Long-term studies of phenology and vegetation dynamics in Lopé, Gabon: *monitoring the impact of climate change in the rain forests of Central Africa*

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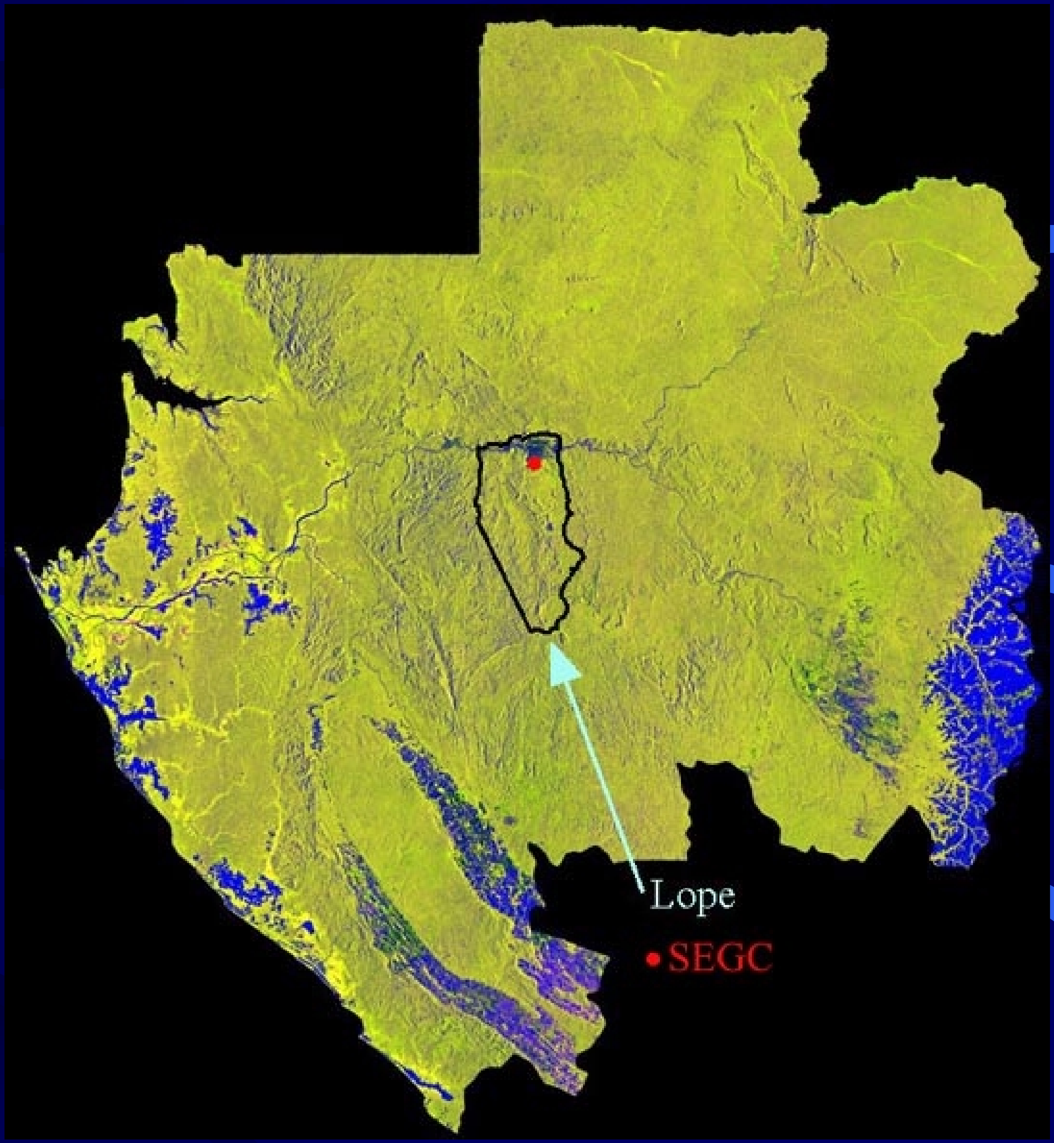
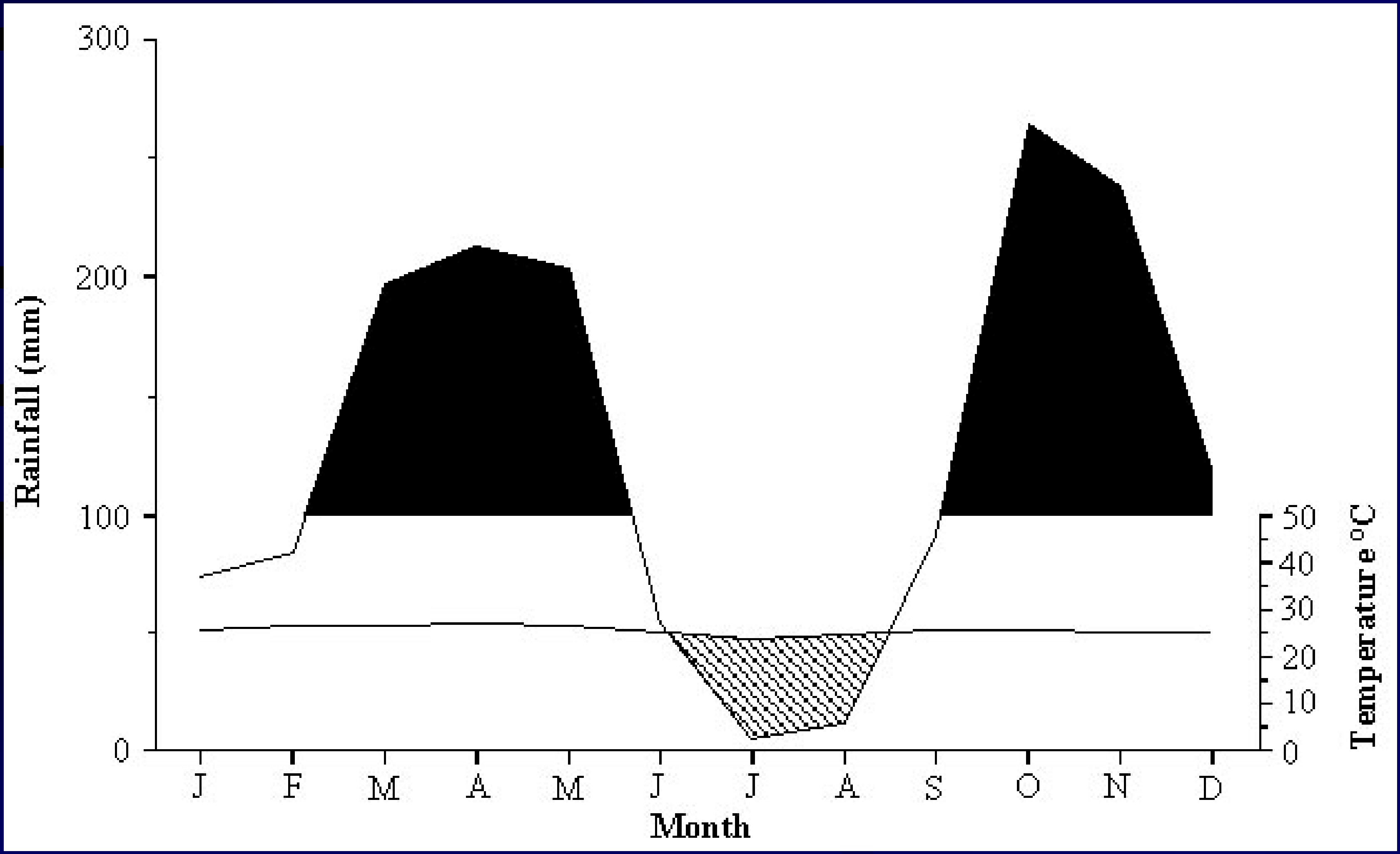
Lopé, Gabon

