LARGE-SCALE EDGE EFFECTS IN TROPICAL RAINFORESTS AND THEIR IMPLICATIONS FOR CONSERVATION

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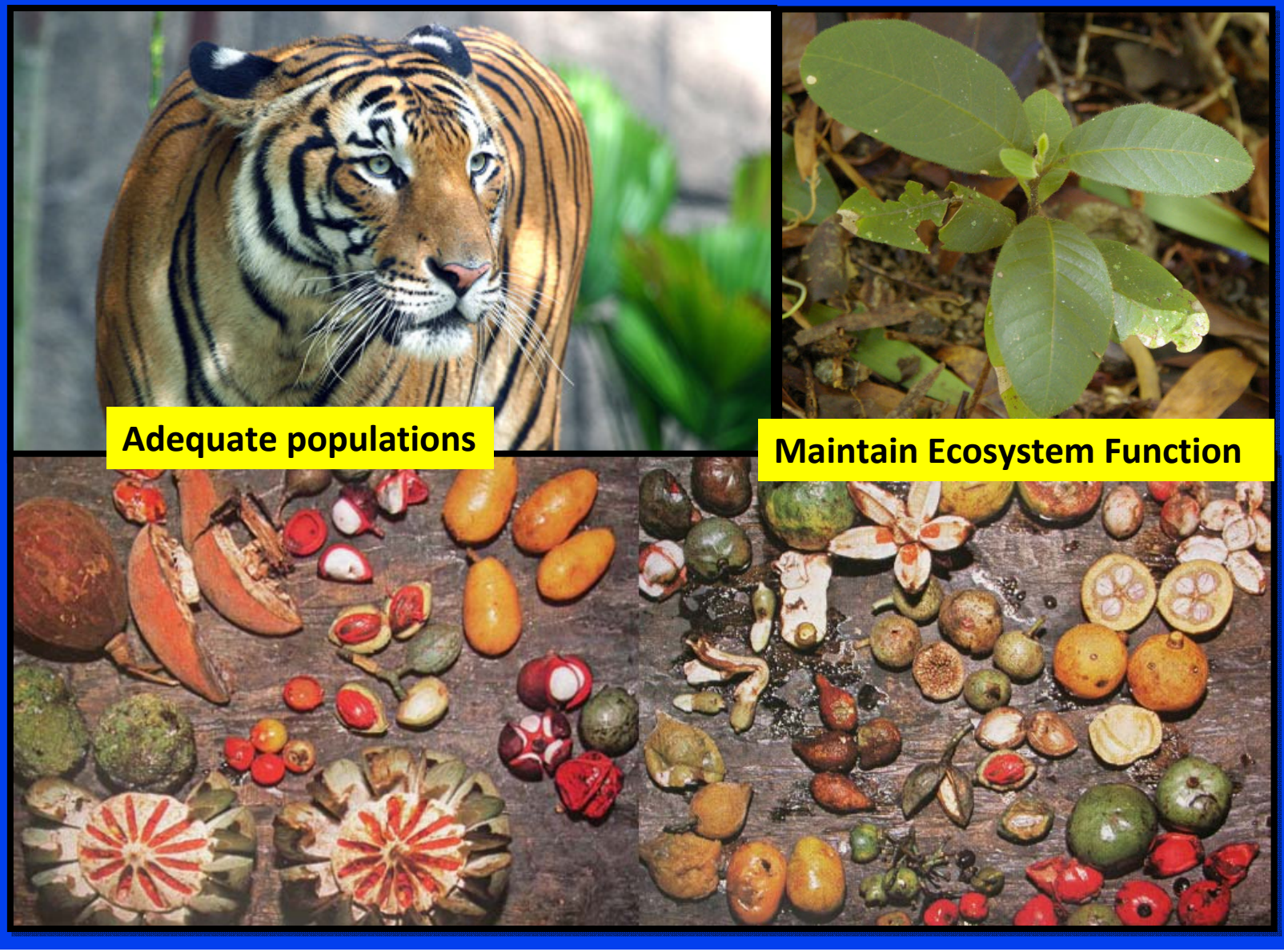
Conservation Assumptions of Protected Areas

