# A Simplified Method For The Analysis of Passive Design Resources on a Project Site

Passive Design, University of Ferrara
Lecture Two: October 3rd, 2011

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The First Part

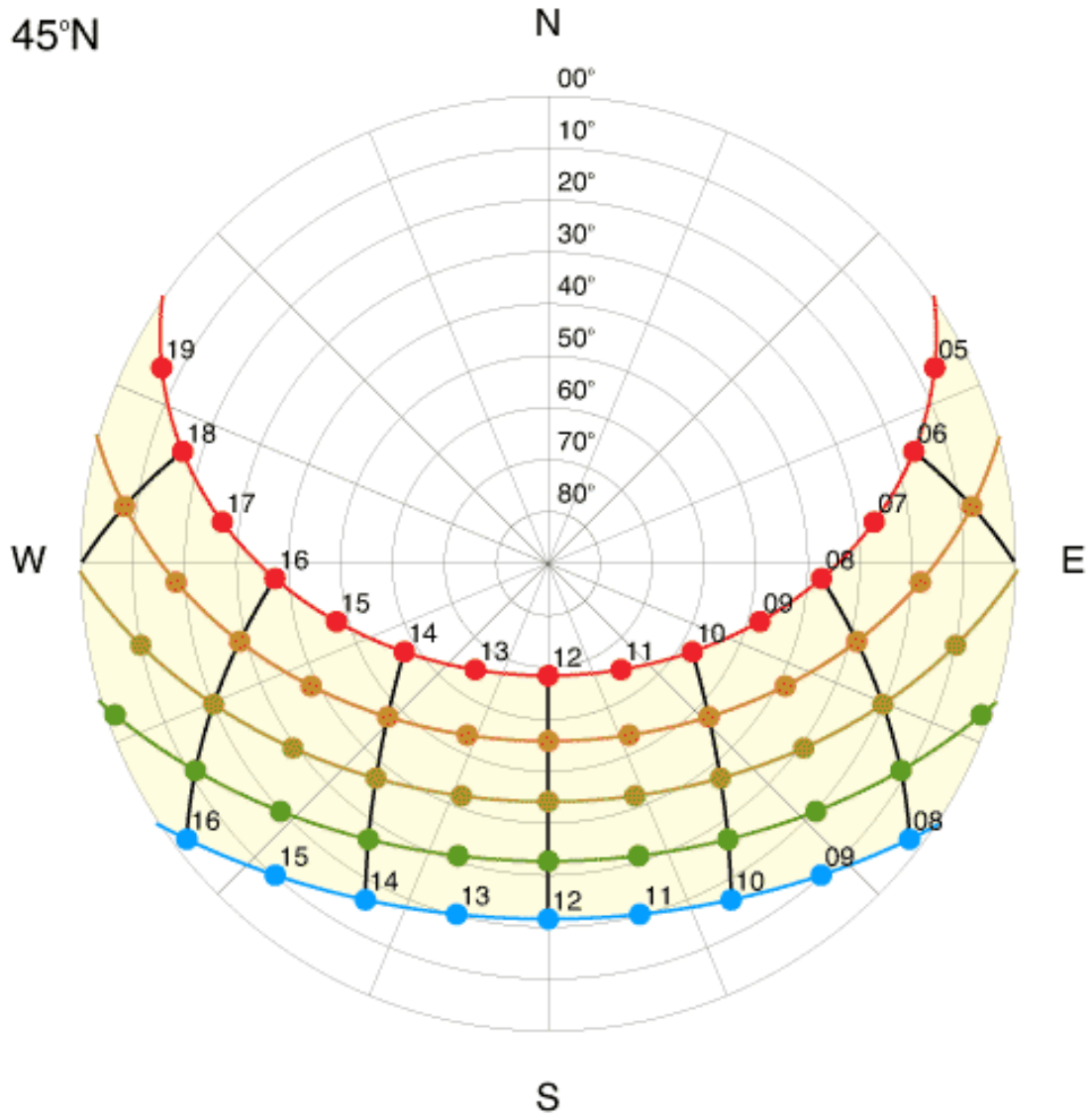
# MACRO ENVIRONMENTAL CONDITIONS

# Step 1: Determine Project Latitude

- The latitude of Ferrara is 44°50′42″N
- This is the same approximate latitude as Halifax and Minneapolis, which tells us that solar azimuth alone isn't enough to determine the environmental characteristics of a site.

