Archaeology and conservation in the tropical forests of the Central African Republic

October 5 2015, by Chris Kiahtipes

FIGURE 1: View of Lobaye River in Ngotto Forest, CAR. Credit: C. Kiahtipes

The tropical forests and savannas of Africa play a central, symbolic role in our modern dialogue about wilderness, conservation, and land management. However, efforts to establish reserves, parks, and wilderness areas often create conflicts with local societies who use the territory for subsistence as laborers, cash-croppers, pastoralists, horticulturalists, or hunter-gatherers. One of the major stumbling blocks for biological conservation in the African tropics is that we know little about the history of the region, which has important implications for our understanding of its ecosystems.

Before a coup d'etat toppled the government of the Central African Republic (CAR), I participated in three field projects in a forest reserve in the southern part of this little-known country where I was collecting archaeological and ecological data for my dissertation. Our team of American and African researchers recently published a piece in *PLOS ONE* titled "On Intensive Late Holocene Iron Mining and Production in the Northern Congo Basin" which described the results of our work in the region. Our research documents the development of a previously unknown iron-producing industry in the rain forest zone of Central Africa, its impacts on rain forest vegetation, and its collapse during French colonization.

Bridging the gap between history and prehistory

Our team of American and African archaeologists completed archaeological surveys and test excavations in the Ngotto Forest Reserve, located on the CAR's southern border, near the Republic of Congo (see Figure 2). This forest is a fascinating field site for a number of reasons: the region is still occupied by hunter-gatherer societies who live

alongside subsistence agriculturalists; the forest contains enclosed "islands" of savanna woodland surrounded by dense rain forest; and satellite photos indicate that between 1976 and 2002 forested area has increased by 5.6%. Together these features point to past disturbances in forest cover and social reorganizations among local populations. These unique cultural and ecological features have attracted ethnographers and ecologists to the region, but almost nothing is known about how or when the modern forest's social and ecological milieu came to be.

