Challenging The Odin Myth of Viewshed Analysis

http://j-vh.me/1uLHHNu

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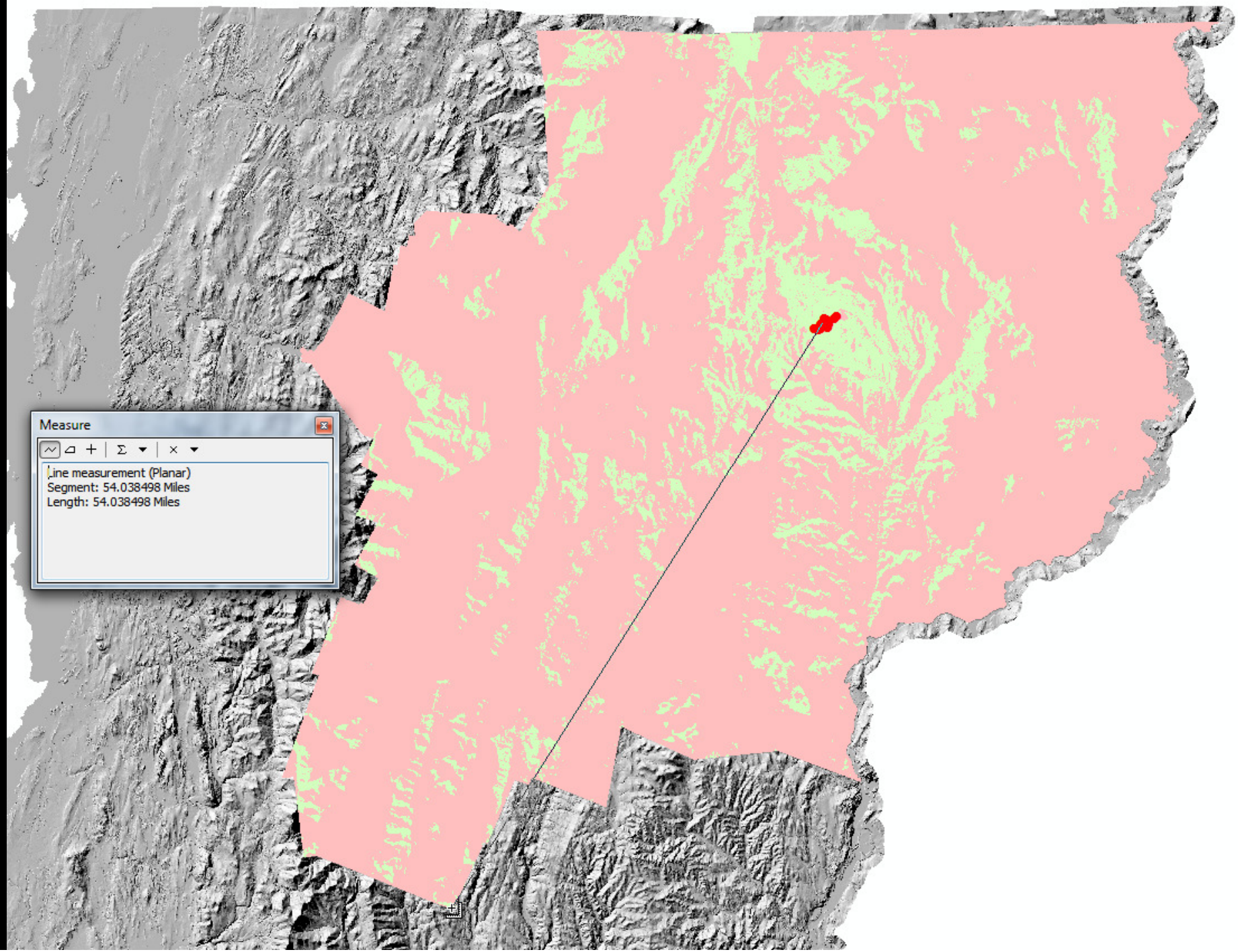
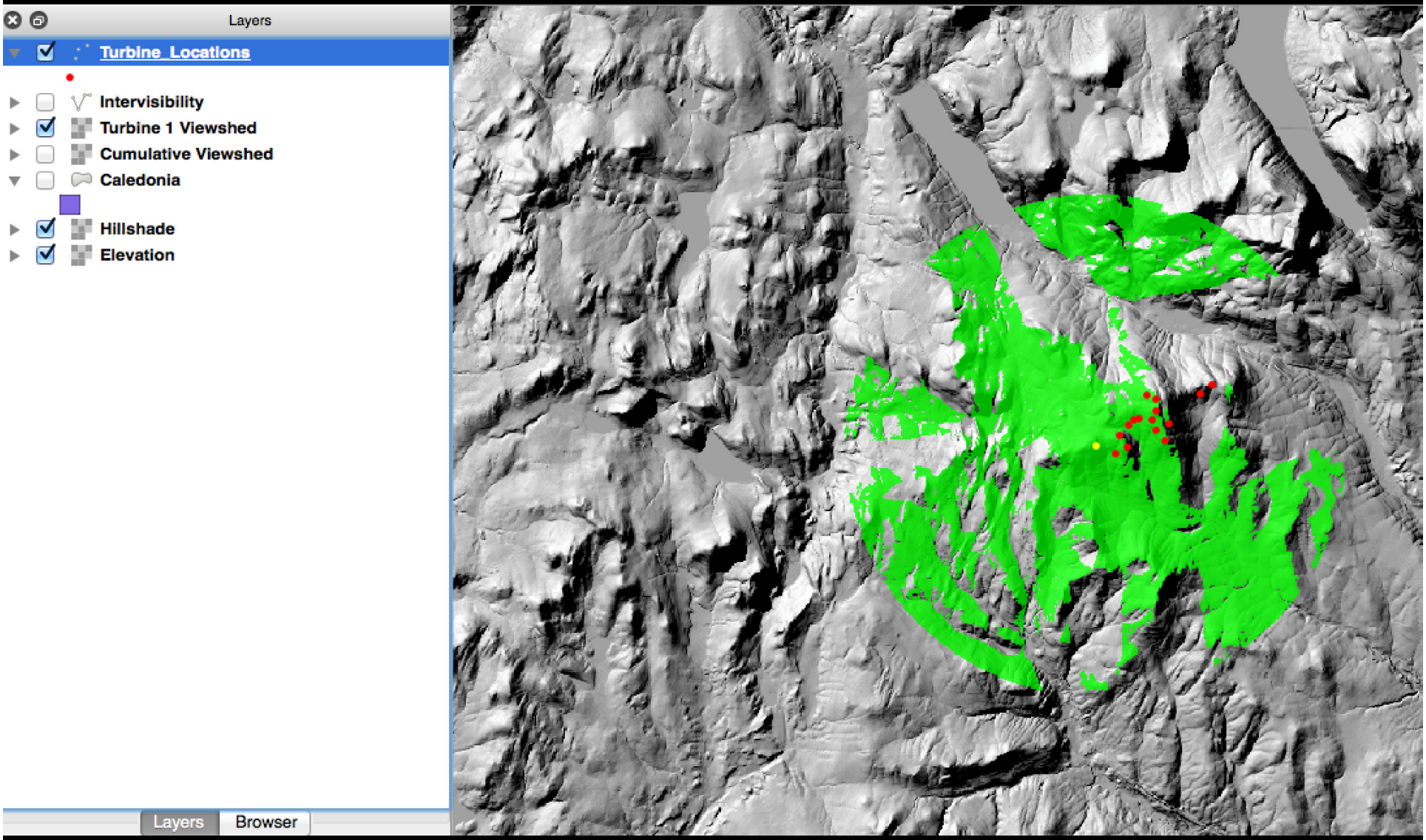
'Sheppey *(n.) Measure of distance (equal to approximately seven eighths of a mile), defined as the closest distance at which sheep remain picturesque'* (Adams and Lloyd 1983:122).


Measure
Line measurement (Planar)
Segment: 54.038498 Miles
Length: 54.038498 Miles


Layers
Turbine_Locations
Intervisibility
Turbine 1 Viewshed
Cumulative Viewshed
Caledonia
Hillshade
Elevation
Layers
Browser

