April 19, 2006

Artificial Windbreak: An Engineer's Perspective

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Introduction

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- Windbreaks have traditionally been used for:
  - Controlling erosion
  - Controlling snow drift
  - Improving animal health and survival in winter
  - Reducing energy consumption of farmstead units

- Windbreak design depends on your objectives

Design Criteria

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- Wind speed and direction
- Windbreak height (H)
- Porosity
- Porosity distribution
- For natural windbreaks,
  - External structure
    - Width, height, shape, orientation
  - Internal structure
    - Arrangement of branches, leaves, stems

Design Criteria

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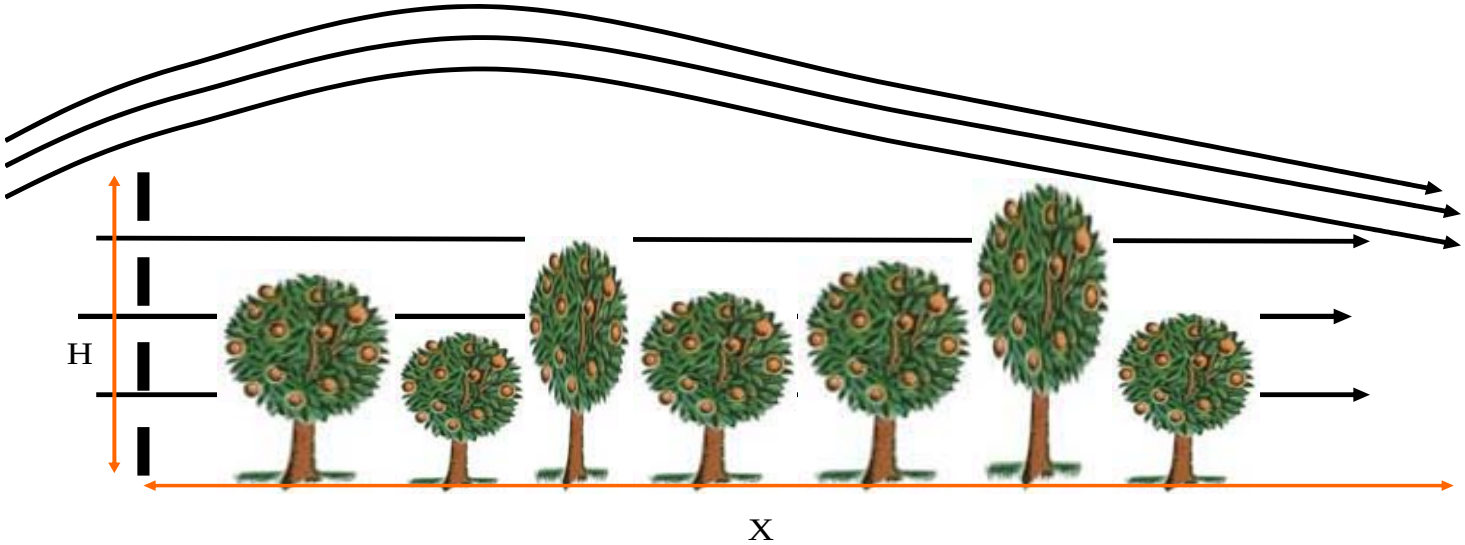
- Windbreak effective protection zone is about 10 to 15 times of its height (H) downwind
- Windbreaks should be made perpendicular to the wind direction to protect the greatest land area
- The wind load is proportional to velocity squared