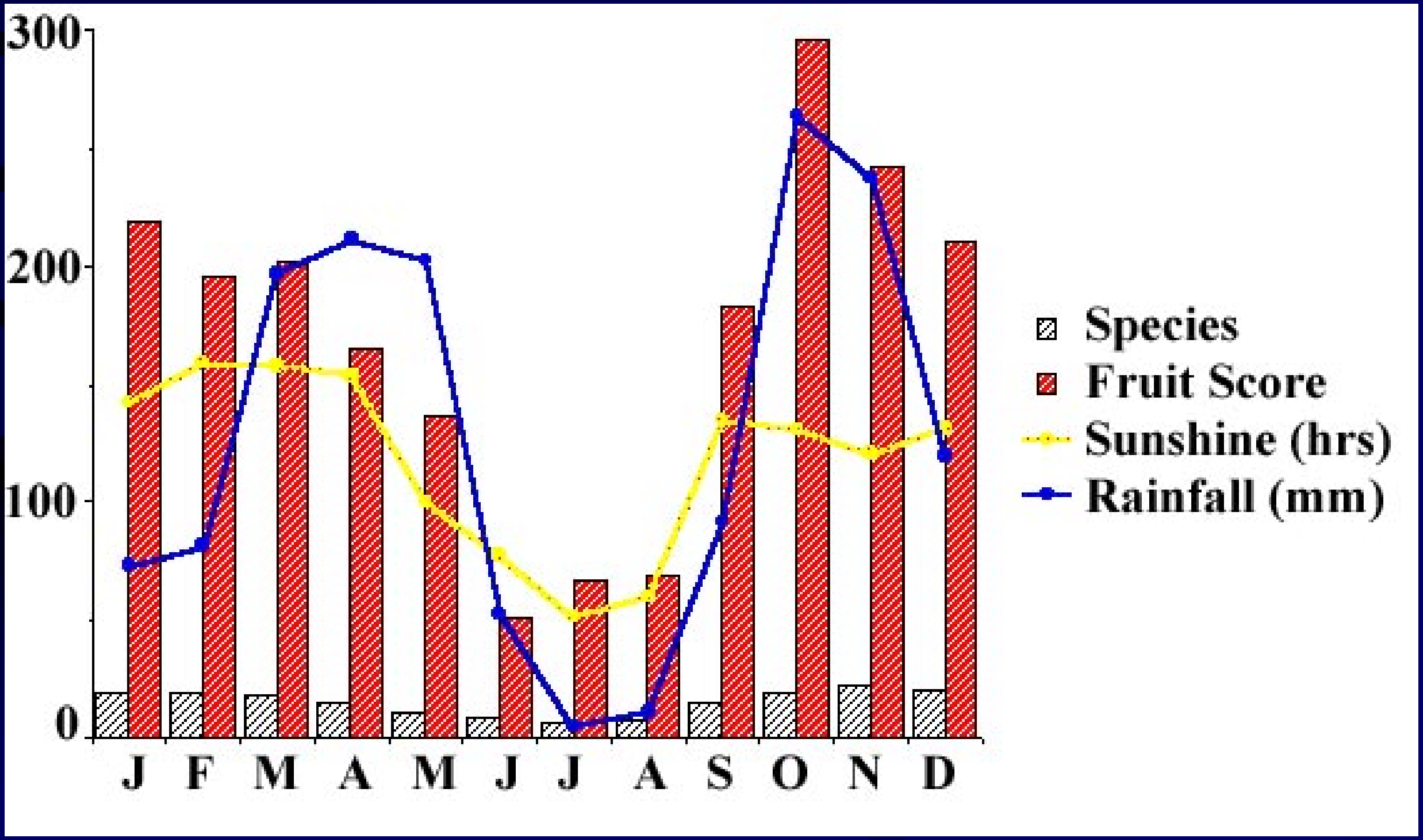


Vegetation Map of Gabon Derived from JERS-1 Radar Image Mosaic. Saatchi et al., (in prep)