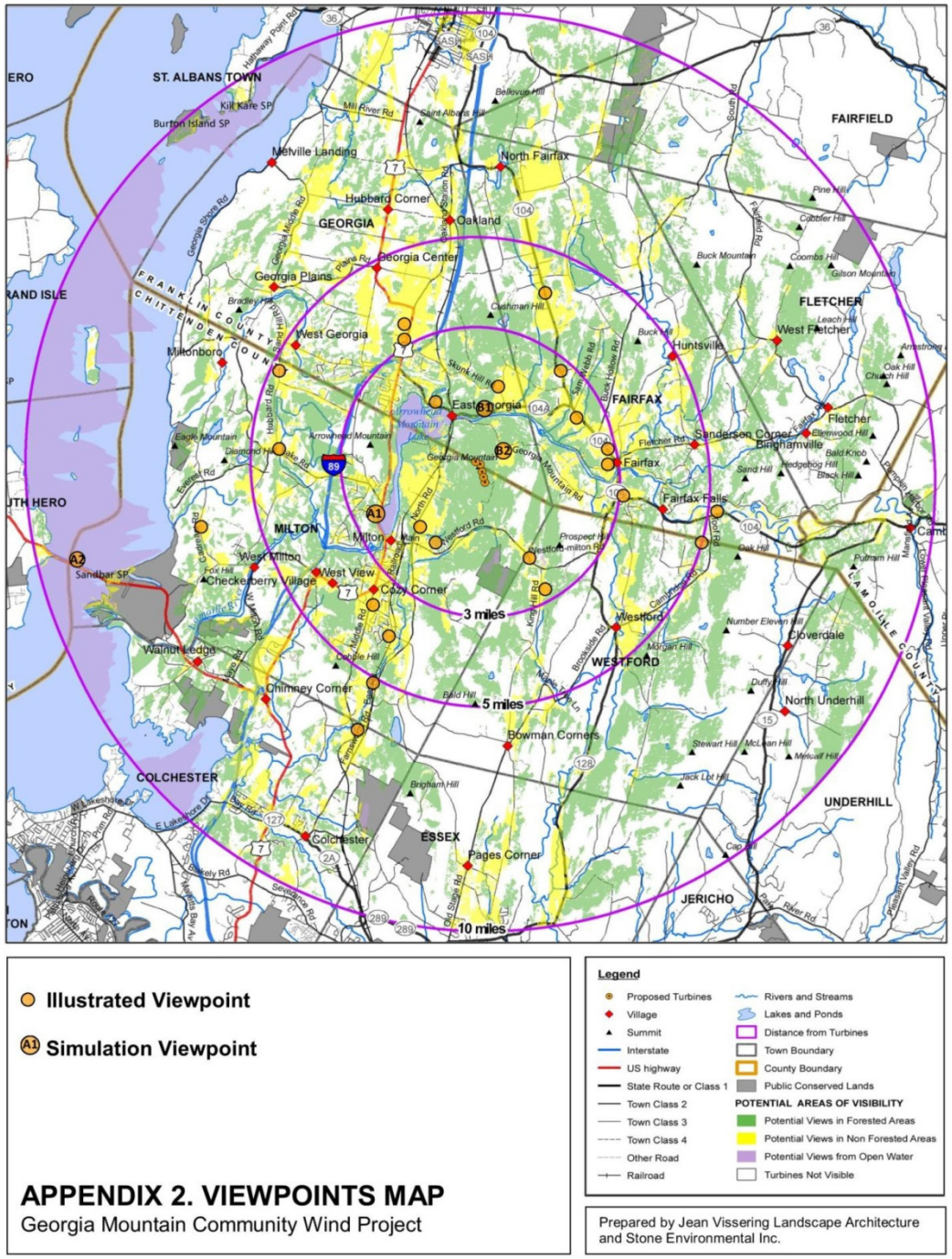
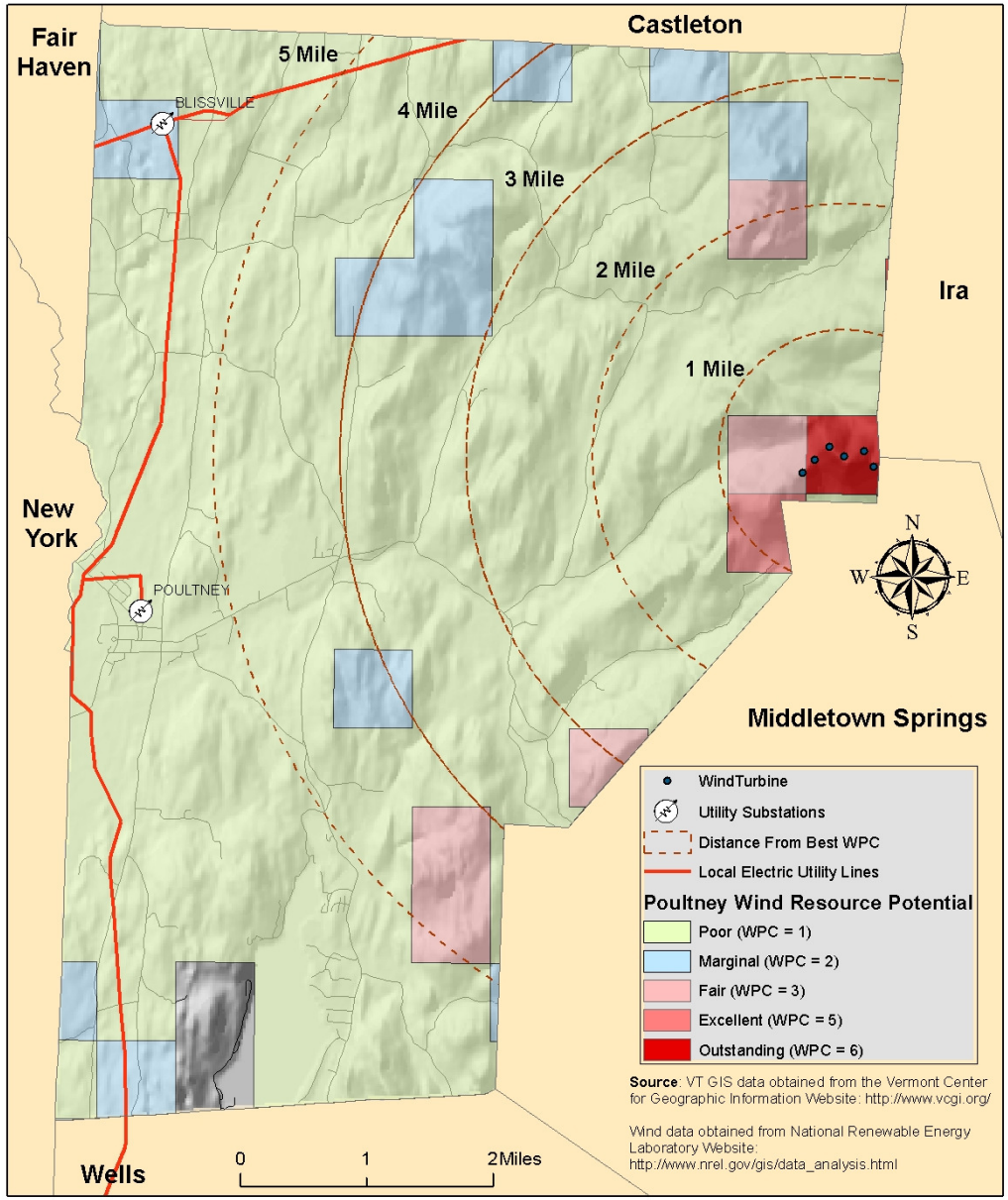
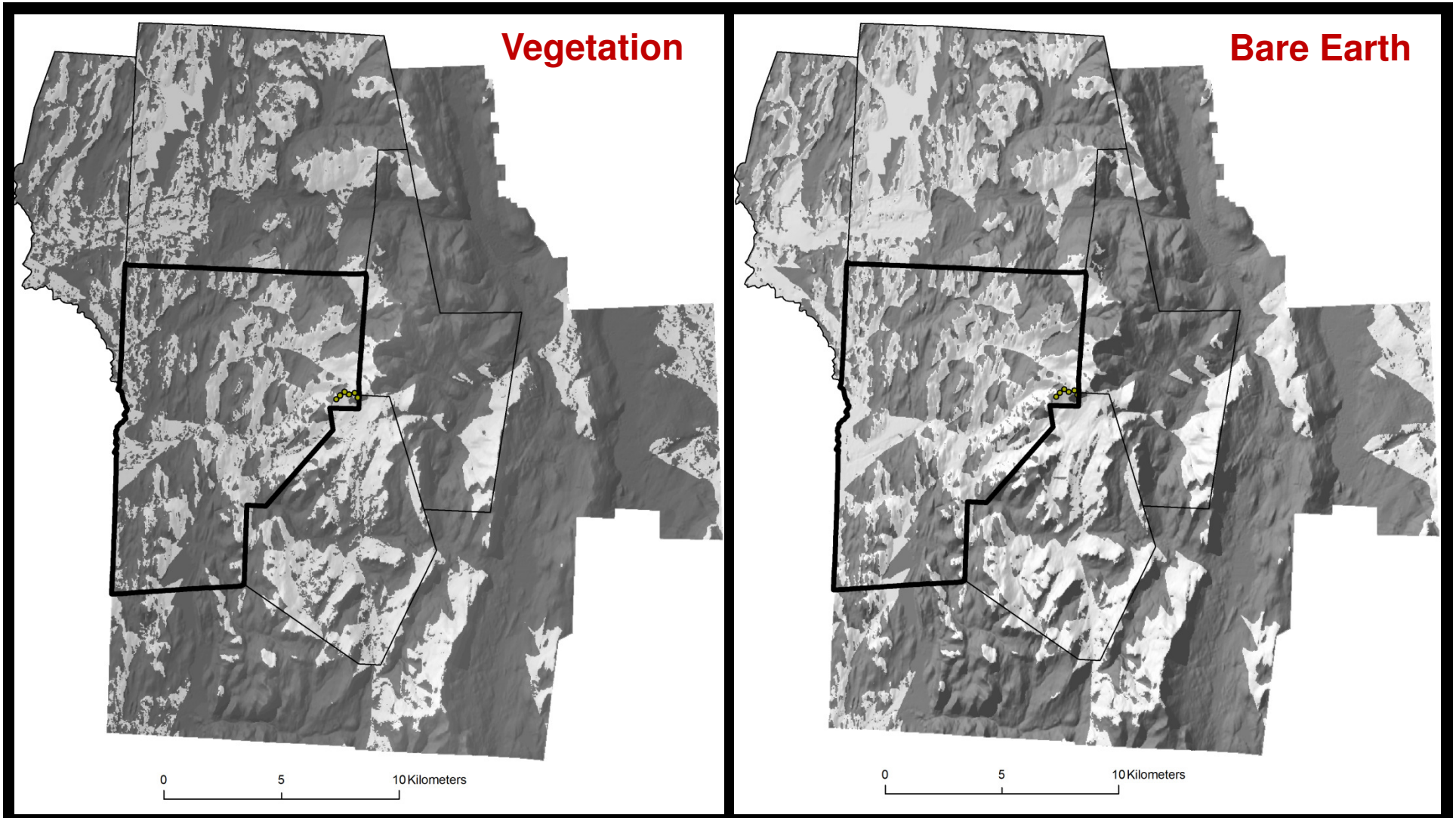


Figure 2 - Example of Viewpoints illustrated on a Viewshed Analysis Map (prepared by Stone Environmental for Jean Vissering and the Vermont Department of Public Service).

Areas Exhibiting Best Wind Resource Potential Within The Town of Poultney, Vermont





Turbine	Corrected For Vegetation		No Vegetation Correction	
	Area Impacted (Acres)	# Homes	Area Impacted (Acres)	# Homes
1	44,560	2460	54,350	3898
2	42,130	2301	51,930	3789
3	31,320	1829	39,180	3010
4	30,260	1798	37,835	2951
5	32,480	1491	43,800	3313
6	28,800	1332	38,073	2836

Table 8. NLCD reclassification criteria used to extract elevation data from dataset.
NLCD Reclassification

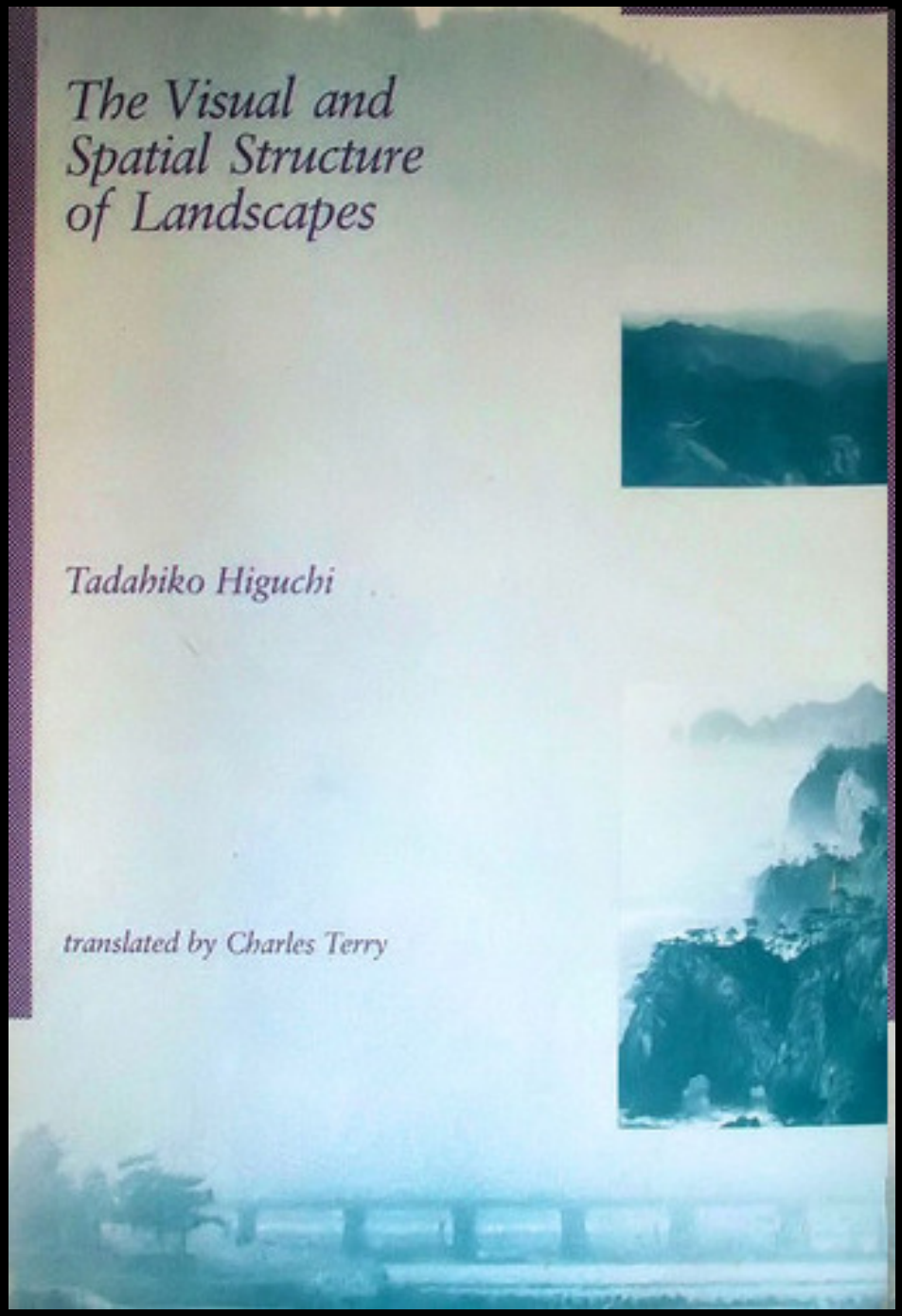
Type	Meters
Pasture & Barren	0
Deciduous Forest	10
Evergreen Forest	10
Mixed Forest	10
Scrub cover & Scrub Trees & Orchards	5
Cultivated Crops	1
Woody Wetlands	10
Emergent Herbaceuous Wetlands	1
Developed Areas	15

Ashton (2010)

Table 9. Landfire reclassification criteria used to extract elevation data from dataset.
LandFire Reclassification

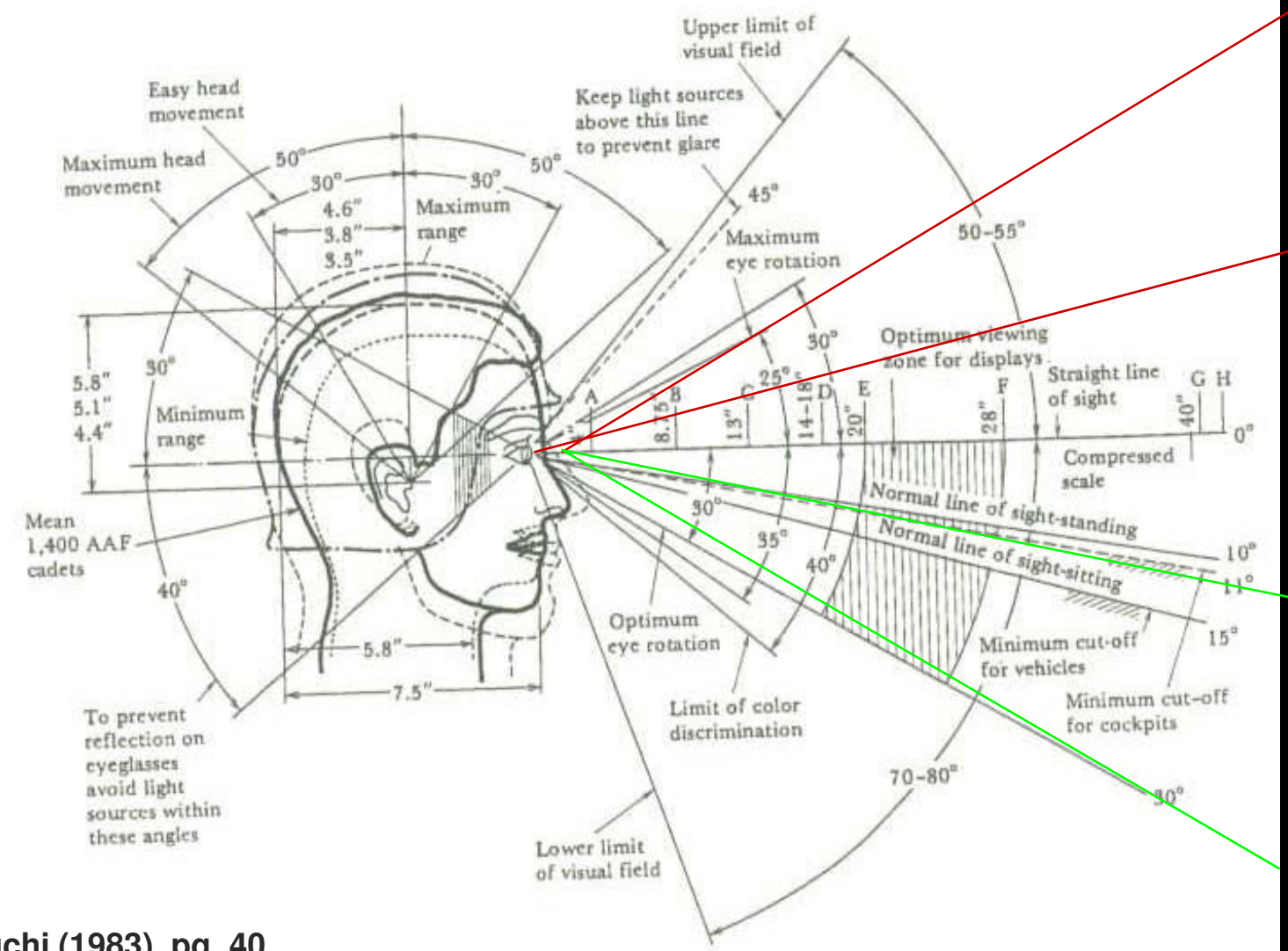
Type	Meters
Open Water	0
Developed-Open Space	0
Developed	15
Barren, Pature/Hay, Cultivated Crops	0
Herb Height 0 to 0.5 meters	1
Herb Height 0.5 to 1.0 meters	1
Herb Height >1.0 meter	2
Shrub Height 0 to 0.5 meters	1
Shrub Height 0.5 to 1.0 meter	1
Shrub Height 1.0 to 3.0 meters	3
Shrub Height >3.0 meters	5
Forest Height 0 to 5 meters	5
Forest Height 5 to 10 meters	10
Forest Height 10 to 25 meters	25
Forest Height 25 to 50 meters	50
Forest Height >50 meters	75