# Step 2: Locate the Sun Path Diagram

- These are published in many sources, Architectural Graphic Standards is one, Sun, Wind and Light is another
- Here's a good web source: http://www.geog.ubc.ca/courses/geog300/applets/sunpath/index.html
- The information is commonly available in two degree intervals, so choose the closest latitude to the project site.
- If more exactitude is needed, a program like Ecotect can provide location specific data




Sun Path Diagram for 45 degrees N, from: http://www.geog.ubc.ca/courses/geog300/applets/sunpath/index.html

# Step 3: Locate Nearest Weather Station

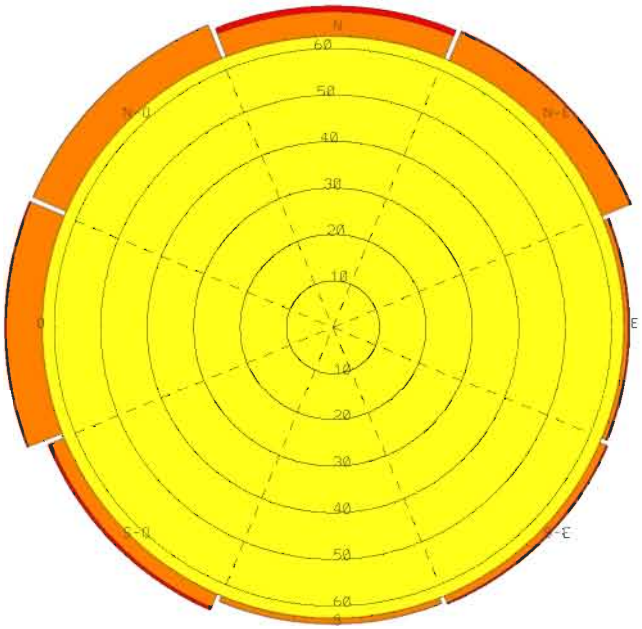
- It is common for the National Weather Service of most western countries to provide weather data on the internet.
- This information is necessary for much of our future analysis but the good news is that if you work locally, you only need to access this information once.
- For Ferrara the link is: http://www.arpa.emr.it/sim/?osservazioni_e_dati/climatologia

# Step 4: Download Wind Data

- In order to get a quick feel for the site, study the extremes (January and July for temperate climates), in the morning and afternoon (or use monthly averages)
- Use a wind rose for a quick visual description of the wind behaviour: The example shown is for July
- If a wind rose isn't available construct one using tabular averages. Sun, Wind and Light provides examples
- Study the shoulder seasons (April and October) and finer scales of data once the design is underway to optimize the building for the location
- To make wind data understandable, this description of the Beaufort scale is very useful: http://en.wikipedia.org/wiki/Beaufort_scale

Stazione Malborgetto di Boara - Comune Ferrara - Provincia Ferrara
Lat.44.85 Lon. 11.66 Alt. 5 metri - Periodo: Quindicennio dal 01-01-1991 al 31-12-2005
mese di Luglio ore : 06 G.M.T.

N.B. :
Le frequenze
indicano la
direzione di
provenienza
del vento




LEGENDA:
Velocità del vento in m/s

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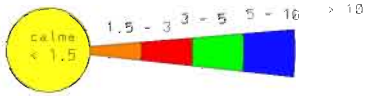
Numero Calme : 201

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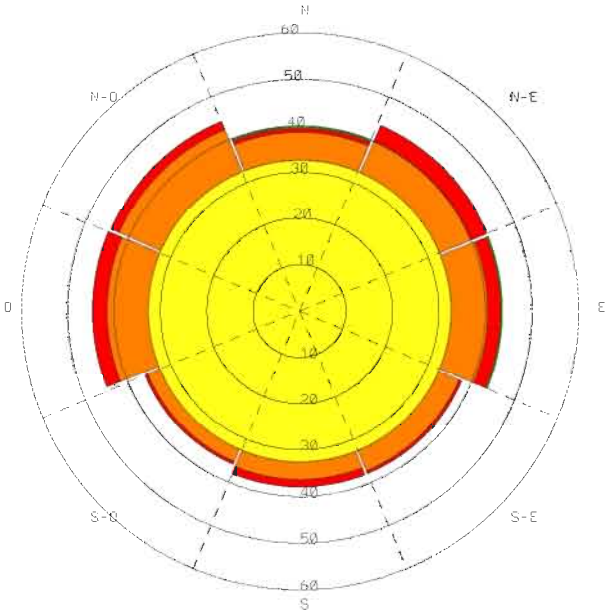
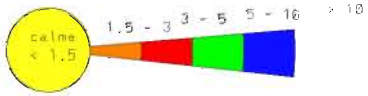
Stazione Malborgetto di Boara - Comune Ferrara - Provincia Ferrara
Lat.44.85 Lon. 11.66 Alt. 5 metri - Periodo: Quindicennio dal 01-01-1991 al 31-12-2005
mese di Luglio ore : 09 G.M.T.