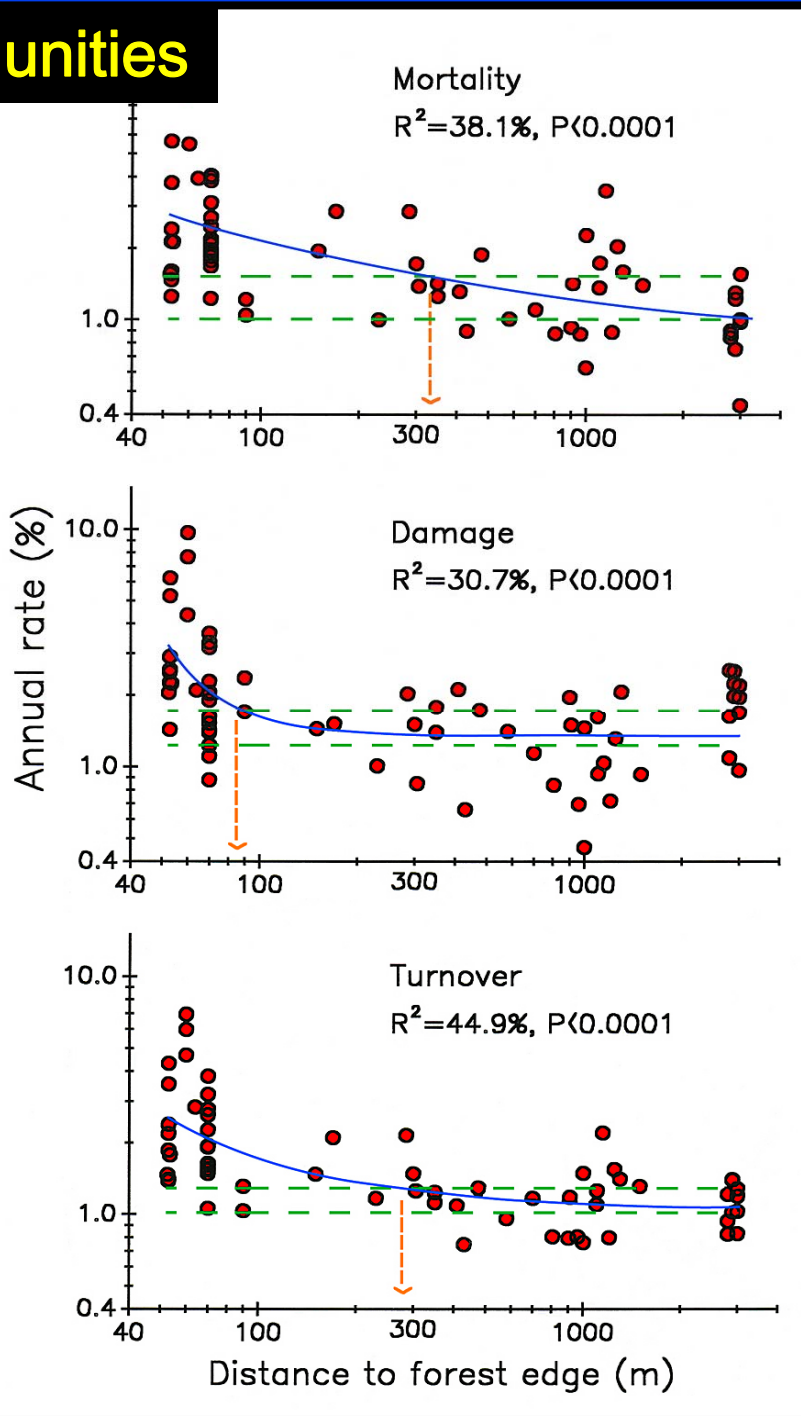


Are protected areas large enough to withstand external pressures?

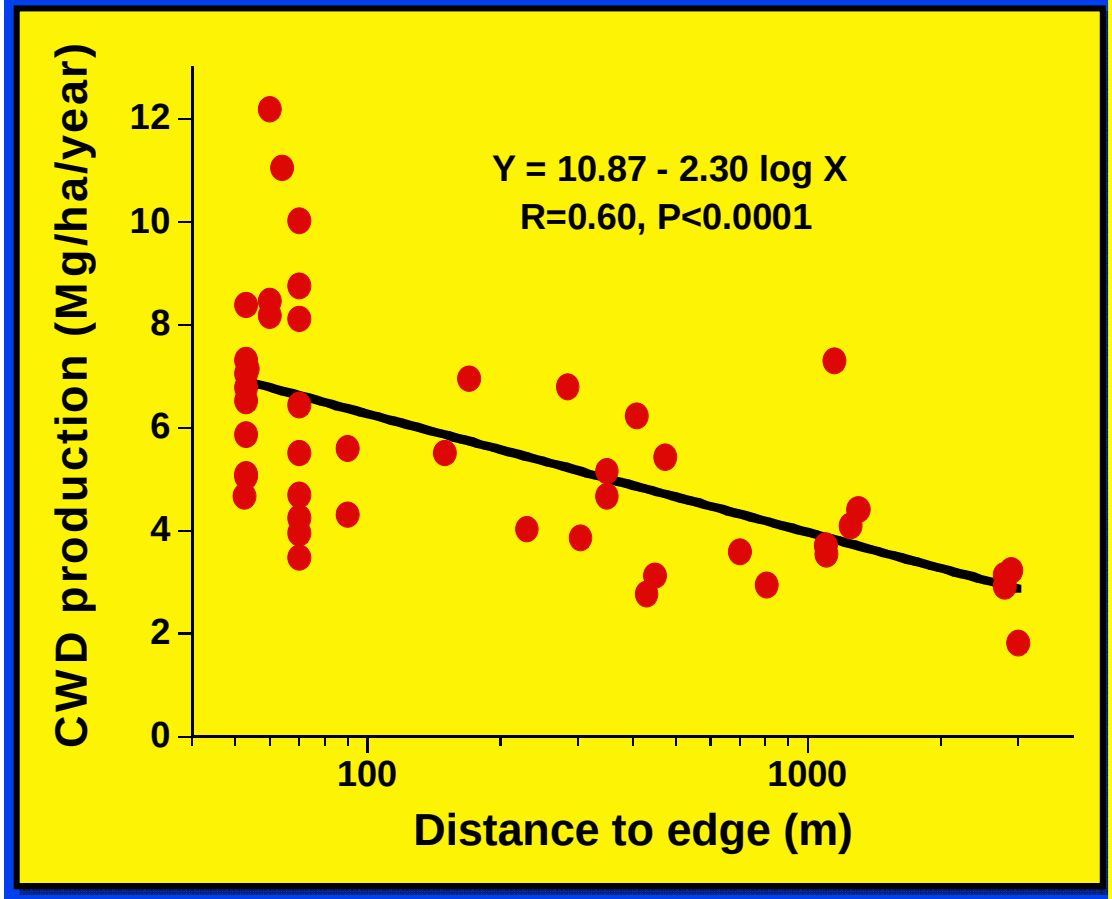
What is happening to rainforest trees on forest edges?

