

Title : Comparative Life Cycle Assessment of Elephant Dung Management:
A Case Study of Paper and Biochar Production at Maetaeng Elephant Camp, Chiang Mai

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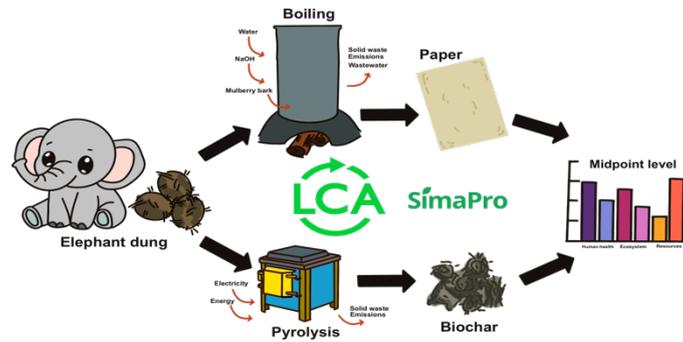
ABSTRACT

Maetaeng Elephant Camps is one of the tourist hotspots in Chiang Mai, with 70 elephants producing approximately 17,500 kg of dung per day, and managing this large amount of waste has become a major challenge. Although current methods such as composting and paper making are eco-friendly, they cannot reduce the generated dung as much as desired. To suggest alternative ways to manage unmanaged dung, this study compares paper and biochar production using a cradle-to-gate Life Cycle Assessment (LCA), a standard method for evaluating environmental impacts and supporting sustainable waste management decisions. The assessment was conducted using Excel, with inventory data and emission factors (EF) source from the SimaPro database and relevant literature. The functional unit was 1 kg of final product, and impacts were calculated from input and output data that obtained from on-site observation and relevant literature with EF values and characterized using the ReCiPe 2016 Midpoint (H) method then normalized with ReCiPe World (H) and grouped into endpoint categories: human health, ecosystem, and resource. The midpoint analysis results show that paper production has higher impacts in most categories, including global warming potential (133 kg CO₂-eq), water consumption (6.18 m³), and human

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toxicity (112 kg 1,4-DCB eq). In contrast, biochar production shows lower impacts in global warming potential (70.2 kg CO₂-eq), water consumption (1.13 m³), and human toxicity (19.0 kg 1,4-DCB eq), but higher fossil resource use (12.6 kg oil eq). At the endpoint level, paper production causes greater damage to human health and ecosystems due to high water consumption and chemical use, while biochar shows higher resource scarcity due to pyrolysis energy demand. Overall, biochar production presents a promising alternative for managing excess elephant dung and supporting more sustainable waste management practices at elephant camps.



Keywords: Life Cycle Assessment (LCA); Elephant Dung; Paper Production; Biochar Production; Environmental impact

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