N.B. :
Le frequenze indicano la direzione di provenienza del vento

LEGENDA:
Velocità del vento in m/s

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Numero Calme : 103

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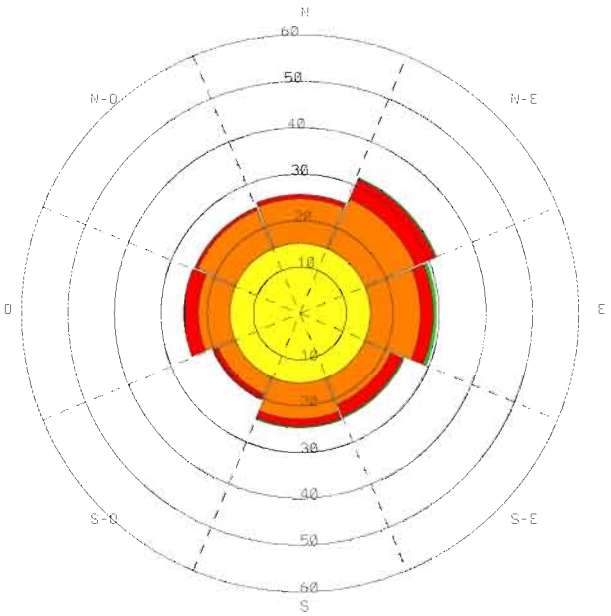
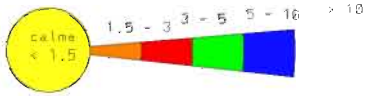
Stazione Malborgetto di Boara - Comune Ferrara - Provincia Ferrara
Lat.44.85 Lon. 11.66 Alt. 5 metri - Periodo: Quindicennio dal 01-01-1991 al 31-12-2005
mese di Luglio ore : 12 G.M.T.

N.B. :
Le frequenze
indicano la
direzione di
provenienza
del vento




LEGENDA:
Velocità del vento in m/s

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Numero Calme : 49

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Stazione Malborgetto di Boara - Comune Ferrara - Provincia Ferrara
Lat.44.85 Lon. 11.66 Alt. 5 metri - Periodo: Quindicennio dal 01-01-1991 al 31-12-2005
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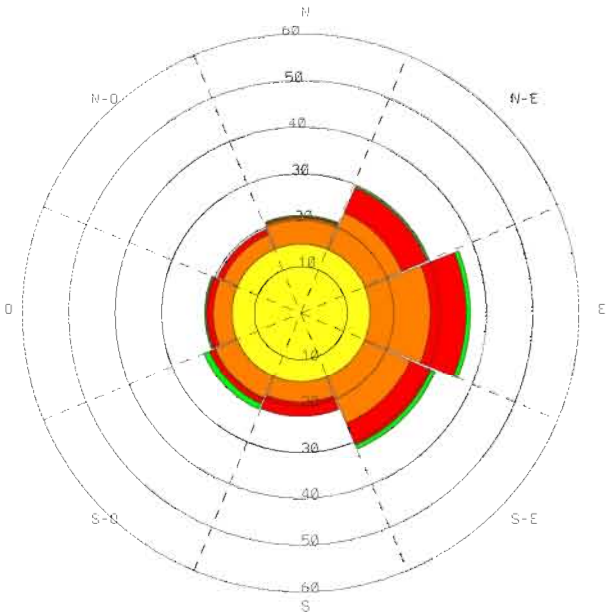
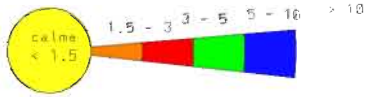



N.B. : Le frequenze indicano la direzione di provenienza del vento

LEGENDA:
Velocità del vento in m/s




Numero Dati : 323
Numero Calme : 48

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Stazione Malborgetto di Boara - Comune Ferrara - Provincia Ferrara
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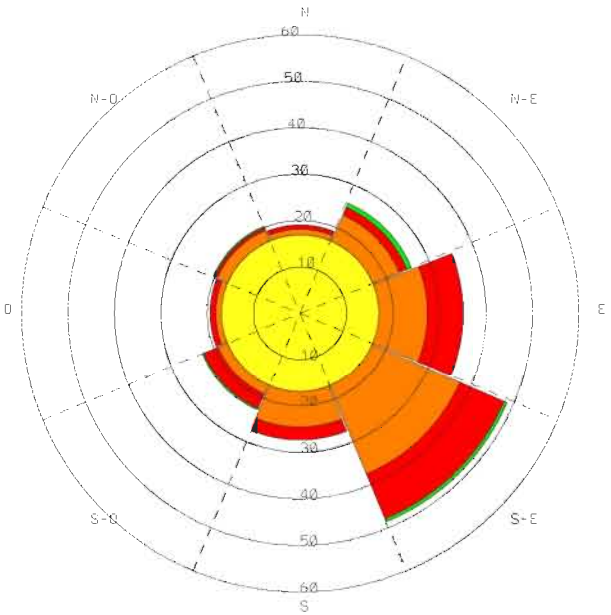
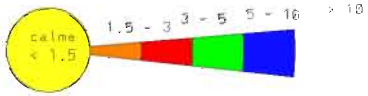
mese di Luglio ore : 18 G.M.T.