Climate at Lopé, (1983-1999)



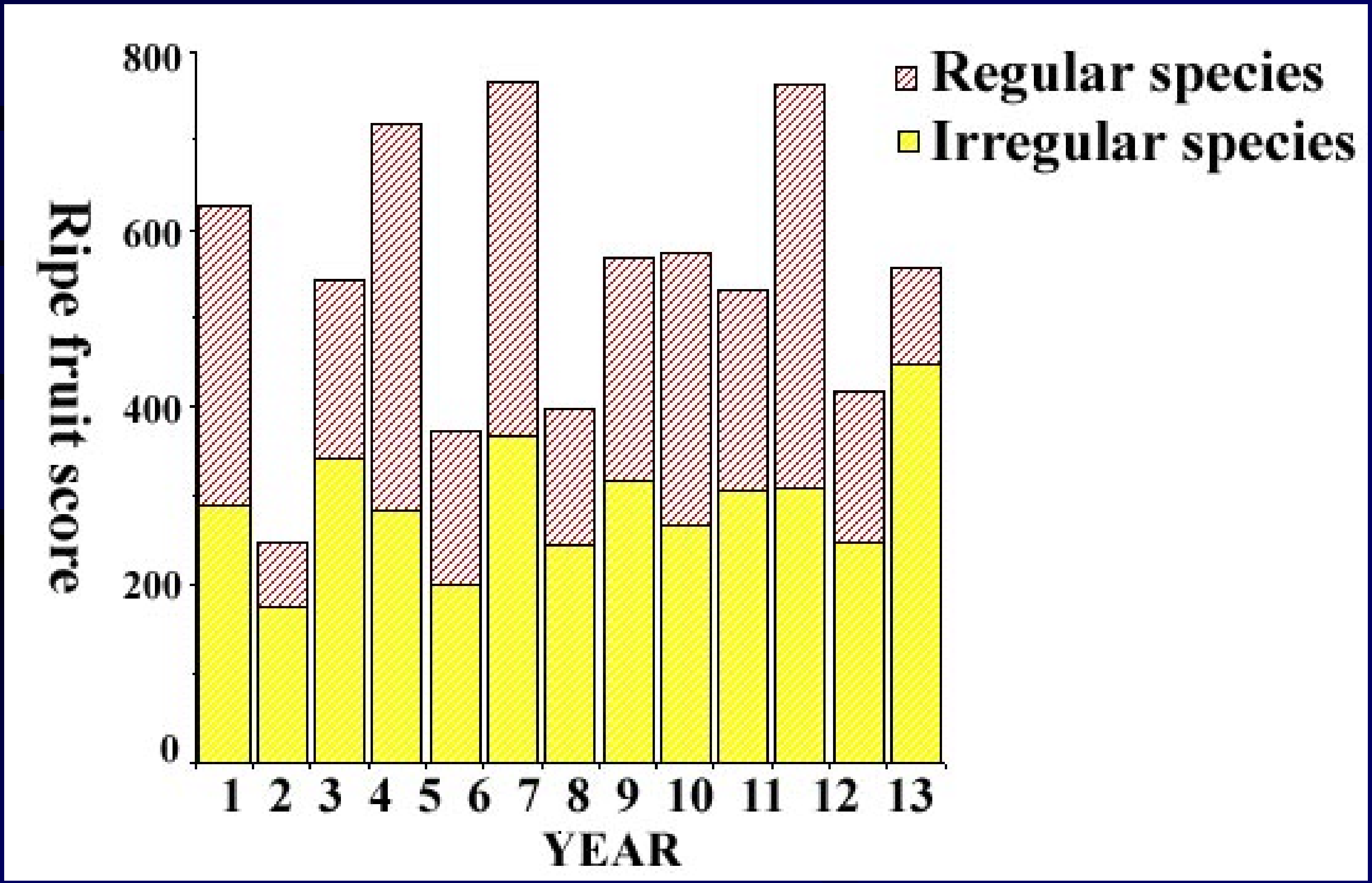
Impact of rainfall and sunshine on fruit production