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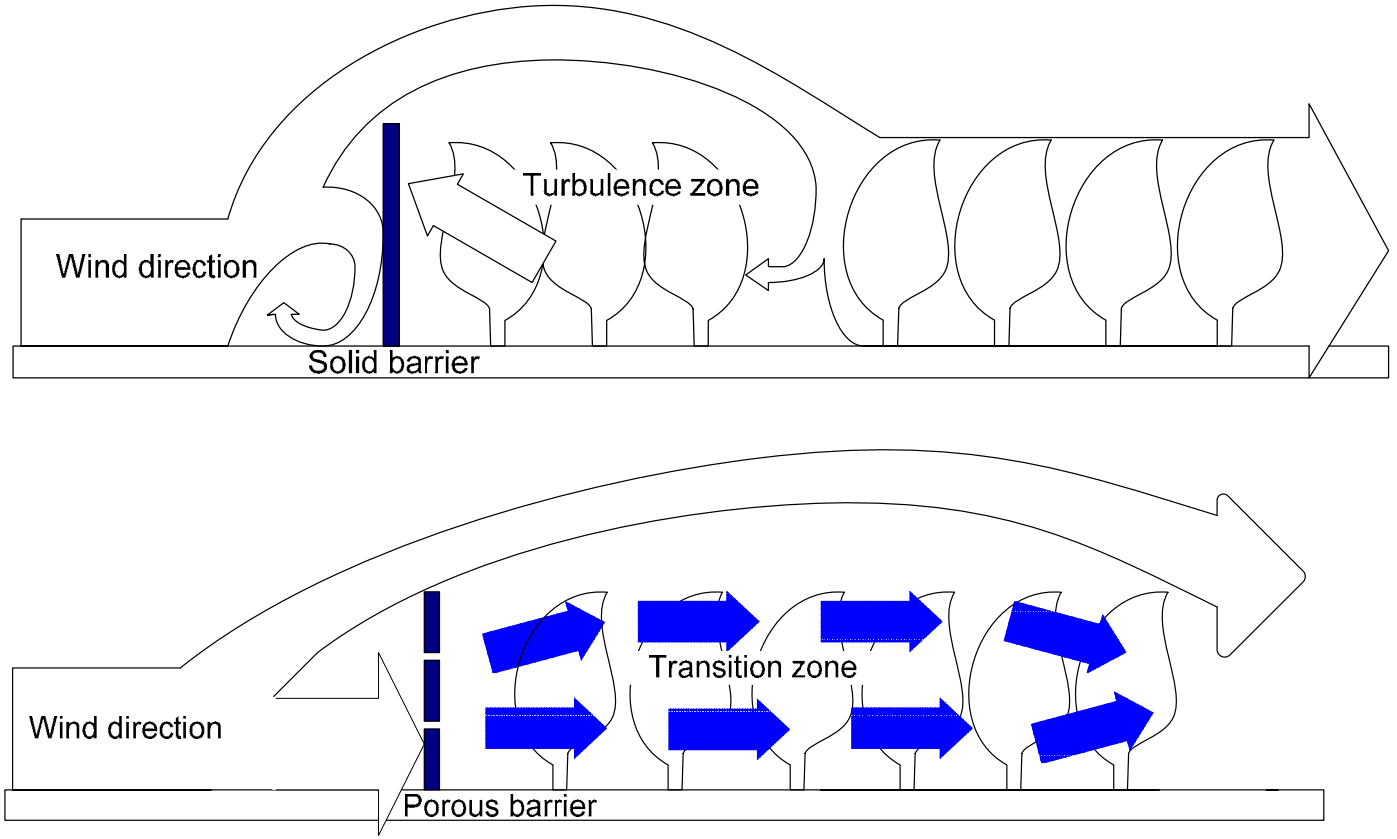
Windbreak and Porosity



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What is the Optimum Porosity

- Reduction in porosity will increase turbulence
- Increase in porosity increases the ground level wind
- Recommended optimum porosity is about 40 %. (where 60% of the wind is blocked)
- Porosity of more than 80% provides little useful wind reduction.

