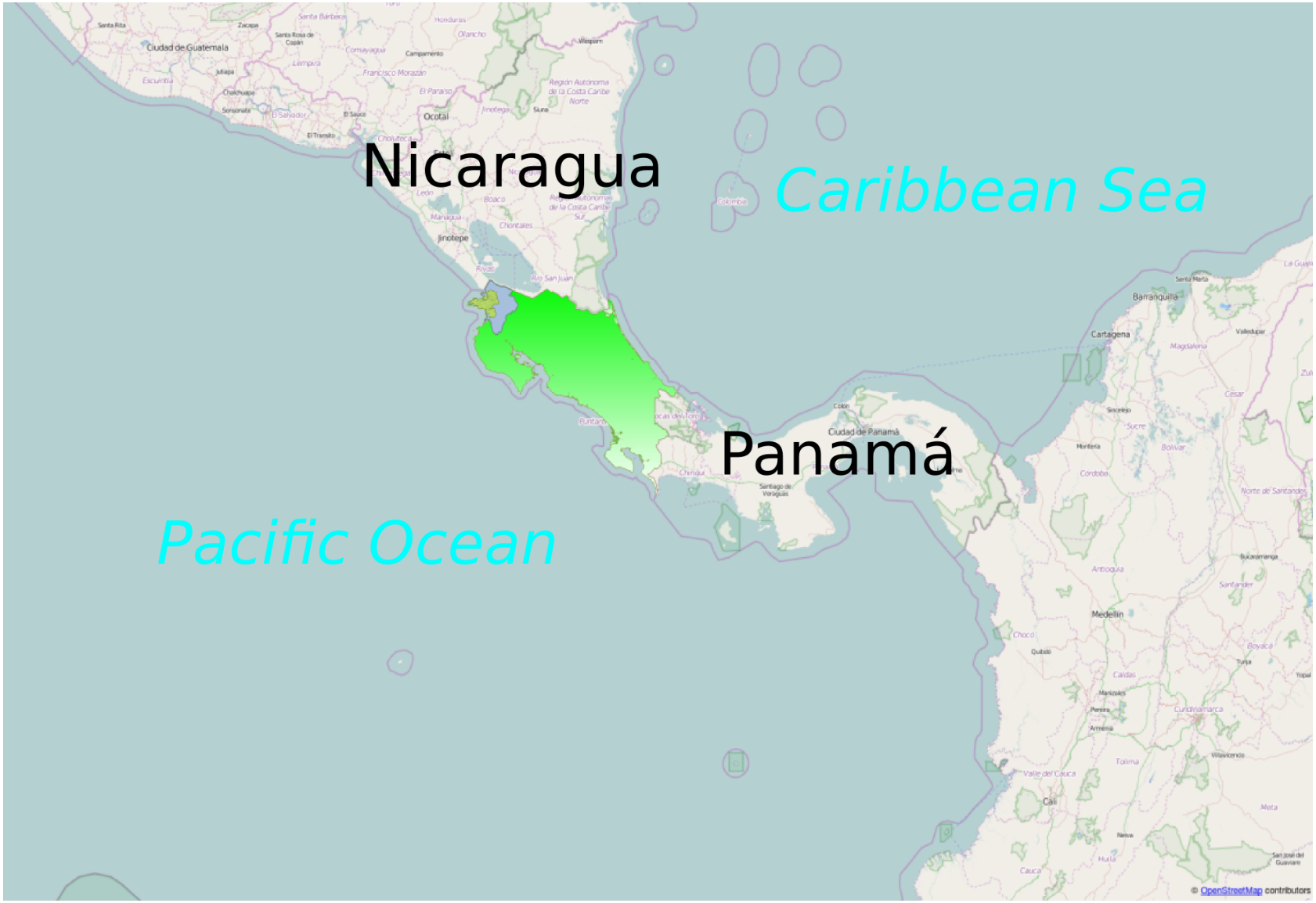
Cooperation



Cooperación Triangular
Marruecos-Costa Rica-Alemania

Presentation Scheme

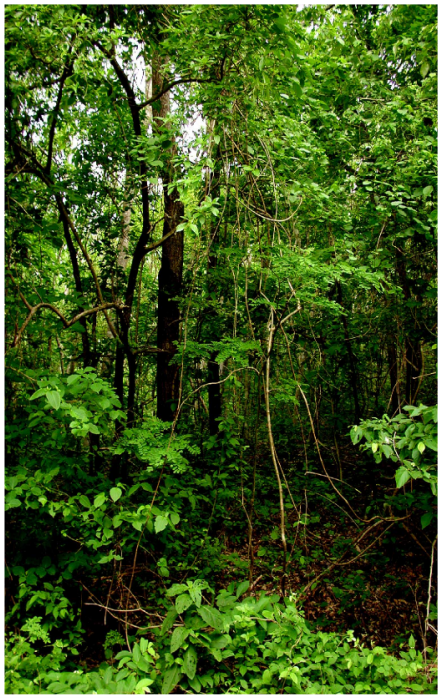
Costa Rica in Central America



ACG in Costa Rica

Guanacaste Conservation Area (ACG)