Ashton (2010)



Developed Nine Indices

- Line of sight
- Depth of invisibility
- Distance zones
- Angle of incidence
- Angle of depression
- Angle of elevation
- Light
- Depth & texture gradient
- Temporal

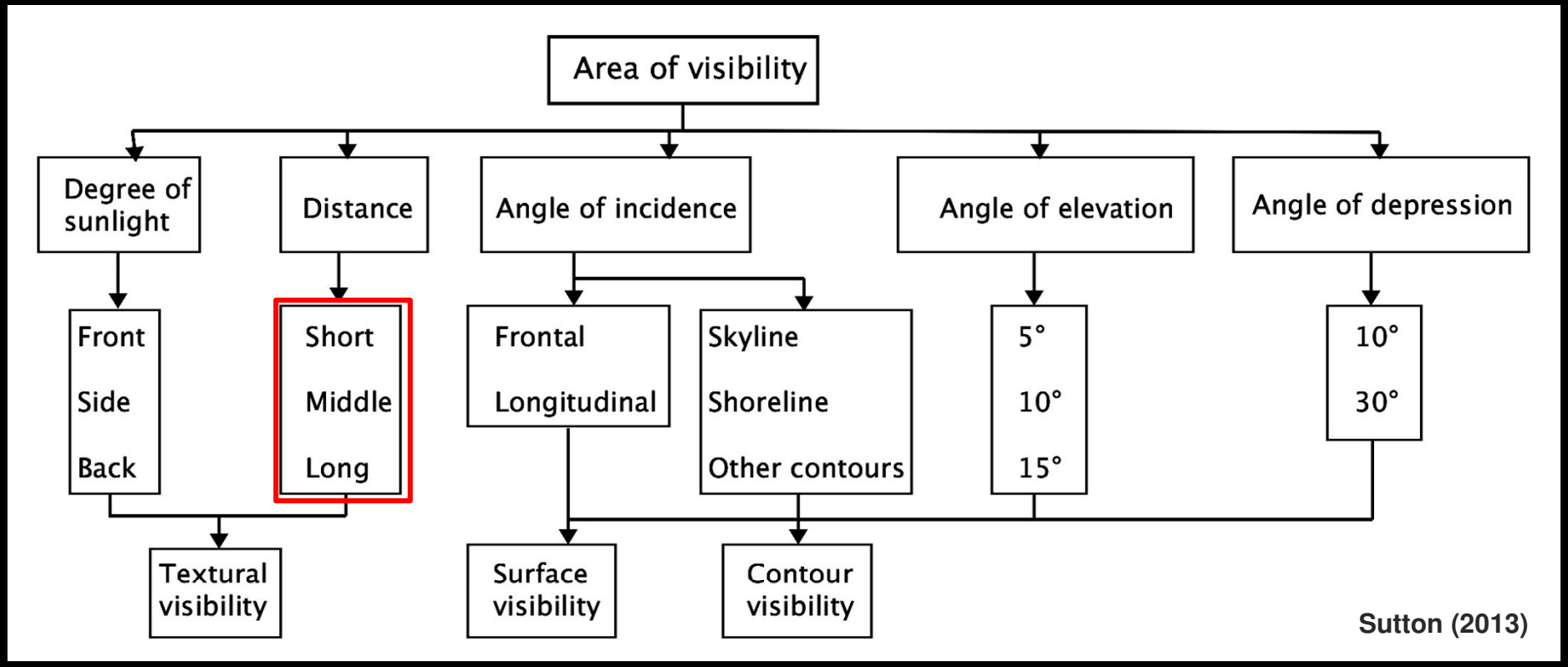


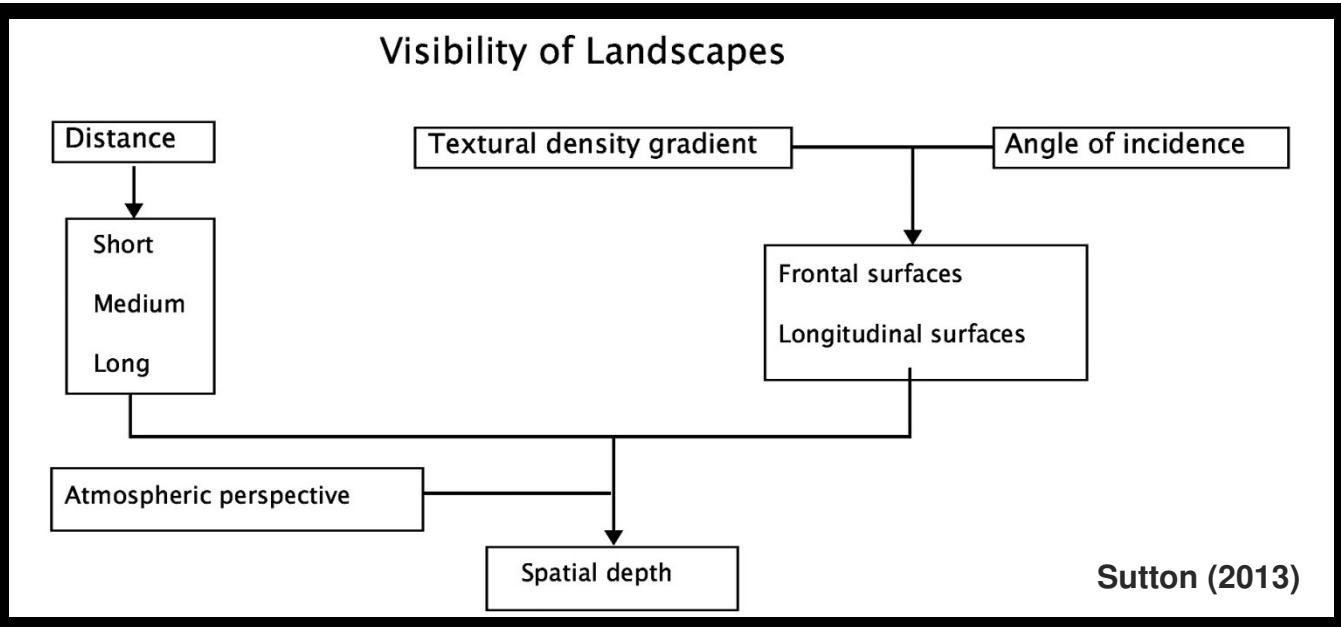
Higuchi (1983), pg. 40

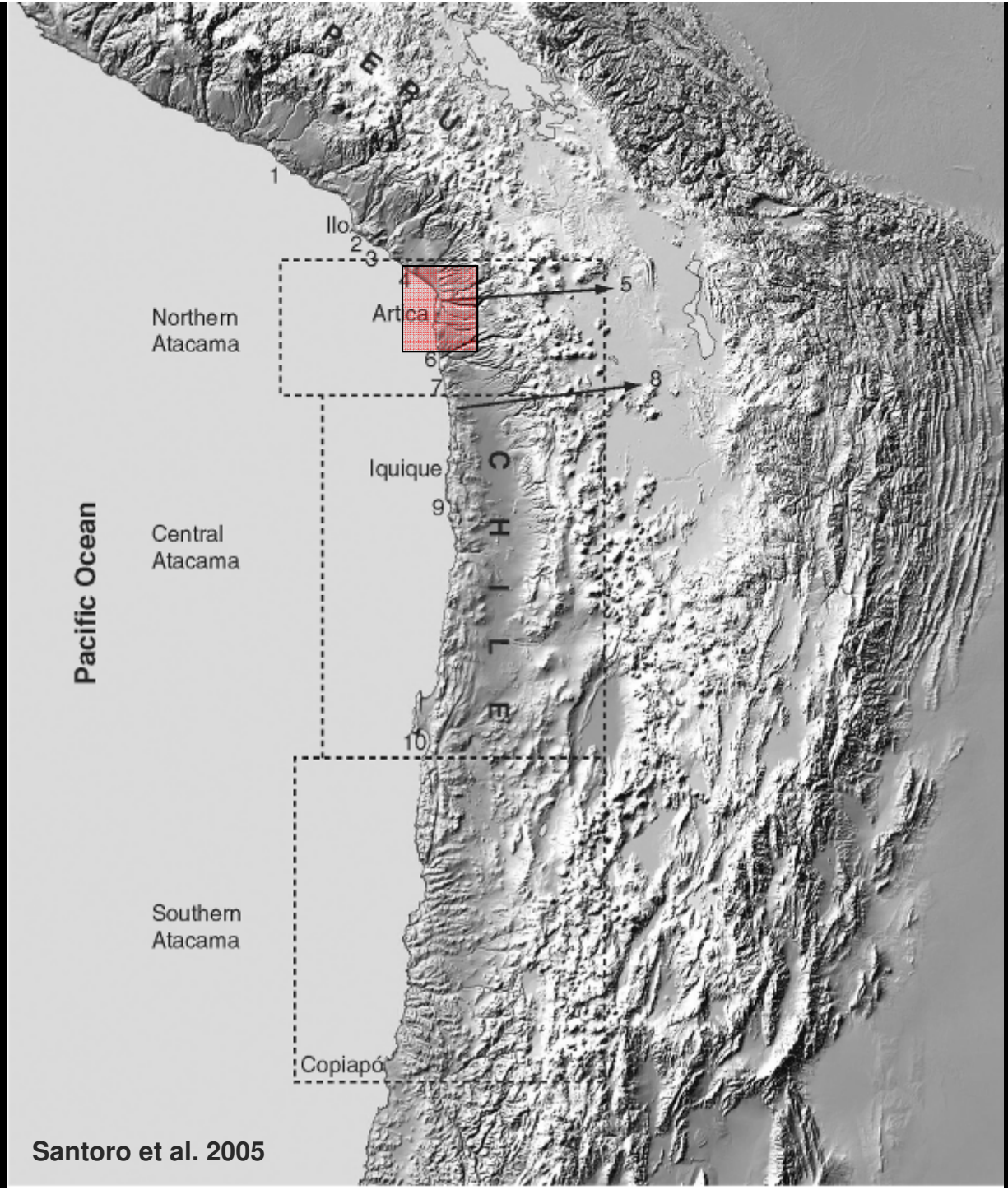
Optimum Angle of elevation

8-10°

Optimum Angle of depression

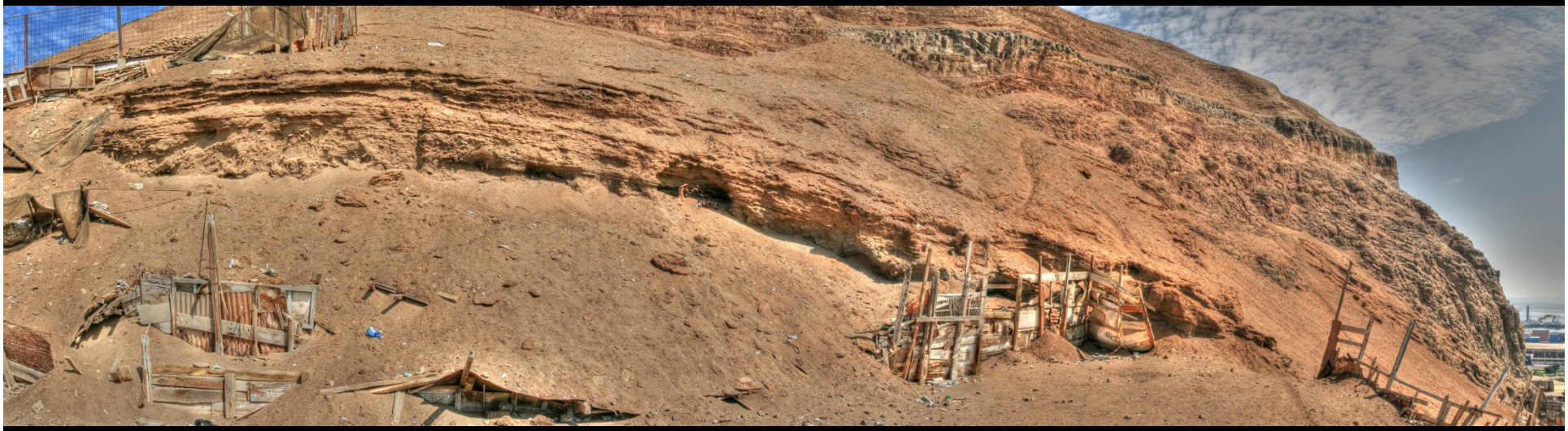

Area of visibility
Degree of sunlight
Distance
Angle of incidence
Angle of elevation
Angle of depression
Front
Side
Back
Short
Middle
Long
Frontal
Longitudinal
Skyline
Shoreline
Other contours
5°
10°
15°
10°
30°
Textural visibility
Surface visibility
Contour visibility
Sutton (2013)


