

Kunnaree Pakkad<sup>1</sup>

Advisor: Asst. Prof. Dr. Dia Panitnard Shannon<sup>2</sup>

<sup>1</sup> Environmental Science Research Center (ESRC), Faculty of Science, Chiang Mai University, Chiang Mai, Thailand

<sup>2</sup> Forest Restoration Research Unit (FORRU), Department of Biology, Faculty of Science, Chiang Mai University, Chiang Mai, Thailand

## Abstract

Fire plays a significant ecological role in many forest ecosystems, influencing processes such as seed dormancy and germination. In fire-prone environments, certain species have developed mechanisms that promote or inhibit germination in response to fire-related cues like heat and charcoal. This study investigates the effects of heat and charcoal on seed germination in three native tree species—*Acrocarpus fraxinifolius* Wight ex Arn., *Cassia fistula* L., and *Prunus cerasoides* D. Don—in Doi Suthep, Northern Thailand.

## Introduction

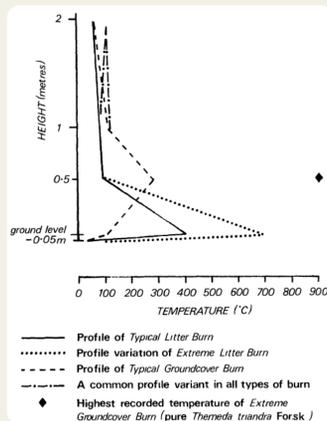


Figure 1: Characteristic vertical temperature profiles (°C) for different types of burn in dry deciduous dipterocarp forest.

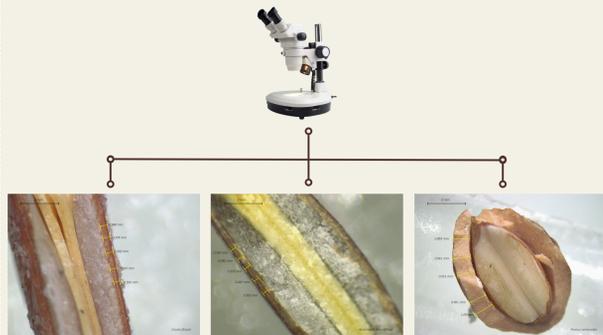
- **Typical Litter Burn** – Sparse groundcover, ≤5 leaves thick. Temps ~400°C at ground level. Minimal long-term impact.
- **Extreme Litter Burn** – Dense litter (>5 leaves). Temps up to 700°C, may harm shrubs.
- **Typical Groundcover Burn** – 50–90% vegetation. Temps peak at 300°C (0.5 m). Spreads like typical litter burn.
- **Extreme Groundcover Burn** – >95% vegetation. Temps up to 900°C, spreads >3 cm/s. Uncontrolled, damaging.

## Methods

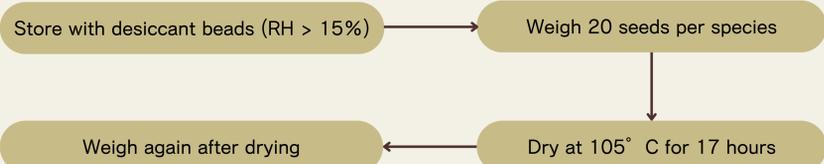
### Species Selection



### Measurement of Seed Coat Thickness



### Measurement of Moisture Content



$$\text{Moisture content (\%)} = \frac{\text{wet weight} - \text{weight after drying}}{\text{wet weight}} \times 100$$

### Heat and Charcoal Treatment

No.	Treatment
1	Control group
2	Charcoal
3	Charcoal + heat at 300° C for 20 s
4	Charcoal + heat at 300° C for 10 s
5	Heat at 300° C for 20 s
6	Heat at 300° C for 10 s

There are six treatments combining charcoal with different temperatures and durations. Each treatment was replicated 3 times, with 50 seeds per replicate, for 3 studied species.



### Germination Test



The results of the germination test was recorded once a week.

$$\text{Germination percentage} = \frac{\text{Seeds germinated} \times 100}{\text{Total seeds}}$$

## Results

- Figure 2 illustrates a significant treatment effect ( $p < 0.05$ ). Exposure to heat at 300°C for 20 seconds resulted in complete seed mortality, while heat treatments at 300°C for 10 seconds significantly reduced germination. Charcoal application did not provide any positive effects.
- Germination remained low (<10%) across all treatments for *C. fistula* and *P. cerasoides*, with no significant differences between treatments ( $p < 0.05$ ).
- Similarly, charcoal had no clear beneficial effect. For *A. fraxinifolius*, heat treatment at 300°C for 10 seconds reduced dormancy by 88%. In contrast, no significant treatment effects were observed for *C. fistula* and *P. cerasoides*.

