VEC/impacts by subcomponent	Construction Phase			Operation Phase		
	Zone 1	Zone 2	Zone 3	Zone 1	Zone 2	Zone 3
Water - dredging	n/a	Medium	n/a	n/a	Medium	n/a
Residual impacts	n/a	Medium	n/a	n/a	Medium	n/a
Sediments – aerial deposition	n/a	n/a	n/a	n/a	None	n/a
Residual impacts	n/a	n/a	n/a	n/a	None	n/a
Sediments - dredging	n/a	n/a	n/a	n/a	High	n/a
Residual impacts	n/a	n/a	n/a	n/a	High	n/a
Freshwater						
Water – aerial deposition	n/a	n/a	n/a	Medium	n/a	n/a
Residual impacts	n/a	n/a	n/a	Medium	n/a	n/a
Sediments – aerial deposition	n/a	n/a	n/a	Medium	n/a	n/a
Residual impacts	n/a	n/a	n/a	Medium	n/a	n/a
Groundwater						

VEC/impacts by subcomponent	Construction Phase			Operation Phase		
	Zone 1	Zone 2	Zone 3	Zone 1	Zone 2	Zone 3
Flow	n/a	Low	n/a	High	n/a	n/a
Residual impacts	n/a	Low	n/a	Medium	n/a	n/a
Quantity	n/a	Low	n/a	High	n/a	n/a
Residual impacts	n/a	Low	n/a	Medium	n/a	n/a
Quality	n/a	Low	n/a	High	n/a	n/a
Residual impacts	n/a	Low	n/a	Medium	n/a	n/a
Soils						
Quantity - stripping	n/a	n/a	n/a	High	n/a	n/a
Residual impacts	n/a	n/a	n/a	Medium	n/a	n/a
Quantity - erosion	n/a	n/a	Medium	Medium	n/a	n/a
Residual impacts	n/a	n/a	Low	Low	n/a	n/a
Quality – aerial deposition	n/a	n/a	n/a	Medium	Medium	Medium
Residual impacts	n/a	n/a	n/a	Medium	Medium	Medium

0.3 Biological Studies

0.3.1 Introduction

The biological studies specifically look at the following main topics:

- Vegetation;
- Large and medium terrestrial mammals;
- Freshwater fauna (Sangarédi only);
- Birds;
- Reptiles and amphibians; and
- Marine mammals, turtles and crocodiles (Kamsar only).

Other studies important studies not directly related to plant or animal inventories were also undertaken:

- Fishing study (Kamsar only);
- Firewood and charcoal study; and
- Hunting and bushmeat study.

For each of these studies, a specialist of international reputation was associated with at least one senior national researcher.

There are tow distinct seasons in Guinea: the rainy season and the dry season. Normally, biological studies are undertaken during both seasons to take into account seasonal variations. The presence or the visibility of different species varies from the rainy season to the dry season. It was decided to carry out a single period of fieldwork to cover the two seasons. The decision to carry out a single field campaign at the interface of the wet and dry season (October to December) is a profitable approach to biological fieldwork, considering that for the majority of taxonomic groups a significant difference will be evident during this short time span.

0.3.2 Biology baseline studies

The biology field surveys for this ESIA were undertaken from October to December 2013 and are described in the appropriate sections of Chapter 3. The following section summarizes some of the more important aspects.

0.3.2.1 Habitats

So as to have some uniformity in the terms used for habitats in the presentation of results for each of the terrestrial groups studied (birds, mammals, reptiles and amphibians), White's (1983) classification of vegetation forms, commonly used in Africa, was used and adapted to the Study Areas of the Project.