Visibility of Landscapes
Distance
Textural density gradient
Angle of incidence
Short
Medium
Long
Frontal surfaces
Longitudinal surfaces
Atmospheric perspective
Spatial depth
Sutton (2013)

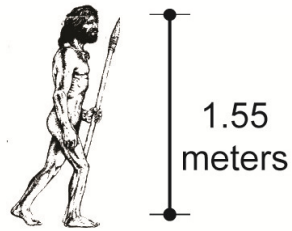
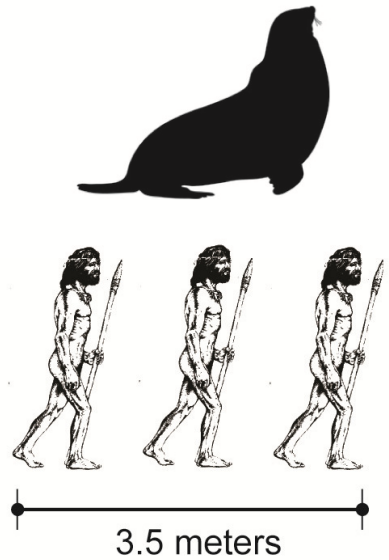
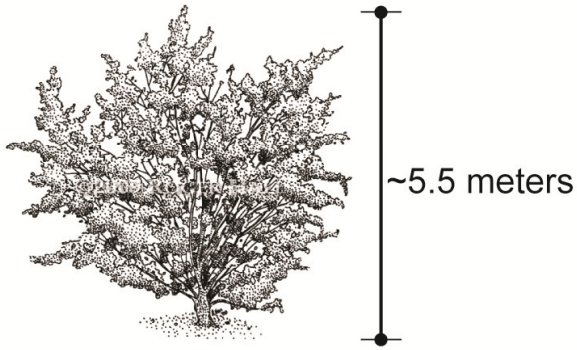


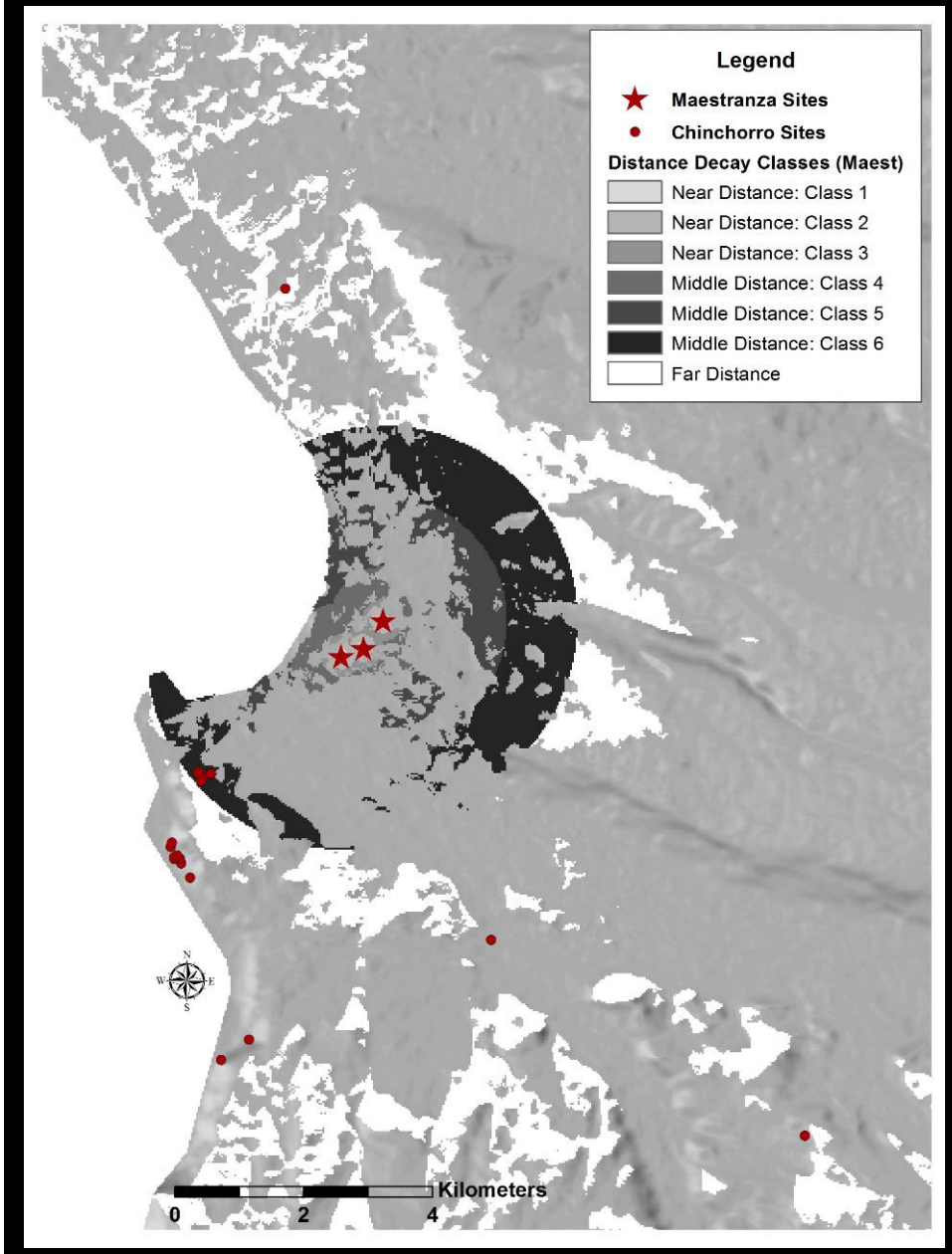
Santoro et al. 2005

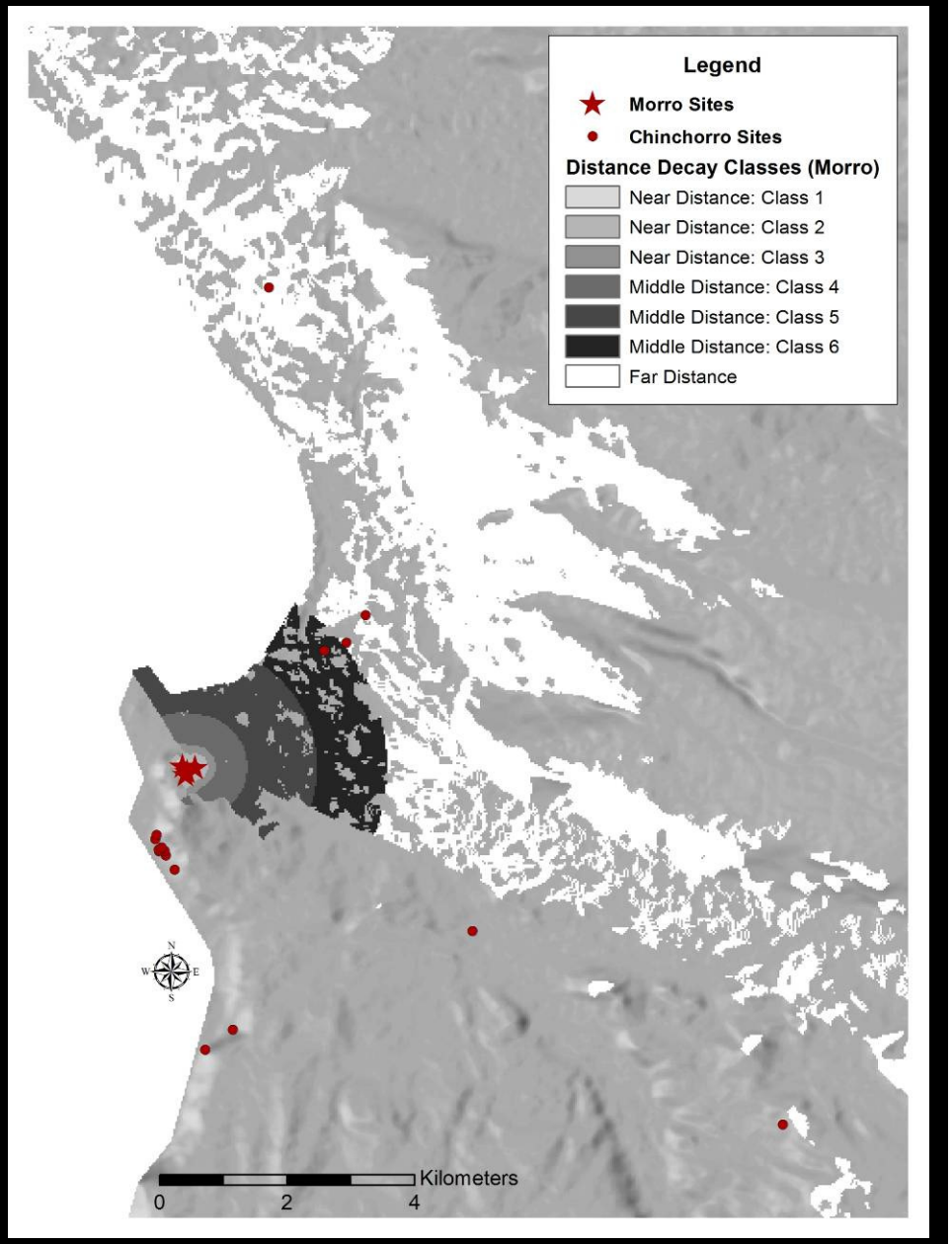
0
0.5
1 Kilometers
Mina
Macarena
Maestranza
Morro
N
W
E
S



ESGAR

	60x	520x	1100x
Mattioli (2008) **Higuchi (1983), pg. 14**	 **Human**	 **Human Groups & Animals**	Lomas?  **Landscape Elements**
Near-Distance complete dominance	1st Class 93 meters	2st Class 210 meters	3rd Class 330 meters
Middle Distance territorial control	4th Class 825.5 meters	5th Class 1,925 meters	6th Class 3,025 meters
Far-Distance horizon		3,025 meters	


Legend
Maestranza Sites
Chinchorro Sites
Distance Decay Classes (Maest)
Near Distance: Class 1
Near Distance: Class 2
Near Distance: Class 3
Middle Distance: Class 4
Middle Distance: Class 5
Middle Distance: Class 6
Far Distance
N
W
E
S
Kilometers
0
2
4


Legend
Morro Sites
Chinchorro Sites
Distance Decay Classes (Morro)
Near Distance: Class 1
Near Distance: Class 2
Near Distance: Class 3
Middle Distance: Class 4
Middle Distance: Class 5
Middle Distance: Class 6
Far Distance
N
W
E
S
Kilometers
0
2
4

Distance Classification	Maestranza	Mina Macarena	Morro
Near Distance: Class 1	96	30	87
Near Distance: Class 2	217	91	195
Near Distance: Class 3	263	161	237
Middle Distance: Class 4	1,011	898	910
Middle Distance: Class 5	2,484	2,714	2,236
Middle Distance: Class 6	8,249	2,385	7,424
Far Distance	67,187	67,724	60,468
Total Area (m^2)	**79,506**	**74,003**	**71,555**

Table 4: The Thomas and Sinclair-Thomas Matrices

THE THOMAS AND SINCLAIR-THOMAS MATRICES (section A) to estimate the potential visual impact of different sizes of wind turbines					
Overall height of turbines (m) >>>		41-45	41-48	53-57	72-74
Descriptors	Band	Thomas Matrix		Sinclair-Thomas Matrix	
		Original	Revised		
		Approximate distance range (km)			
Dominant impact due to large scale, movement, proximity and number	A	0-2	0-2	0-2.5	0-3
Major impact due to proximity: capable of dominating landscape	B	2-3	2-4	2.5-5	3-6
Clearly visible with moderate impact: potentially intrusive	C	3-4	4-6	5-8	6-10
Clearly visible with moderate impact: becoming less distinct	D	4-6	6-9	8-11	10-14
Less distinct: size much reduced but movement still discernible	E	6-10	9-13	11-15	14-18
Low impact, movement noticeable in good light: becoming components in overall landscape	F	10-12	13-16	15-19	18-23
Becoming indistinct with negligible impact on the wider landscape	G	12-18	16-21	19-25	23-30
Noticeable in good light but negligible impact	H	18-20	21-25	25-30	30-35
Negligible or no impact	I	20	25	30	35
Suggested radius for ZVI analysis		15	At least Junction of Band F and Band G; extended to reflect local circumstances or if cumulative impact may be involved		

THE SINCLAIR-THOMAS MATRICES (section B)
Potential visual impact matrix for wind turbines of 72-74m overall height (field observation) and 90-100m (extrapolated). Distances in km

Band		72-74m	90-100m	Magnitude (subject to other factors)	Significance
A	Dominant impact due to large scale, movement, proximity and number	0 - 3	0 - 4	High	Potential for independent significant impact
B	Major impact due to proximity: capable of dominating landscape	3 - 6	4 - 8	Medium/High	
C	Clearly visible with moderate impact: potentially intrusive	6 - 10	8 - 13	Medium	Potential for contributory significant impact
D	Clearly visible with moderate impact: becoming less distinct	10 – 14	13 - 18		
E	Less distinct: size much reduced but movement still discernible	14 – 18	18 - 23	Low/Medium	Potential for ancillary non-significant impact: only becoming significant if numerous or cumulative with other installations
F	Low impact, movement noticeable in good light: becoming components in overall landscape	18 – 23	23 - 30	Low	
Approximate recommended threshold for ZVI analysis					
G	Becoming indistinct with negligible impact on the wider landscape	23 –30	30 - 38	Negligible	
H	Noticeable in good light but negligible impact	30 -35	38 - 45		
I	Negligible or no impact	35+	45 +		