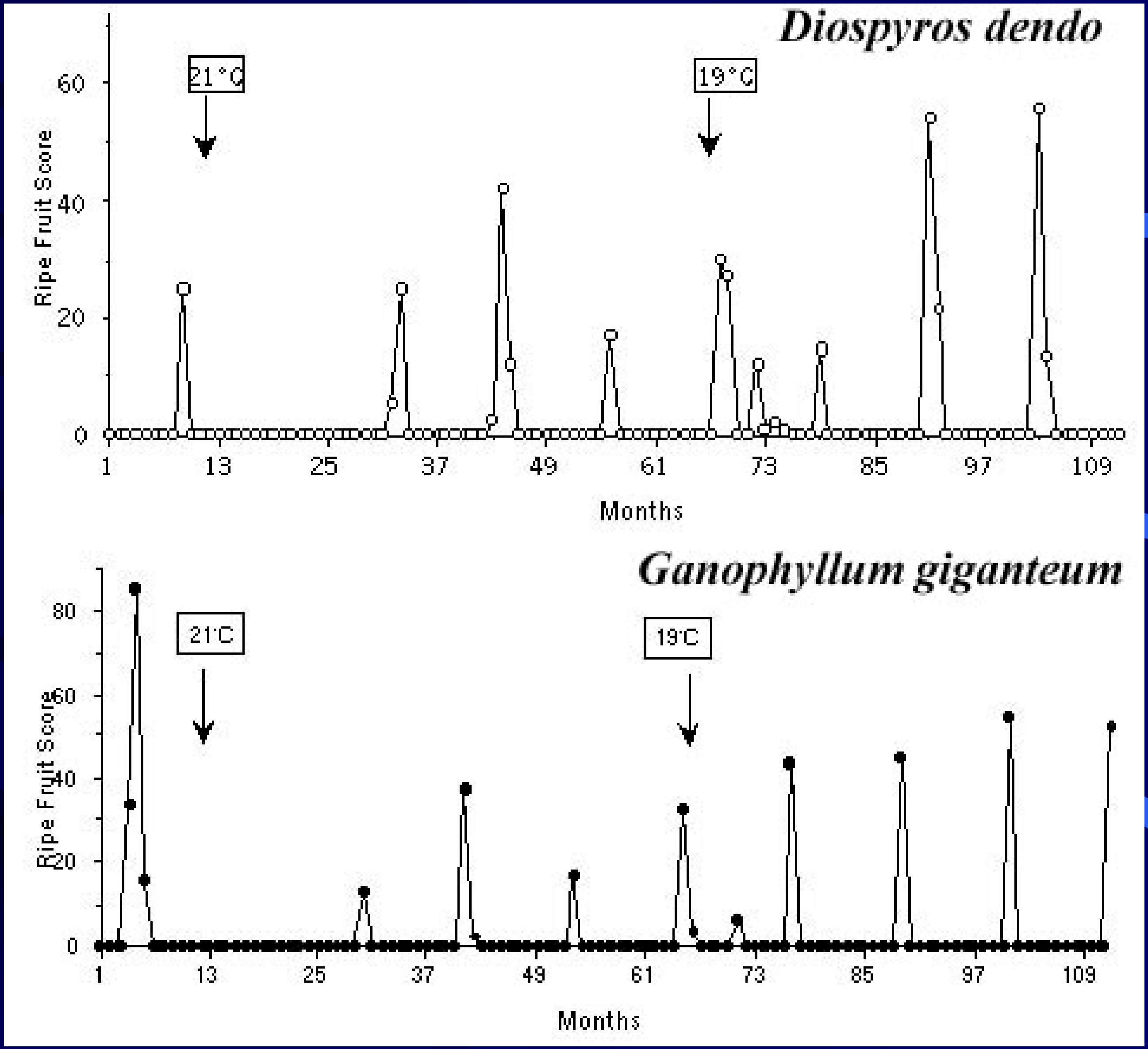
The graph above shows that ripe fruit is scarce during June, July and August. This corresponds to the long dry season when both rainfall and hours of sunshine are minimal. During the minor dry season months of December, January and February, the quantity and diversity of fruit remain high. These data suggest that both rainfall and sunshine influence fruit ripening, but that sunshine is the key climatic variable in these broad patterns. Hours of sunshine is the only climatic variable that correlates significantly, and positively, with both diversity and abundance of ripe fruit. This pattern holds for the entire plant community at Lopé (see White, 1994); for the 65 species monitored in this study; and for the 26 important species (see Tutin & White, 1998).

