

Design and Manufacturing of a Model Forest Canopy

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Deforestation

“About 36 football fields worth of trees lost every minute” (World Wildlife Fund)

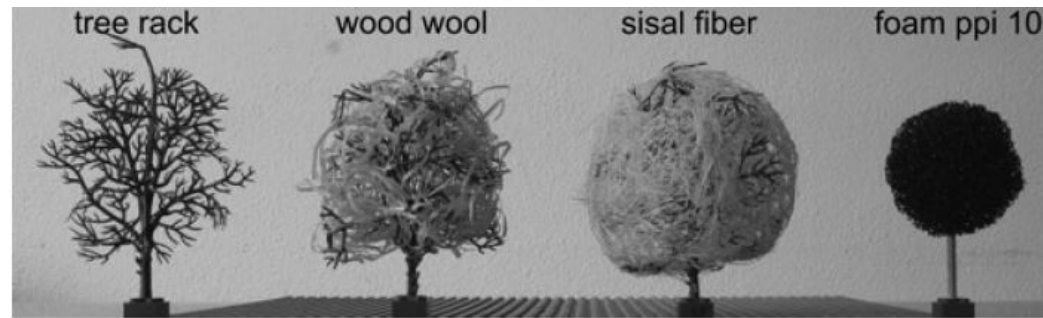
- Definition
- Locations
 - Brazil, Indonesia, Thailand, and Democratic Republic of Congo
 - 90% of the continental United States' forests have been removed since 1600
- Causes
 - Land development (housing and urbanization)
 - Resources (timber, paper, oil)
 - Agriculture



(<http://earthinnovation.org/our-work/case-studies/amazon-deforestation/>)

Introduction

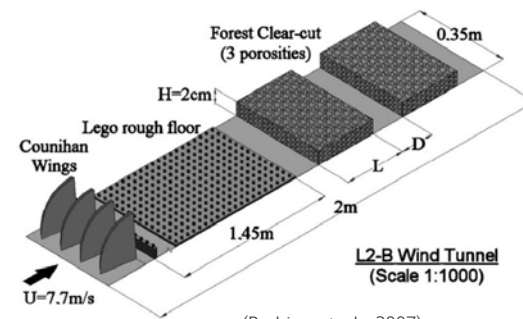
- Our Model
 - 2,500 trees on 95 in x 48 in Styrofoam base
- Forest Types
 - Boreal, Tropical, Deciduous
- Basic Fluid Model
- Previous Models



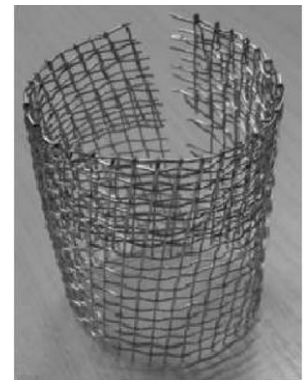
(Gromke et al., 2008)



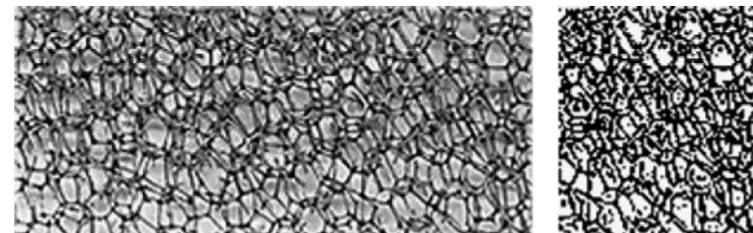
(Meroney et al., 1969)



(Rodrigo et al., 2007)