N.B. : Le frequenze indicano la direzione di provenienza del vento

LEGENDA:
Velocità del vento in m/s




Numero Dati : 325
Numero Calme : 55

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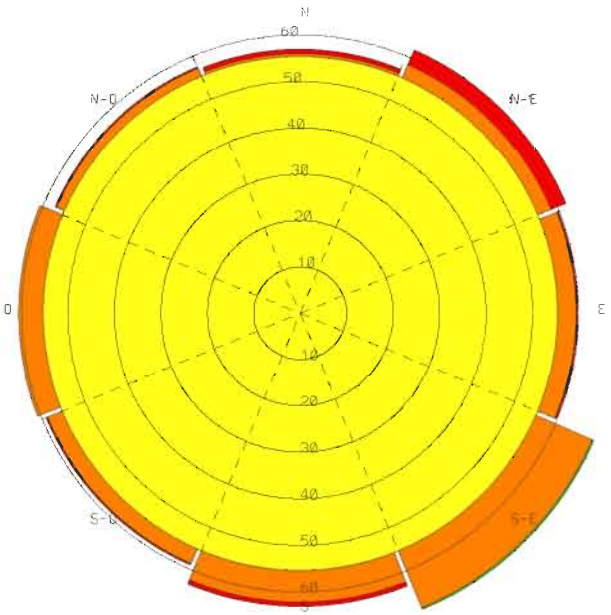
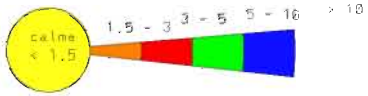
Stazione Malborgetto di Boara - Comune Ferrara - Provincia Ferrara
Lat.44.85 Lon. 11.66 Alt. 5 metri - Periodo: Quindicennio dal 01-01-1991 al 31-12-2005
mese di Luglio ore : 21 G.M.T.




N.B. : Le frequenze indicano la direzione di provenienza del vento

LEGENDA:
Velocità del vento in m/s




Numero Dati : 325
Numero Calme : 180

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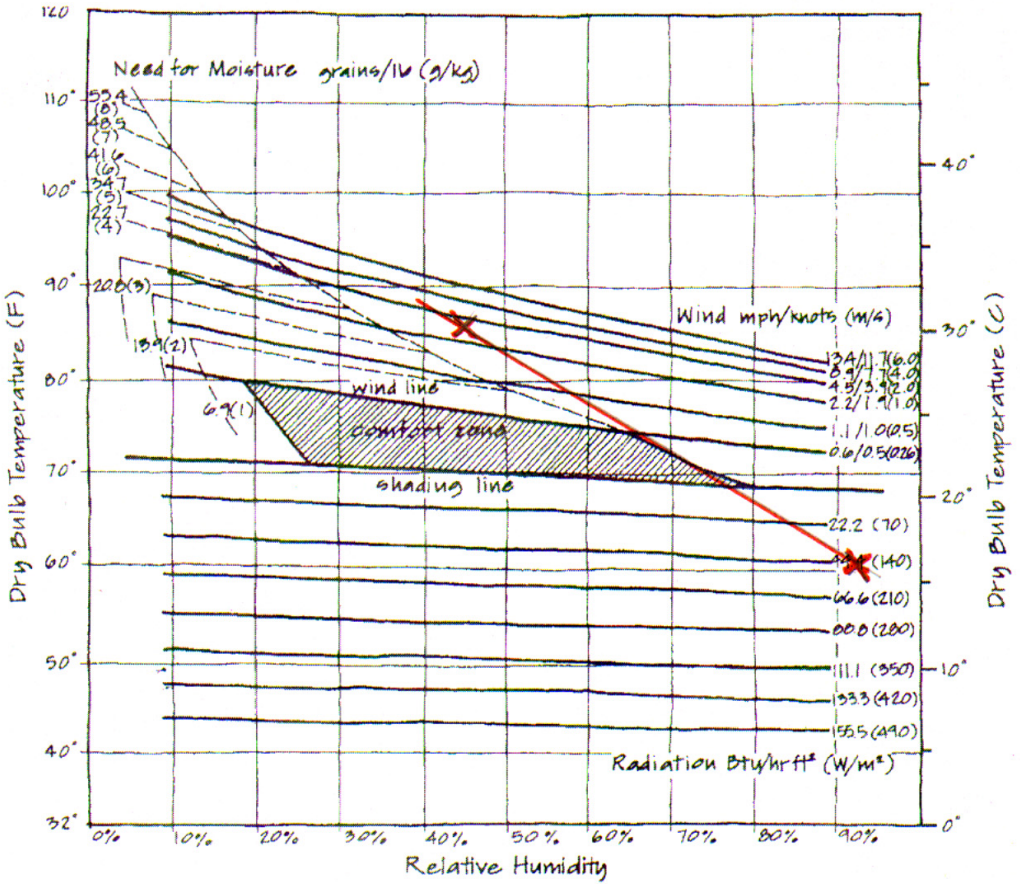
# Step 5: Study the Bioclimatic Chart