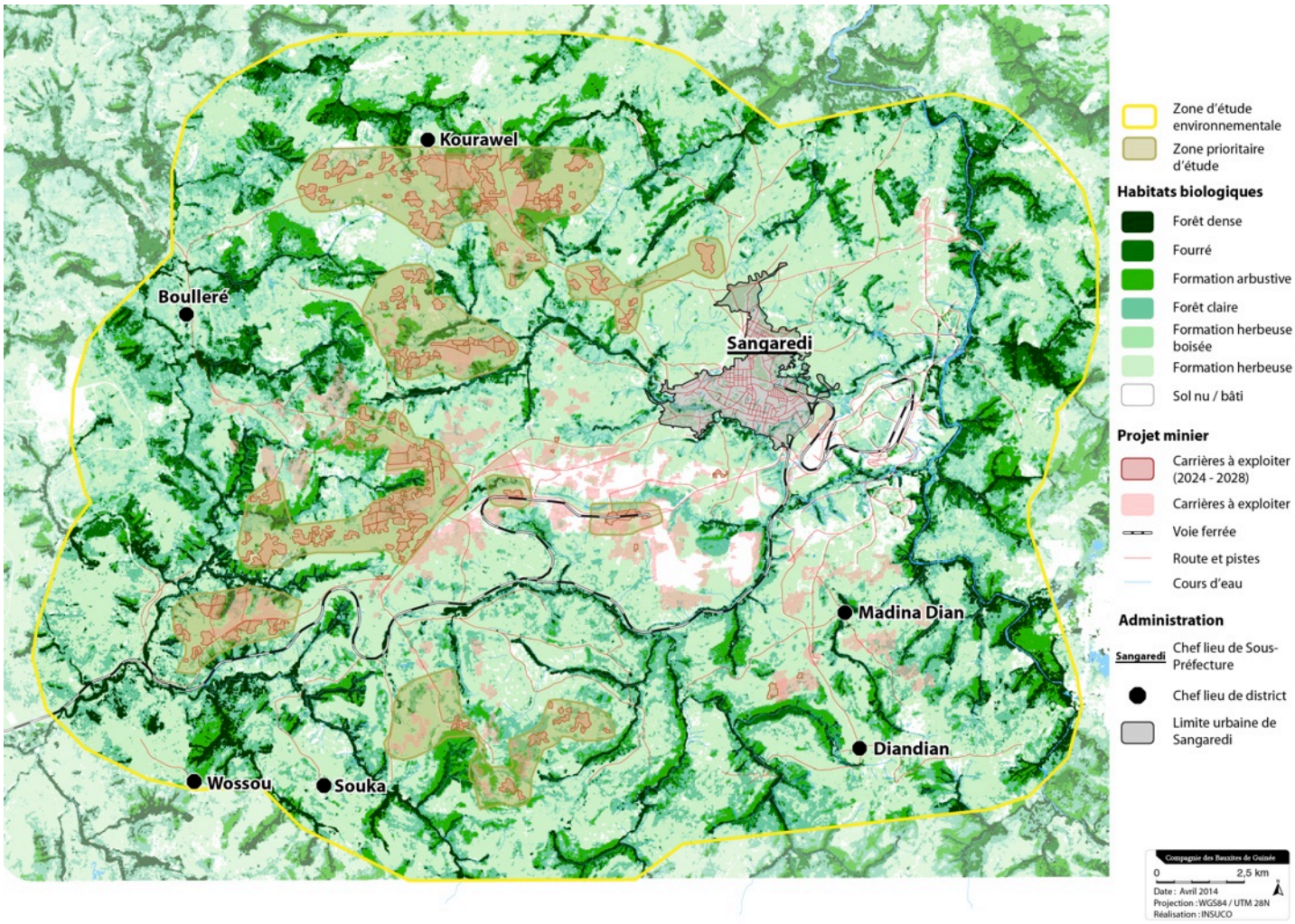
Table 0-12 Main vegetation formations found in the Project Study Areas (adapted from White, 1963)

Main vegetation formations found in the Study Areas	
Habitat Types	Description
Forest	A continuous stand of trees at least 10 m tall, their crowns interlocking
Woodland	An open stand of trees at least 8 m tall with a canopy cover of 40 % or more. The field layer is usually dominated by grasses
Bushland	An open stand of bushes usually between 3 and 7 m tall with a canopy cover of 40% or more
Thicket	A closed stand of bushes and climbers usually between 3 and 7 m
Shrubland	An open or closed stand of shrubs up to 2 m tall
Grassland	Land covered with grasses and other herbs, either without woody plants or the latter not covering more than 10 % of the ground
Wooded grassland	Land covered with grasses and other herbs, with woody plants covering between 10 and 40 % of the ground

Main vegetation formations found in the Study Areas	
Mangrove	Open or closed stands of trees or bushes occurring on shores between high and low water mark
Freshwater aquatic	Herbaceous freshwater swamp and aquatic vegetation
Halophytic	Saline and brackish swamp vegetation
Anthropic	Manmade landscapes, e.g. agricultural, urban etc.

