

ENERGY VALUE OF ELEPHANT LABOUR

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Introduction

The intricate relationship between the elephant and Thai society dates back centuries. The annals of Thai history contain a number of epic battles fought on the backs of war elephants. In addition, Thailand is one of the few countries in the world where the elephant still plays a significant role in the forestry industry. The practice of using elephants for forestry work was imported into Thailand from neighboring Myanmah (Burma) and India (Corvanich, 1976). Since then, the art of training working elephant has become a source of national pride.

In order to obtain a net energy analysis of any system involving elephant labour, which is used almost exclusively in the forestry industry, it is first necessary to calculate the amount of energy expended by the elephant at work.

Calculation

The calculation are based upon the following facts and assumptions :

1. The daily intake of a mature working elephant is 250 kilograms of biomass (leaves, branches, grass, straw and stalks) (Corvanich, 1976).
2. The energy value of the above food-stuffs was estimated, on average, as follows

Item	Energy value (kcal/kg)
Stalks and straw	3300.0 (Mitchell, 1979)
Leaves	4229.0 (Golley, 1961)
Stems and branches	4267.0 (Golley, 1961)
Average	3783.5

3. The elephant is capable of metabolizing 33% of its energy input (Benedict, 1936).

4. The amount of energy an elephant is capable of metabolizing
= energy of basal metabolism + energy expended on daily work.

5. The basal metabolism of an elephant is 49,000 cal/day (Benedict, 1936).

In accordance with the above data base, the expenditure of a working elephant was calculated and the results presented in Table 1.

Table 1
Energy expenditure of an elephant at labour

Item	Value (kcal)
Energy input (per day)	945,875.00
Energy capable of metabolising (per day)	312,138.75
Energy needed to perform work (per day)	312,089.75
Energy expended on work (per hour)	13,003.74

Discussion

Never before has anyone attempted, in an analytical study, to calculate the energy value of an elephant at work. Leach (1976) assigned the value of 8 MJ/hr (1910.68 kcal/hr) to the amount of energy expended by all kinds of draft animals. Cox and Atkins (1979) quoted the energy value for the labour of large draft animals as 2400 kcal/hr. This study calculated the energy expended per hour by a working elephant to be 6.8 and 5.4 times higher than both figures respectively. The discrepancy may be attributable to differing degrees of difficulty of the work itself, this is in accordance with the observation by Rose (1938), that energy expenditure is variable, depending on the degree of difficulty involved. Conversely, most of these large draft animals were employed in agriculture, which is generally less demanding in terms of energy expenditure than forestry work. On the other hand, Corvanich (1976) mentioned that a full-grown elephant might be assigned to haul a 2 tons load of timber over very rough terrain.

The working specification for a full-grown bull elephant are shown in Table 2.

An elephant reaches maturity at about the age of 25, with an average weight of 4,000 kilograms. It can haul a load half its body weight. The elephant is unable to work continuously. Its working hours should be limited to 3 days, followed by a 2-day break. The elephant itself, however, would prefer to work from early morning to noon only, and requires a vacation during the long, hot, dry summer (March-May). The mahout, who works with an elephant for life, starting with the training period

and lasting until the retirement of the one or the other, allows the elephant to retreat into the jungle for a peaceful rest during the summer. Elephants working in Thailand are employed exclusively by the Forest Industry Organisation, a government enterprise, which has drawn up a set of specifications for using elephants in forest silviculture according to the difficulty to the terrain, as follows (Corvanich, 1986):

- Very rough terrain : 1 elephant for production volumes of 150-300 m³
- Moderately rough terrain : 1 elephant for production volumes of 300-450 m³
- Fairly good terrain : 1 elephant for production volumes of 450-600 m³

Table 2
Working specifications of an elephant engaged in forestry work

Duration of working life	25-50 yrs
Weight at maturity	4,000 kg
Daily working hours	7 hours
Working days per annum	164 days
Maximum capable of hauling	2,000 kg
Maximum capable of lifting	700 kg
Max. load capable of carrying	180 kg
Maximum speed	4 km/hr

(Modified from Corvanich, 1976)

Even though the elephant has given way to machinery in the timber industry, it is definitely worthwhile preserving both as a renewable form of energy and as an exotic art form.

Acknowledgements

The author is thankful to the staffs at the Elephant Training Center, Lumpang, Thailand; and the Forest Industry Organisation who devote their time and energy to preserving this worthy practice that is such an integral part of Thai culture and heritage. This study is dedicated to Plai.

SUMMARY

Never before has anyone attempted to calculate the energy value of an elephant at work. There are several countries where the elephant still plays a significant role in the forestry industry. This study calculated the energy expended per hour by a working elephant to be 13,003.74 kcal. It differs from assigned values for large draft animals. The working specifications for a full-grown bull elephant were also given. Even though the elephant has given way to machinery in the timber industry, it is worthwhile preserving both as a renewable form of energy and as an exotic art form.

हाथियों के श्रम ऊर्जा अर्हा

जीरागोन गजसेनी

सारांश

अब से पहले किसी ने भी काम में लगे हाथी की ऊर्जा अर्हा का आगणन करने का कभी प्रयास नहीं किया। कई देश अभी ऐसे हैं जहाँ हाथी वानिकी उद्योग में महत्वपूर्ण भूमिका निभाते हैं। इस अध्ययन में काम में लगे हाथी द्वारा प्रति घंटे खर्च की गई ऊर्जा की गणना 13,003.74 कि० कैलरी लगाई है। यह अर्हा काम में लगाए बड़े जानवरों की मनोनीत अर्हा से भिन्न है। पूरे जवान हुए नर हाथी के काम की विशिष्टियाँ भी दी गई हैं। यद्यपि प्रकाष्ठ उद्योग में हाथियों की जगह अब यंत्रों ने ले ली है फिर भी उसे ऊर्जा के नवीकरण संभव रूप और एक बाह्य कला रूप दोनों दृष्टियों से बनाए रखना उपयोगी होगा।

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