- Using temperature and humidity data from the local weather station plot climate characteristics on the Bioclimatic chart (Exercise 11 of Sun, Wind And Light)
- To get a quick feel for the site, study the extremes (January and July)
- The goal is to determine if human comfort is possible in the ambient conditions, or if other means need to be used to extend the conditions of comfort




# Bioclimatic chart for Ferrara in July

The Example Plots the Relative Humidity and Temperature Data for July using date from arpa.emr.it  Per Sun, Wind and Light, Exercise 11 a plot of the maximum temperature with the minimum relative humidity and the opposite provides an indication of the 24 hour comfort profile for the site.

# Step 6: Determine the Dominant Daylighting Condition(s)

- Using the mean monthly sky cover data from the local weather station, complete the attached matrix to determine the typical design condition(s)
- Expect to see a number of different design conditions for daylight depending upon the season
- This information, when combined the sun path diagram, will substantially inform the development of your daylighting strategies

**daylight design conditions** **location: Ferrara, Italy**

| month | days clear | days partly cloudy | days overcast | % clear | % partly cloudy | % overcast |
|---|---|---|---|---|---|---|
| January | xx | xx | xx | xx | xx | xx |
| February | xx | xx | xx | xx | xx | xx |
| March | xx | xx | xx | xx | xx | xx |
| April | xx | xx | xx | xx | xx | xx |
| May | xx | xx | xx | xx | xx | xx |
| June | xx | xx | xx | xx | xx | xx |
| July | xx | xx | xx | xx | xx | xx |
| August | xx | xx | xx | xx | xx | xx |
| September | xx | xx | xx | xx | xx | xx |
| October | xx | xx | xx | xx | xx | xx |
| November | xx | xx | xx | xx | xx | xx |
| December | xx | xx | xx | xx | xx | xx |

The Second Part

# MICRO ENVIRONMENTAL CONDITIONS

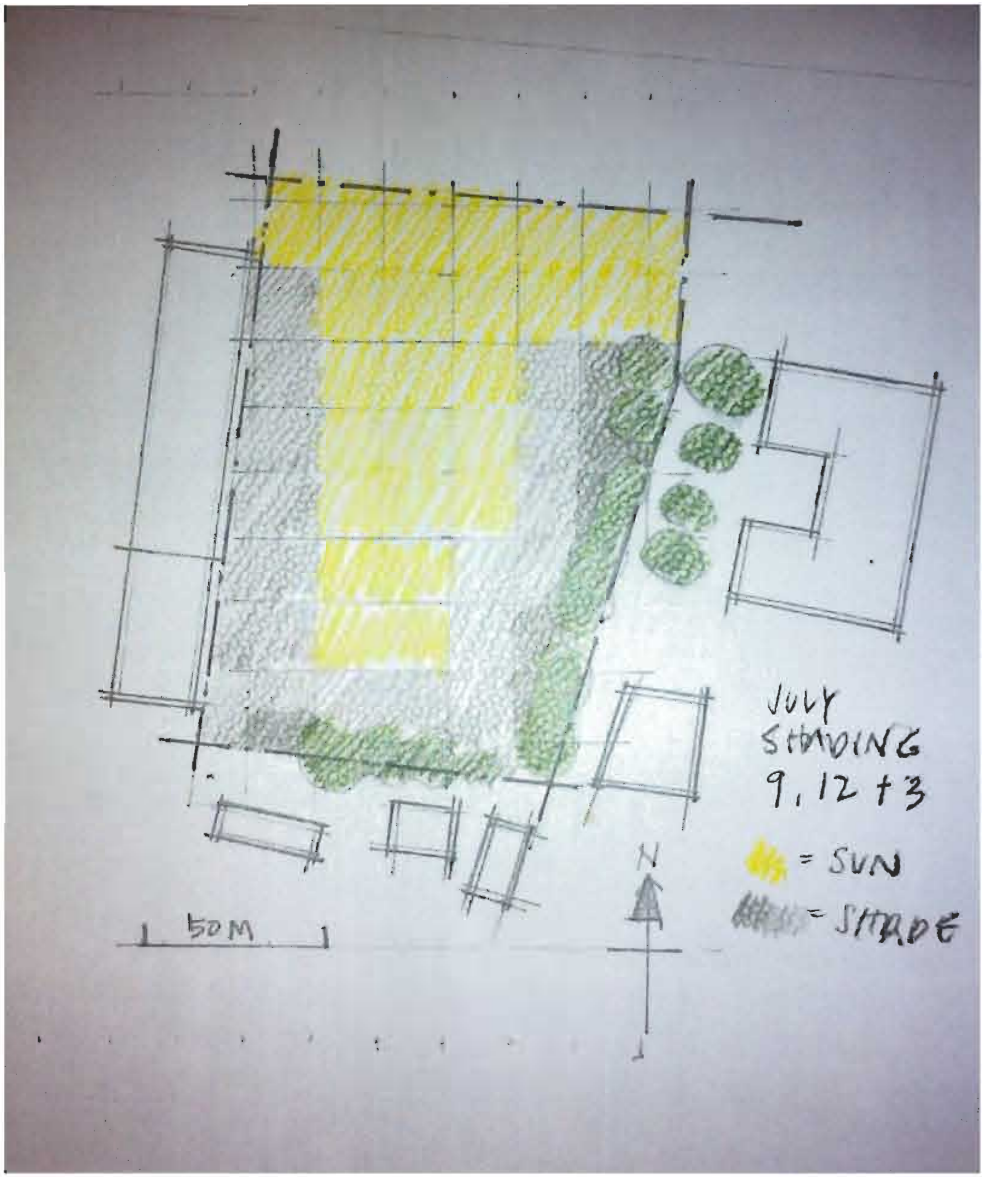
# Step 7: Prepare a Simplified Site Plan