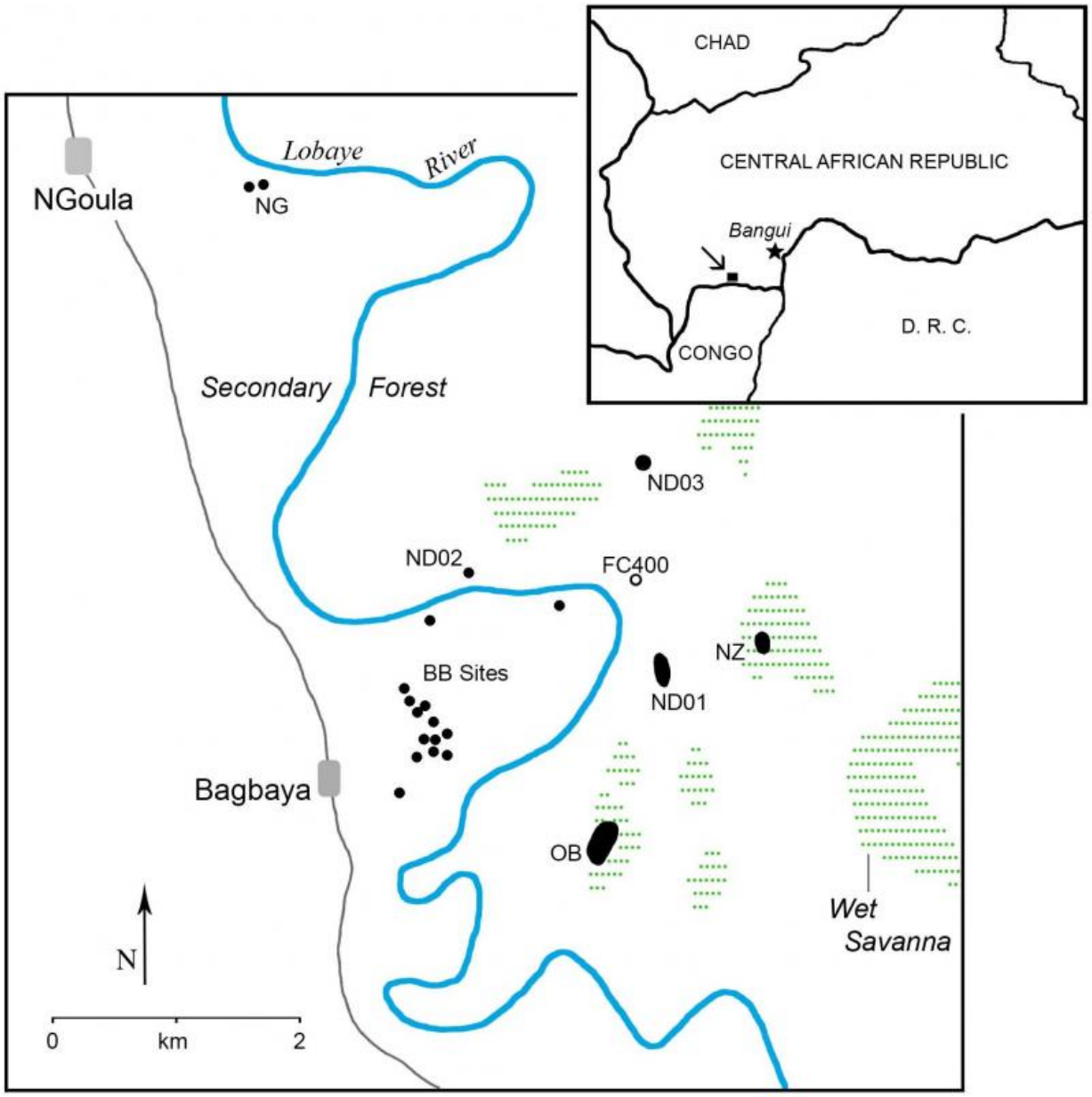

FIGURE 2. Map of Study Region in CAR from Lupo et al. (2015) showing archaeological sites (black circles/ovals) and one of the coring locations (open circle).

I specialize in archaeological palynology, a field dedicated to the recovery and analysis of plant pollen from sedimentary sequences and/or

archaeological sites. Plant pollen is made from sporopollenin, a durable organic compound that is well preserved in inundated conditions, such as swamps or lake bottoms. Because plants produce diagnostic pollen types, the preserved pollen can be used to reconstruct vegetation cover from sedimentary records. I hypothesized that because rivers are essential to both ecological and cultural activities, their marshy floodplains would provide both the appropriate conditions for pollen preservation and a locally-specific record of vegetation change sensitive to human impacts. This approach seeks to bridge ecological and cultural histories in the Ngotto Forest by documenting vegetation responses to prehistoric cultural developments, such as the adoption of slash-and-burn farming methods or iron metallurgy.

Our research in CAR has produced some exciting results in regards to understanding the history of the Ngotto Forest region. A previous study from our team describes the changes in vegetation cover from a 1,200 year old sediment core associated with archaeological sites in the northern part of the forest. This record indicates that the most dramatic changes in forest cover took place during the last 800 years, well after the region was settled by farming societies. Because the change from closed canopy forest to open forest environments takes place after the arrival of farming communities, we argue that the impacts of farming societies alone are insufficient to explain rapid deforestation events. This vegetation record shows very little change in the amount of grass pollen, which we would expect if local agriculturalists were degrading forest cover or soils and encouraging transition to savanna. Analysis of stable carbon isotopes, which are fixed in organic molecules at different rates in tropical grasses and rain forest trees, shows a signature consistent with forest cover through the entire 1,200 year sequence. This evidence argues for some degree of forest resilience at low population densities using low-intensity resource extraction methods.