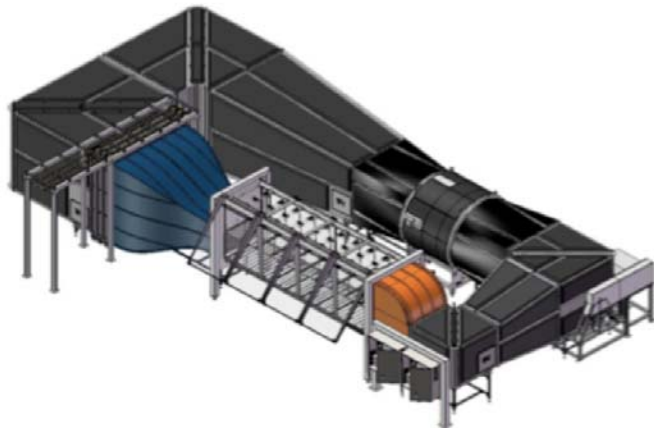


(Conan et al., 2015)

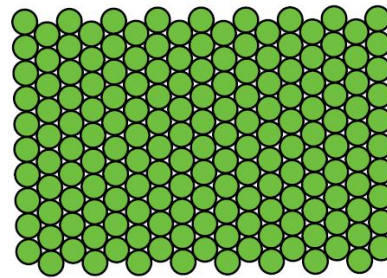


Materials and Methods

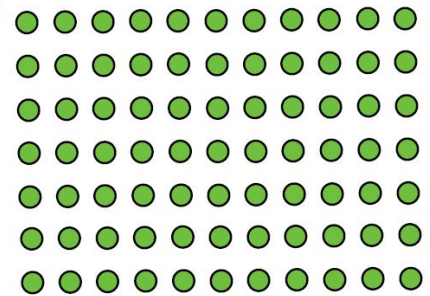
- Scale
 - 2 m → 4 cm; 1.5 m → 3 cm
- Closed-Circuit Wind Tunnel
 - test section has a length of 5 m and a cross section of 0.8x1.2 m.



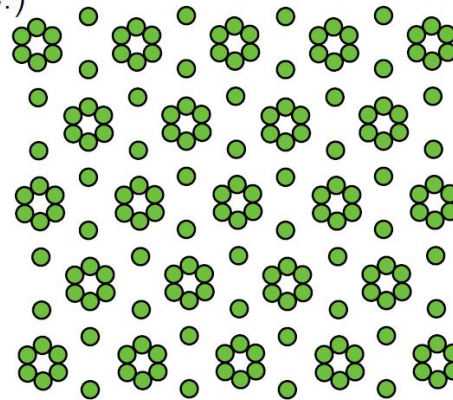
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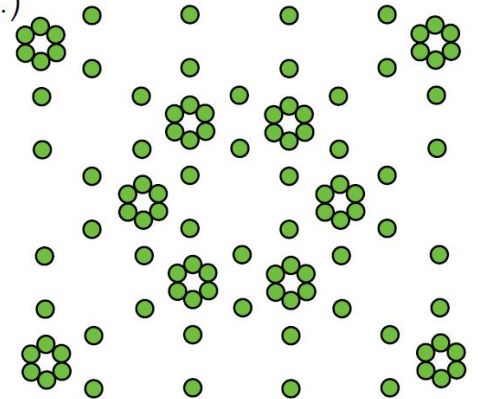
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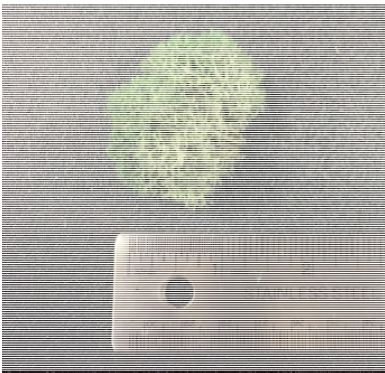
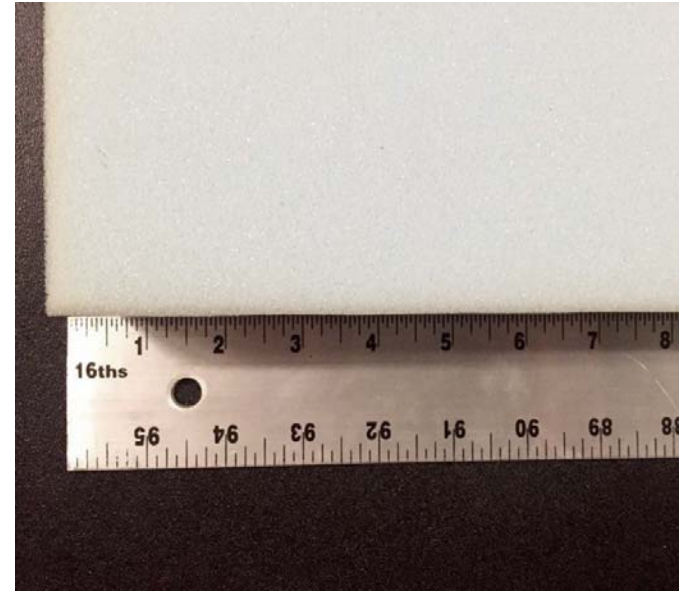