Fruit production by about half the species monitored is regular and appears to be driven by strong endogenous rhythms linked, in a general way to climate. The other half are irregular and do not fruit consistently every year. We suspect that exogenous, i.e. climatic, factors play a more direct role in triggering flowering (and thus fruit production) in the group of tree species that reproduce irregularly. It also appears that both regular and irregular species are subject to physiological "fatigue" as illustrated in the graph below that illustrates inter-annual variation in the quantity of fruit produced. While alternation between "good" and "bad" years shows no clear rhythm over the whole study period, the four best years (1, 4, 6 & 11) were each followed by a "bad" year when relatively little fruit was produced (Years 2, 5, 7 & 12).

Inter-annual variation in fruit production



Effect of dry season temper-ature on fruiting patterns



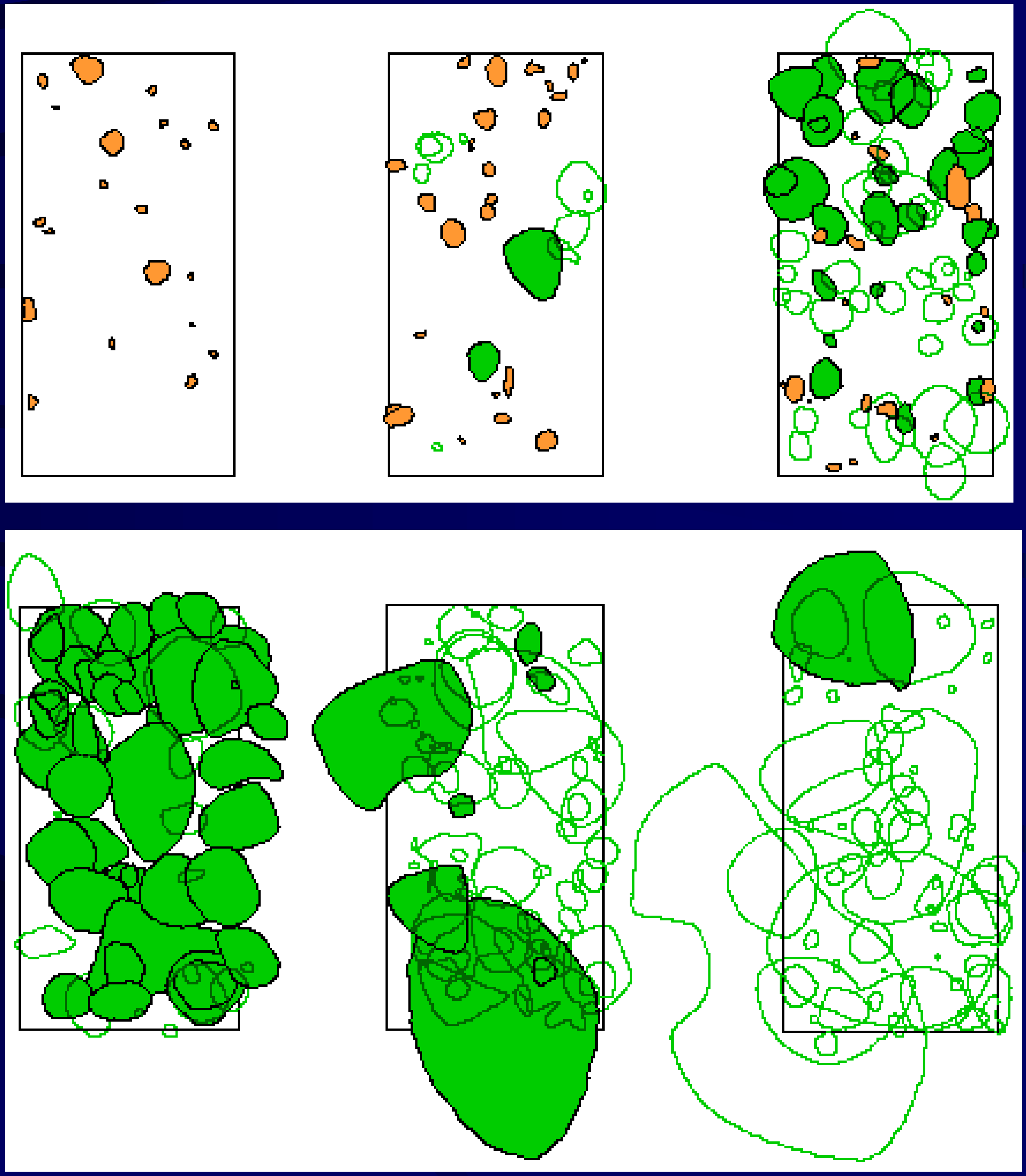
Mortality rates in six botanical samples followed for 10 years.