Maps 0-8 and 0-9 show the cartography of the vegetation of the Study Areas around Sangarédi and Kamsar. It is based on White's classification to the extent that interpretation of 2013 satellite images allowed.

Map 0-8 Habitats around Sangarédi



Map 0-9 Habitats around Kamsar

0.3.2.2 Vegetation

Context

The Upper Guinea forest area is a biodiversity hotspot (Myers *et al*, 2000), though it is under great pressure across the region due to an increasing human population. There are remnants of this forest left in the gallery forests and occasional treed islands found in the general area of the Project. The Fouta Djallon, further east of the Study Area, is a hotspot for regional endemics, but many of these do not stretch as far west as the Project area.

The Study Area around Sangarédi was once largely a matrix of wooded grassland and woodland, grassland bowal vegetation and forest along the rivers and watercourses. Much of this wooded grassland and woodland has been cleared for farming over previous centuries, the gallery forests are increasingly impinged upon from the fires set to clear land for agriculture; however fragments and gallery forest can provide refuge for a number of conservation important forest species.

Although there is now a published flora (Flore de la République de Guinée, Lisowski 2009), botanical knowledge in the country is incomplete with little progress in recent decades. For example, currently only 3 - 5% of plant species in Guinea have been formally assessed for their IUCN conservation status.

Inventory

Table 0-13 presents the distribution of sampling units by habitat type.

Table 0-13 Distribution of vegetation sampling points by habitats

Habitat type	Number of ground truth points recorded
Bowal	24
Undisturbed wooded grassland and grassland	17

Habitat type	Number of ground truth points recorded
Woodland patches in bowal	6
Secondary shrubland and thicket	21
Gallery forest	5
Anthropic	5

A total of 242 specimens and 748 sight records were recorded during this survey between the 18th and of 27th November 2013. This resulted in 255 species from 82 families. This survey has identified two species that are Vulnerable according to IUCN and other species that are known to be range restricted or rare were also noted.

A few important vegetation types are described below:

Dense forest

This is a climax vegetation type that is generally diverse in species including conservation priority species. Surviving forest is rarely encountered since all of the forests visited have been modified more or less strongly by human activities (harvesting of species for wood and encouraging the growth of specific species such as the oil palm [*Elaeis guineensis*]). In the Study Area what remains are therefore degraded forests, particularly along watercourses: the gallery forests.

Gallery forest

Occurring in ribbons along watercourses, possibly persisting due to the need to stabilize river banks, the vegetation is relatively respected by people on the banks. The gallery forests often include swamp forest species present since the water table is higher on river banks than under "forest islands". In general the gallery forests in the survey areas were small in width (around 50m wide) and partially degraded on the landward edges due to agriculture, including burning.

Wooded grassland and woodland

The wooded grassland and patches of woodland are typical of the Sudan-Guinea grassland-woodland biome and the diversity of these formations is lower in areas with limited precipitation, as in the Study Area. These are the most widespread and common vegetation types in Guinea and have a broadly similar species composition from Mauritania in the West to South Sudan in the East. In Sangarédi one subtype appears to occur, Haute Niger Region Woodland. This vegetation type has often been termed "savannah" but that term has been widely misapplied.

Bowal grassland

Bowal is a form of grassland characterized by a hard substrate, impeded drainage and thin or absent organic soils that results in an absence of woody plants. It is seasonally inundated grassland and with a unique assemblage of species including some restricted to bowal.

Bowal appears superficially as unremarkable flat grassland without trees. It is defined by the substrate of concretized iron stone that forms an orange-red rock-like, usually flat surface, more or less impervious to water. Bowal grassland is usually shorter (typically 1 m) and sparser than the grassland that occurs in wooded grassland, where soils are deeper. The bowal in the Sangarédi area appears to have a lower diversity than other bowal grassland found in Guinea such as that at the edge of the Fouta Djallon near Mamou where it stays wetter for longer (Schnell, 1976).

Mangrove

Mangrove is characterized by open or closed stands of trees or bushes occurring on shores between high and low water mark. Mangrove in Guinea is characterized by the three Atlantic coast species: *Rhizophora mangle, R. harrisonii* and *R. racemosa,* in addition to *Avicennia germinans*.