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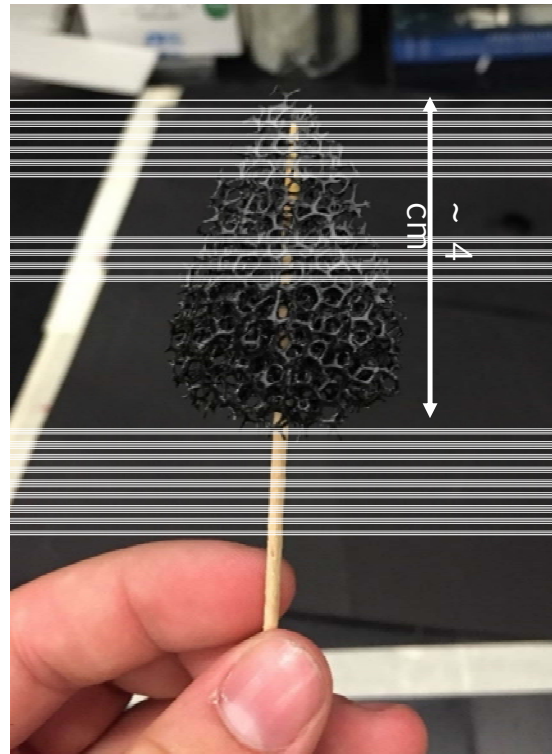
d.)





Results

- Model 1: Porous foam and toothpick
- Model 2: Styrofoam ball and toothpick
- Model 3: Model pine tree



Discussion

- Materials that did not work
 - Cylindrical wooden sticks, foam block, artificial moss, pine tree model
- Models that did not work
 - Styrofoam ball and toothpick (blockage)
 - Porous foam and toothpick
- Selected Model
 - Pine tree model



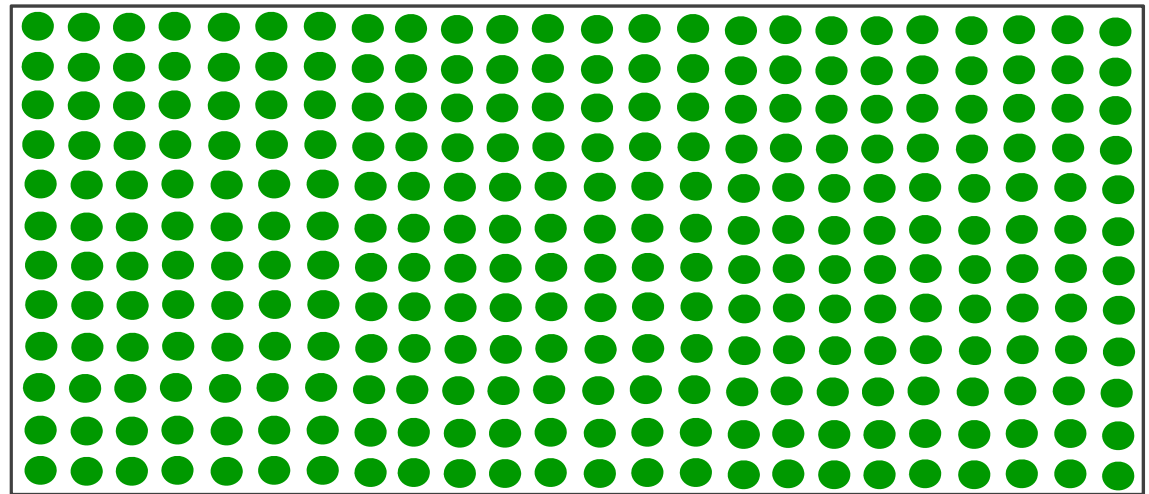
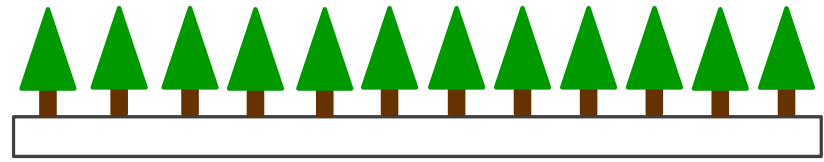
Other Forest Canopy Models