Porosity Distribution

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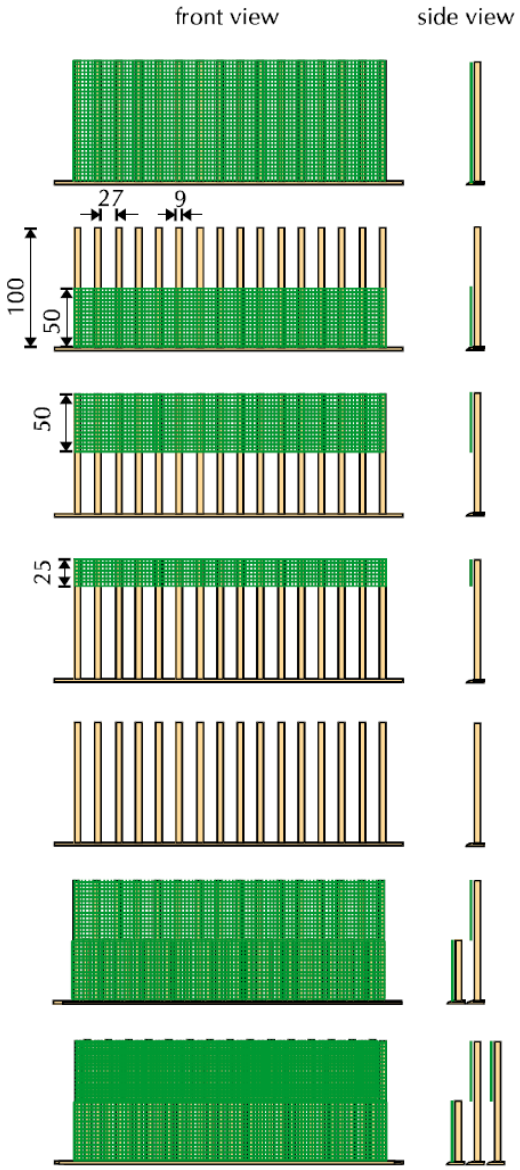


windbreak 1
evenly distributed porosity
stem porosity : 75 %
canopy porosity : 32 %

windbreak 2
dense lower part (0.5 H)
stem porosity : 75 %
canopy porosity : 32 %

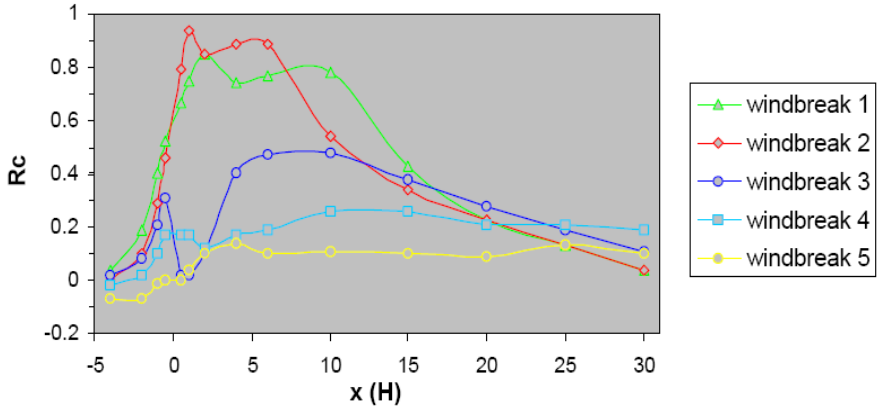
windbreak 3
dense upper part (0.5 H)
stem porosity : 75 %
canopy porosity : 32 %

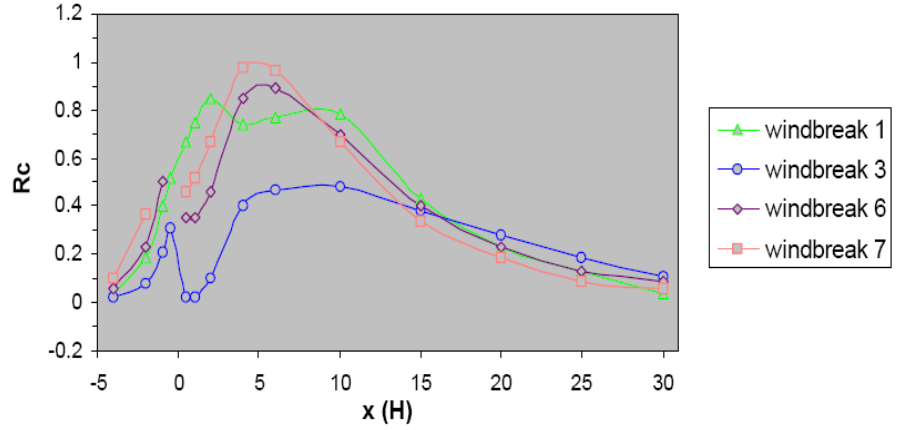
windbreak 4
dense upper part (0.25 H)
stem porosity : 75 %
canopy porosity : 32 %