Dry season in tropical dry forest–ACG



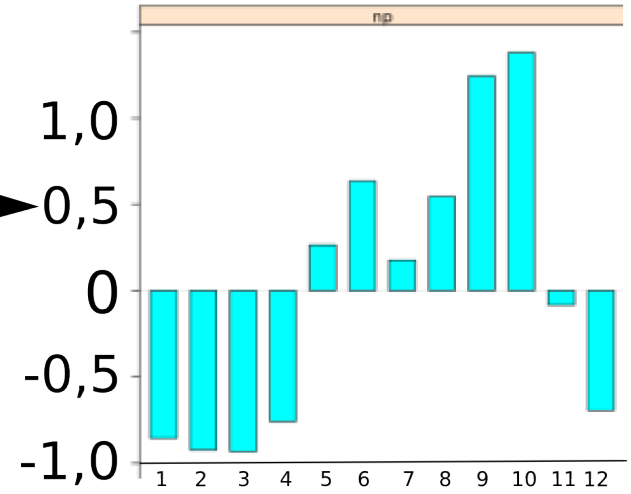
April

October

Fotos: D. Jansen

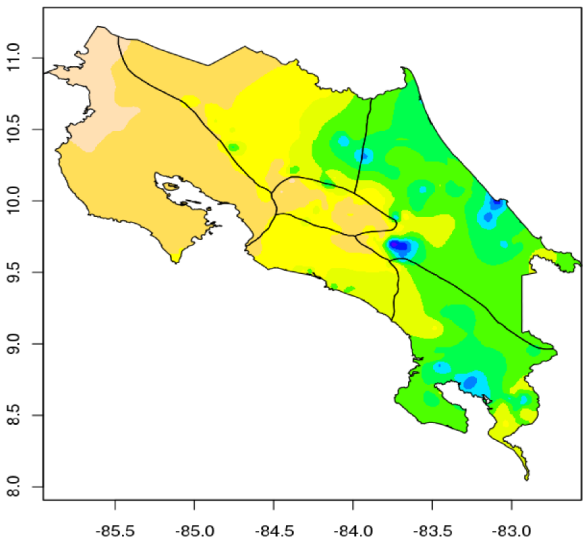
Dry season in ACG

Guanacaste Reconnaissen Drought Index

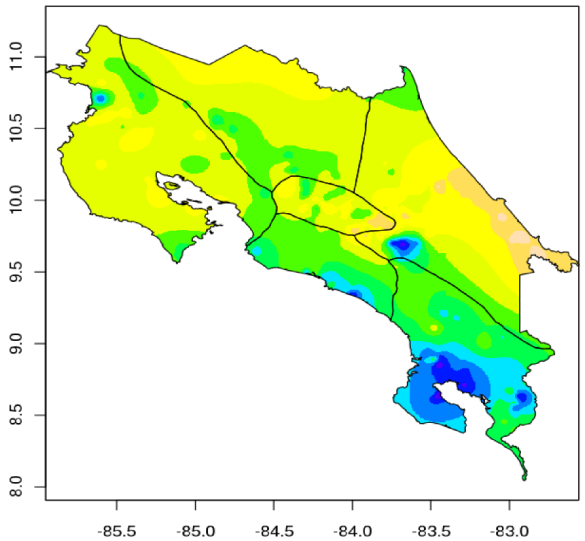


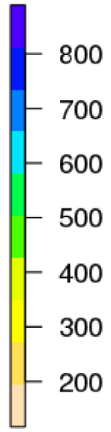
Precipitation

April



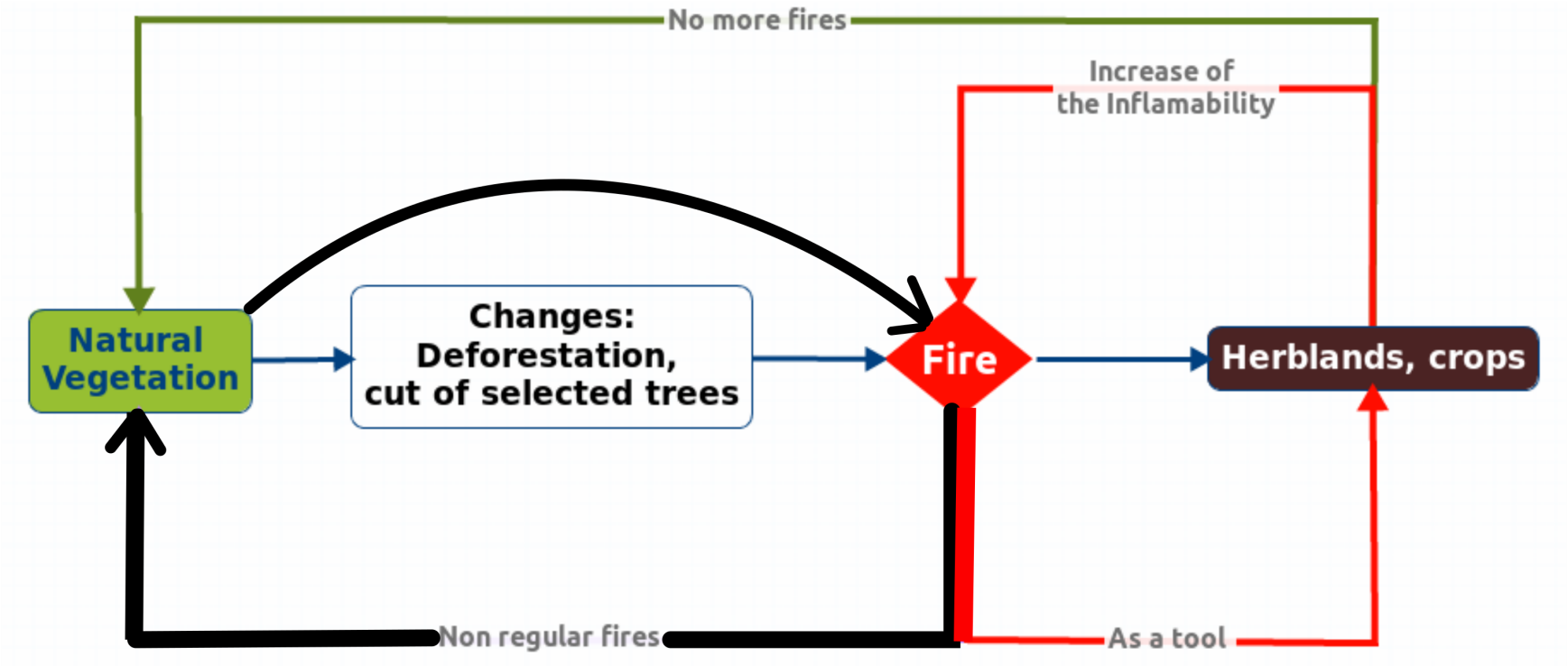
October





Forest fires: complex phenomenon

The role of Fires in tropical dry forest



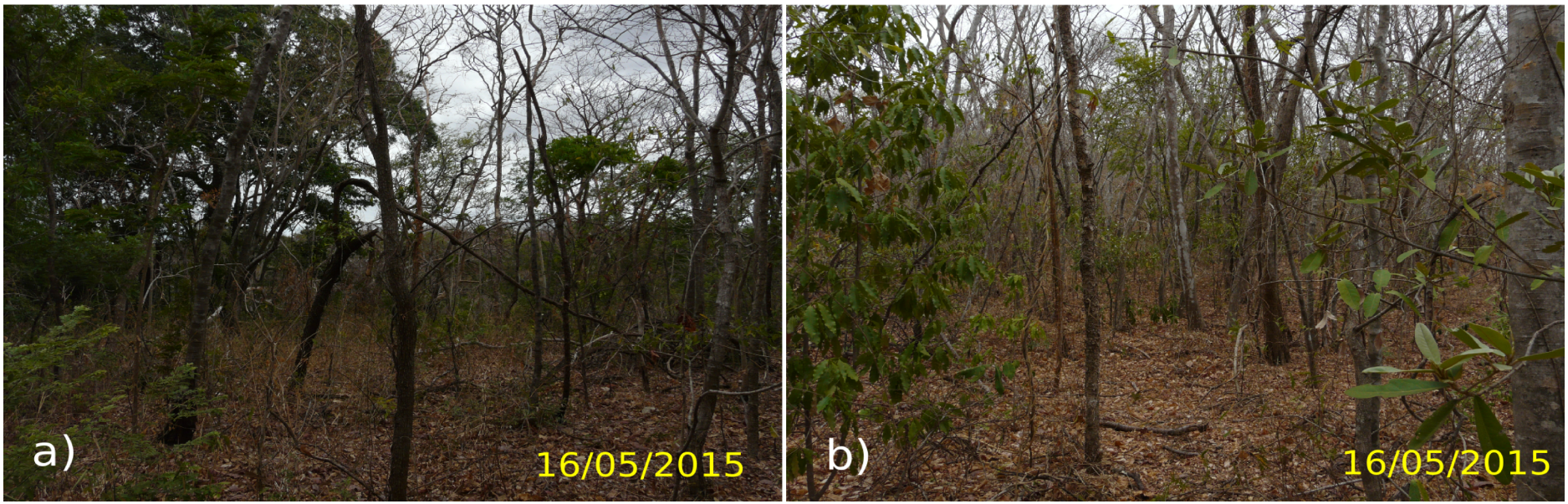
Source: adapted from Myers (2006)

