

Making Matchstick Forests

Materials

- block of wood (masonite is best, but other wood is OK, no more than 1/2 inch thick, about 6 x 7 inches)
- backing block to drill into (a piece of wood which can be discarded)
- bolt with two nuts, 3 inches or longer (per block)

Tools

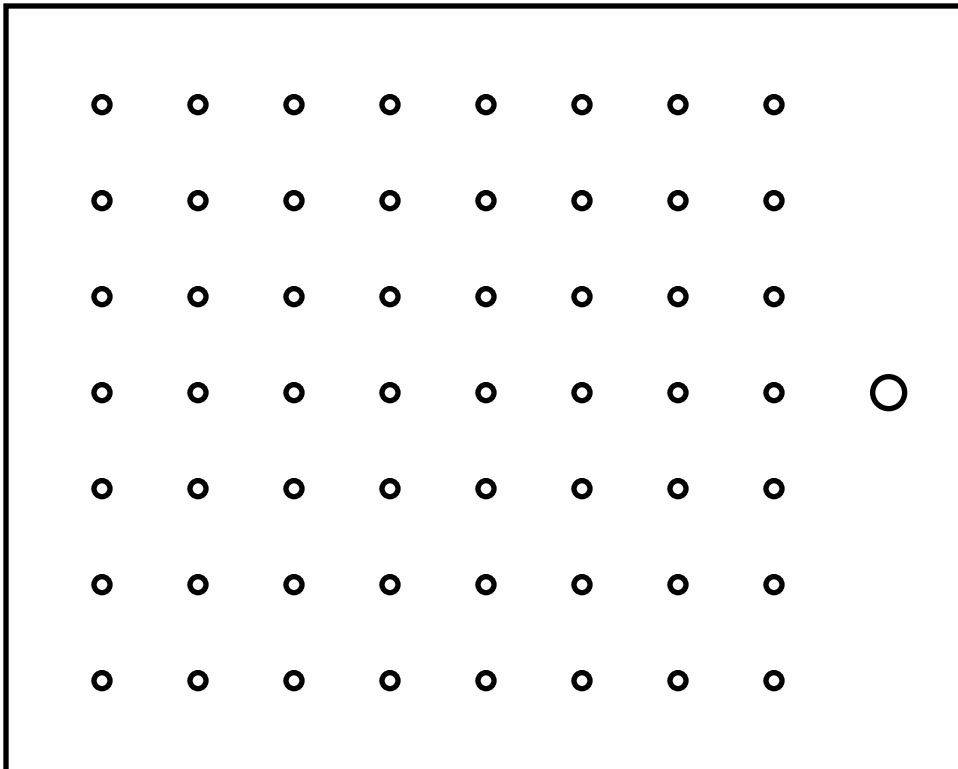
- hand or electric drill, 7/64 inch drill bit
- carpenters triangle or other tool for measuring and marking holes
- pencil for marking holes

Instructions

Decide on on your hole spacing and then mark the pattern on the wood block. Drill each hole all the way through the block (so that matches which are stuck can be pushed out from the back side). The 7/64 inch bit size allows standard large kitchen matches to be pushed into the hole, a bit tightly; a 1/8 inch bit makes the hole too loose. Drill the larger bolt hole so that the bolt easily passes through. Clean off any splinters or wood fragments.

Example Block

4x5 inches, 1/2 inch spacing between matchstick holes; there is no “right” pattern, spacing, or number of holes, but this example works well; greater spacing will make the “fire” less likely to pass from tree to tree, smaller spacing will make it more likely; with the 1/2 inch spacing, fire will not usually pass in the flat forest test (if there is no wind), but will in the sloped forest tests; the 56 matchstick holes allow a reasonable number for later tests which represent various for forest types or management prescriptions where not all holes filled with matchstick trees



Matchstick Forest Lesson

This lesson is a brief adaptation from FireWorks Curriculum, Activity 3-4: The Fire Triangle in Wildlands, available at http://www.fs.fed.us/rm/pubs/rmrs_gtr65.pdf.

Description: Matchstick forests are used to explore how slope and arrangement of trees affect the spread of fire. The fire to be observed models, in a simple way, crown fires, and the matchsticks model conifer trees with few lower branches and heavy crowns, such as ponderosa or jeffrey pine.

Materials:

- matchstick forest blocks, 3 or more
- protractors, one per block
- nonflammable metal pan, or metal trashcan lid, or nonflammable floor
- safety goggles or glasses
- spray bottles, fire extinguisher
- large kitchen matches, at least 224 (250 matches in a full box)
- watch or stopwatch

Safety: This activity uses kitchen matches. Any students lighting or closely observing burning of the matches should be wearing safety goggles or glasses. Spray bottles can be used to put out matches burning normally. A fire extinguisher must be handy for any unexpected flare-ups or accidental ignition of match boxes. Some students may attempt to steal matches, so it is best to address this up front. Strike-on-box matches are safer in this situation, though they will behave somewhat differently from strike-anywhere matches. Some lesson versions recommend using long-handled fireplace lighters to light the matches, however, it is difficult to control which matches are lit with these lighters, and they are not any safer than using a match to light other matches. This lesson is most safely done outside on a nonflammable surface such as concrete or asphalt, however, any wind will change the results of the experiments and may make it impossible to see the effects of other variables.

Instructions:

1. The teacher will demonstrate the first fire test, a fully populated forest (block) laying flat, talking about and modeling safety during the demonstration. Have students predict whether fire will spread from one match to another in the forest. Light an edge tree and observe (the fire is not likely to spread, unless there is wind; the heating, ventilation and air conditioning systems in buildings produce “wind”). After this match burns out or is put out, light an interior match and observe to see if results are different.
2. Brainstorm variables which might change the way fire spreads or does not. Students will probably suggest wind, and may suggest slope (depending on what their previous learning about fire is) and arrangement of trees in a greater or lesser density. Wind is very interesting to consider, but is a difficult variable to control in the classroom. To isolate variables, the second round of tests will vary only slope. Assign two teams to create fire blocks with different slopes, over a range of 10 to 40 degrees (measured with the protractor). Once these forests have been created, have the team or team representatives under supervision of the teacher light one match on the lower edge so that the entire class can observe. Keep track of the time from first ignition until the fire has gone out or is no longer spreading. Discuss how the blocks behaved differently, including both which trees burned and how rapidly the fire spread.
3. Brainstorm (and draw) arrangements of trees that might slow or stop fire spread, both natural patterns such as a historical yellow pine forests with large widely spaced trees, and management prescriptions such as removal of some trees. Have each team create a forest with a different density and pattern. Again, have the team or team representatives under teacher supervision ignite one match in their forest so that the entire class can observe. Again, keep track of time from ignition to end. Discuss which trees burned and how rapidly the fire spread. Discuss why some natural forests are more prone to rapid and complete spread, such as lodgepole, while others normally do not develop crown fires at all, such as natural yellow pine forests. Discuss how management can change fire behavior.