

Fundamentals of Fire Behaviour Lab

Objective

In this Lab we will be working with small experimental fires in order to observe basic fire behaviour, and to analyze how slope affects the different variables of a fire.

We will be using Hawkes boards to contain the experimental fires (Pearce et al. March 1995). Hawkes boards are pieces of plywood 1.2 meters long, covered with aluminum flashing. The boards may be positioned at different angles to study the effect of slope on fire behaviour. Reference nails placed .2 meters apart provide a means to estimate the height of the flames at different distances.

Fuel for this experiment will consist of dead pine needles. We will be focusing on the speed at which the flame front moves across the forest litter floor. Data collected during the lifespan of the fire will be used to perform some basic calculations.

Safety Precautions

- Supervision is required at all times
- Do not wear loose, highly flammable clothing.
- If you have long hair, make sure to tie it back.
- Make sure that you wear safety goggles.
- No fooling around with the fire
- All fire experiments will be done outside

Materials

Clipboard
Notepaper
Experiment Fires Recording Sheet
Lighter Fluid
Stop Watch

Pine Needles
Weigh Scale
Matches/lighter
Hawkes Board

Procedure

In groups of four:

1. On the Hawkes board place a layer of litter approximately 3.5 cm deep (level with the sides of board). Ensure that the compression and distribution of the material is approximately the same across the board
2. Carefully remove the litter material and weigh it. At this point, check with the other groups to ensure you all have approximately the same weight of fuel. Record the weight of the material in the data sheet.
3. Return the litter material to the Hawkes board and ensure that once again, the compression and distribution of the material is approximately the same across the board.
4. Position the Hawkes board so that it is level (0° slope).
5. Before lighting the fuel, make sure that the roles for collecting this data have been assigned and that each person knows what their responsibilities are. THIS CRITICAL.
 - Person #1: Flame Travel Observer – Call out to the group when the flame front has reached each nail positioned along the Hawkes board.
 - Person #2: Stop watch – Write down the time when the flame front reaches the various nails positioned along the Hawkes board and write it down on data their sheet.
 - Person #3: Determine the flame height and depth at the various nail positioned along the Hawkes board and write it down on data their sheet.
 - Person #4: Estimate slope of flame and wind speed at the various nail positioned along the Hawkes board and write it down on data their sheet.
6. When all the roles have been clarified, light the fuel along the bottom of the Hawkes boards using a thin line of lighter fluid. Several students may work together to light the line of lighter fluid simultaneously, thus creating a uniform, straight flame front.
7. After the fire has travelled the length of the Hawkes board, and the fire has been extinguished, the observers carefully should enter their data onto one of the sheets provided.
8. Repeat this procedure two more times but with 30° slope and 60° slope. Be sure to rotate group jobs so everyone has a chance to try everything.

Experiment Fires Recording Sheet

0° slope

Distance (m)	Time (s)	Wind Speed	Flame Height	Flame Depth	Flame Angle (deg)
0					
0.2					
0.4					
0.6					
0.8					
1.0					
1.2					
Average					

