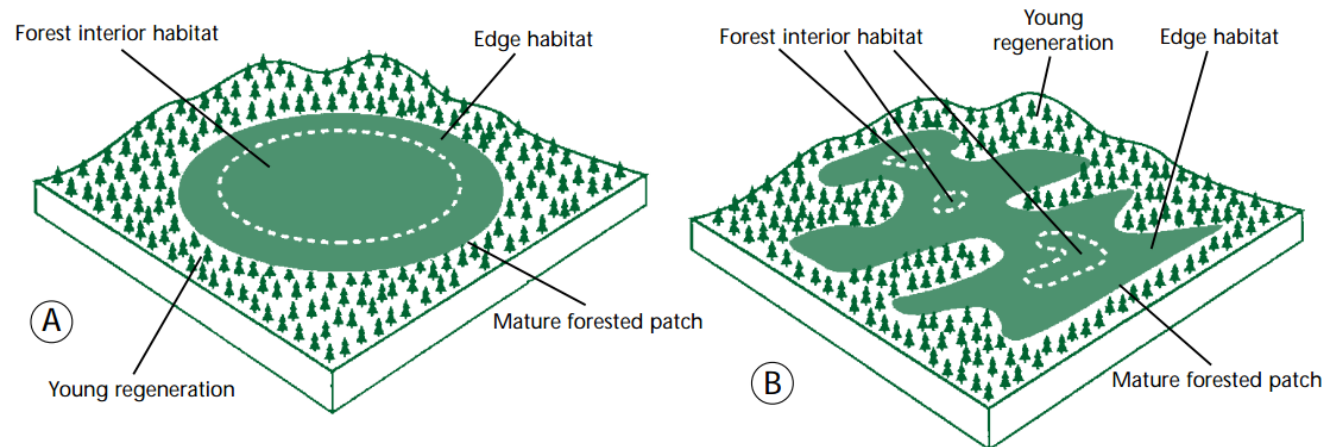


# Estimation of forest interior condition in southern Appalachian Mountains using airborne LiDAR data

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From B.C. Ministry of Forests and B.C. Ministry of Environment, Lands and Parks 1996



## Decline of forest interior conditions in the conterminous United States

Kurt H. Riitters<sup>1</sup> & James D. Wickham<sup>2</sup>

SUBJECT AREAS:  
SUSTAINABILITY  
BIODIVERSITY  
PLANT SCIENCES  
BIOLOGICAL MODELS

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<sup>2</sup>National Exposure Research Laboratory, United States Environmental Protection Agency, Research Triangle Park, NC 27711, USA.

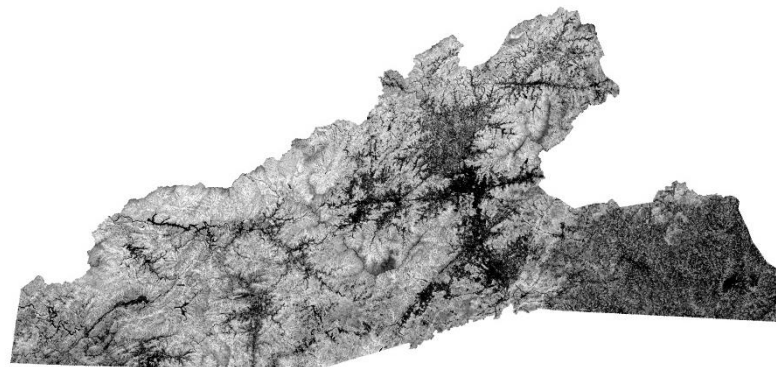
## Beyond Deforestation: Restoring Forests and Ecosystem Services on Degraded Lands

Robin L. Chazdon  
*Science* **320**, 1458 (2008);  
DOI: 10.1126/science.1155365

