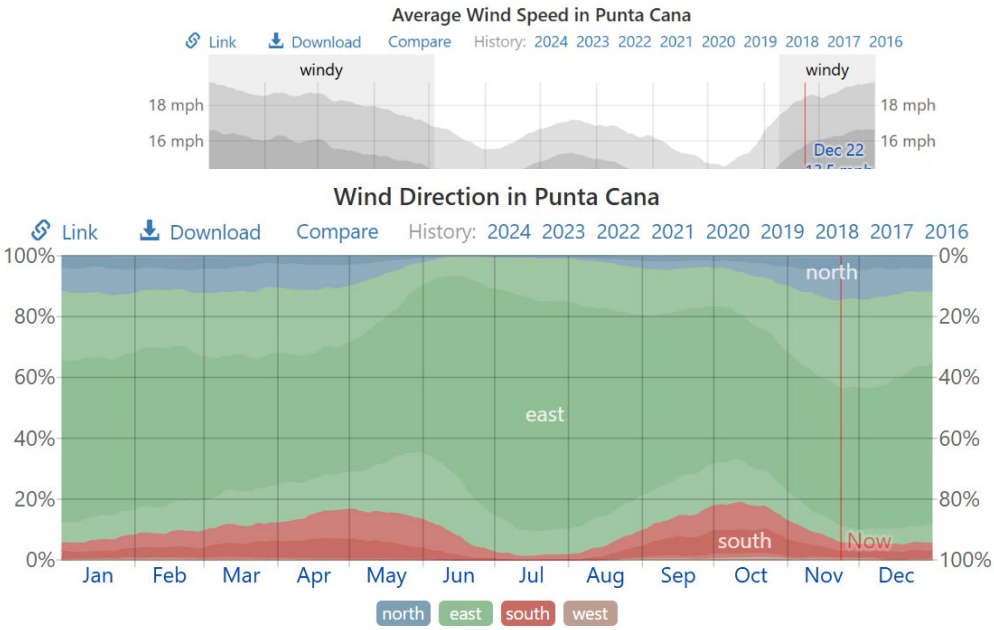
Engineering for Extreme Weather

# Building in the Tropics

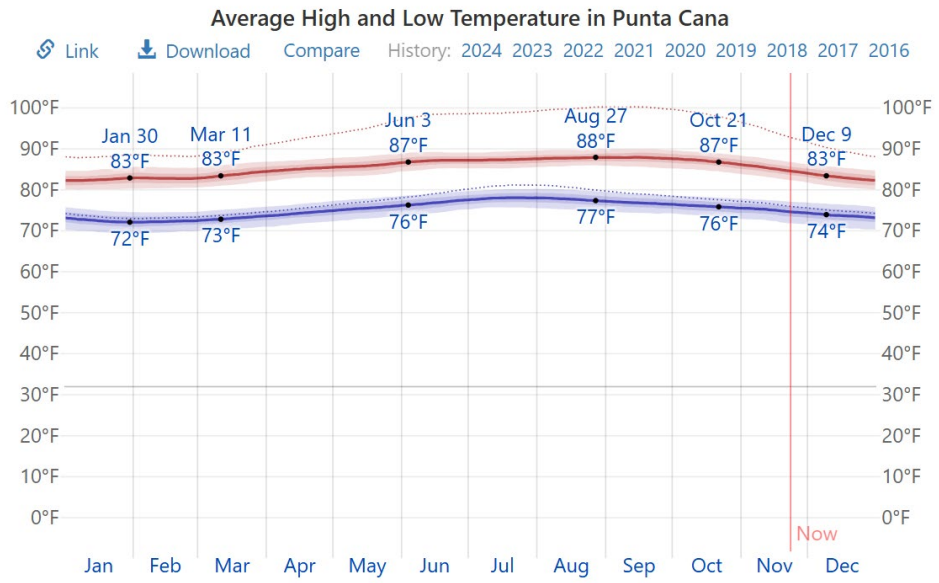
## Problem

Designing a home with a focus on sustainability in the tropics requires paying attention to prevailing winds, the power of the sun, and a building site that can drain, rather than collect, rainfall. Sustainable design relies on the prevailing breeze rather than electrical air conditioning to cool a home. The hot tropical sun will heat the home throughout the day, so ideally, we want to limit exposure.