Degradation on secundary forest

a) tipical forest fire b) tree damage

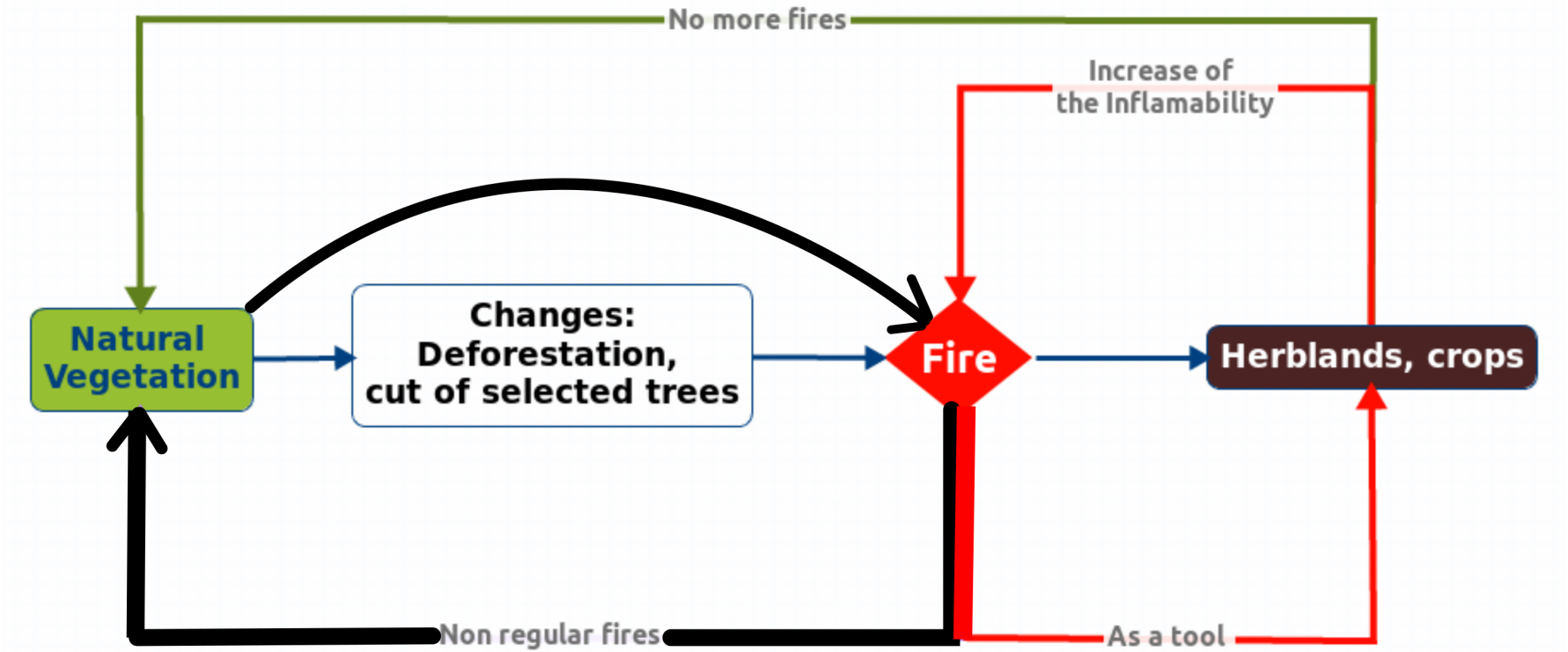
Degradation on secundary forest

Forest Fire in Mars 2013



a) whith fire b) without fire

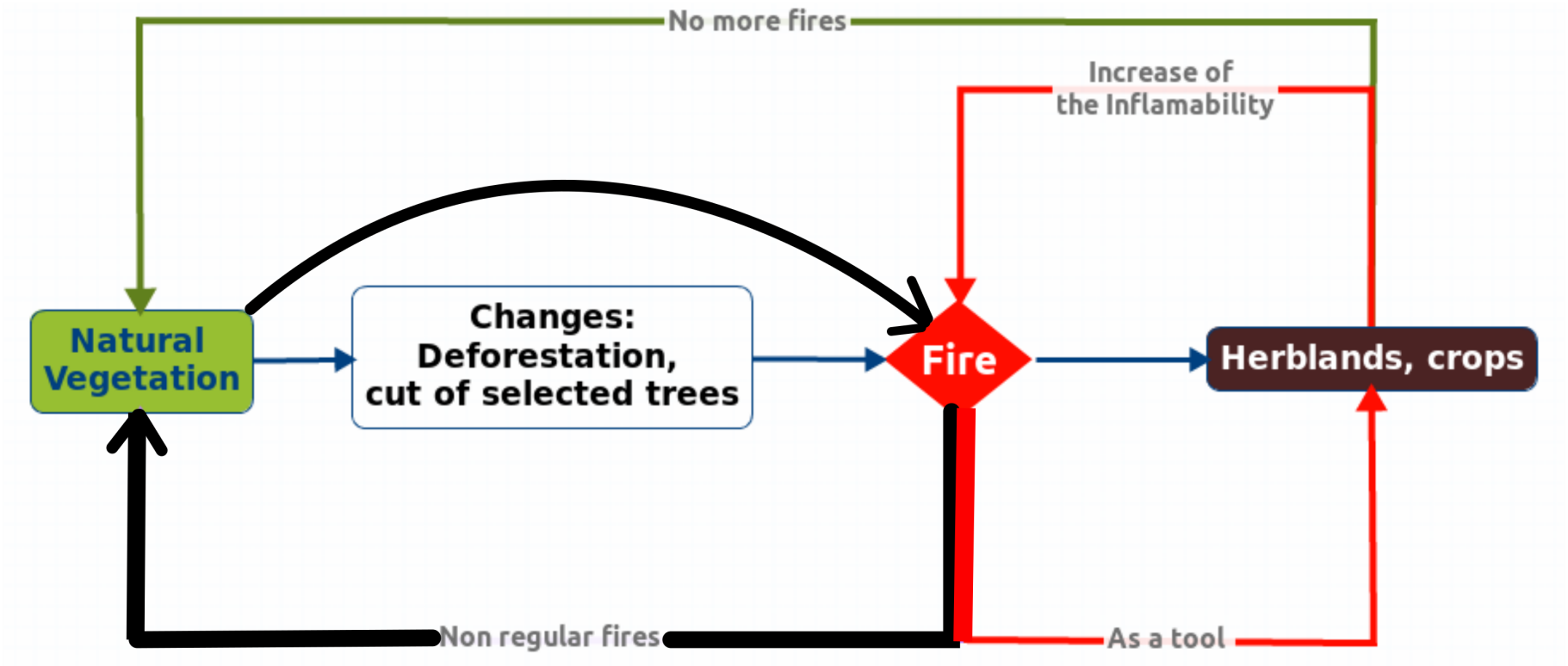
Fire in the tropical dry forest



Source: adapted from Myers (2006)