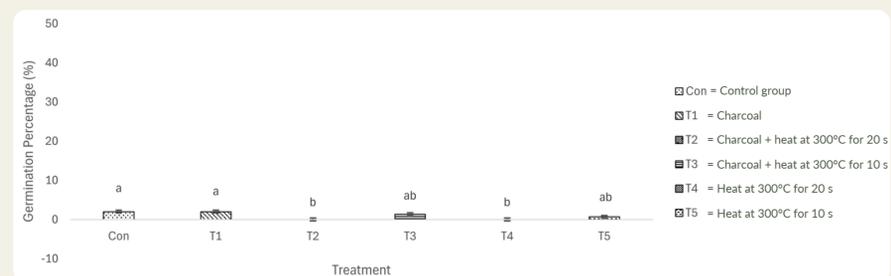


Figure 2 Seed germination of *A. fraxinifolius* under different charcoal and heat treatments

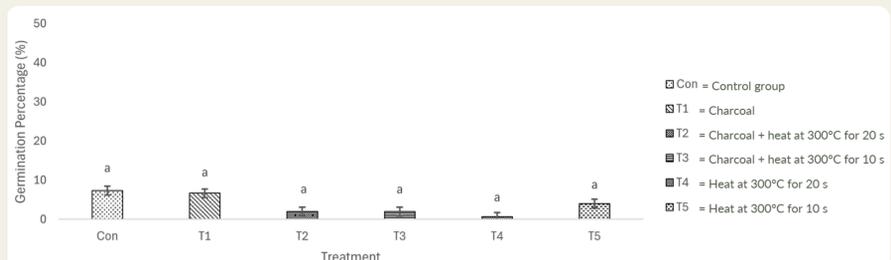


Figure 3 Seed germination of *C. fistula* under different charcoal and heat treatments

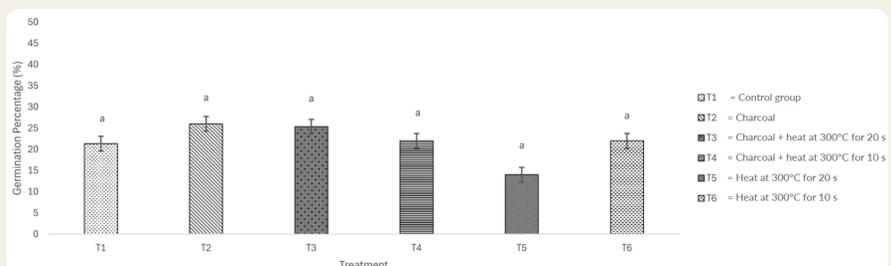


Figure 4 Seed germination of *P. cerasoides* under different charcoal and heat treatments

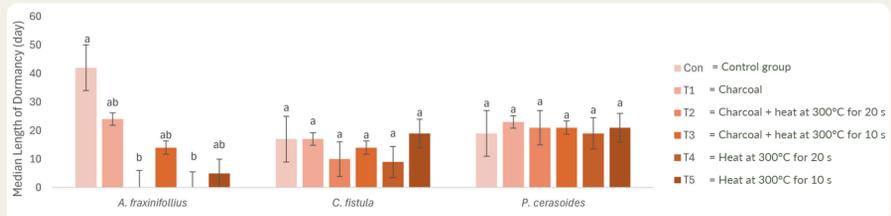


Figure 5 Median length dormancy of three native species under different charcoal and heat treatments

## Conclusion

Prolonged heat exposure (300°C for 20 seconds) caused complete seed mortality in *A. fraxinifolius*, whereas shorter exposure (10 seconds) broke dormancy but reduced overall germination. In contrast, heat had no significant effect on *C. fistula* or *P. cerasoides*, and charcoal treatment did not influence germination in any of the species.

## Acknowledgement

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## References:

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- Peter D. Moore. (1969). Burning issues in fire control. *Science*, 165(3893), 568-571. <https://doi.org/10.1126/science.165.3893.56>