The rise and fall of iron smelting at Bagbaya

Our most recent findings, published in *PLOS ONE*, describe the results of archaeological and paleoecological study of the southeastern portion of the forest. This area yielded dramatically different results from our work in the northern part of the forest. Cooperating with the village elders of Bagbaya (or Bacbaya), we identified and mapped more than a dozen large mounds of iron slag. Slag is the byproduct of iron smelting, when ore is heated in a furnace to produce chemically reducing conditions, which separates the slag and workable iron. The biggest of these mounds measured 2.5 meters tall and more than 10 meters in diameter. Nearby, there is a large extensively mined ore deposit. Radiocarbon dates from charcoal in the mound suggests this ore deposit was mined somewhere between AD 1700-1900, although some earlier dates (ca. AD 1600) come from nearby sites. Oral traditions among the community of Bagbaya attribute the mounds to their ancestors, who fled to this part of the forest from slave raiding in what is now the Democratic Republic of Congo. We hypothesized that because iron smelting requires a great deal of charcoal, these activities likely led to substantial disturbances of forest area and the development of savanna "islands" near Bagbaya.

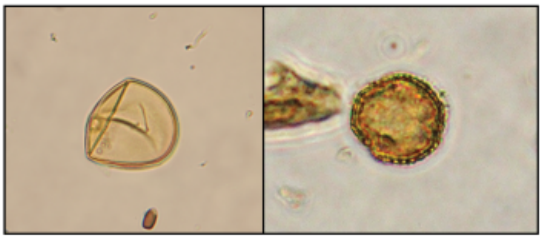

FIGURE 3. Examples of grass (Poaceae/Gramineae, left) and forest (Uapaca sp., right) recovered from Ngotto sediment cores. Credit: C. Kiahtipes

In order to reconstruct the impacts of iron smelting on vegetation cover, I analyzed pollen remains in sediments from filled river channel in the immediate vicinity of the iron smelting sites and mined ore deposit. This core shows some dramatic changes in vegetation cover that overlap chronologically with the archaeological deposits and the oral traditions of the Bagbaya community. Mixed rain forest and riparian forests are best represented in the oldest deposits dating to the 16th century and the youngest deposits from late 19th century. During the 17th and 18th centuries, there is a distinct increase in the representation of grasses and trees that thrive in disturbed settings. These data suggest that after a period of increased ecological disturbance, closed rain forest vegetation made a substantial recovery during the last 50 years. The timing of forest

regrowth suggests the observed expansion of forest area between 1970-1990 is part of an almost century-long trend of forest recovery in the wake of French colonial rule driven by depopulation, forced labor programs, and the collapse of local iron-production centers in the early 20th century. Our results suggest that aspects of the modern ecological and cultural features of the Ngotto Forest appeared as recently as the last century, illustrating both the depth of colonial-era disturbances among African societies and ecosystems and the complexity of Africa's prehistoric peoples.

Resistance and resilience in the Ngotto Forest

The most exciting finding from our research in the Ngotto Forest is the documentation of the 17th and 18th century iron smelting industry at Bagbaya and its environmental consequences. Iron smelting centers are known in other parts of west Africa, but few of them are located in or near the forest zone and none have been paired with palynological studies of vegetation change. The environmental evidence for forest disturbance at this time suggests that the Bagabaya community did not produce iron for local consumption only. They produced significant amounts of iron, which may have been traded to other parts of central Africa. Together, these lines of evidence indicate that the tropical forests of Central Africa are more than just wilderness. These forests are home to impressive indigenous industries and are sources of resilience and resistance for human and ecological communities alike.

FIGURE 4: Photo of mound feature and DN Schmitt. Credit: C. Kiahtipes.