- This drawing should be done to scale and contain all of the gross site elements, (trees, buildings, hills or valleys, etc)
- The simplified nature of the drawing means that you won't get bogged down in irrelevant detail


**Project Site**

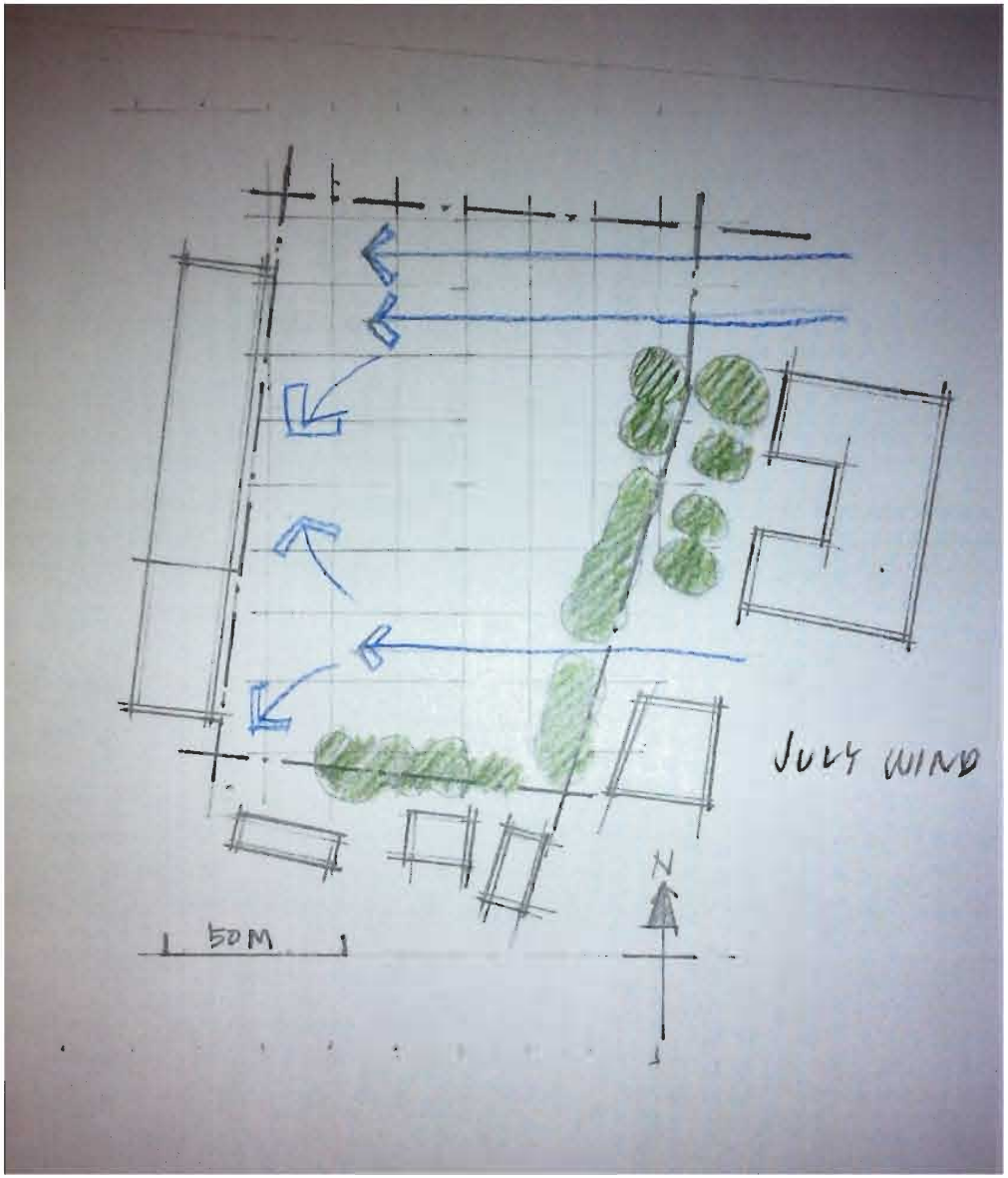