- Deciduous Forest Canopy Model
- Tropical Forest Canopy Model



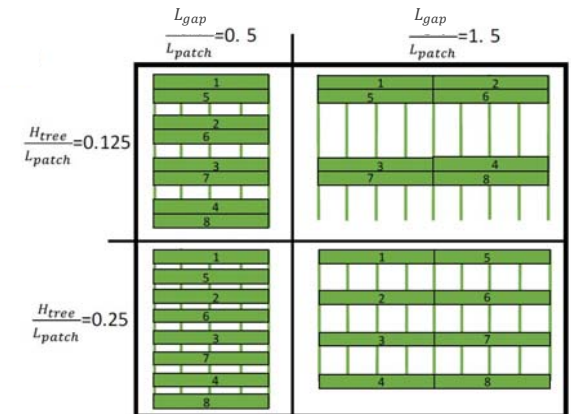
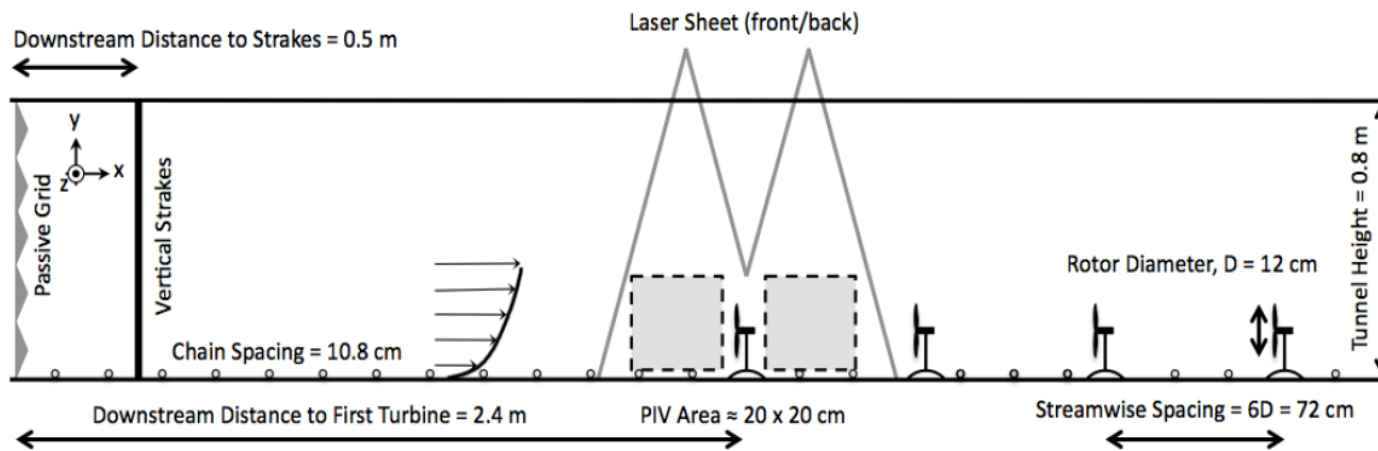
Conclusion