Typical land use change

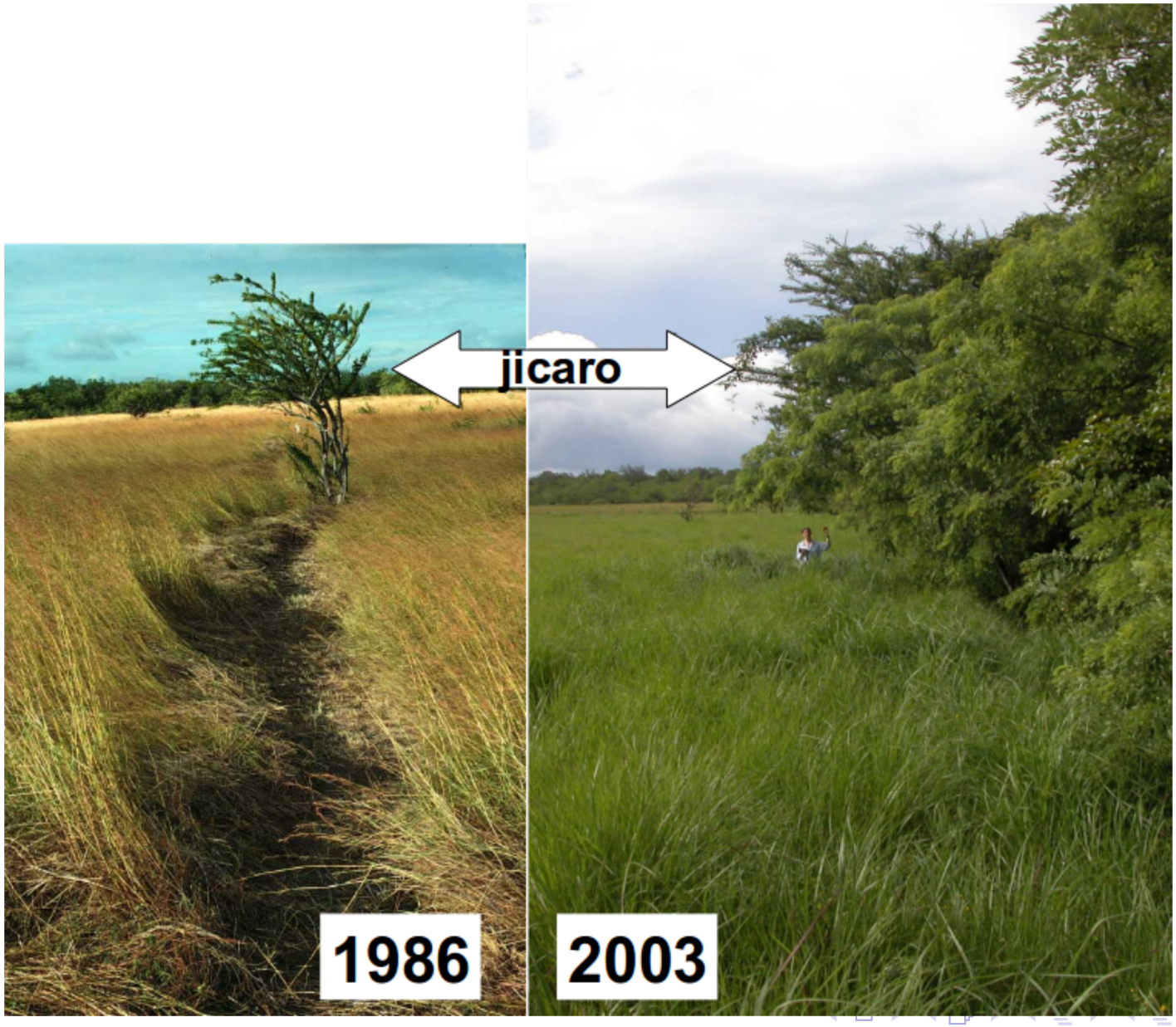
Fire in the tropical dry forest



Source: adapted from Myers (2006)

Forest fires: complex phenomenon

Typical land use change



Drone image in 2016

Long term Planning:
-Infrastructure
-Equipment
-Personal

MAP:
STATIC RISK

Day by day Planning:
-Real time alerts
-Very soon intervention

DINAMIC MAP

Prob of ignition \ Intensity of Propagation	1	2	3	4	5
1	1	1	2	3	4
2	1	2	3	3	4
3	2	3	3	4	4
4	3	3	4	4	5
5	4	4	4	5	5

Leyend of Risk	
Very Low	1
Low	2
Medium	3
High	4
Very high	5

Prob of ignition \ Intensity of Propagation	1	2	3	4	5
1	1	1	2	3	4
2	1	2	3	3	4
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4	3	3	4	4	5
5	4	4	4	5	5