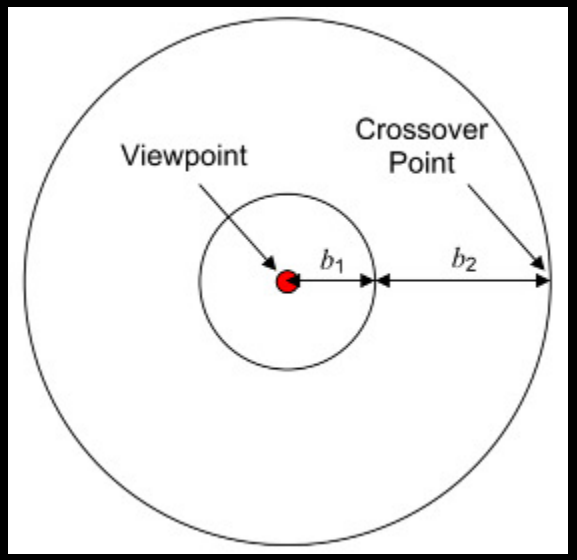
Source: Sinclair (2001)

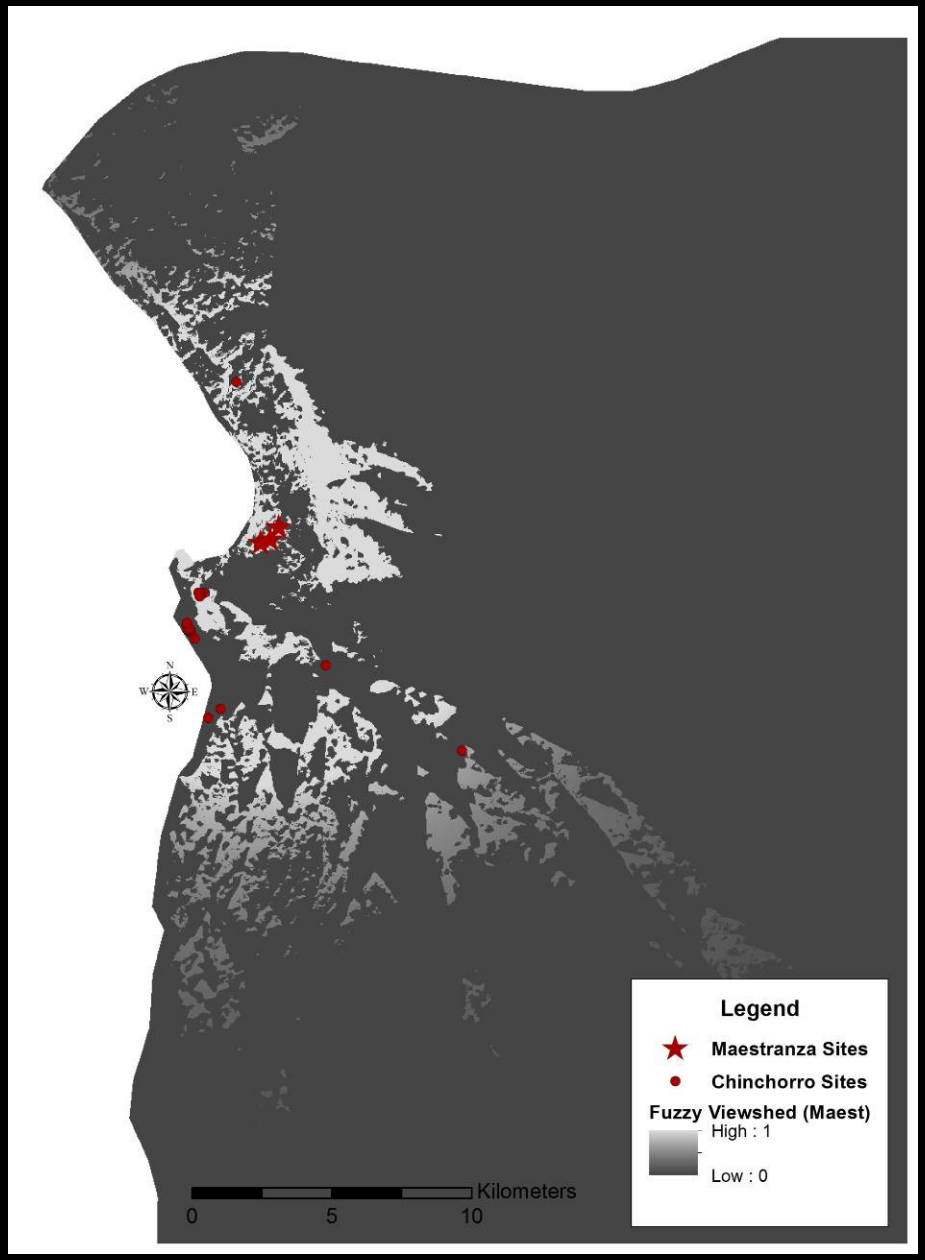
$$\mu(x_{ij}) = \begin{cases} 1 & \text{for } d_{vp\to ij} \le b_1 \\ \dfrac{1}{\left(1+\left(\dfrac{d_{vp\to ij}-b_1}{b_2}\right)^2\right)} & \text{for } d_{vp\to ij} > b_1 \end{cases}$$

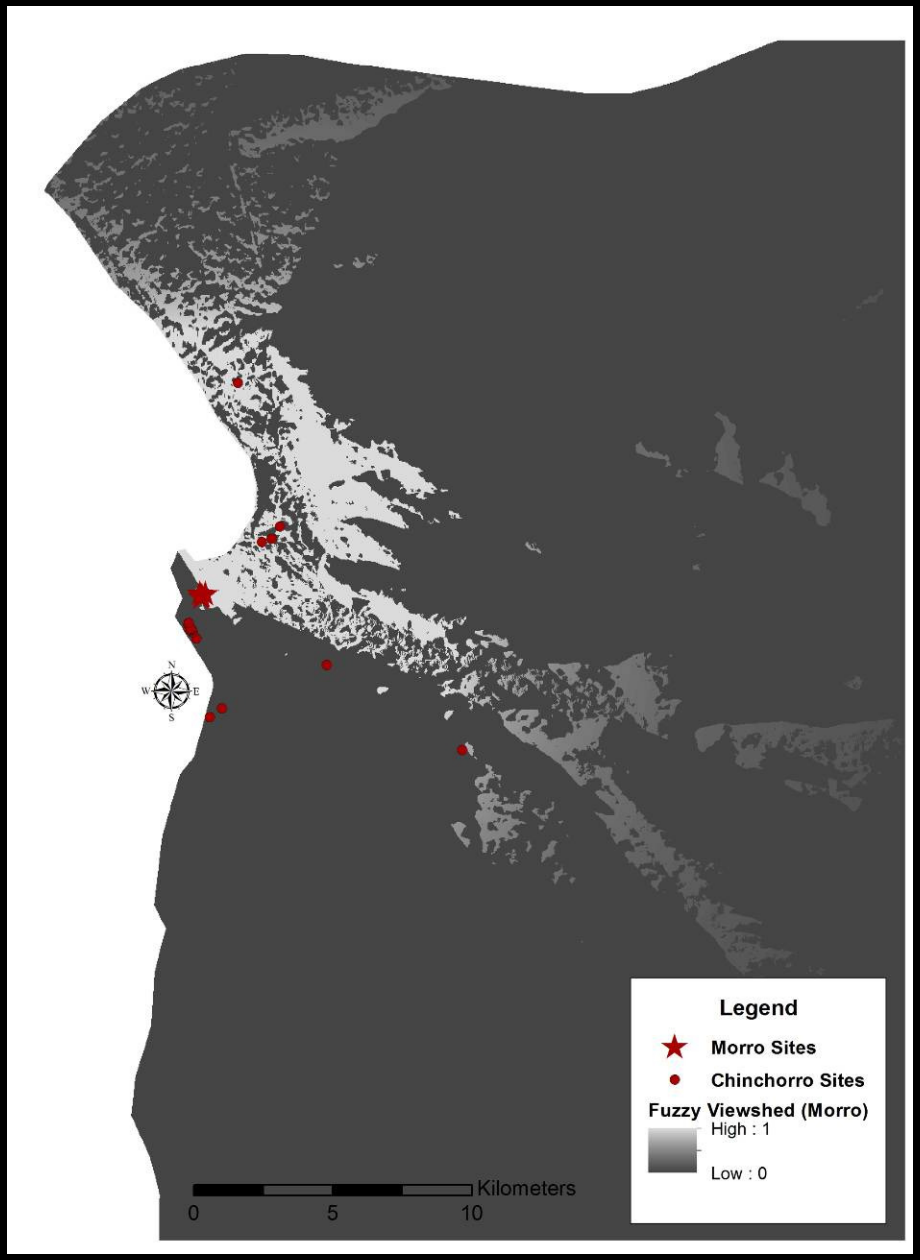
Fisher (1994), p. 165

WHERE:

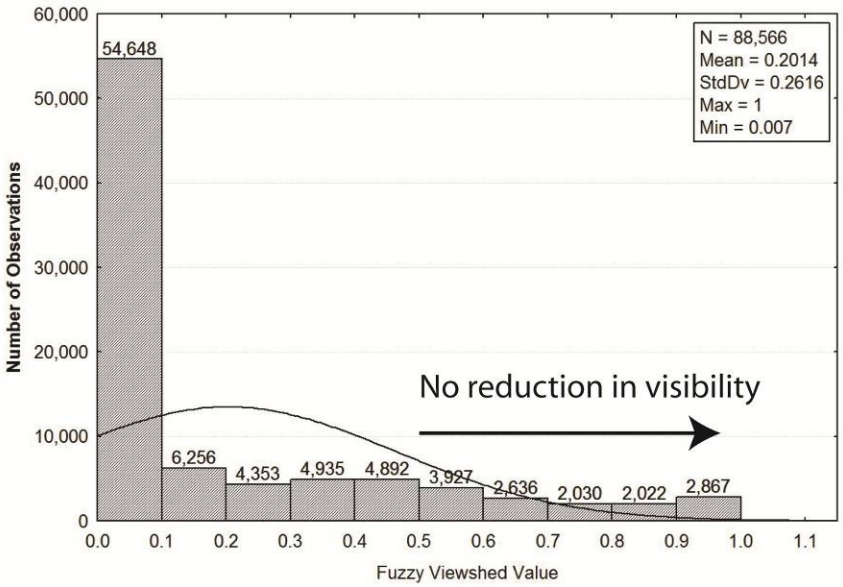
μ = fuzzy membership
d = distance from viewpoint
b1 = maximum distance from viewpoint of clear visibility – (1km)
b2 = distance from viewpoint at which visibility drops to 50% – (2km)



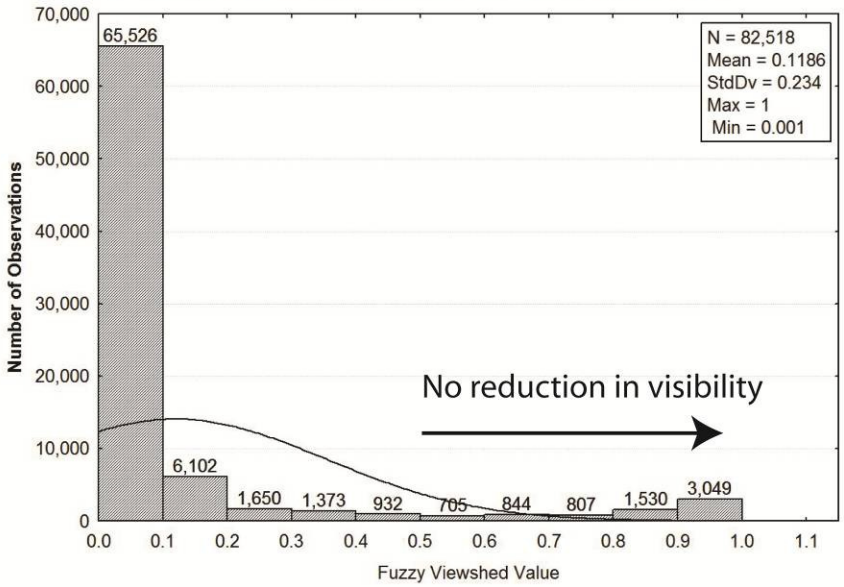

Legend
Maestranza Sites
Chinchorro Sites
Fuzzy Viewshed (Maest)
High : 1
Low : 0
Kilometers
0
5
10


Legend
Morro Sites
Chinchorro Sites
Fuzzy Viewshed (Morro)
High : 1
Low : 0
Kilometers
0
5
10

