Bio-Physical Land Suitability for Oil Palm in Ghana

Demand for palm oil has resulted in rapid expansion of oil palm cultivation globally. Due to limited available land for the new oil palm plantation development in Southeast Asia, most current expansion in the industry is taking place in Latin America and Sub-Saharan Africa (Laurance *et al*., 2014; Sayer *et al*., 2012). As a result, oil palm production in many West African countries (WA) has increased in the past decade. However, compared to the major producing countries in Southeast Asia and Latin America, average bunch yields in WA are very low; 18.9 and 16.5 vs. 3.9 t ha^{-1} respectively (FAO, 2015). Smaller yields in WA are partly the result of sub-optimal climate conditions (Quencez, 1996), particularly water stress, the main yield-determining factor outside management control in WA (van der Vossen, 1974), and poor management practices.

In order to guide government policy makers and investors, it is essential to know where suitable bio-physical conditions for oil palm expansion in WA occur. Using Ghana as a case study, we evaluated areas that were both suitable and available for oil palm production based on bio-physical land suitability evaluation methods and GIS techniques.

Compared to a previous suitability assessment (van der Vossen, 1969), our methodology showed that areas with suitable climatic conditions for oil palm production in Ghana (annual average water deficit <400 mm) is about 20% greater. The observed differences are the result of using different methods to determine bio-physical suitability and climate change. A major climatic factor limiting suitability for oil palm production in Ghana is the annual water deficit (Caliman, 1992; Corley and Tinker, 2003; Danso *et al*., 2008; Olivin, 1968; Quencez, 1996; van der Vossen, 1969), with the most suitable areas located in the rainforest and semi-deciduous forest zones with higher rainfall in southern Ghana. De-forestation should of course be avoided.

Opportunities for large-scale oil palm plantation development is limited, due to the lack of availability of large and contiguous tracts of land required for commercial development (Figure 1). This is further exacerbated by complex land tenure arrangements that prevail in southern Ghana that make it difficult for investors to acquire land for the development of large-scale plantations. One feasible strategy for oil palm expansion is therefore smallholder production, using smaller parcels of land. Complementary, research in Southeast Asia (Donough *et al*., 2010) and Ghana (Rhebergen *et al*., 2014) indicated that production increased by applying Best Management Practices (BMPs) to land already planted with oil palm. Closing yield gaps in Ghana could make a significant contribution to the

national palm oil supply, and could lead to an increased profitability for investors and farmers alike, Moreover, yield intensification in already existing palm stands reduces the need to clear land for new plantations.

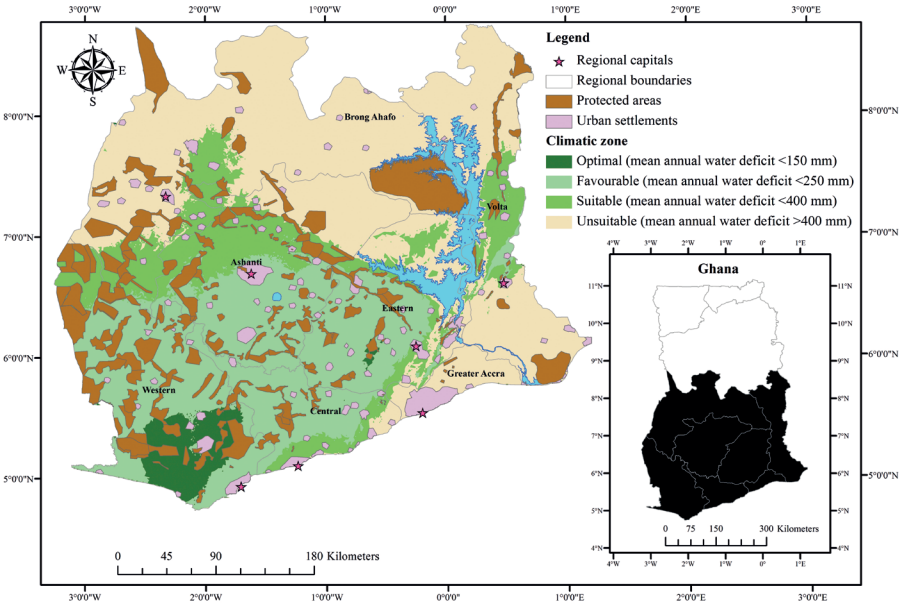

Figure 1. Map of southern Ghana showing suitable and available areas with potential for expansion in oil palm production.

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