Edge-related changes in tree communities

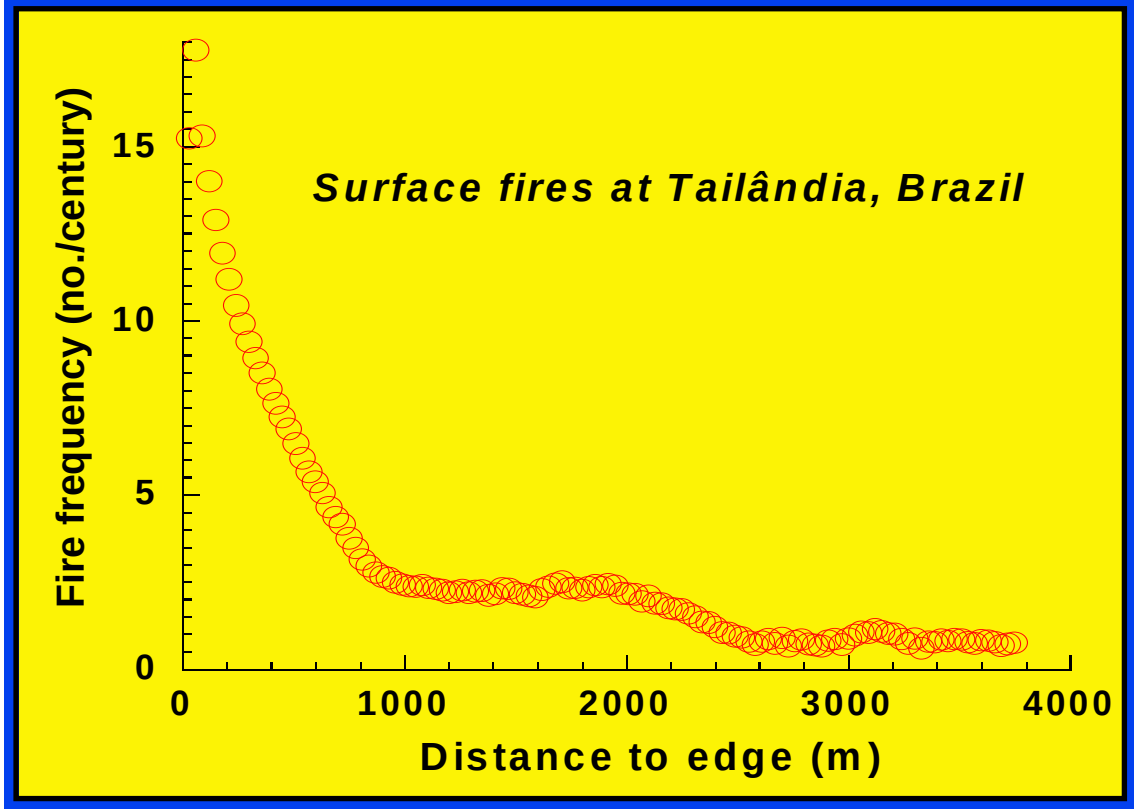
- Major increases in mortality, damage, and turnover within ca. 100 m of edges
- Detectable increases in mortality and turnover up to ca. 300 m of edges