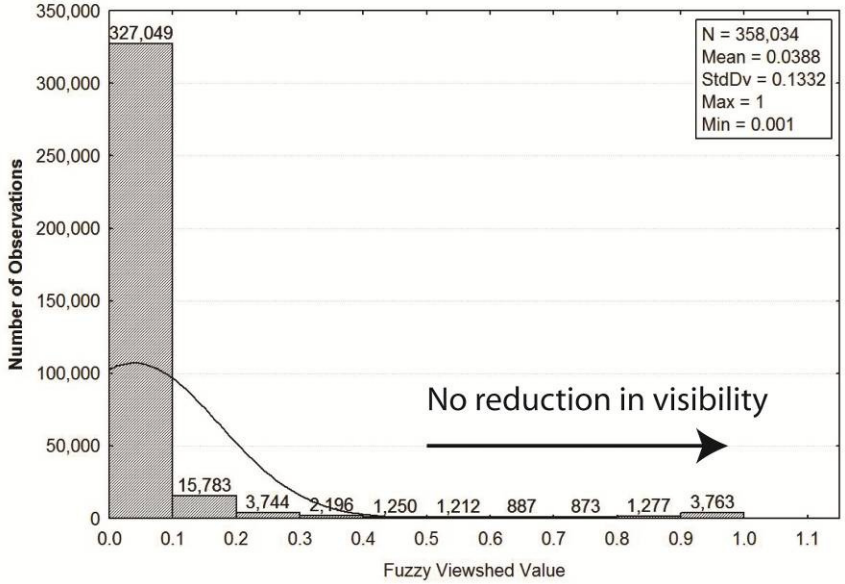
A

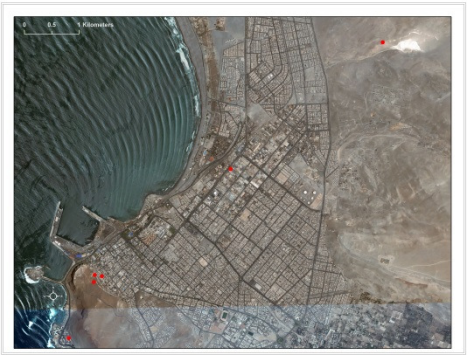

Histogram of Fuzzy Viewshed Values for Maestranza Sites
N = 88,566
Mean = 0.2014
StdDv = 0.2616
Max = 1
Min = 0.007
No reduction in visibility
54,648
6,256
4,353
4,935
4,892
3,927
2,636
2,030
2,022
2,867
Number of Observations
Fuzzy Viewshed Value

B


Histogram of Fuzzy Viewshed Values for Mina Site
N = 82,518
Mean = 0.1186
StdDv = 0.234
Max = 1
Min = 0.001
No reduction in visibility
65,526
6,102
1,650
1,373
932
705
844
807
1,530
3,049
Number of Observations
Fuzzy Viewshed Value

C


Histogram of Fuzzy Viewshed Values for Morro Sites
N = 358,034
Mean = 0.0388
StdDv = 0.1332
Max = 1
Min = 0.001
No reduction in visibility
327,049
15,783
3,744
2,196
1,250
1,212
887
873
1,277
3,763
Number of Observations
Fuzzy Viewshed Value



Seen Area Analysis

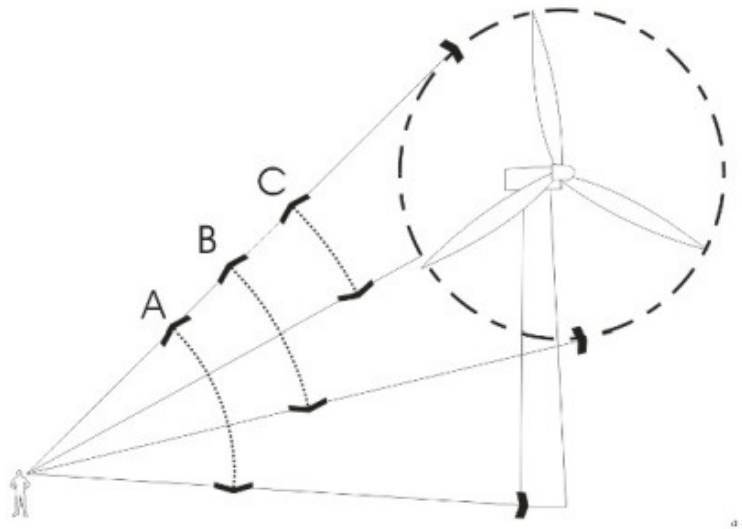


Figure 6.1 *Visibility parameters (not to scale)*

Table 6.1 *Mapping visibility parameters*

Zone	Extent that wind turbines are visible
Zone A	One or more wind turbines in their entirety
Zone B	The entire swept path of the blades of one or more wind turbines
Zone C	At least half of the swept path of one or more wind turbines
Zone D	Any part of the wind turbine blades of one or more wind turbines

These zones are not exclusive. For example, a location that has the potential to view a wind turbine in its entirety falls into Zone A. A viewer at this location will also be able to see "any part of the wind turbine blades" and this location will also fall into Zone D.

ERM (2009)

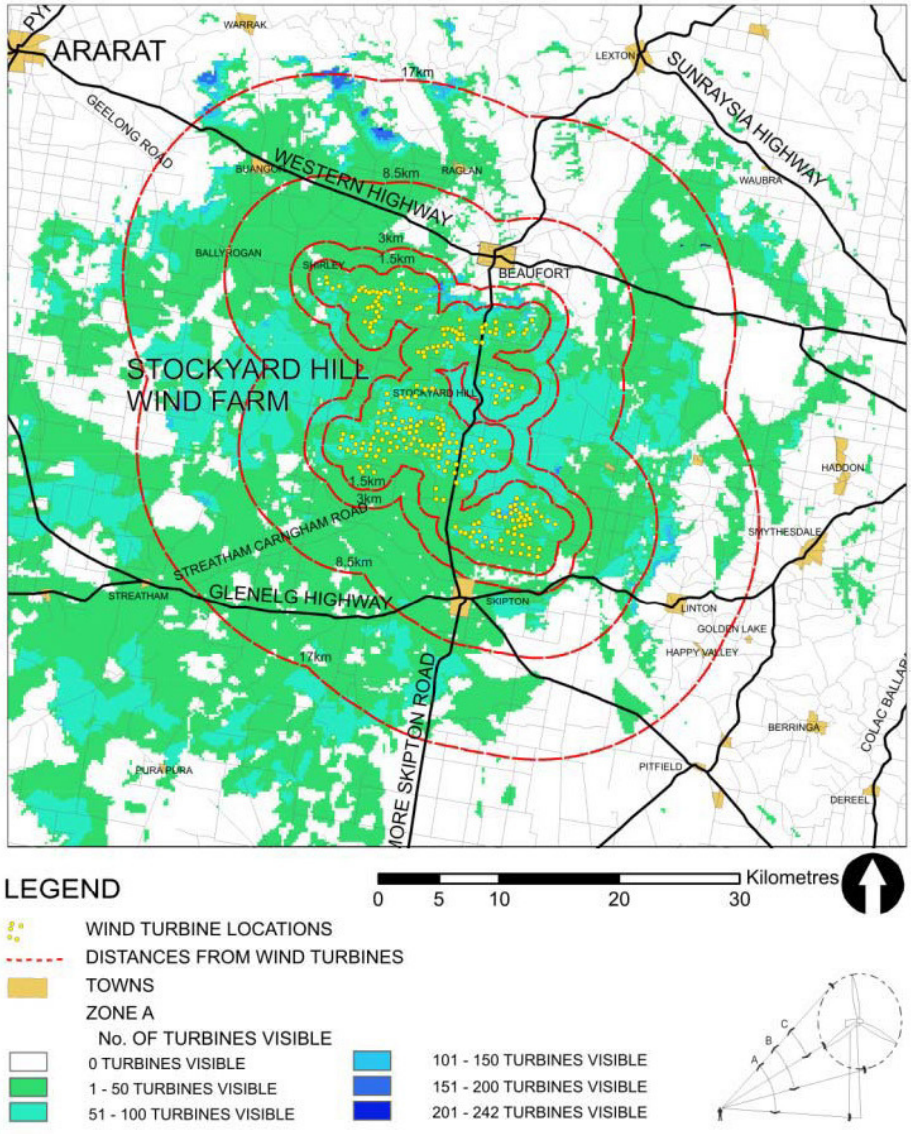


Figure 6.2 Zone A - Areas from where viewers can potentially see wind turbines in their entirety

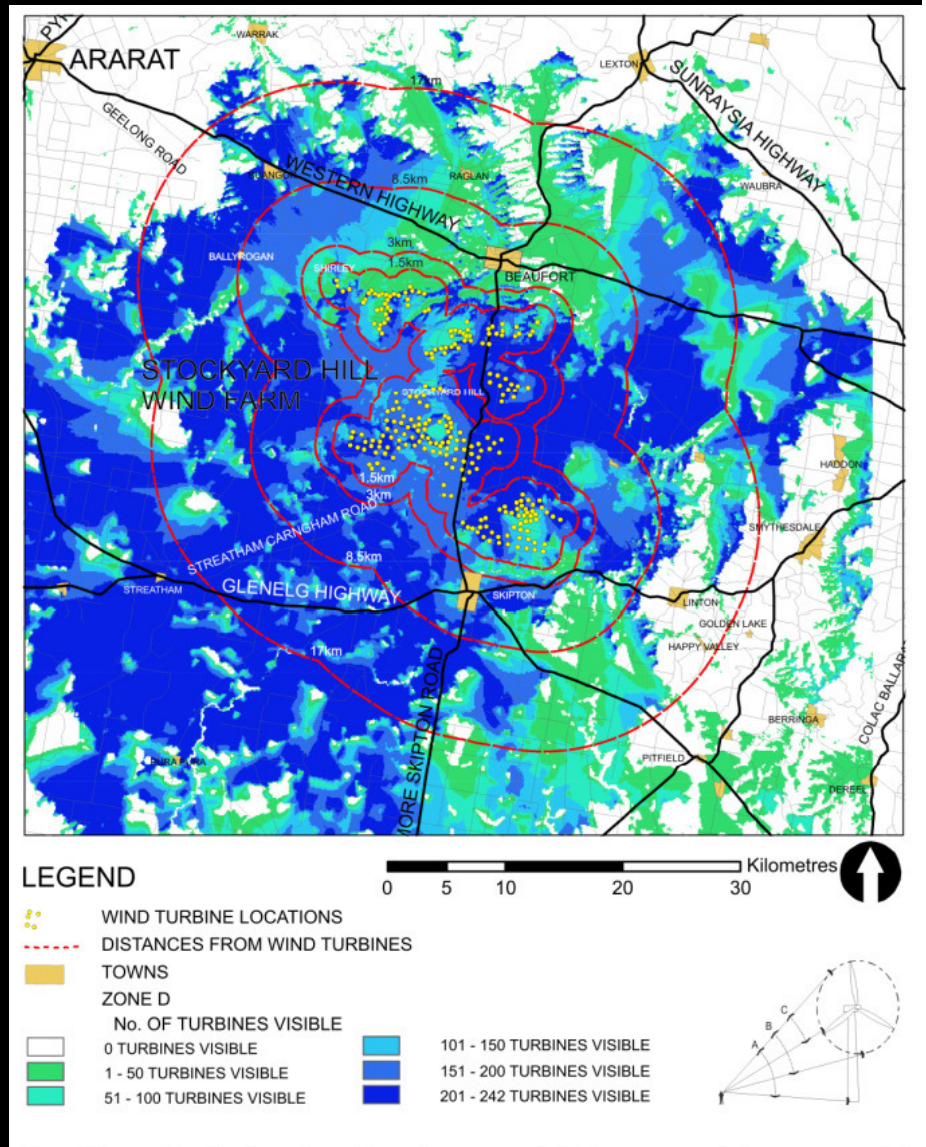
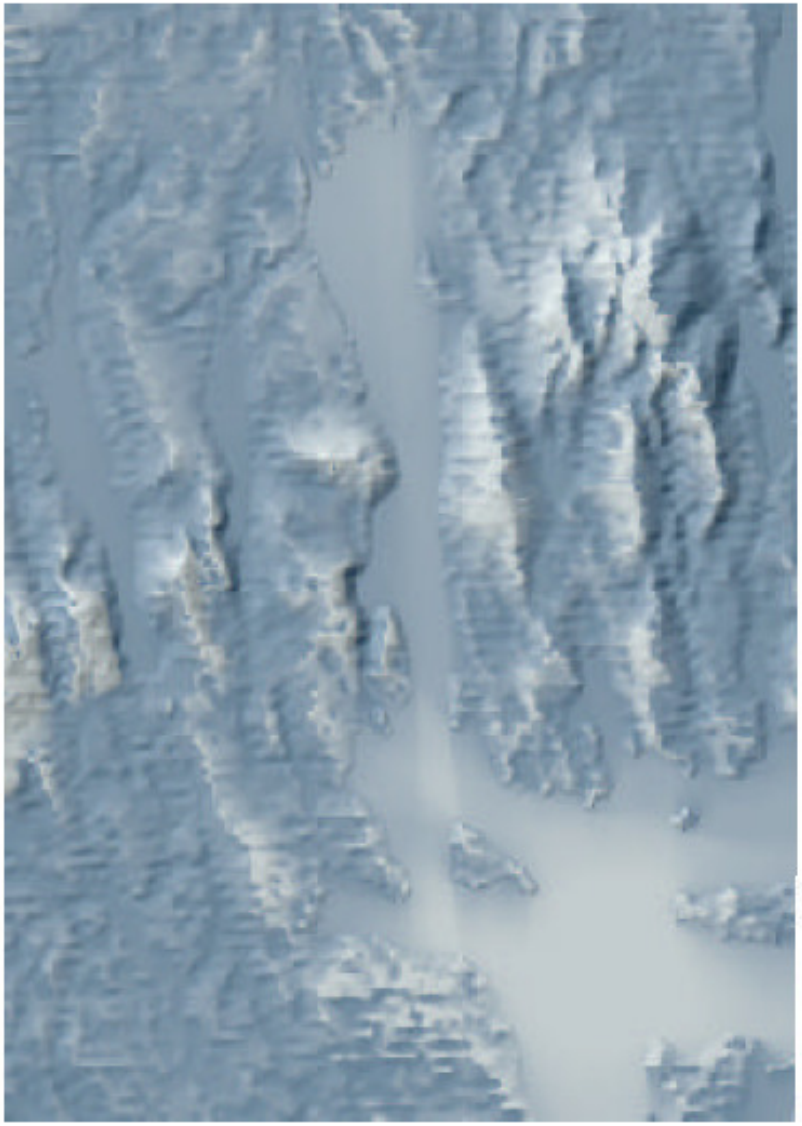
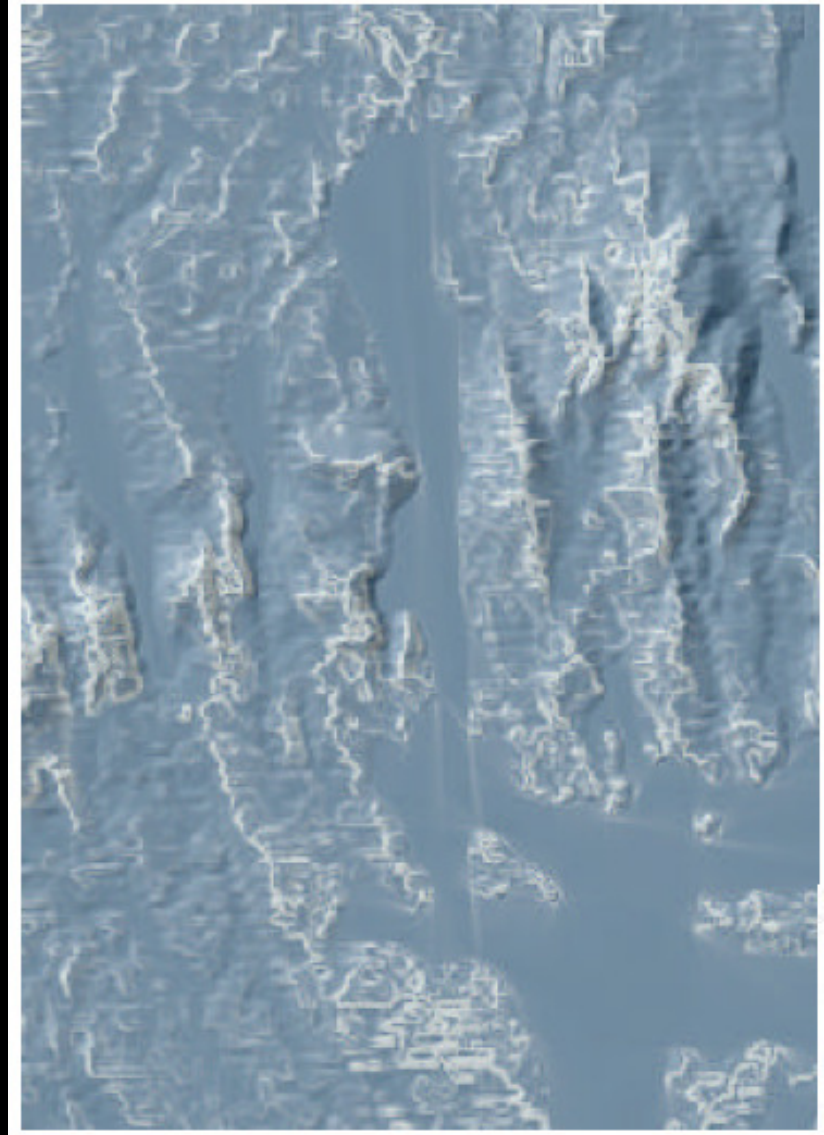


