

Assessment of Spatio-temporal Changes of Land Use/Cover of Three Transboundary River Basins in West Africa and Their Relations with Variations of Discharges

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I. BACKGROUNDS

Land use/cover (LULC) in West Africa (WA) has changed fast in the past due to climate extreme events, biological and socio-politico-economic, demographical factors [1];

Originality
Study on impacts of CC and LULCC on hydrology are rare in WA.

Study Aim
Assess LULCC in three transboundaries river basins (Mono, Volta and Sassandra) in WA and their incidences in hydrological systems.

II. DATA and METHODOLOGY

The studied basins are located in the southern part of West Africa (Figure 1) in which hydropower plants are built.

Mono, Sassandra and Volta basins cover an area of 24,282.26Km², 75,749.79 Km² and 413,520.15 Km²

Mainly covered by shrubs, savanna, forest, barren land, agricultural land, built-up and water bodies

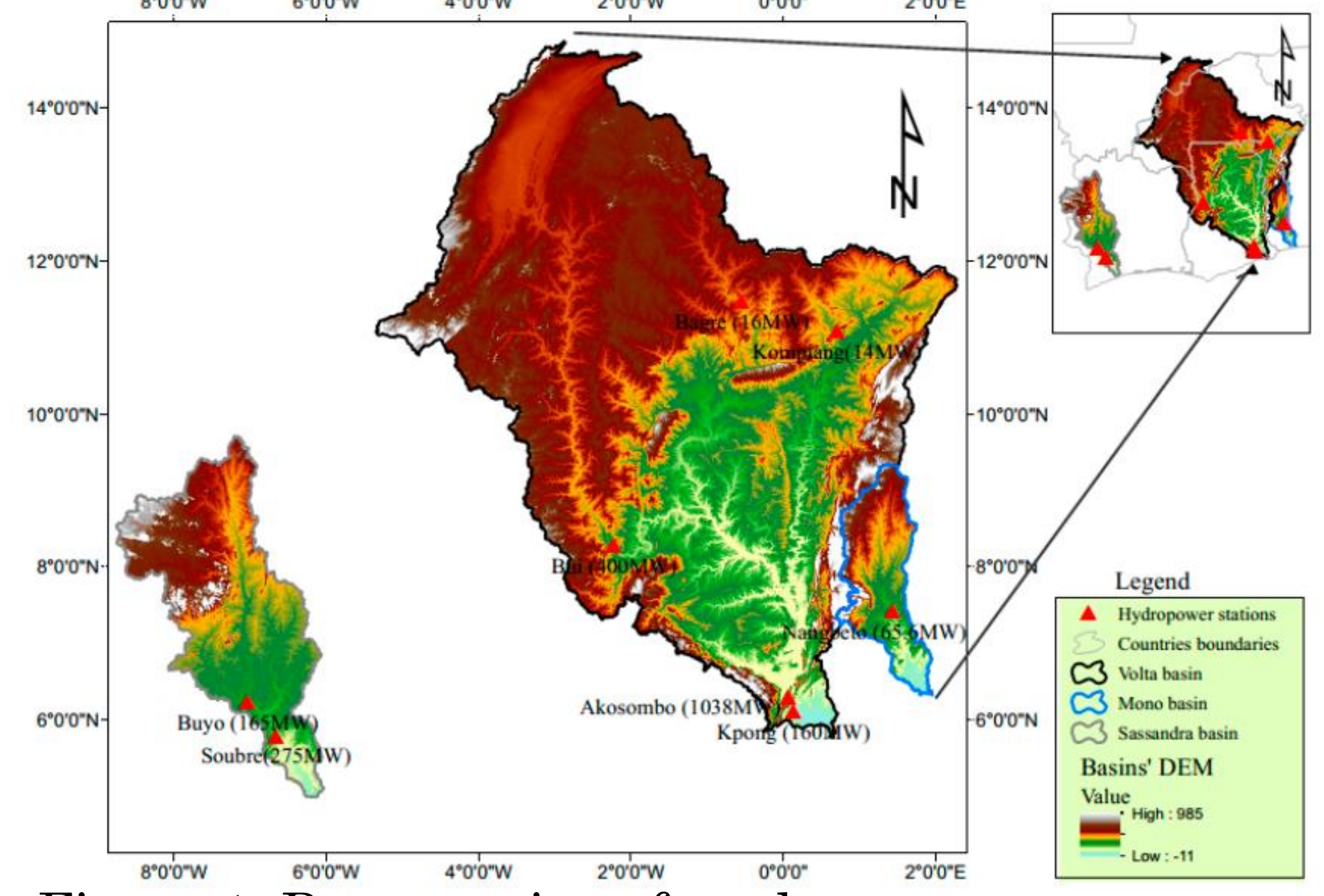
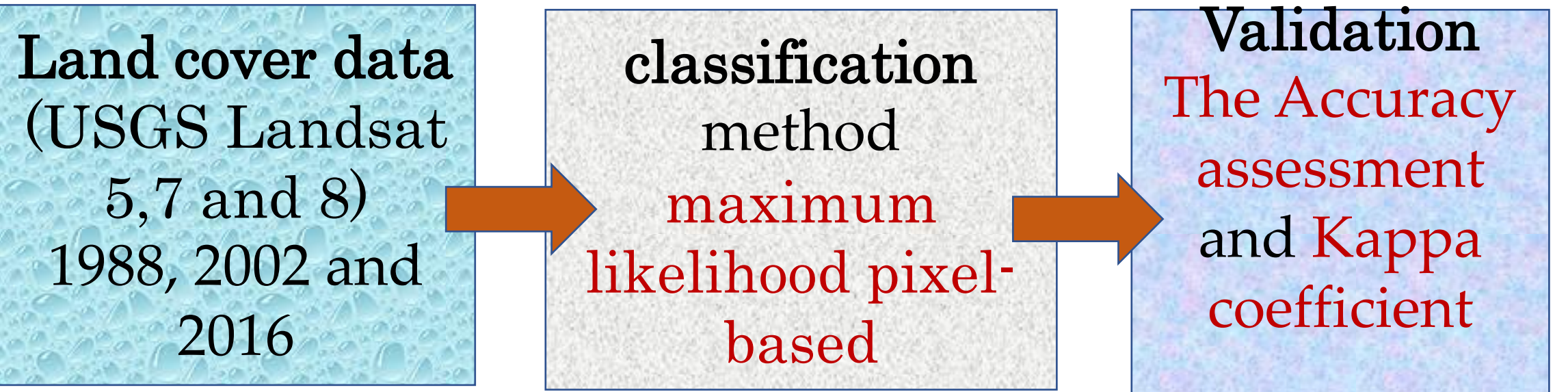