Increased wood debris

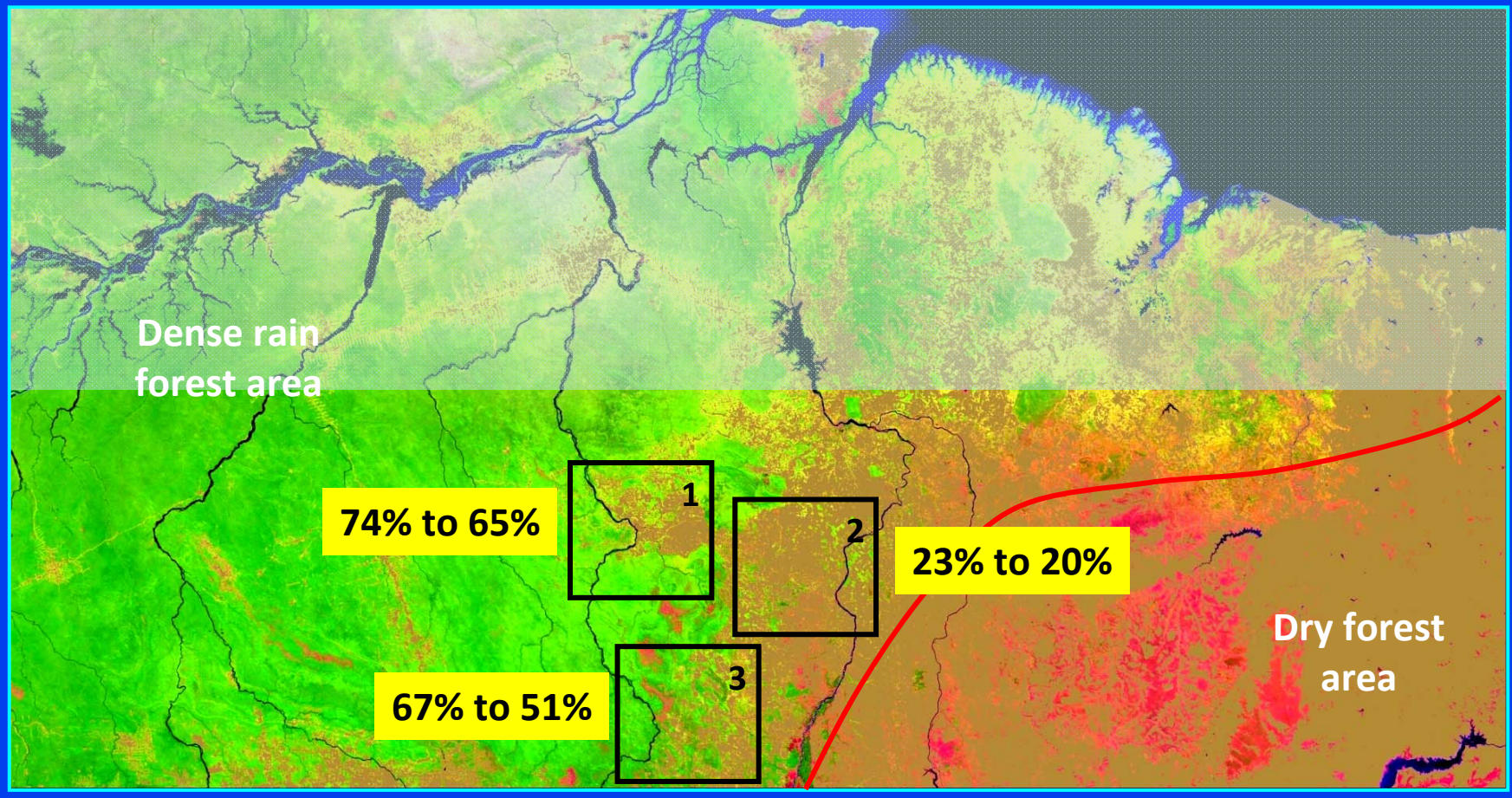


Increased fire incursion



Cochrane & Laurance (2002) *Journal of Tropical Ecology*

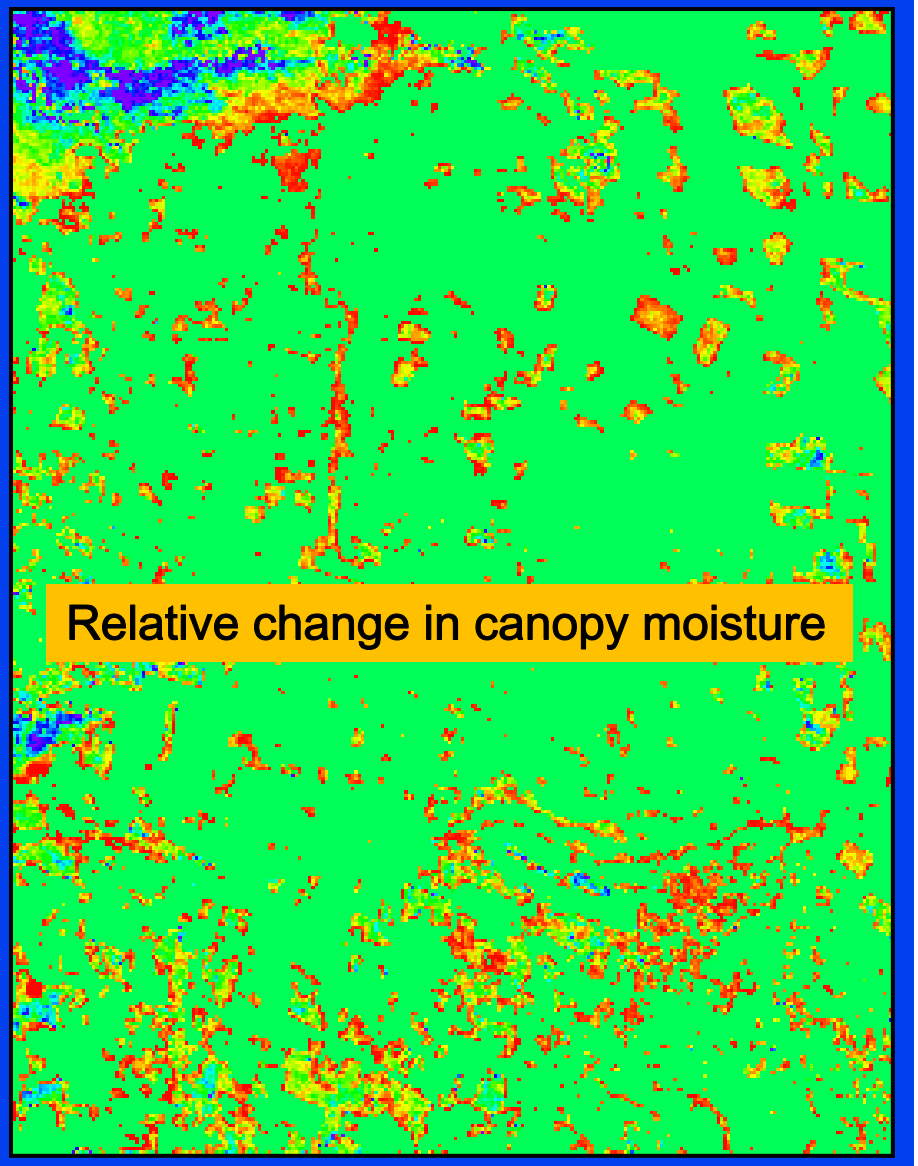
Large-scale desiccation of rainforest trees in fragmented landscapes