# Step 8: Plot Shadows

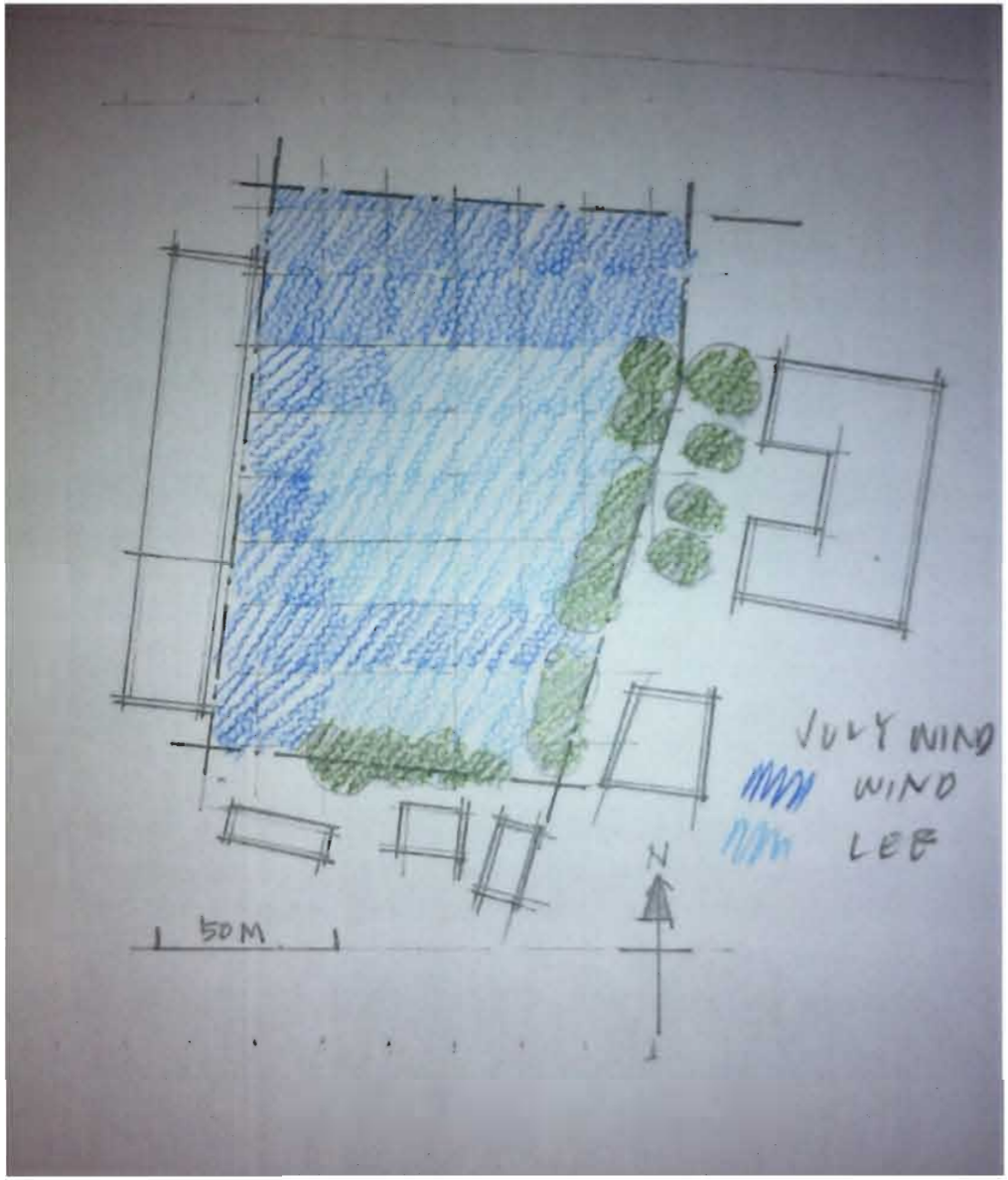
- Plot shading for extreme conditions (9am, noon and 3pm for January and July) to get a feel for the site.
- Developing an understanding of the shoulder seasons will be necessary as the design develops.