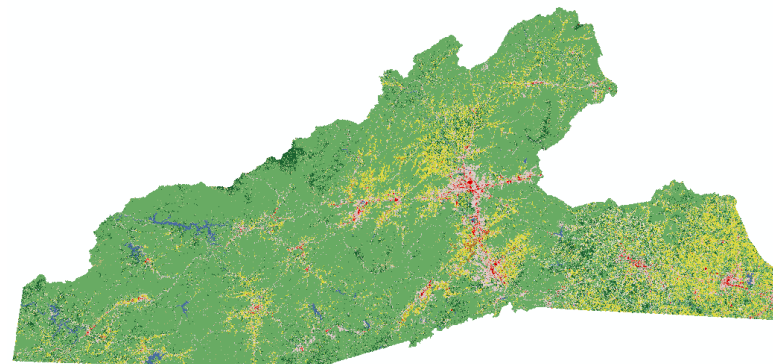
# Objectives

- Using airborne LiDAR to estimate forest cover and forest interior after eliminating canopy gaps and young regeneration.
- Compare the differences between LiDAR derived and NLCD derived estimations of forest cover and forest interior

# Study site and data



Canopy Height Model



NLCD 2006

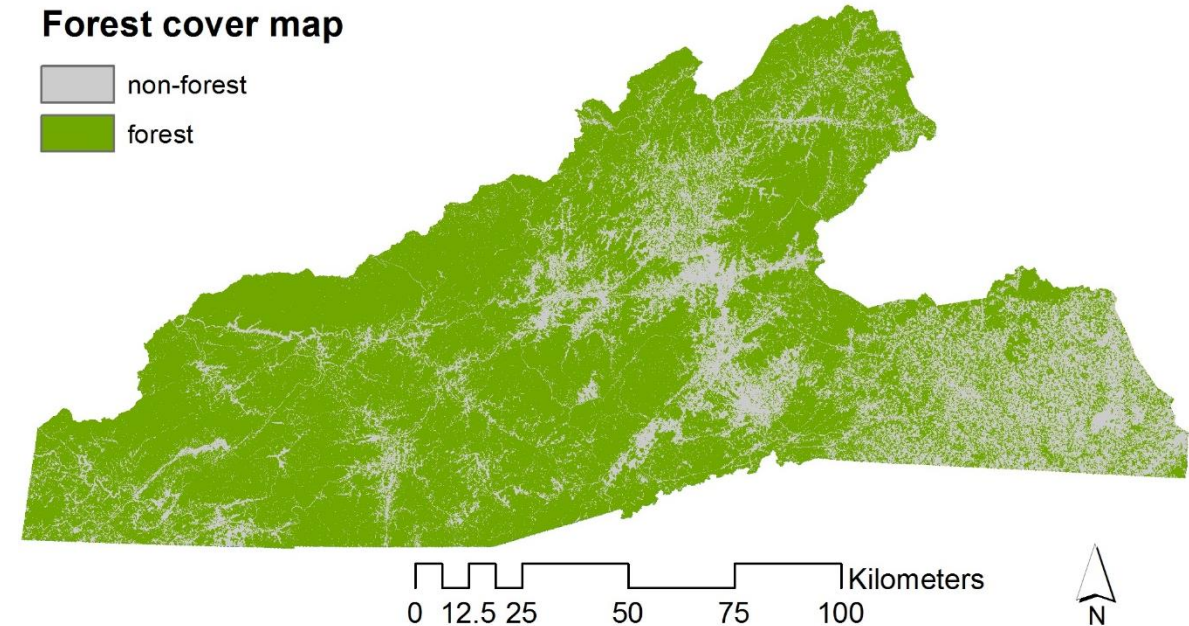


NAIP 2005

# Results

## Accuracy assessment of threshold 10 m (right)

refer\map	Gap	Forest	Total	Producer's accuracy
Gap	26	4	30	86.67%
Forest	2	68	70	97.14%
Total	28	72	100	Overall
User's accuracy	92.86%	94.44%		94.00%