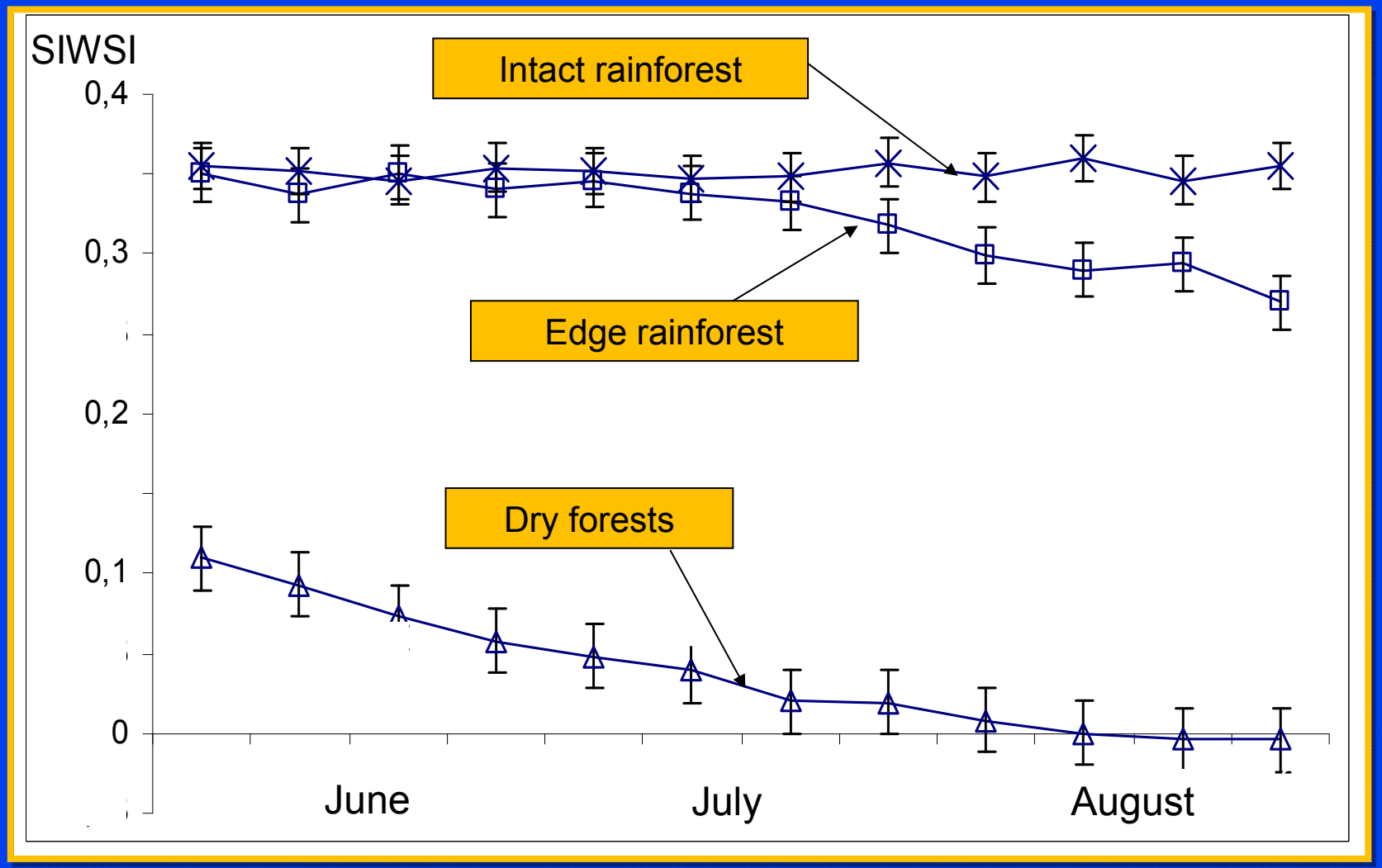
G. Briant, V. Gond & S. Laurance. 2010. Biol Cons.