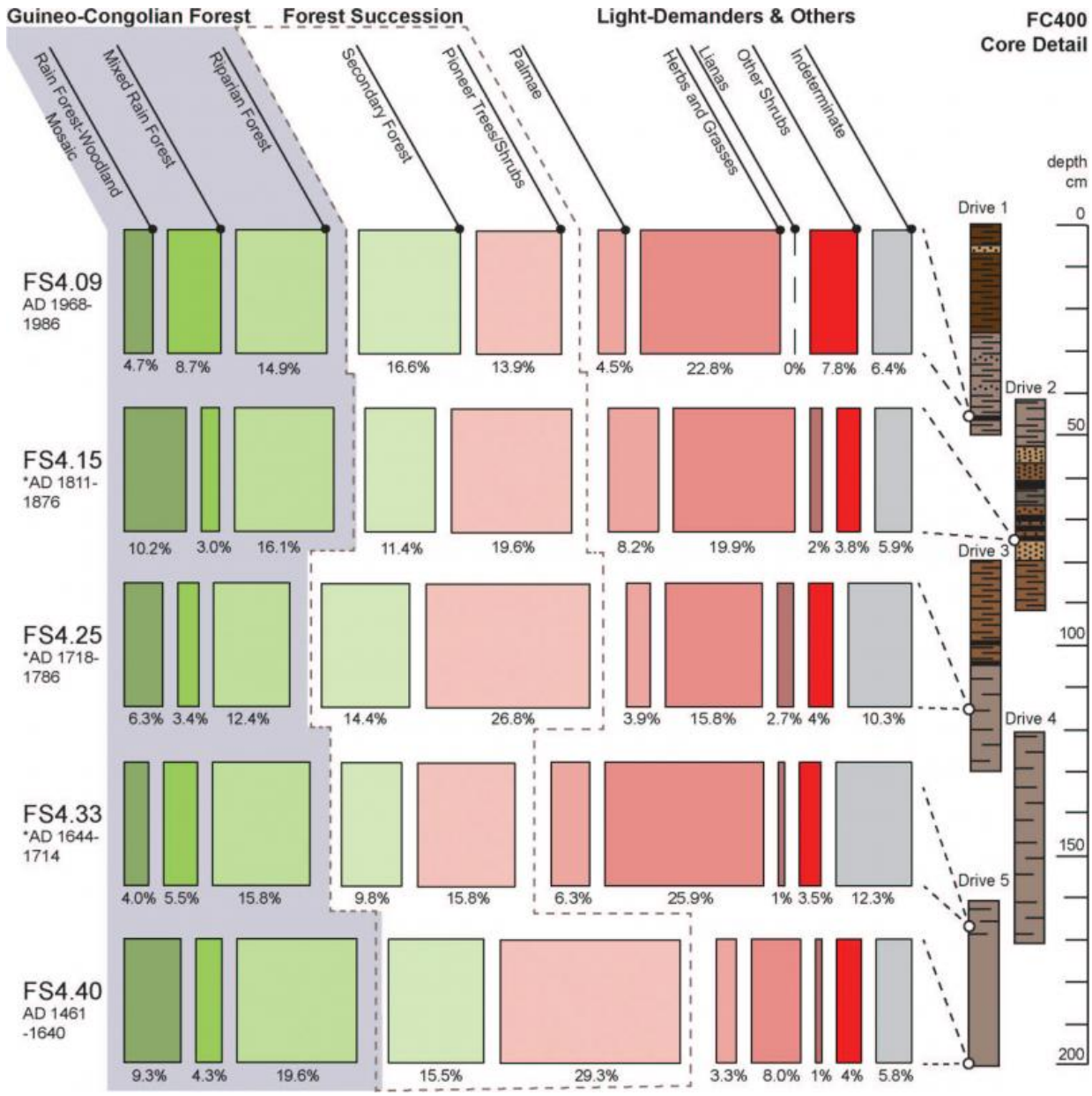

FIGURE 5: Diagram showing relative % of pollen from major types of vegetation cover in the Ngotto Forest from Lupo et al. (2015)

More information: Holl, AFC (2009) Early West African Metallurgies: New Data and Old Orothodoxy. *Journal of World*

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