Leyend of Risk	
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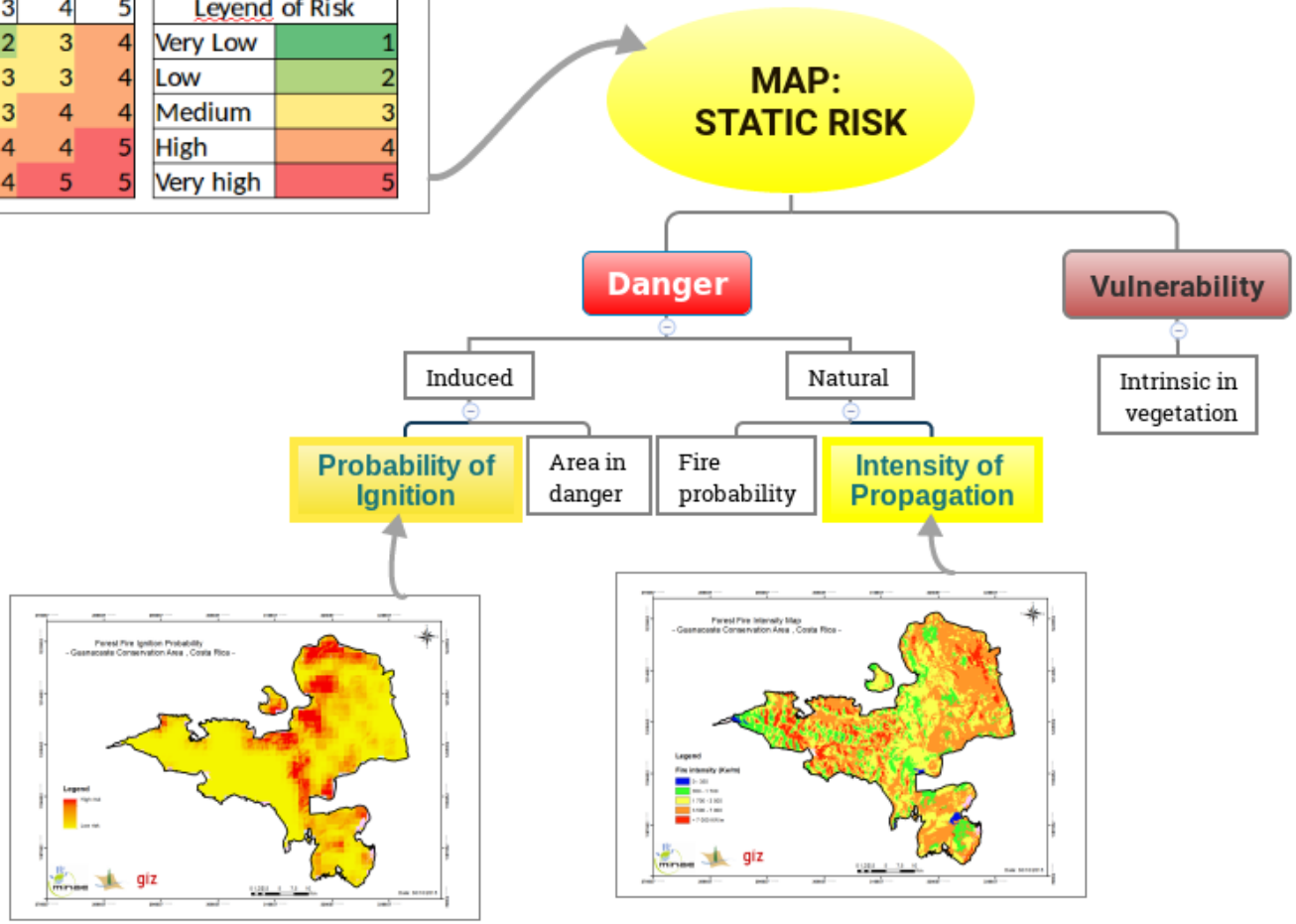
