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Agroforestry systems towards rehabilitation of West Africa marginal areas through an integrated green biotechnology approach

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Unsuitable agriculture management pratices

Improper solid waste management

Unsafe storage of hazardous chemical and nuclear waste

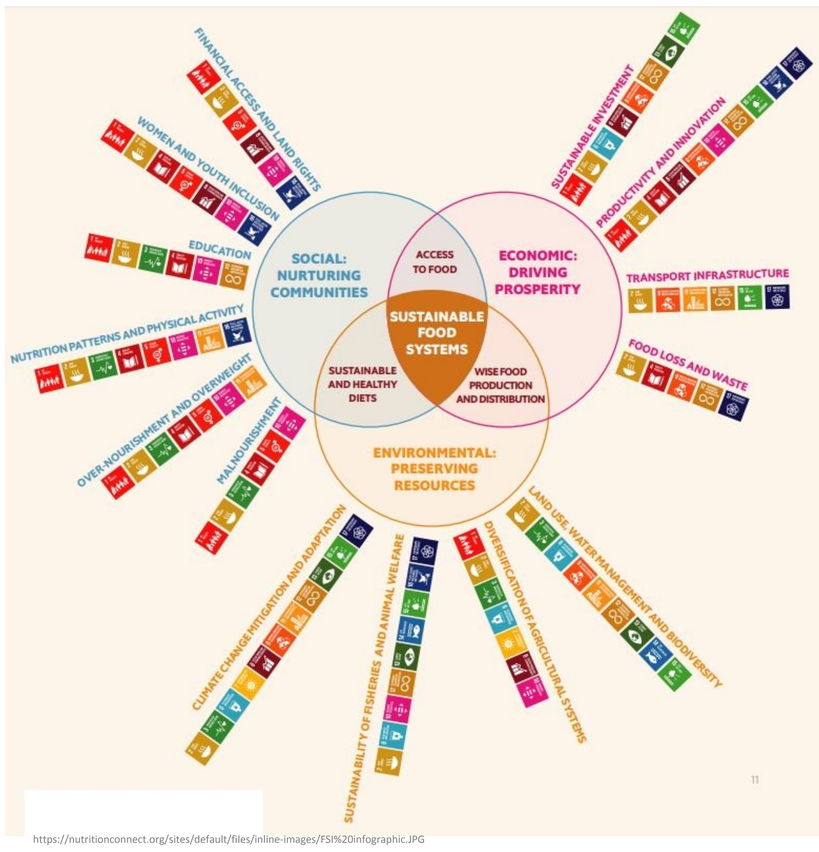
Leachates from mismanagement landfills

Uncontrolled dumping of waste from households, industrial plants and mining

POTENTIALLY HAZARDOUS ELEMENTS (PHE)

1 **To achieve the goals set by the 2030 agenda for Sustainable Development, sustainable solutions are imperative for recovering marginal lands (e.g. landfills or abandoned mining areas) and create conditions for agriculture activities. Landfills, poses health and environmental concerns due to the presence of potentially hazardous elements (PHE), among other contaminants that cannot be degraded leading to soil and water contamination, with increasing concern in the African continent.**

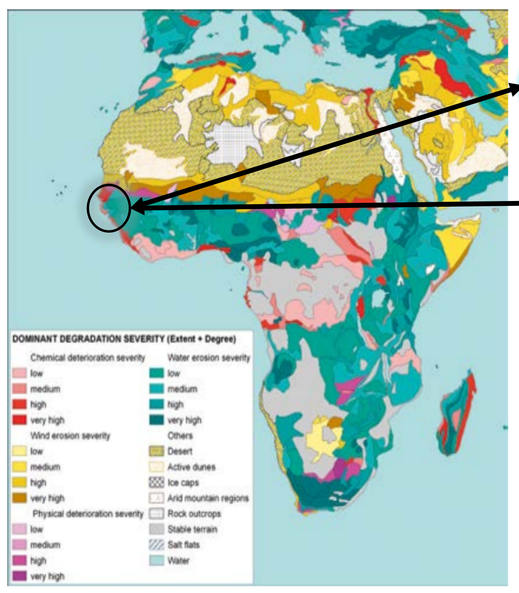
SUSTAINABLE DEVELOPMENT GOALS



https://nutritionconnect.org/sites/default/files/inline-images/FSI%20infographic.JPG