JULY
STANDING
9, 12 + 3
= SUN
= SHADE
N
50M

# Step 9: Plot Wind Information

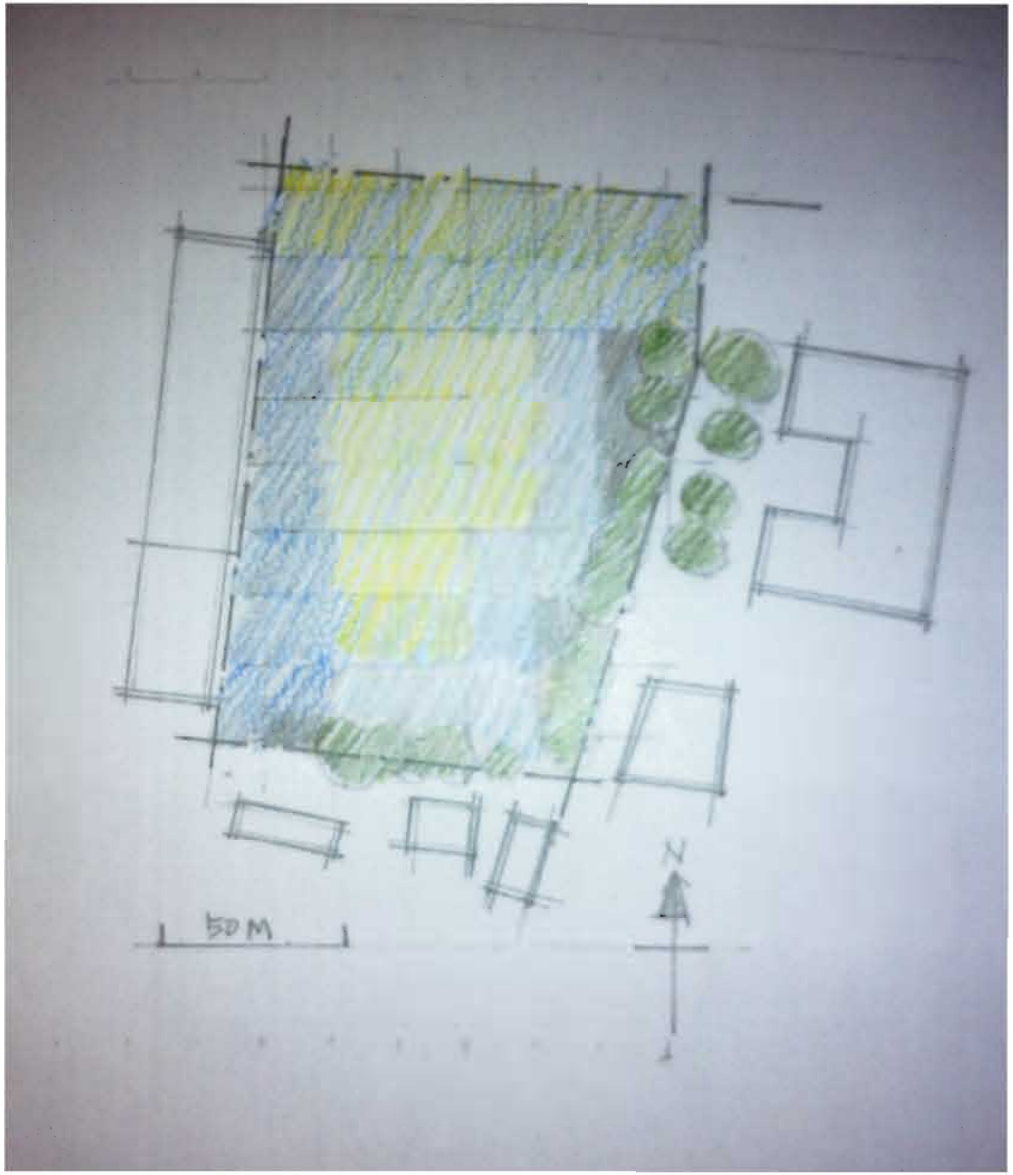
- This is a three part process.
- Firstly, using the wind rose data from Step 4 determine the average wind direction for the extreme seasons.
- Secondly, turn this into simplified Wind and Lee information to determine the general wind performance on the site using the principles from Exercise 6 in Sun, Wind and Light
- Thirdly overlay this information on the shading plots you did as a part of Step 8.


JULY WIND
50M
N


JULY WIND
WIND
LEE
N
50M

# Step 10: Determine Optimum Siting Locations

- The Bioclimactic Chart will tell you what to look for in siting character
- This summary will tell you if it's available and then help you develop climate optimizing methods (such as the location of evaporative cooling ponds)
- Don't forget that this process is analytical. It's not architecture, and your vision and skill are required to make the building worthy of construction.


50M
N

# Summary: So Now You Know the Following:

- Solar Behavior
- Dominant daylighting conditions
- The ambient potential for human comfort
- Basic opportunities for extending human comfort
- Optimum siting opportunities to take advantage of these conditions