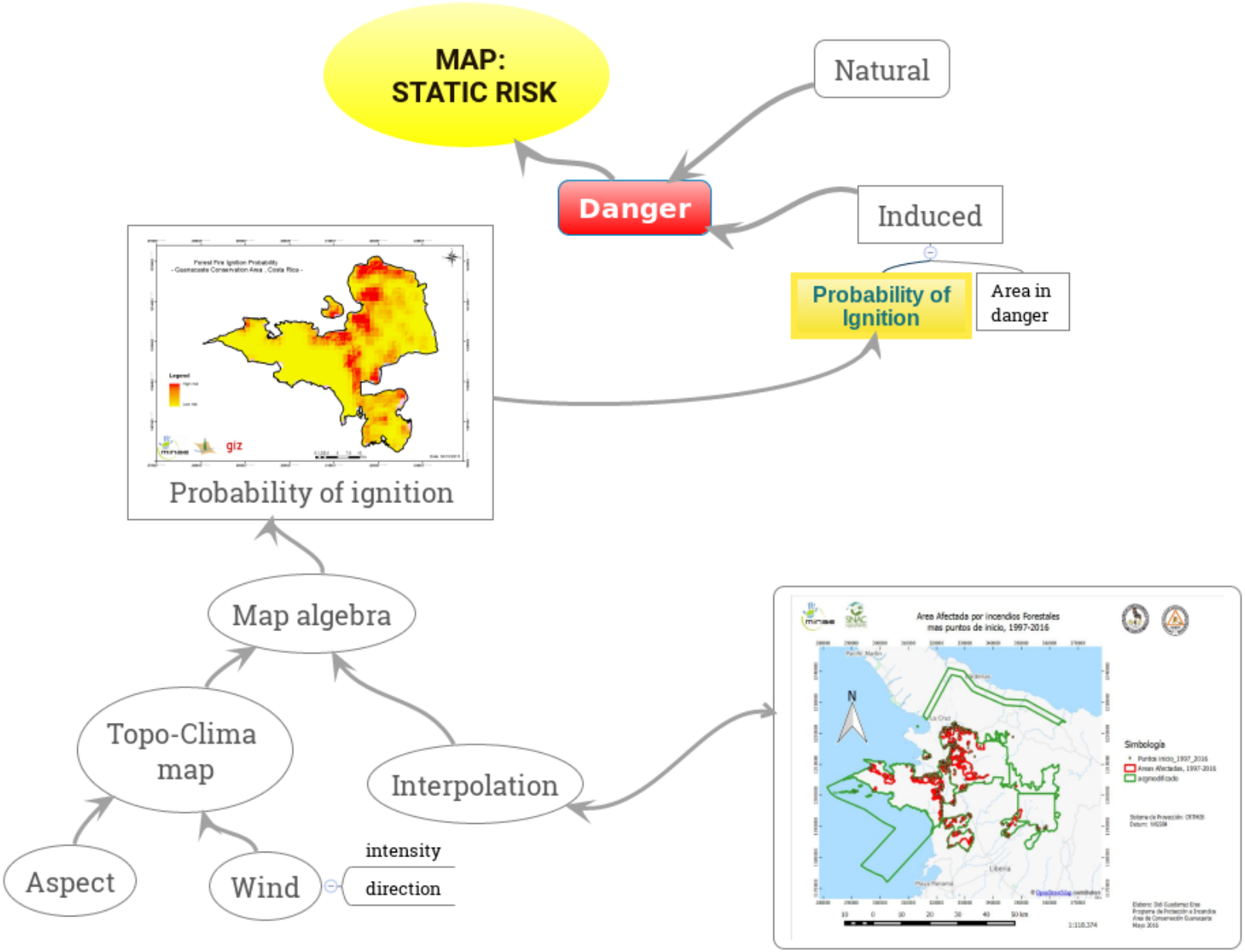
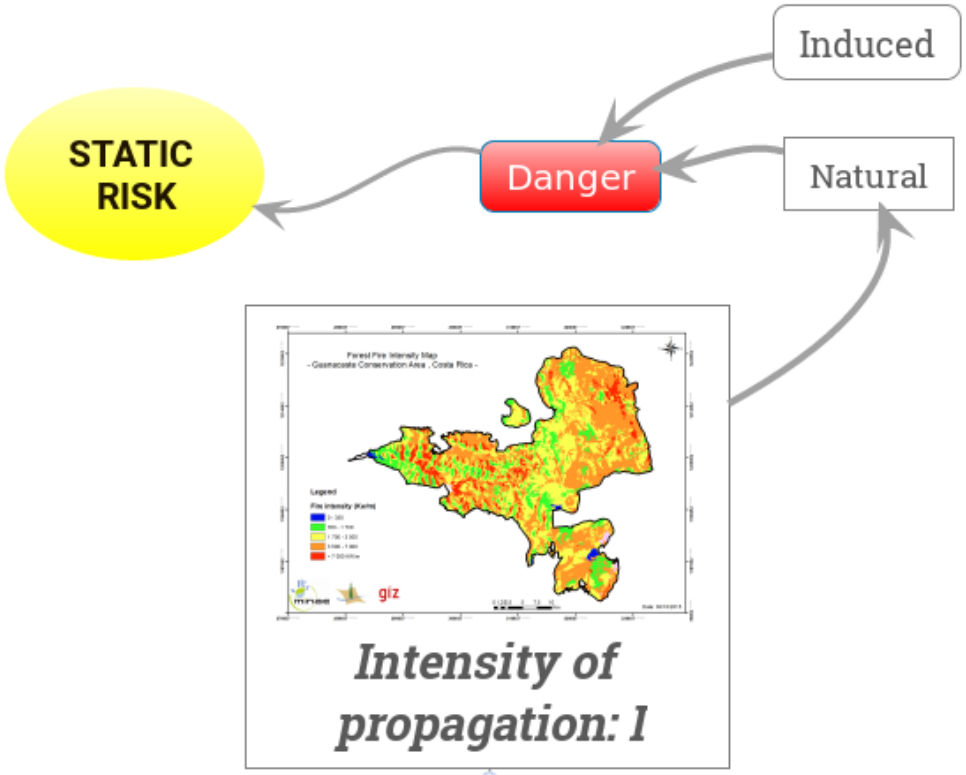