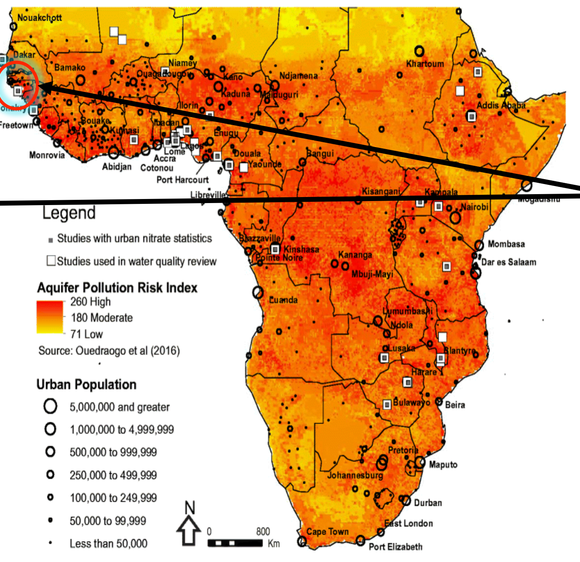
2 **In 2018, Guinea-Bissau (UN Report) reported that waste management is one of the major problems that the country faces. Thus, it is essential to create solutions, beyond waste management, such as the rehabilitation of such areas. A potential rehabilitation strategy is the combination of phytostabilisation with geotechnologies (engineered soils – Technosols). Phytostabilisation uses plants to decrease mobility or immobilize PHE in the rhizosphere. These plants should also have low PHE translocation factors from the soil/ roots to the shoots. For the Technosols construction it is necessary to use landfill wastes together with other specific organic and/or inorganic amendments to have a anthropic soil whose properties (e.g. fertility, water-holding capacity, structure) decrease PHE availability and promote plant growth, minimizing the risk to both human health and the environment. A possible strategy for the rehabilitation of contaminated areas, could be the establishment of an agroforestry system - by intercropping legumes, towards phytostabilisation, using cashew as a case study due to its importance as an important agriculture commodity in West Africa countries (e.g. Guinea-Bissau).**

SOIL AND WATER CONTAMINATION



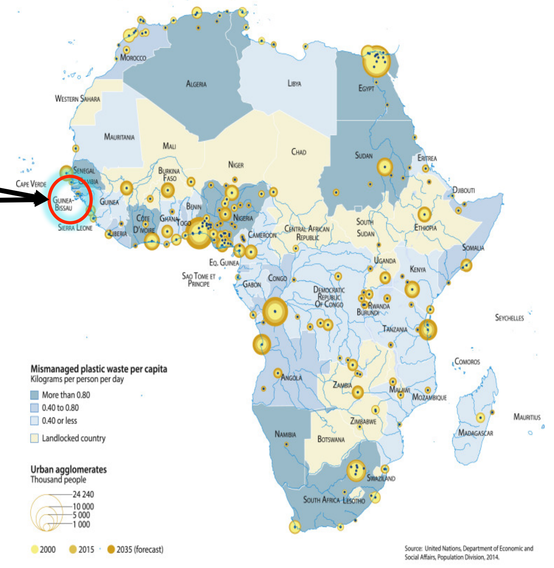
Soil degradation severity, by type extent, and degree

ELD Initiative & UNEP (2015). The Economics of Land Degradation in Africa: Benefits of Action Outweigh the Costs. Available from www.eld-initiative.org.