If we focus on Punta Cana, in the Dominican Republic, we find:



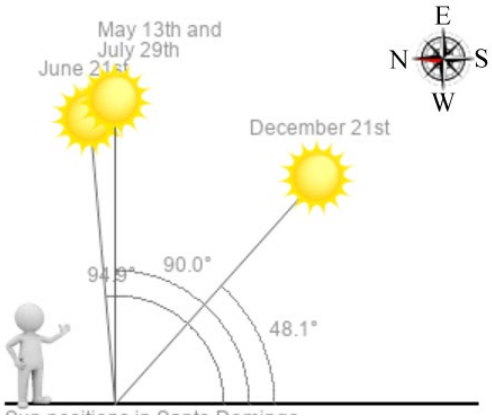

*The percentage of hours in which the mean wind direction is from each of the four cardinal wind directions, excluding hours in which the mean wind speed is less than 1.0 mph. The lightly tinted areas at the boundaries are the percentage of hours spent in the implied intermediate directions (northeast, southeast, southwest, and northwest).*




*The daily average high (red line) and low (blue line) temperature, with 25th to 75th and 10th to 90th percentile bands. The thin dotted lines are the corresponding average perceived temperatures.*

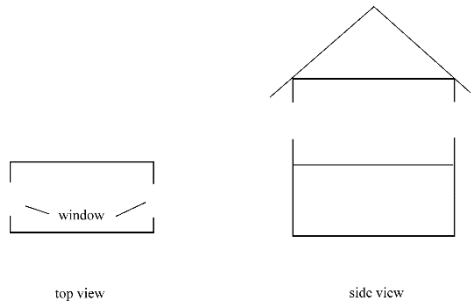
| Average | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| High | 83°F | 83°F | 84°F | 85°F | 86°F | 87°F | 87°F | 88°F | 88°F | 87°F | 85°F | 83°F |
| Temp. | 77°F | 77°F | 78°F | 79°F | 80°F | 82°F | 82°F | 82°F | 82°F | 81°F | 80°F | 78°F |
| Low | 73°F | 72°F | 73°F | 74°F | 76°F | 77°F | 78°F | 78°F | 77°F | 76°F | 75°F | 74°F |

And angle of the sun:

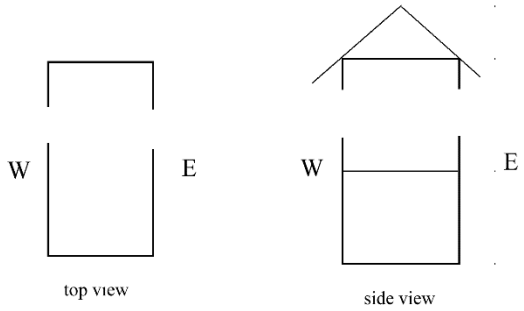


**Question #1:** Which of the following 2-story homes would be most efficient and would best utilize sustainable building practices, and why?

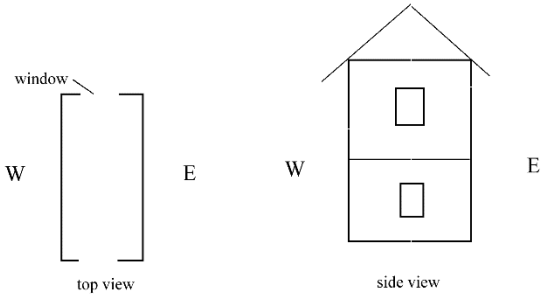
a)



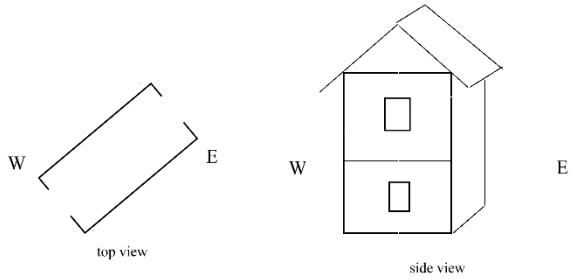

b)




c)




d)




**Question #2:** Name 2 things you can do to the best building configuration to make the design more sustainable.