Figure 1: Presentation of study area

II.2 Methodology



I.II. RESULTS AND DISCUSSION

III.1 Validation of Land cover classification

The Kappa coefficient and Accuracy assessment are greater than 80% (Strong) (Table.1); therefore the classifications are well performed

Table 1: Kappa Coefficient and Accuracy Assessment of the land cover classification

Basin	Parameters	1988	2002	2016	Qualification
Volta	Kappa Coefficient	89.17%	85.97%	90%	Strong
	Accuracy Assessment	90.37%	87.53%	89.84%	
Mono	Kappa Coefficient	86.67%	86.33%	89.33%	strong
	Accuracy Assessment	88.89%	88.61%	91.11%	
Sassandra	Kappa Coefficient	88%	87.33%	86.67%	strong
	Accuracy Assessment	90%	82.46%	88.89%	

III.2 LULC Changes

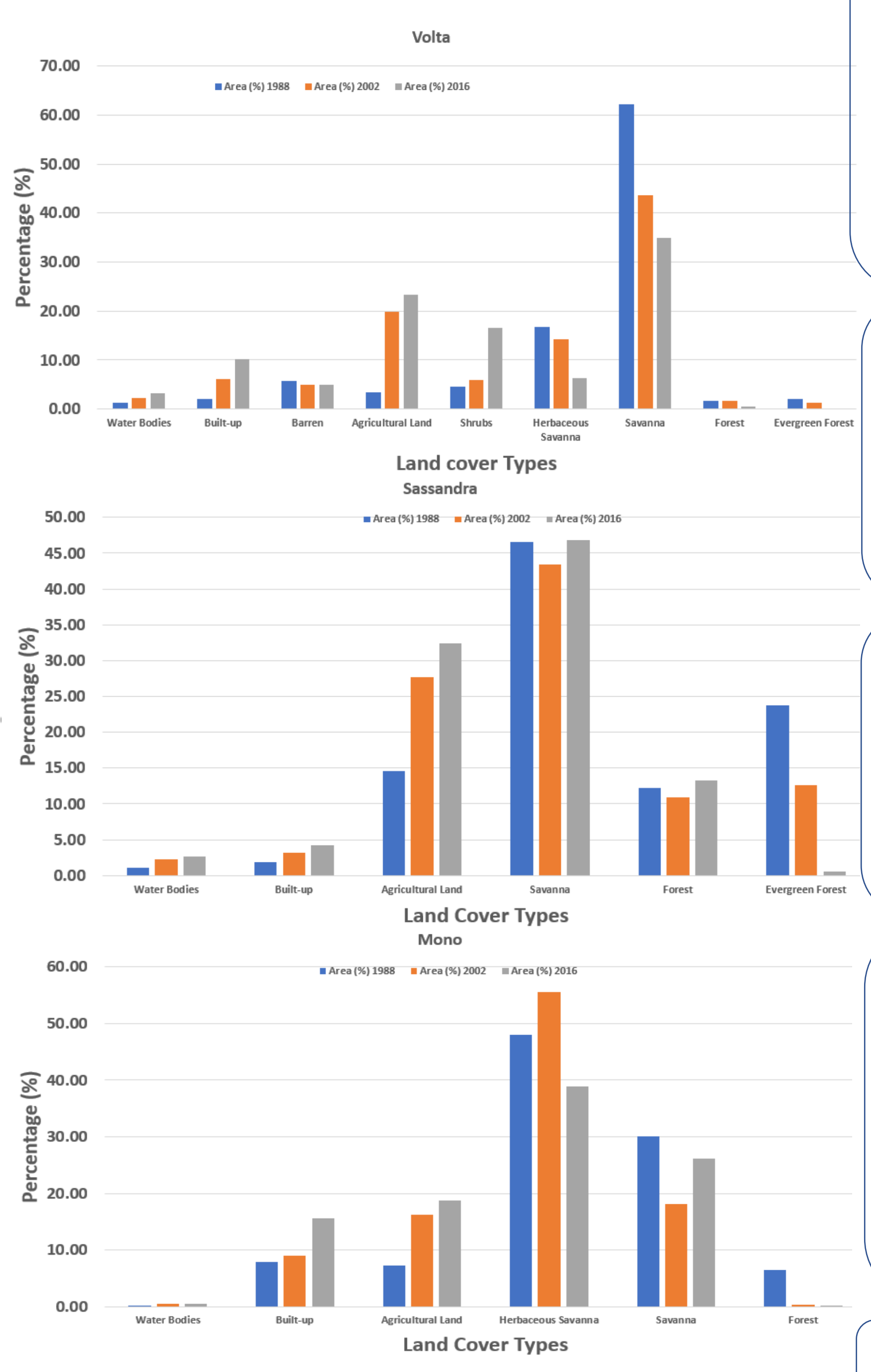


Figure 2: Statistical trend of LULC

Water bodies (causes: construction of small reservoirs, dugouts and dams), built-up and agricultural lands (causes: population growth) have increased rapidly for all studied basins within the basins (Fig.2).

A decline in vegetative areas (herbaceous savanna, savanna, forest and evergreen forest) due to the expansion of agricultural and urbanized areas.

In WA, between 1975 and 2013, the forest areas has decreased by 24.6% while the settlement and agricultural land coverage have increased by 140% and 11.7%, respectively [1].

In Africa, 8000 km², 7000 km², 2500 km², 2000 km² and 500km² of forest are converted yearly respectively into commercial agriculture, local agriculture, infrastructure, mining and urban expansion (2000–2010) [2].

LULCC trigger alterations in hydrodynamic soil surface behaviour.