- Selected model based on scaling + constraints
 - Final Model with base



Outlook

- Measure flow field (mean velocity and Reynolds stresses) via wind tunnel experiments
- Vary canopy density and patch design

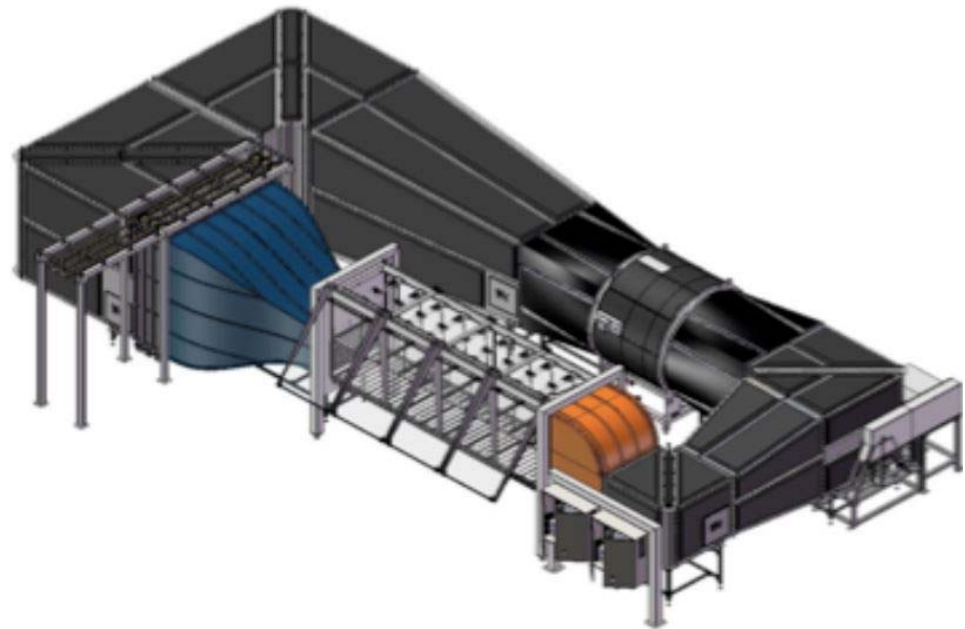


Acknowledgements

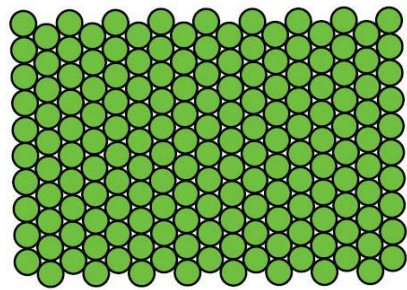
- A special thank you to Raúl Bayoán Cal for introducing me to this project and supporting me throughout my work.
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References

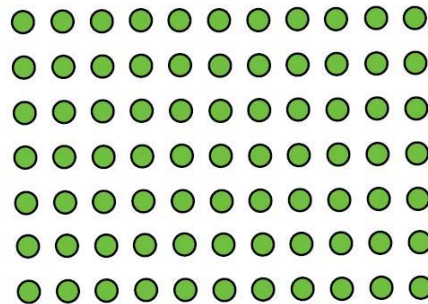
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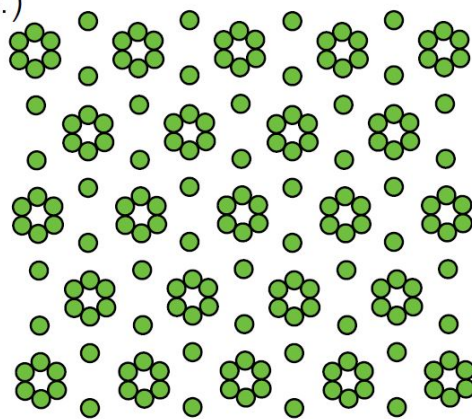
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