MAP:
STATIC RISK
Natural
Danger
Induced
Probability of Ignition
Area in danger
Probability of ignition
Map algebra
Topo-Clima map
Interpolation
Aspect
Wind
intensity
direction
Area Afectada por incendios Forestales mas puntos de inicio, 1997-2016
Simbología



$$I = C * Bio * Vp \qquad [\mathrm{kW\,m^{-1}}] \quad (1)$$

Where:

$$C = \text{Calorific power (constant)} \quad [\mathrm{J\,g^{-1}}] \quad (2)$$

$$Bio = \text{Consumable biomass} \quad [\mathrm{kg\,m^{-1}}] \quad (3)$$

$$Vp = \text{Speed of propagation} \quad [\mathrm{J\,g^{-1}}] \quad (4)$$

Speed of propagation
Fire star (physical model)
Vp

Where:

Vo = Initial prop. speed without slope or wind $[\mathrm{m\,s^{-1}}]$ (6)

H = Relative humidity $[\%]$ (7)

VV = Wind speed $[\mathrm{m\,s^{-1}}]$ (8)

DV = Wind direction [degress] (9)

Ex = Aspect [degress] (10)

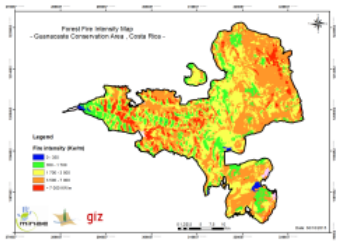
P = Slope [degress] (11)

$$Vp = 0.0025 * Vo(-0.02 * H + 10.5) * \ln(VV - 0.3) * \exp\left[0.07 * P * cos(Ex - DV)\right] \quad [\mathrm{m\,s^{-1}}] \quad (5)$$

RIESGO ESTATICO

Danger

Natural



Intensity of propagation (kw/m)

Formula:

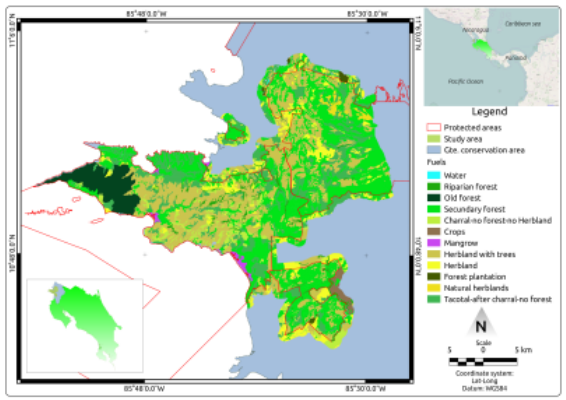
$$I_{(Kw/m)} = C_{(J/g)} \times B_{(kg/m^2)} \times V_{(m/s)}$$

B
(Kg/m2)
Consumible biomass

Formula

$$Biomasa = \Sigma\ ((Hi \times Ri \times Di \times Pi)/100) + ((0{,}05 \times Lx\ 1x5)/100)) + ((0.5xNx2x1)/100)$$

Species | Litter | Necromas



Fuels map

The dynamic map process

http://sarapiqui.imn.ac.cr/modelo/ACG/humedad.txt

http://sarapiqui.imn.ac.cr/modelo/ACG/humedad.csv

http://sarapiqui.imn.ac.cr/modelo/ACG/lluvia.txt

http://sarapiqui.imn.ac.cr/modelo/ACG/lluvia.csv

http://sarapiqui.imn.ac.cr/modelo/ACG/vientoU.txt

http://sarapiqui.imn.ac.cr/modelo/ACG/vientoU.csv

http://sarapiqui.imn.ac.cr/modelo/ACG/vientoV.txt

http://sarapiqui.imn.ac.cr/modelo/ACG/vientoV.csv

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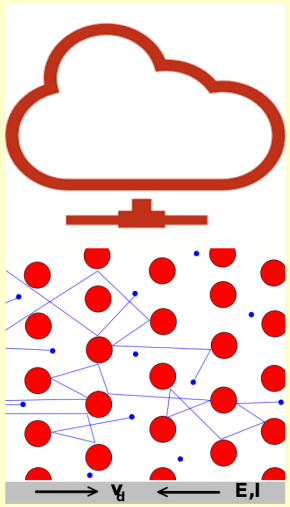
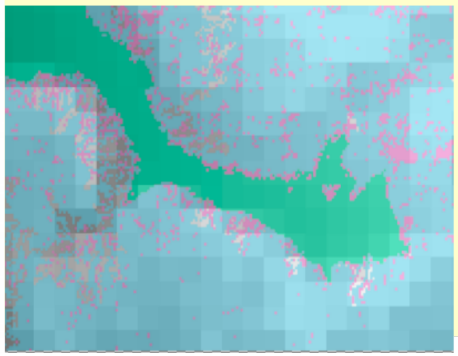
http://sarapiqui.imn.ac.cr/modelo/ACG/temperatura.csv



