

SCIENTIFIC ASSESSMENT OF THE DOCTORAL THESIS

Title of the thesis: The valuation of forest ecosystem services in Kenya: a comparative case study of Karura Forest Reserve and Kakamega National Forest Reserve

Doctoral candidate: Erick Odhiambo OSEWE

Doctoral field: Forestry

The doctoral thesis submitted by Erick Odhiambo Osewe examines a question of direct relevance to forest management: how can the benefits provided by forests be assessed in ways that reflect both their ecological condition and their importance to local communities? The candidate addresses this question through a comparison of Karura Forest Reserve, an urban forest in Nairobi, and Kakamega National Forest Reserve, a tropical rainforest in western Kenya. In my capacity as scientific supervisor, I consider this choice of research topic and comparative design well justified.

The contrast between the two reserves gives the work its central analytical value. Karura is characterised by controlled access, recreation and ecotourism, with employment and community activities linked to conservation. Around Kakamega, forest products play a more substantial role in household subsistence. The thesis uses these differences to examine the relationship between forest structure, management arrangements, resource use and the economic value of ecosystem services.

The research is presented in nine chapters, with five peer-reviewed publications forming its empirical and methodological core. The sequence is coherent: a regional review establishes the gaps in ecosystem service valuation; spatial analysis documents forest change; two case studies assess benefits and community perspectives; and a further study examines the reliability of biomass estimates. The final chapters bring these findings together and set out the original contributions and implications for forest policy and practice.

A particular strength is the combination of methods suited to different dimensions of the subject. The candidate brings together satellite observations, field measurements, stakeholder and household surveys, local market prices, visitor records and willingness-to-pay responses. The comparison of Global Ecosystem Dynamics Investigation (GEDI) and Random Forest biomass estimates with field data is especially relevant where comprehensive forest inventory information is unavailable. This approach allows the economic assessment to be interpreted alongside the ecological evidence and the circumstances of forest users.

The spatial analysis documents approximately 826.6 hectares of forest cover loss in Kakamega over the period 2000–2020, with consequences for habitat continuity and ecosystem service provision. The biomass research also shows that the performance of remote sensing estimates varies with forest structure. These findings underline the

importance of field validation in heterogeneous tropical forests and of distinguishing a large carbon stock from the precision with which that stock can be measured.

The valuation results give substance to the comparison between urban and rural forest benefits. Firewood is the most frequently used forest product in Kakamega, reflecting the importance of provisioning services to surrounding households. In Karura, annual entrance-fee revenue is estimated at approximately US\$412,414, alongside benefits associated with employment and community participation. The thesis therefore provides evidence on how livelihood opportunities and management arrangements influence the forms of value that communities derive from forests.

The treatment of cultural services deserves recognition. The investigation of the Tiriki Ikavakava sacred shrines records a strong attachment to spiritual forest values, with 93% of respondents expressing willingness to pay for access within the stated price ranges. The candidate interprets these findings in their social context, acknowledging that monetary indicators capture only part of the relationship between communities and culturally significant forest sites.

The contribution of the thesis is most evident in its comparative synthesis. By linking ecological measurements with economic estimates and community perspectives, the work explains why ecosystem service assessment must account for governance, access and local livelihood conditions. It offers useful evidence for natural capital accounting, participatory forest management and conservation financing. The limitations of the surveys and valuation methods, as well as uncertainties in biomass estimation, are recognised and provide a basis for further research.

The five publications included in the thesis demonstrate that the research findings have been communicated through peer-reviewed scientific outlets. Taken as a whole, the thesis constitutes a coherent body of research, with original contributions and clear relevance to the assessment and management of forest ecosystem services. I consider that Erick Odhiambo Osewe has fulfilled the scientific requirements for a doctoral thesis in Forestry and give my agreement for the thesis to proceed to public defence.

Prof. Dr. Eng. Ioan Vasile ABRUDAN

Scientific supervisor

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