Total Weight of Fuel: _____ kg

30° slope

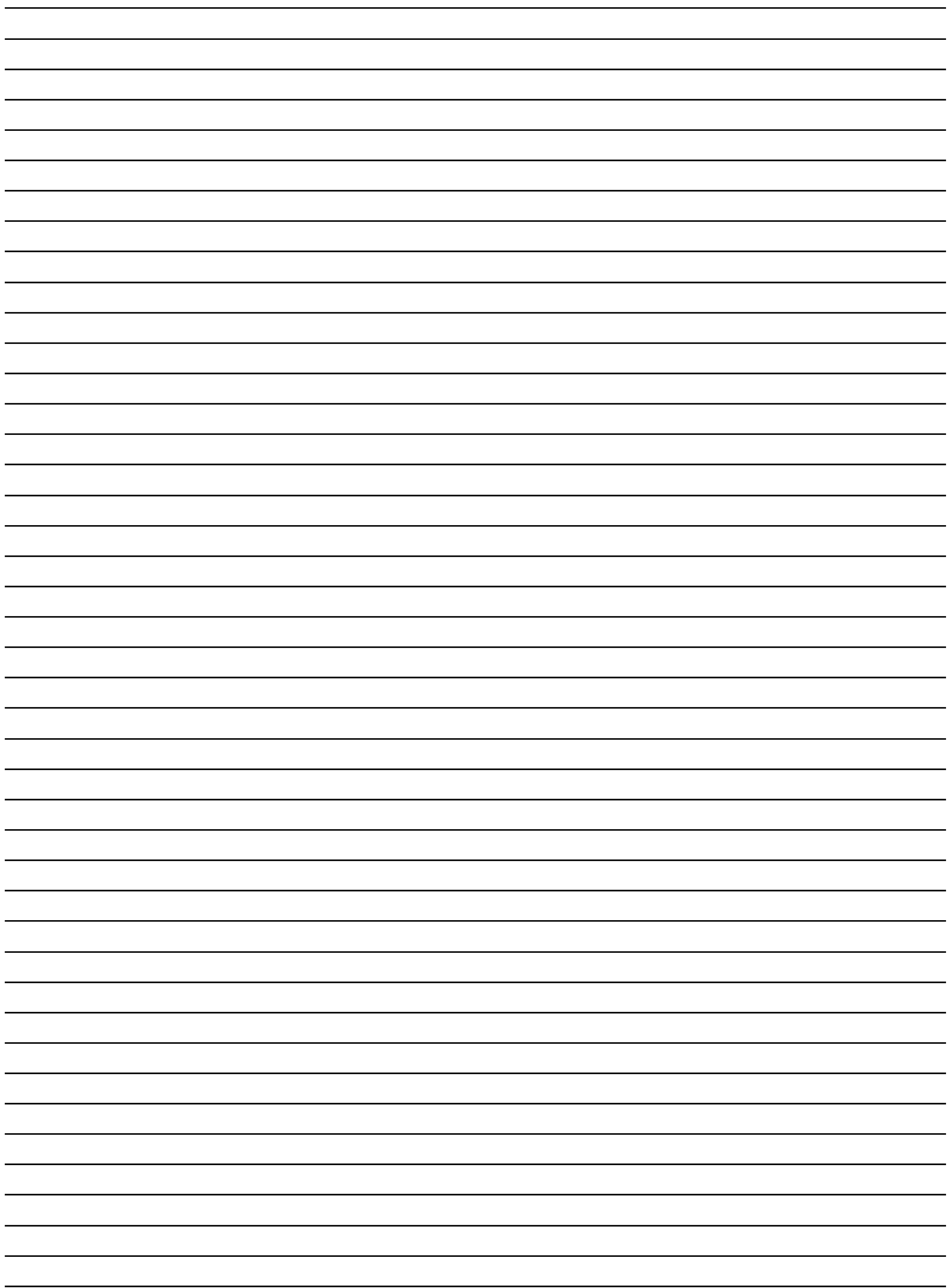
Distance (m)	Time (s)	Wind Speed	Flame Height	Flame Depth	Flame Angle (deg)
0					
0.2					
0.4					
0.6					
0.8					
1.0					
1.2					
Average					

Total Weight of Fuel: _____ kg

60° slope

Distance (m)	Time (s)	Wind Speed	Flame Height	Flame Depth	Flame Angle (deg)
0					
0.2					
0.4					
0.6					
0.8					
1.0					
1.2					
Average					

Total Weight of Fuel: _____ kg



Instructions in Making a Hawkes Board

- Dimensions: pieces of plywood 1.2 meters long and 0.75 meters wide
- Cover boards with aluminium flashing (nail on)
- Nail 1 inch (~ 2.5 cm) nails across board at 0.2 m intervals. Ensure that the majority of the nail is exposed as it will hold the pine needles in place
- Nail 3 ¼ inch (~ 8 cm) nails on the edge of the board at 0.2 m intervals. Ensure that 3 inches of the nail is exposed, as they will give reference to the height of the flame.

Note: You could just use 3 ¼ inch nails for all of the nails if you choose