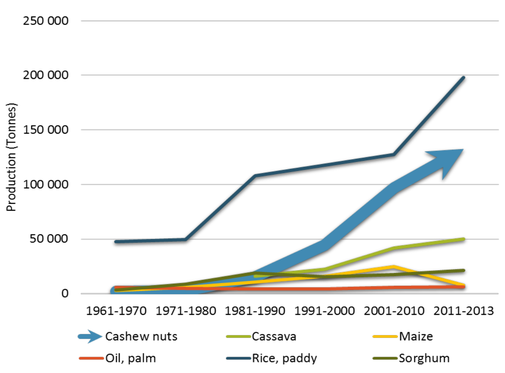
Relationship between urban centres in SSA and estimated aquifer pollution risk.

Lapworth, D. J. et al. Urban groundwater quality in sub-Saharan Africa: current status and implications for water security and public health. Hydrogeol. J. 25, 1093–1116 (2017).



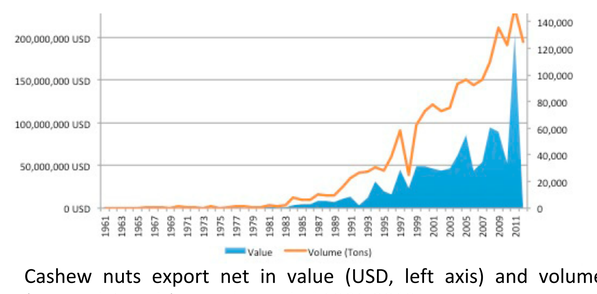
Waste generation rates and urban population centers in Africa

Jambeck, J. et al. Challenges and emerging solutions to the land-based plastic waste issue in Africa. Mar. Policy 96, 256–263 (2018)



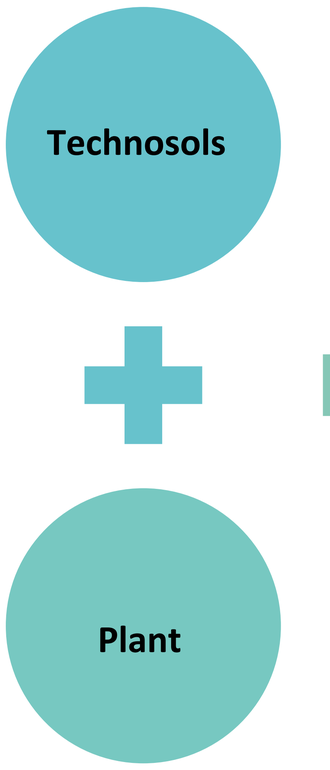
Harvested area of main agricultural commodities in Guinea-Bissau 1961-2013.

Monteiro, F.; Catarino, L.; Batista, D.; Indjai, B.; Duarte, M.C.; Romeiras, M.M. Cashew as a High Agricultural Commodity in West Africa: Insights towards Sustainable Production in Guinea-Bissau. Sustainability 2017, 9, 1666.



Cashew nuts export net in value (USD, left axis) and volume (tones, right axis) over the period 1961-2012.

Havik, P.J.; Monteiro, F.; Catarino, S.; Correia, A.M.; Catarino, L.; Romeiras, M.M. Agro-Economic Transitions in Guinea-Bissau (West Africa): Historical Trends and Current Insights. Sustainability 2018, 10, 3408.



3 **Several West African countries rely on cashew nuts as national economy revenues. In 2019, cashew production in the region accounted for about 50% of the world production. To respond to global market needs, cashew is produced under extensive cultivation regime in a monoculture agrosystem.**

4 **It is of utmost importance to identify the nature/quantity of PHE and wastes as well as climatic conditions for each contaminated site, before creating an agroforestry system in those areas, thus ensuring the sustainability of the phyto-geo-technology towards food security. Furthermore, potential alternative revenues obtained from the agroforestry system arise. As such, we present a potential rehabilitation agroforestry system that can in the future be useful for African countries attain the goals set for 2030 and beyond.**

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