windbreak 5
no canopy
stem porosity : 75 %
canopy porosity : 100 %

windbreak 6
2 rows
stem porosity : 75 % (upp
50 % (lowe
canopy porosity : 32 %

windbreak 7
3 rows
stem porosity : 50 % (upp
50 % (lower)
canopy porosity : 32 %





Cornelis et.al (1997)

Construction Guideline

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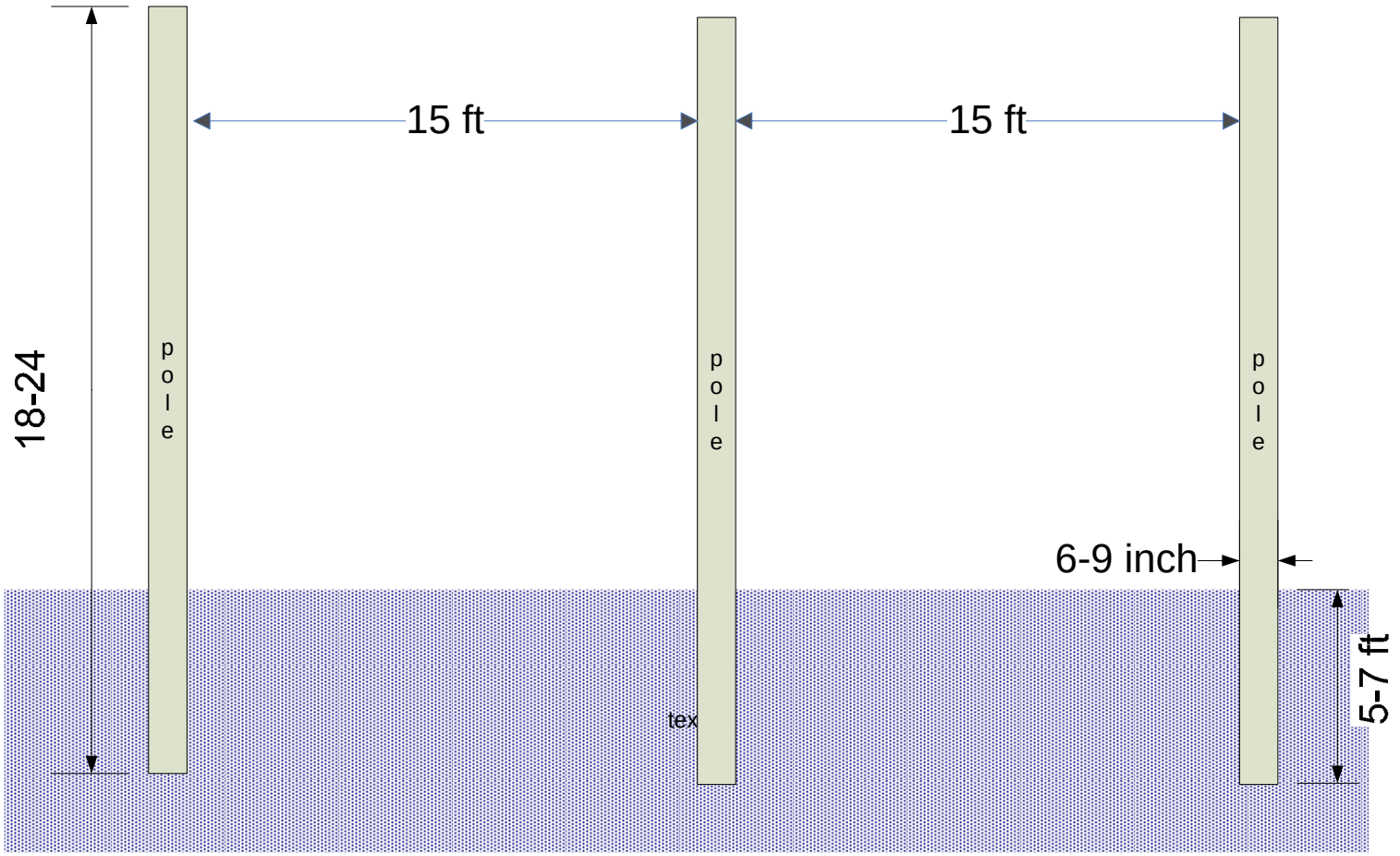