Methods

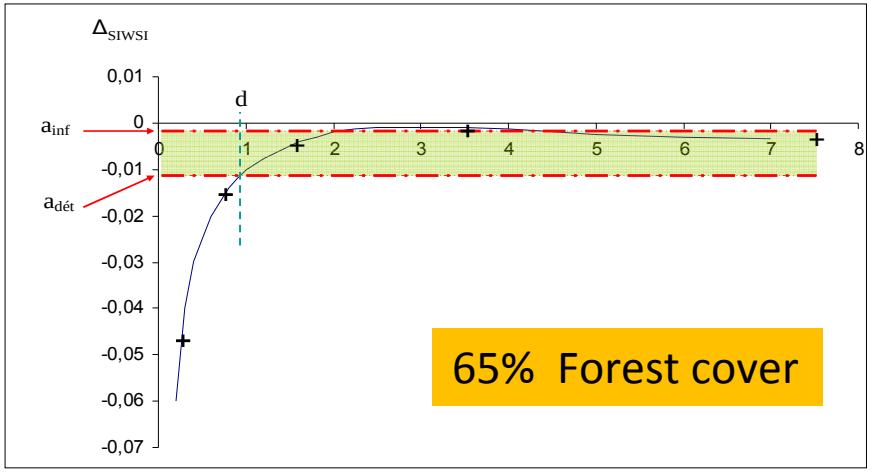
- **Tree canopy moisture**
  measured over dry season (June – August) ~ 8 years (2000-2007)
- **MODIS satellite images**
  12 x 8-day composites examined pa.
- **Leaf water canopy content**
  measured as SIWSI (Short-wave Infrared Water Stress Index) using spectral bands 2 (NIR:841-876 nm) & 6 (SWIR:1628-1652)
- **Five edge distances**
  0-500m, 500-1km; 1-2km & 2-5 km

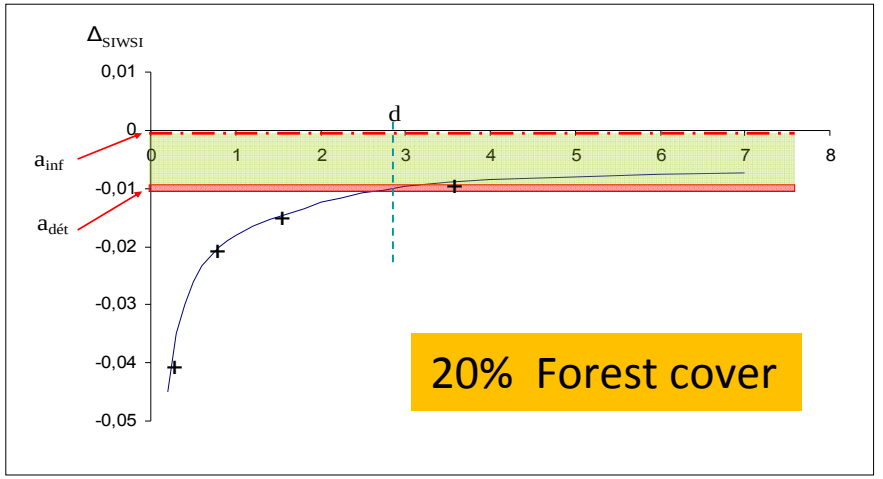


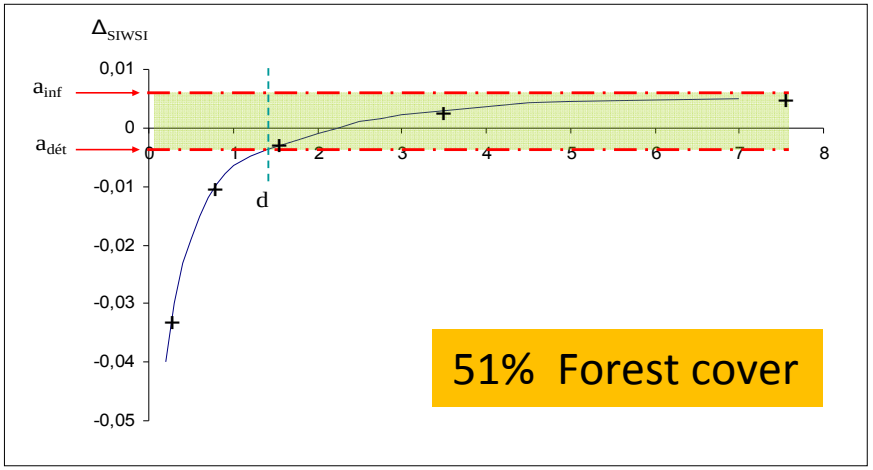
Results - Average dry season canopy desiccation rates of three forest types