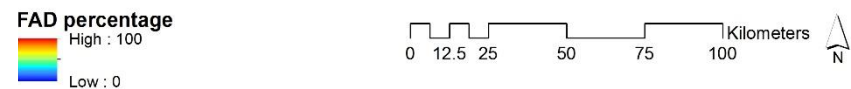
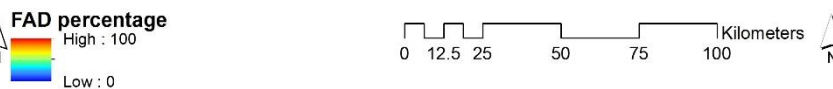
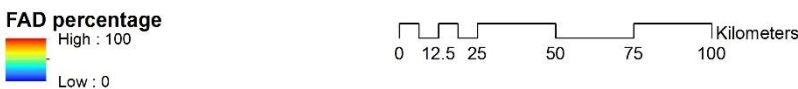
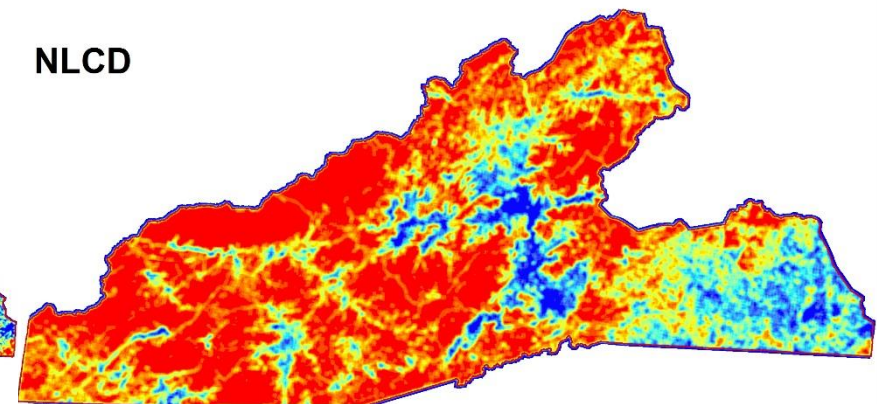
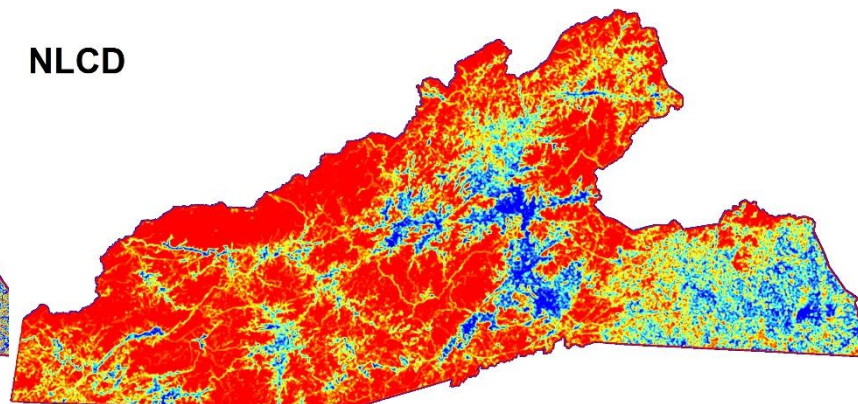