III.3 LULCC and their incidences on discharge

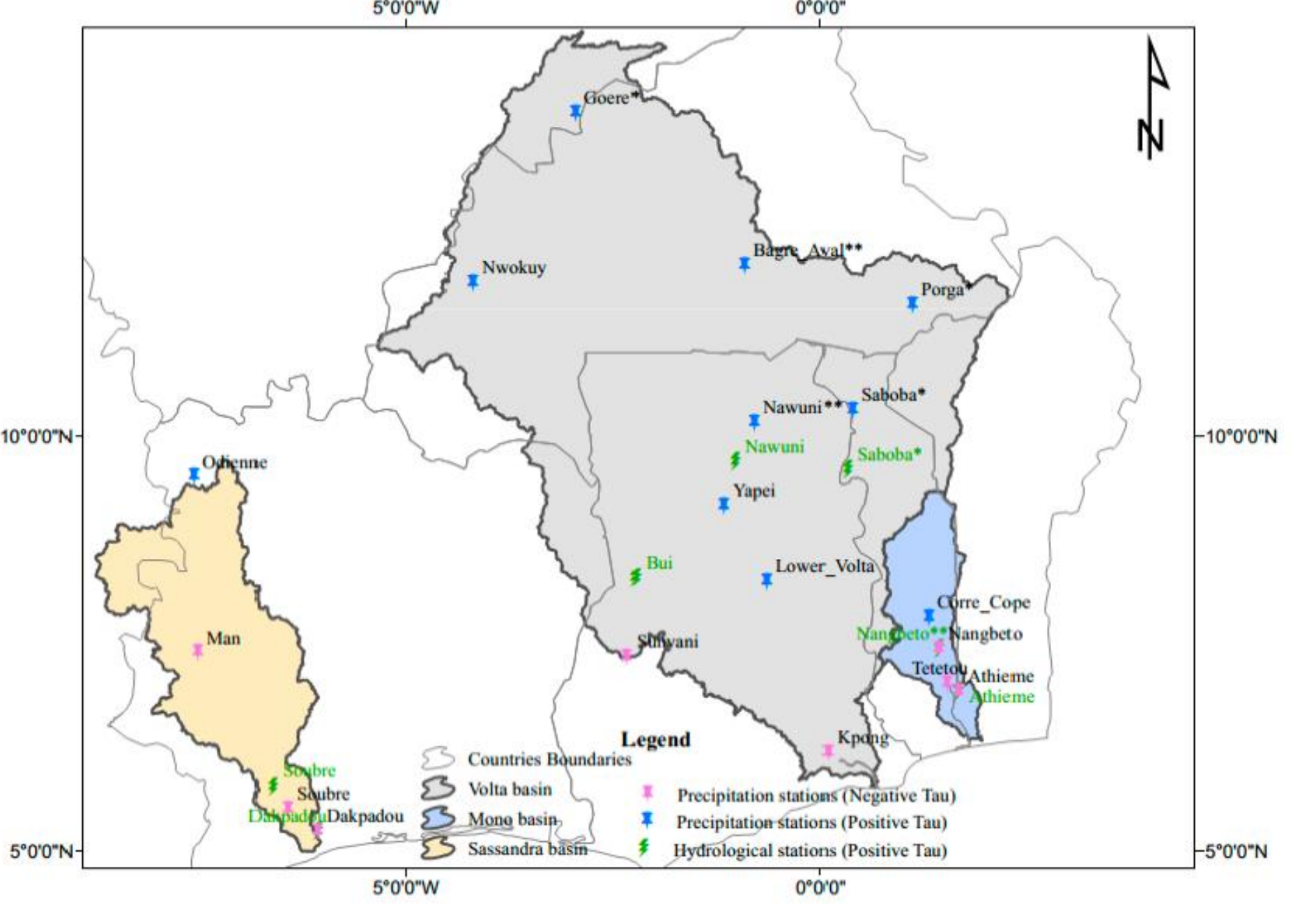


Figure 3: Map of spatio-temporal distribution of Precipitation and Discharge trend analysis (1979–2000 in Mono, 1979–2004 in Sassandra and 1979–2008 in Volta).

NB: * the statistically significant trends at the 5% significance level (95% confidence level) and ** statistically significant trends at the 10% significance level (90% confidence level).

IV. CONCLUSION AND PERSPECTIVES

All the studied basins are subject to more intense usage of land (built-up and agricultural land) due to population growth rate and socio-economic drivers.

The annual water bodies (built-up) has increased by 4.8% (13.4%); 8.2% (3.33%) and 5.23% (4.56%) for Volta, Mono and Sassandra basins, respectively, while the agricultural land has increase by 20.27%, 5.57% and 4.19%.

The coefficient of variation of precipitation and discharge analysis for the three basin reveals that the discharge varies much more (at least three times) than the annual precipitation at the three basins.

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