Transect	N(1)	% Mort. 1990	N(2)	% Mort. 1994	% Mort. 10 years
1	361	1.39	331	2.27	2.08
2	230	1.09	215	1.28	1.20
3	338	1.08	316	1.74	1.63
4	421	2.30	363	2.48	2.14
5	187	1.69	168	1.93	1.74
6	396	1.46	370	1.99	1.86

Savanna colonisation

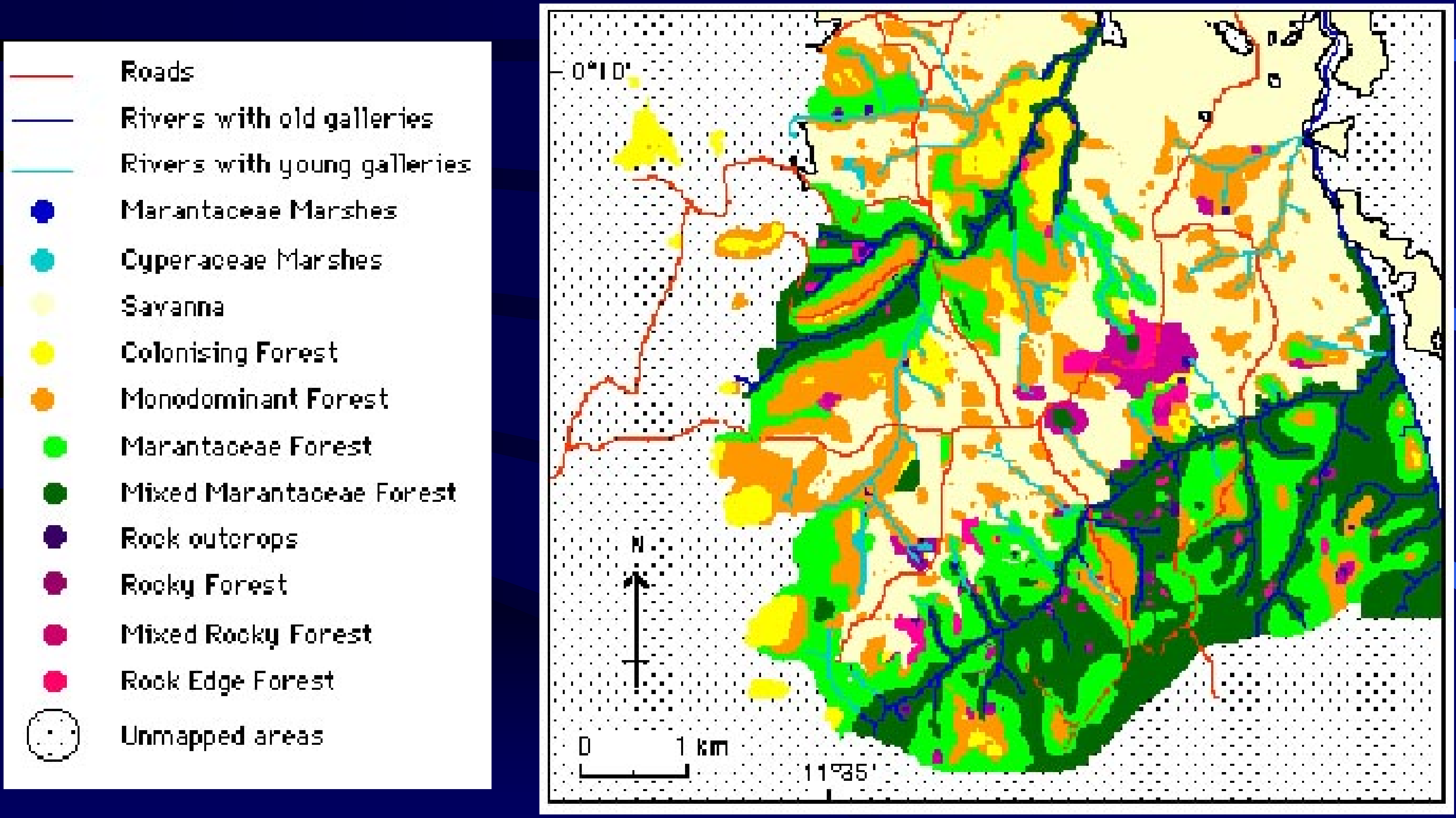
Vertical projections of all canopies of trees and lianes with dbh>5 cm in 40x20m plots in burnt savanna, unburnt savanna, colonising, monodominant, Marantaceae and mixed Marantaceae forest types.