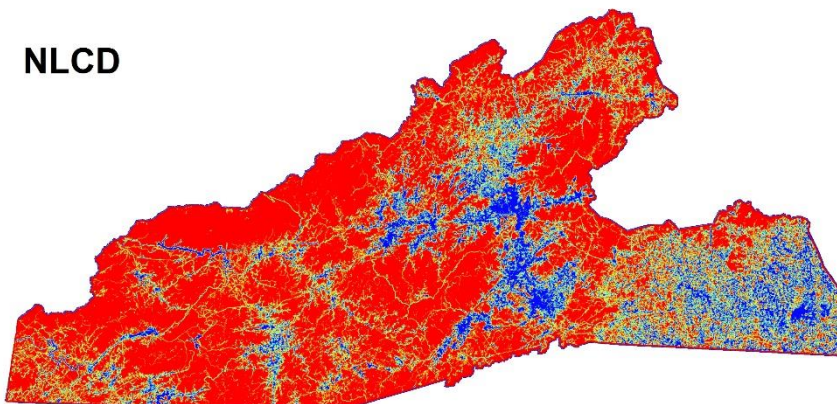
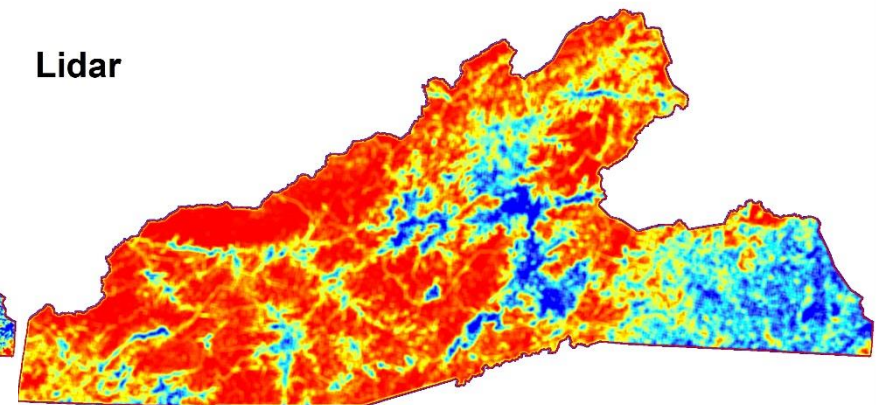
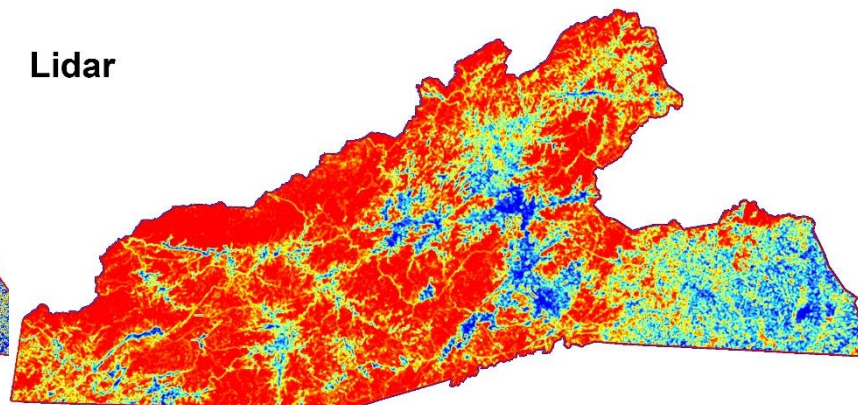
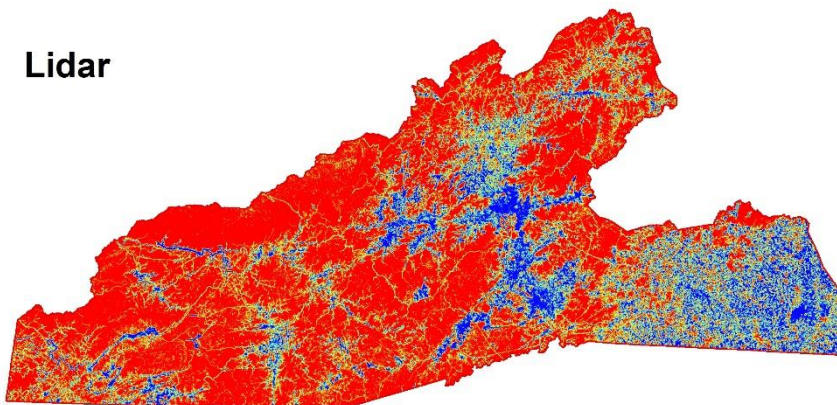
### Forest area:

- 9.1% disagreement with the NLCD 2006
- 3.7% forest in our resultant map but as non-forest in the NLCD 2006
- 6.4% non-forest in our resultant map but as forest in the NLCD 2006.



# Selected results of Forest Area Density (FAD)

$$FAD = \frac{\text{Forest pixels}}{\text{Total pixels}} \times 100\%$$



4.41 Ha (7 by 7)

36 Ha (20 by 20)

225 Ha (50 by 50)

# Area Change Analysis

Intact (>90%) (forest interior)  
 Fragmented (10% - 60%)

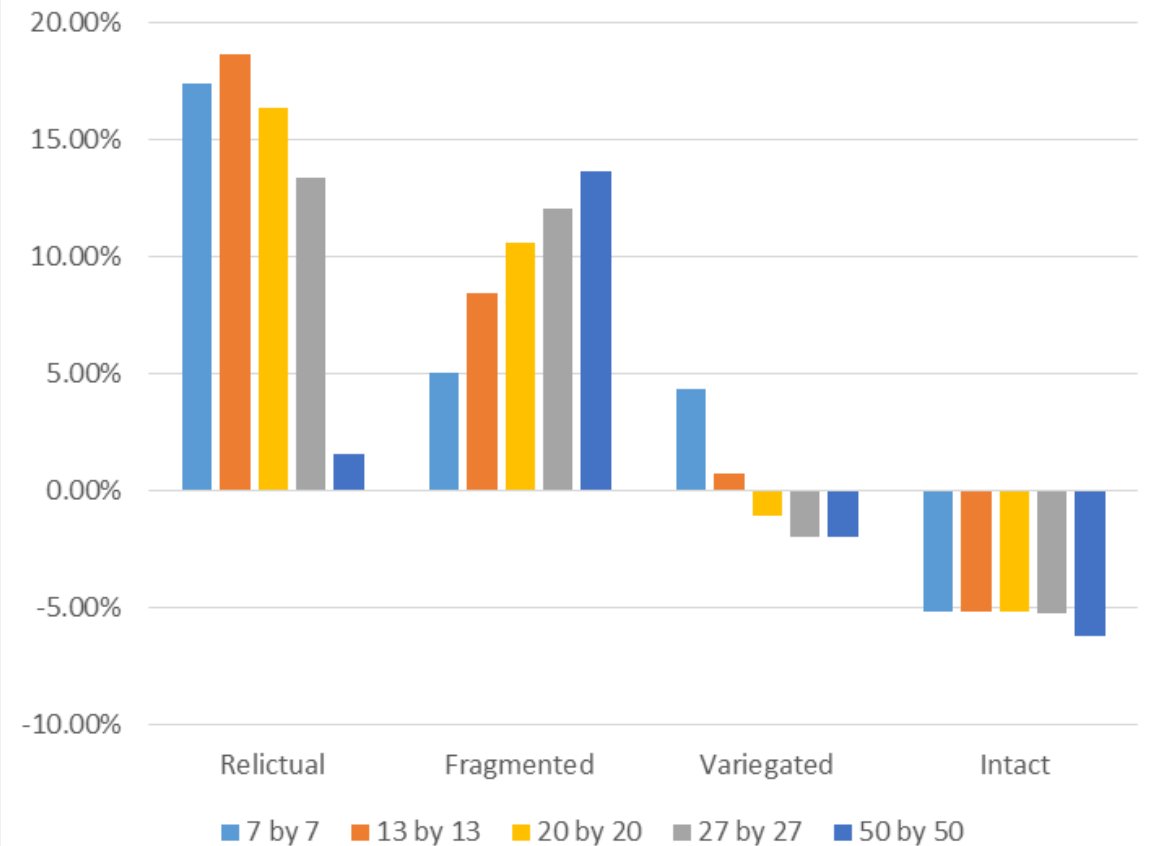
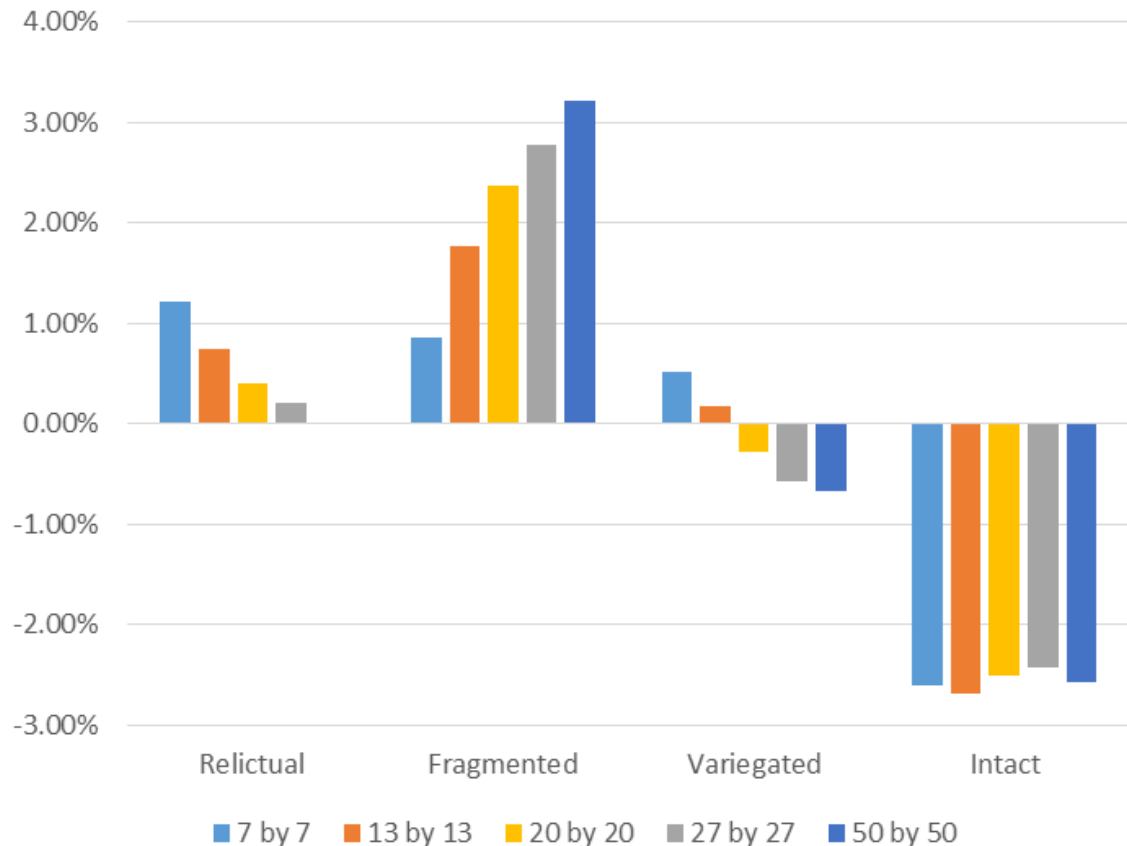
Variegated (60% - 90%)  
 Relictual (<10%)