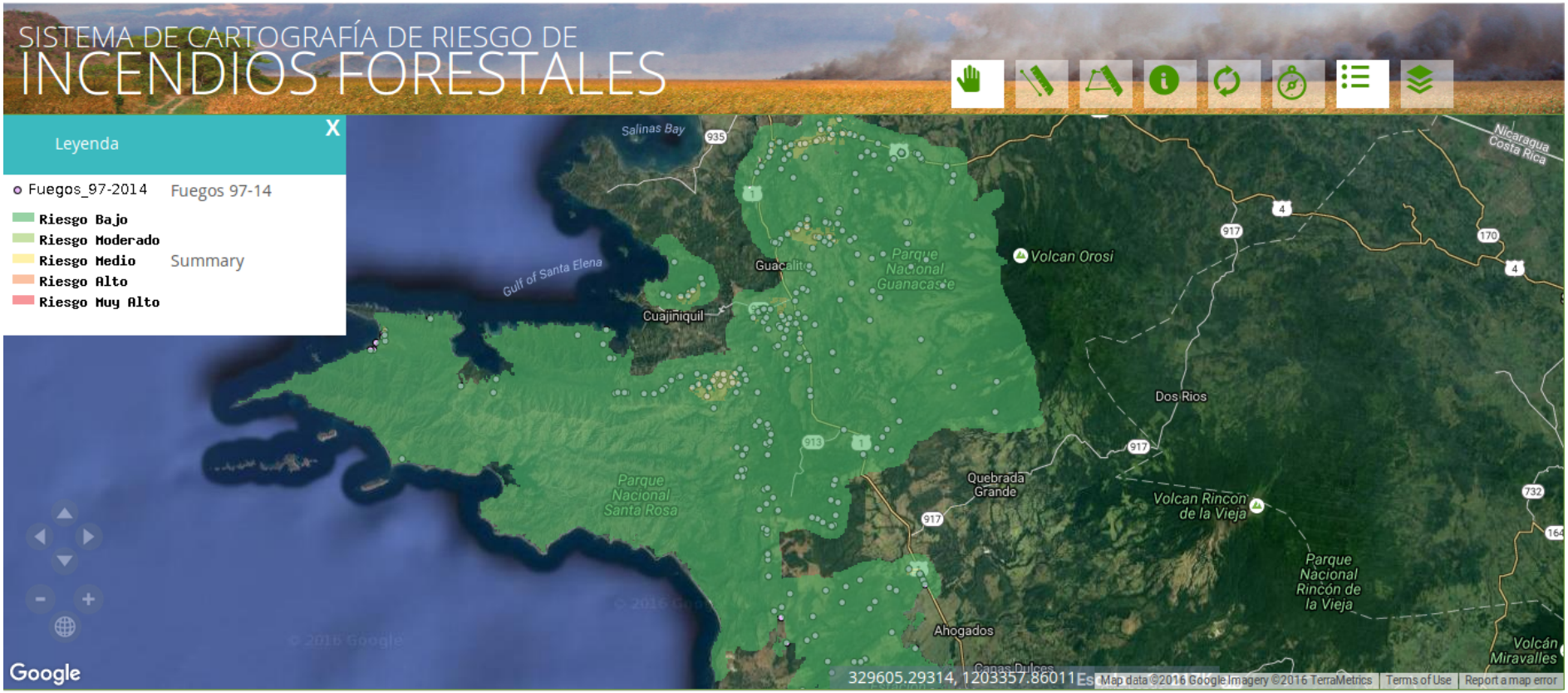
4 am

and



11 am

Available in: http://incendiosforestales.cr/



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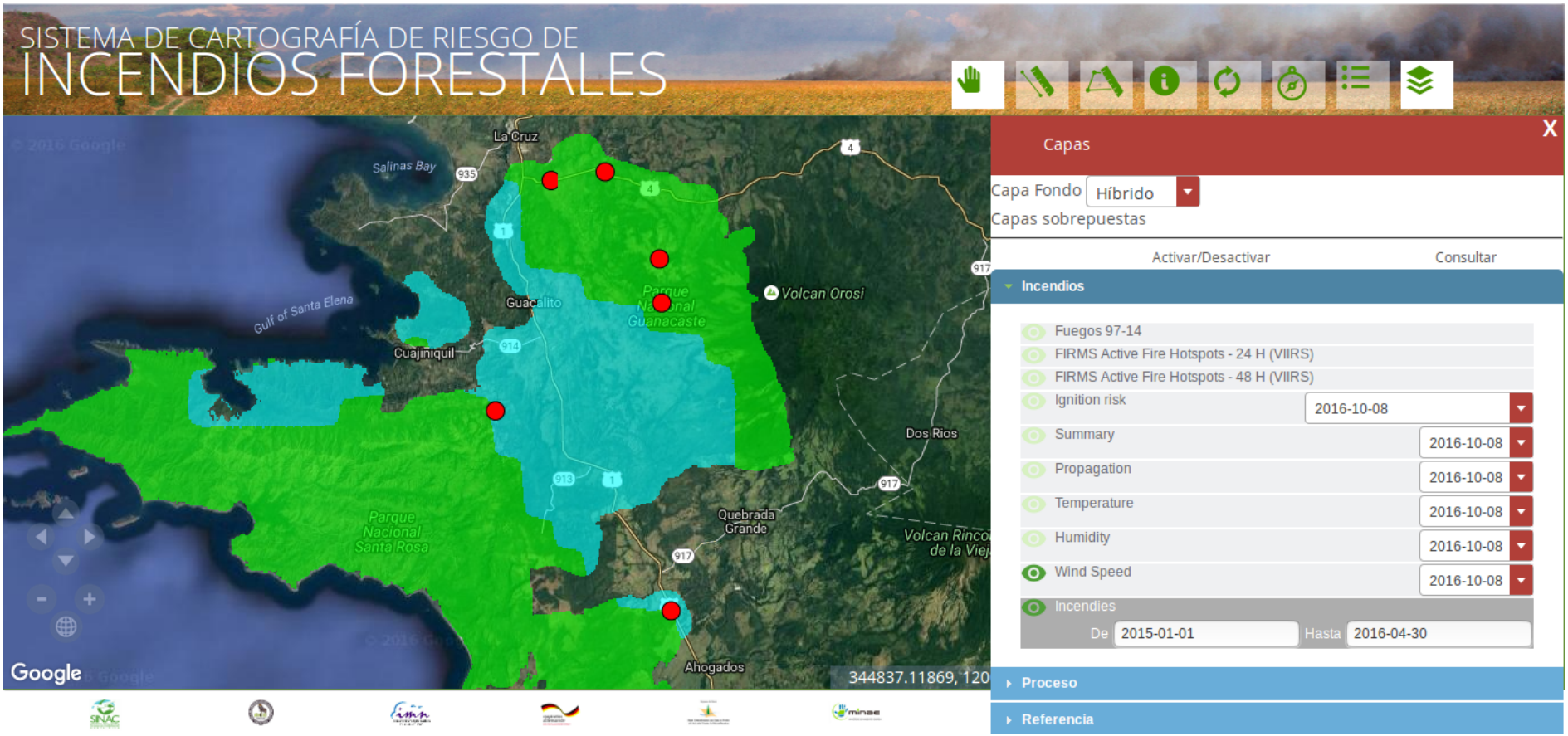

Muchas Gracias!