(clockwise from top left)

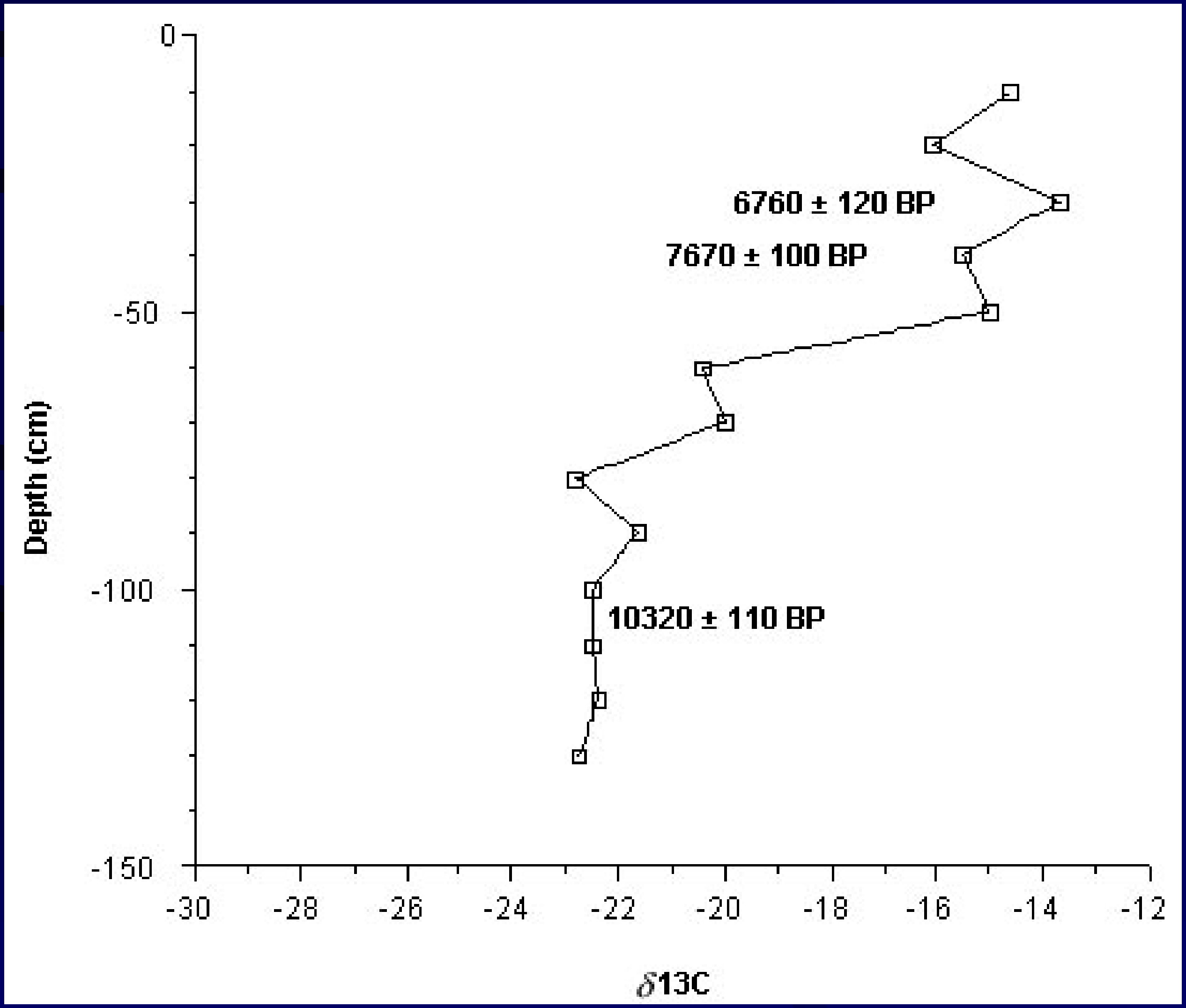


Vegetation classification

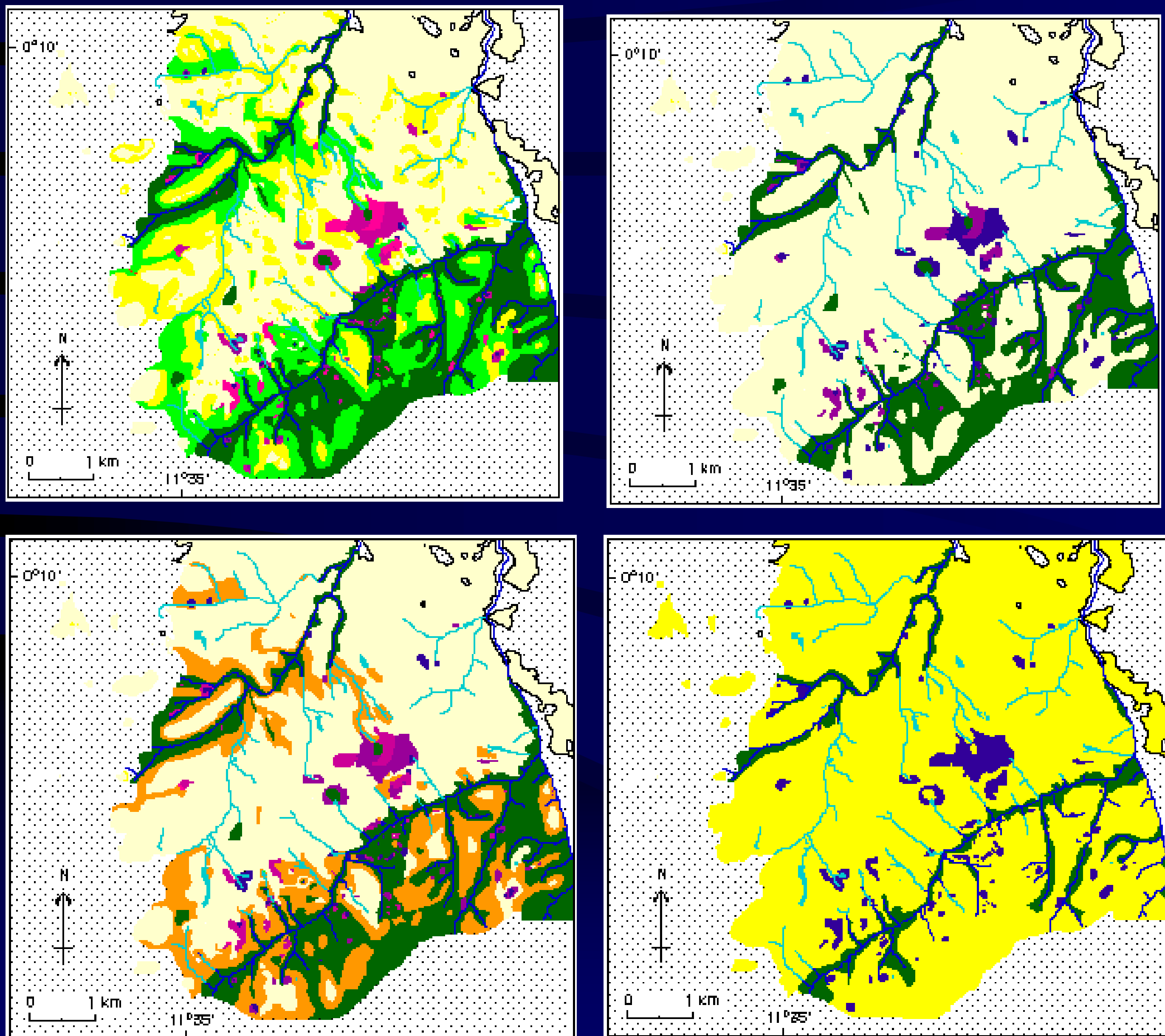
Vegetation mapping



Age of vegetation types from isotopic analyses



Modelling vegatation change



Model of Lopé vegetation 75 years ago (top left), 250 years ago (bottom left), 700 years ago (top right) and 1400 years ago (bottom right)

Potential contribution of Lopé

- Good quality weather data
- Long-term monitoring of phenology - an early warning system?
- Transects / plots with over 10,000 trees tagged, measured and identified; regular remeasurements of mortality, turnover, growth rates.
- Vegetation dynamics, savanna colonisation, permanent plots to measure biomass increases.
- Using past changes to predict the future.