1) Landscape fragmentation influences the *spatial extent* of desiccation

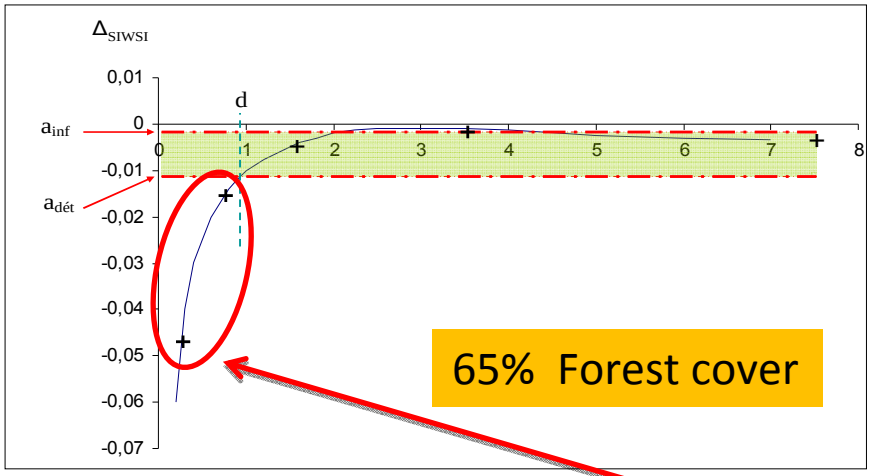


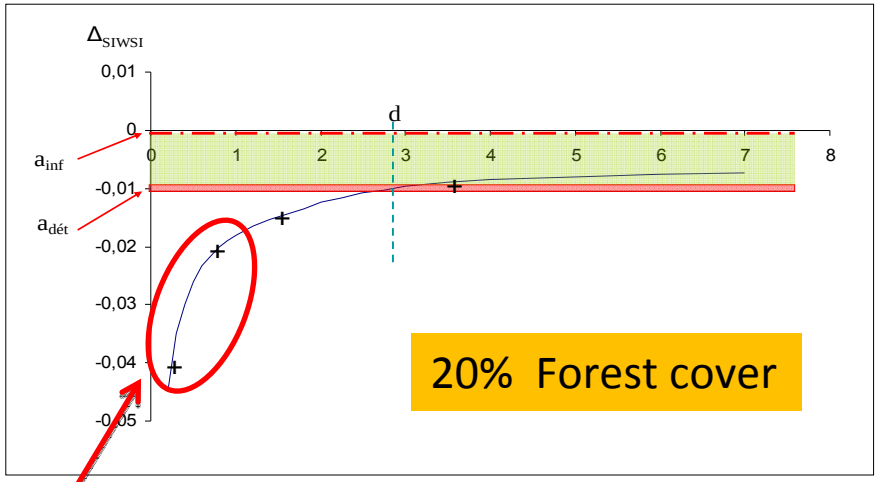


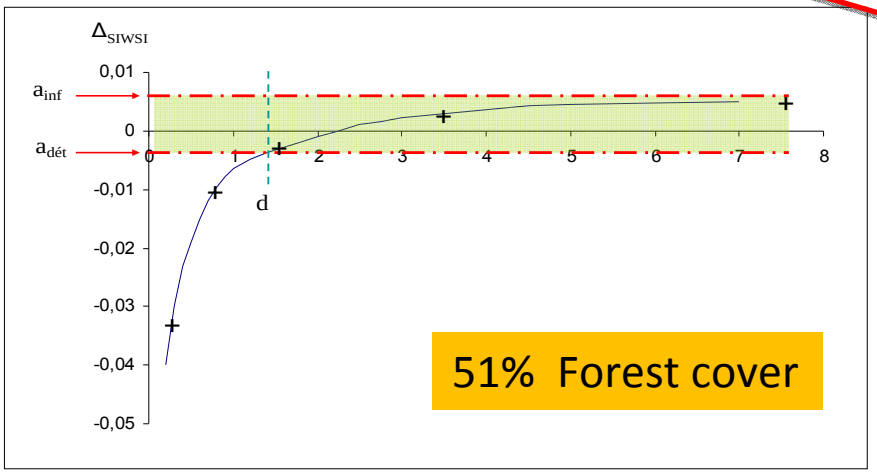


Site 1 and 3 edge penetration distance (d) observable desiccation to <u>1 & 1.5 km</u> from edge;
Site 2 up to <u>2.7 km</u>