Figure 6.5 Zone D - Areas from where viewers can potentially see any part of one or more wind turbines

ERM (2009)



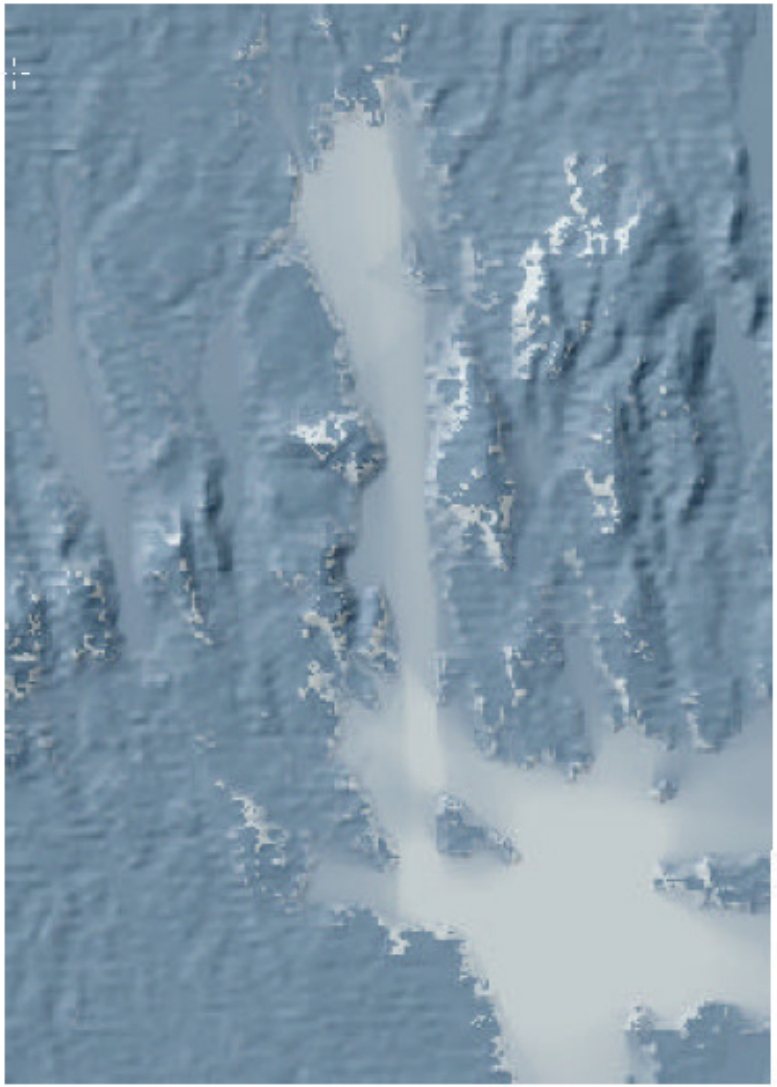


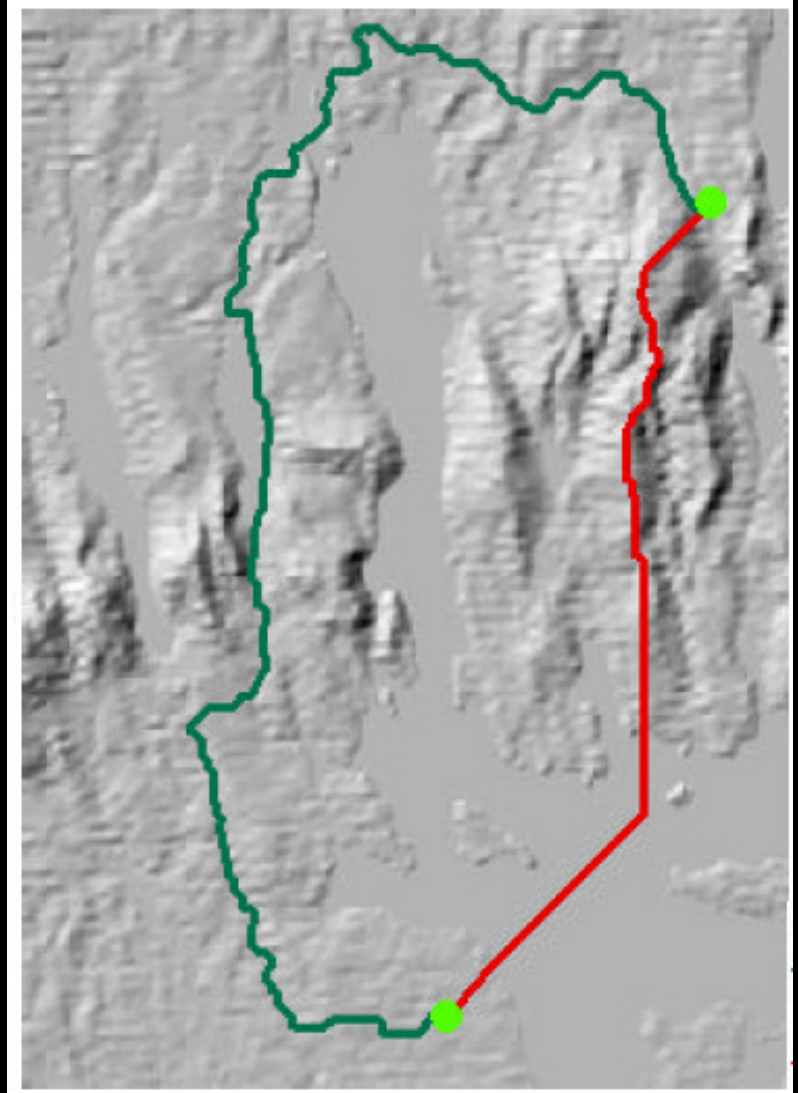
Cumulative Visibility (Count)
Value
High : 73632
Low : 0

Complete Intervisibility Database Toolbox

Caldwell et al. (2003)

Slope of Cumulative Visibility (Percent)
Value
High : 117230.781250
Low : 0.000000