by Gale Pacific, Inc

Construction Guideline

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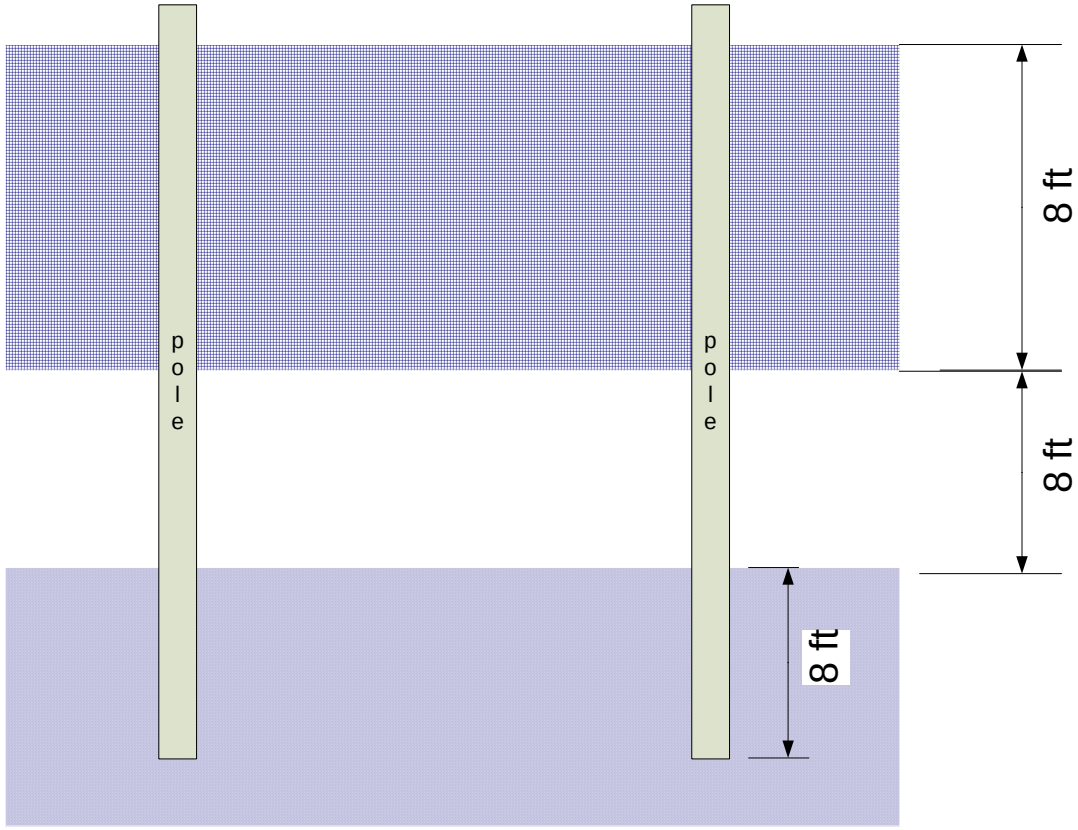
- 6” x 6” x 25 ft. wooden pole - $65.50
- 7” x 7” x 30 ft. wooden pole - $128.95
- Steel pipe 3/8’ thick. 12 x 12 x 42ft. - $27.50 per foot

(approximate price)



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Thanks and Questions