2) Landscape fragmentation influences the *magnitude* of desiccation

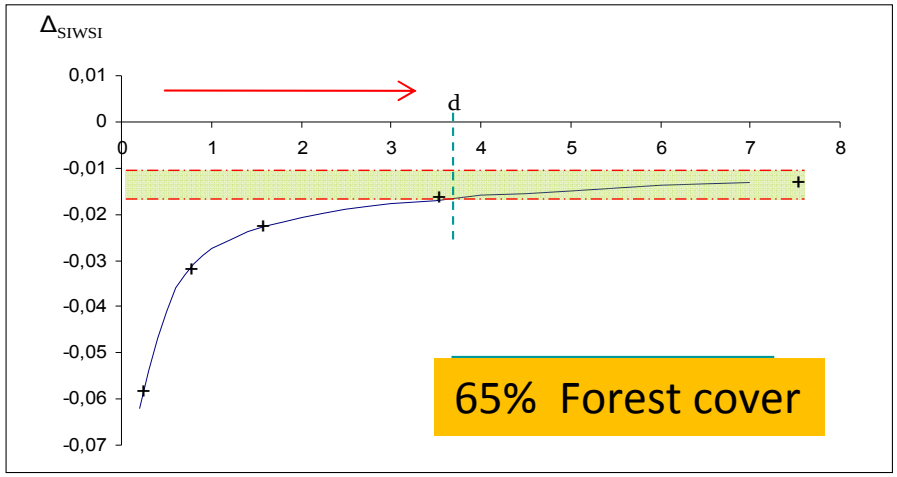


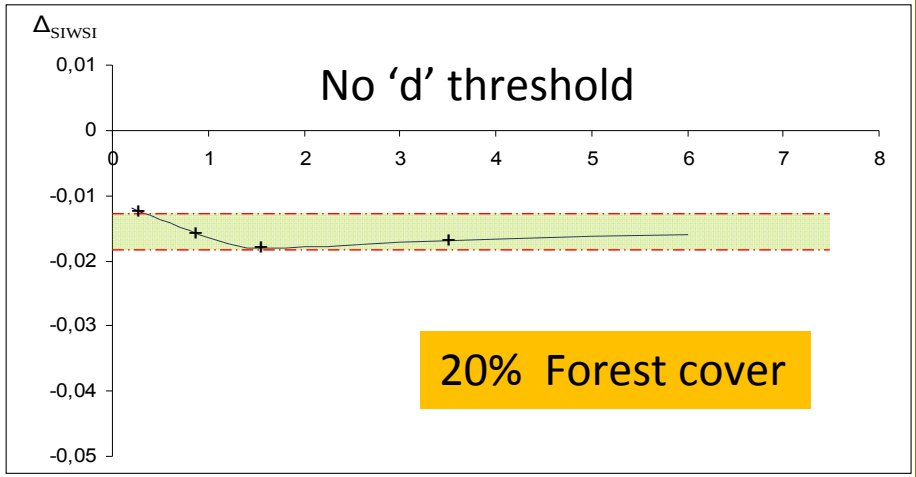


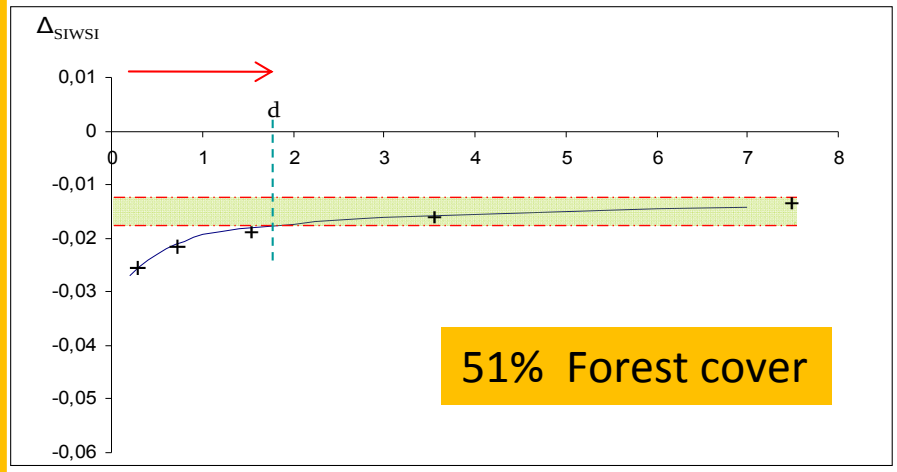


Steepness of the edge-interior gradient: New edges Sites 1 & 3 had steepest gradients, but after 1 km little change; Old edges Site 2 had lower canopy moisture but the gradient longer and flatter with strong differences evident at 500m-1km and 1-2km.

3) Landscape fragmentation influences the *progression* of desiccation







Site 1 & 3 showed increased desiccation distance to 3.7 & 1.8 km

Site 2 showed no change – fragments are "saturated" by edge effects

Four main effects of deforestation on dry season canopy desiccation

1) Intact forest show no detectable change yet edge forests declined significantly in canopy moisture
2) Penetration distance of canopy desiccation differed among heavily and moderate fragmented landscapes
3) Magnitude of canopy desiccation differed among fragmented landscapes
4) Progression of canopy desiccation occurred in moderate fragmented forest over time but not in heavily fragmented landscapes

IMPLICATIONS

Intact rainforests in eastern Amazonia exhibit a **strong resilience** to prolonged dry season (typical of this region) - with no detectable changes in canopy water during this study.

IMPLICATIONS

Once fragmented these forests showed large changes in canopy water that extended deep into the forest. Such patterns of desiccation predispose fragmented forests to fire potentially leading to the loss of millions of hectares of forest.