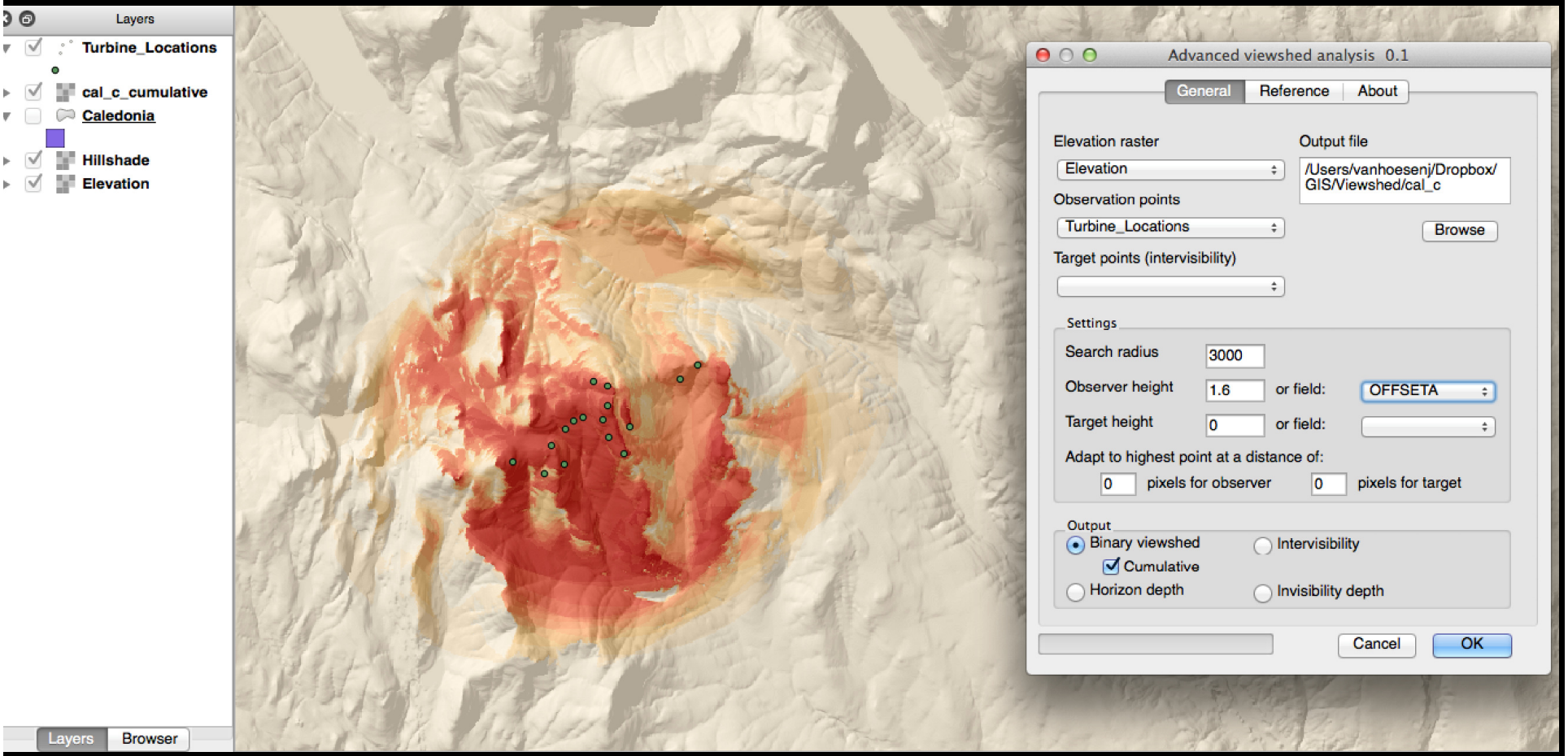


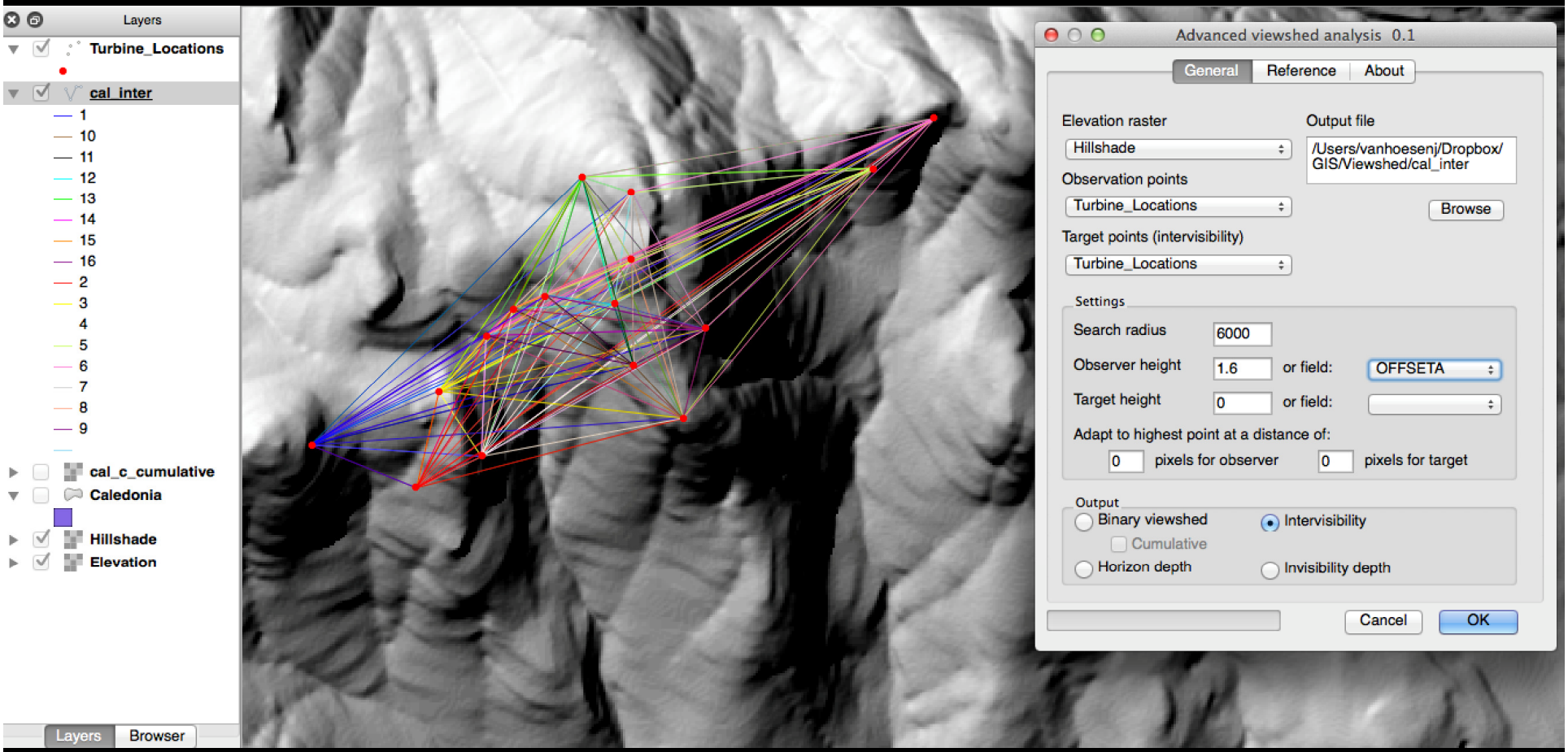


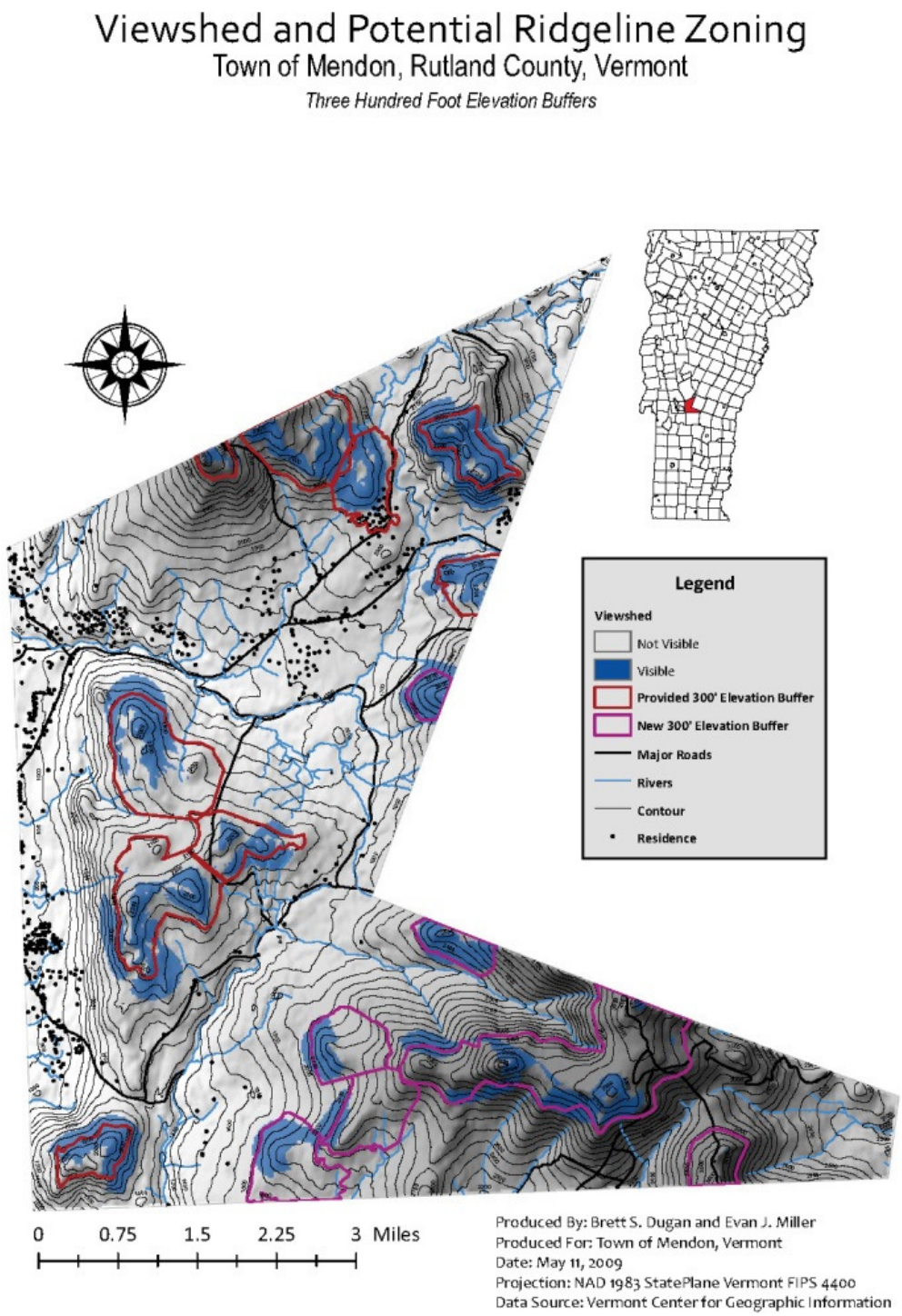
Core Area Visibility
Value
High : 58343
Low : 0

Least Visible Path
Most Visible Path

Caldwell et al. (2003)


Layers
Turbine_Locations
cal_c_cumulative
Caledonia
Hillshade
Elevation
Layers
Browser
Advanced viewshed analysis 0.1
General
Reference
About
Elevation raster
Elevation
Output file
/Users/vanhoesenj/Dropbox/GIS/Viewshed/cal_c
Observation points
Turbine_Locations
Browse
Target points (intervisibility)
Settings
Search radius
3000
Observer height
1.6
or field:
OFFSETA
Target height
0
or field:
Adapt to highest point at a distance of:
0
pixels for observer
0
pixels for target
Output
Binary viewshed
Cumulative
Intervisibility
Horizon depth
Invisibility depth
Cancel
OK


Layers
Turbine_Locations
cal_inter
1
10
11
12
13
14
15
16
2
3
4
5
6
7
8
9
cal_c_cumulative
Caledonia
Hillshade
Elevation
Layers
Browser
Advanced viewshed analysis 0.1
General
Reference
About
Elevation raster
Hillshade
Output file
/Users/vanhoesenj/Dropbox/GIS/Viewshed/cal_inter
Observation points
Turbine_Locations
Browse
Target points (intervisibility)
Turbine_Locations
Settings
Search radius
6000
Observer height
1.6
or field:
OFFSETA
Target height
0
or field:
Adapt to highest point at a distance of:
0
pixels for observer
0
pixels for target
Output
Binary viewshed
Intervisibility
Cumulative
Horizon depth
Invisibility depth
Cancel
OK



BUFFER BY RISE

Areas that are 50’ above roads, within 350’ of roads, and within 1500’ of ridges.

ROUTE 340 VIEWSHED SURVEY:
Jefferson County West Virginia

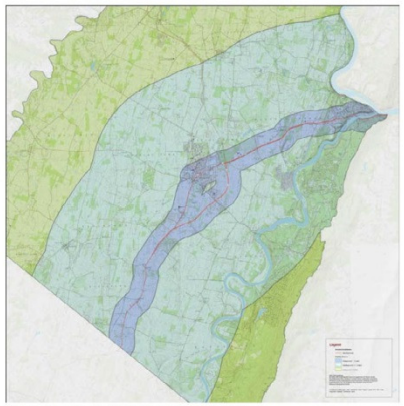
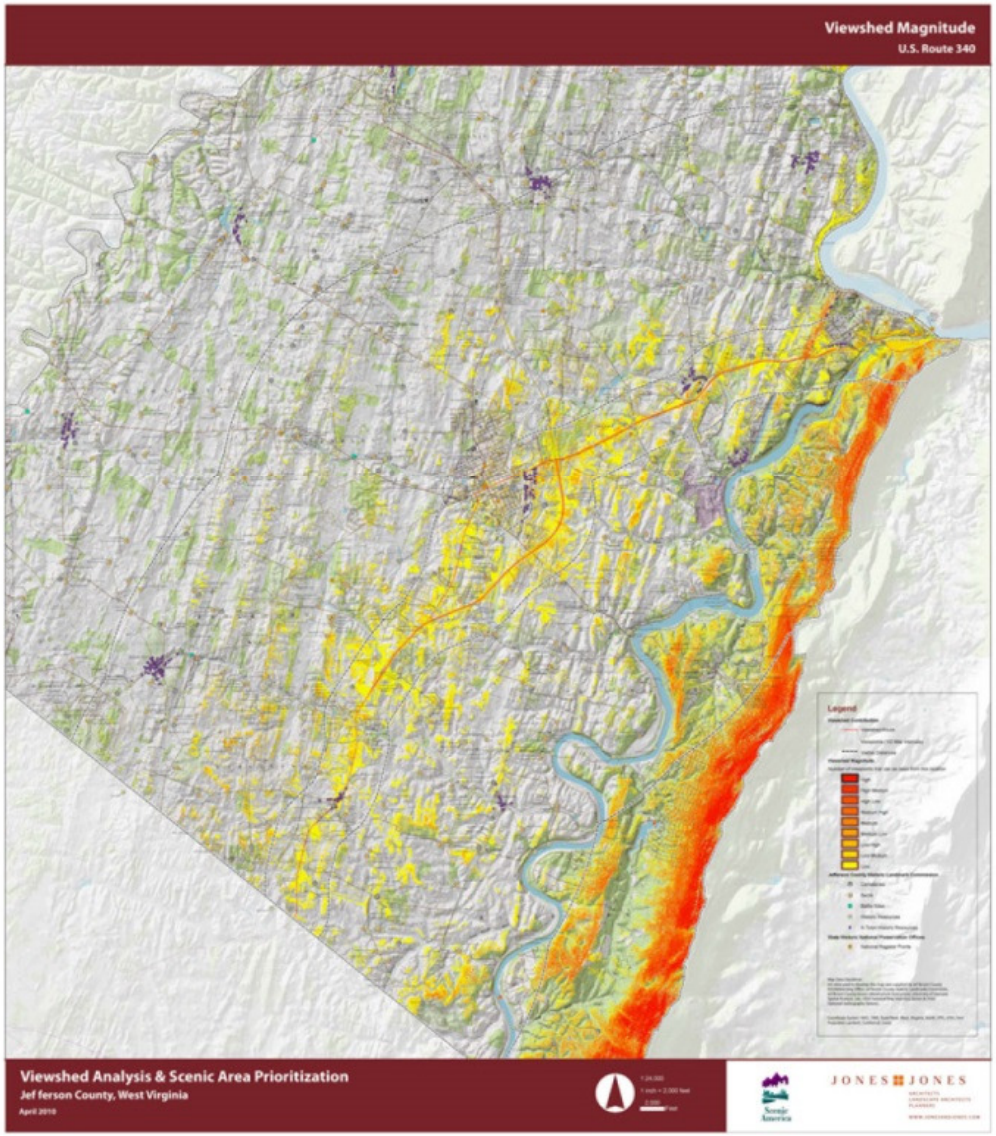


Figure 3 – Route 340 Viewshed Model

Foreground Zones (Dark Blue) – ¼ to ½ mile from observer
The viewer can perceive details such as forms, lines, and colors. It is located up to a ¼-½ mile distance from the viewer. Changes in the landscape view are most significant within the foreground view because they are most immediate to the viewpoint. This is the zone that can be most easily manipulated to improve the scenic quality along a corridor.

Middleground Zones (Light Blue) – From limit of foreground to 4 miles from the observer
The viewer can perceive details such as forms, lines, and colors in masses. It is located from between a ½ mile to 4 mile distance.

Background Zones (Light Green) – From the outer limit of middle ground to an infinite distance from the observer. The background zone essentially extends to the physical limit of the viewshed. For this project, the background zone was clipped at the edge of the county line. The viewer can perceive broad forms but cannot visually pick out textures, details nor colors.



Scenic America (2010)

QUESTIONS?

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