$$\text{Change percentage} = \frac{FAD_{Lidar} - FAD_{NLCD}}{\text{Total Area}} \times 100\%$$

$$\text{Relative Change percentage} = \frac{FAD_{Lidar} - FAD_{NLCD}}{FAD_{NLCD}} \times 100\%$$

Change Percentage

Relative Change Percentage

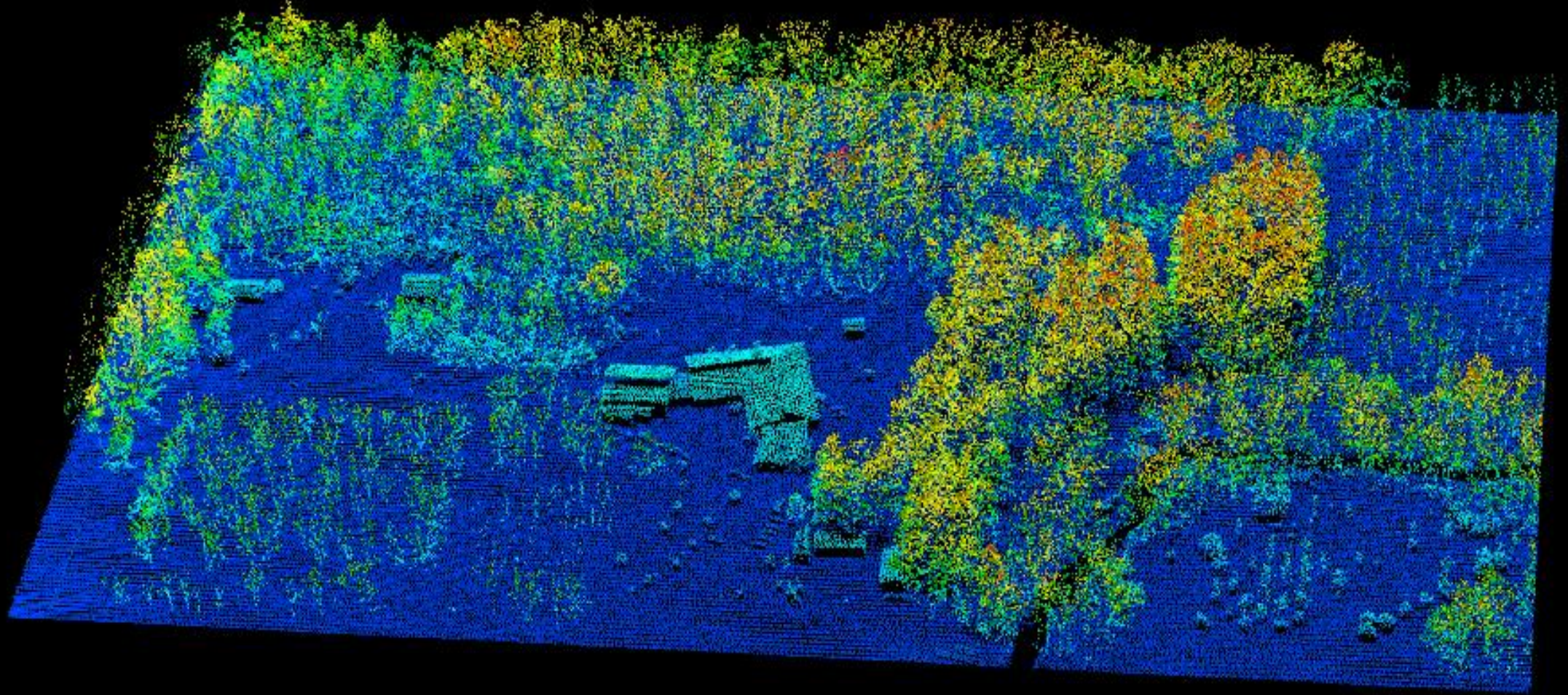


# Take home messages

- Canopy gaps and young regeneration affect the estimation of forest interior conditions.
- Vertical information performs better than spectral features to distinguish canopy gaps and young regeneration from mature forest.
- Airborne LiDAR has the ability to improve the estimation of forest cover and forest interior conditions.



Questions or comments?





# Method (Forest cover)

$$\text{Forest cover map} = \begin{cases} \text{forest,} & \text{when CHM} > \text{threshold height} \\ \text{non forest,} & \text{when CHM} < \text{threshold height} \end{cases}$$

4 threshold height were tested:

- 1 m
- 3 m
- 5 m
- 10 m

30	26	25	31	27	23	16
18	49	21	26	22	19	5
33	28	32	30	25	20	7
36	20	30	28	30	4	3
31	22	33	29	25	2	1
29	24	28	30	33	40	35
26	2	3	2	26	28	29

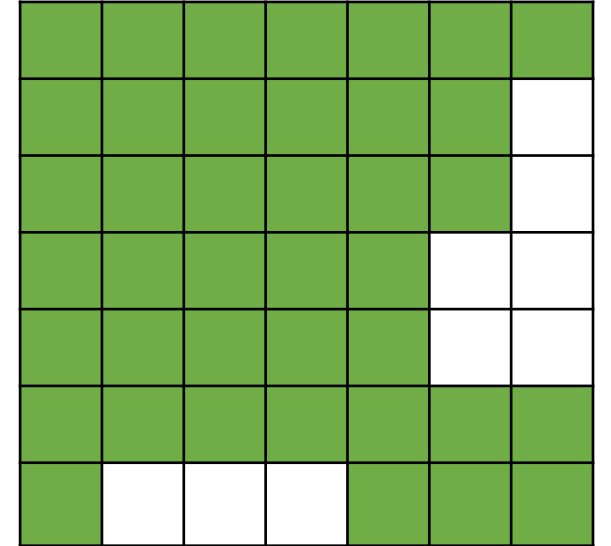
# Method (Forest Area Density)

$$FAD = \frac{\text{Forest pixels}}{\text{Total pixels}} \times 100\%$$

$$FAD = \frac{40}{49} \times 100\% = 81.6\%$$

5 Moving windows for both NLCD and Lidar derived forests:

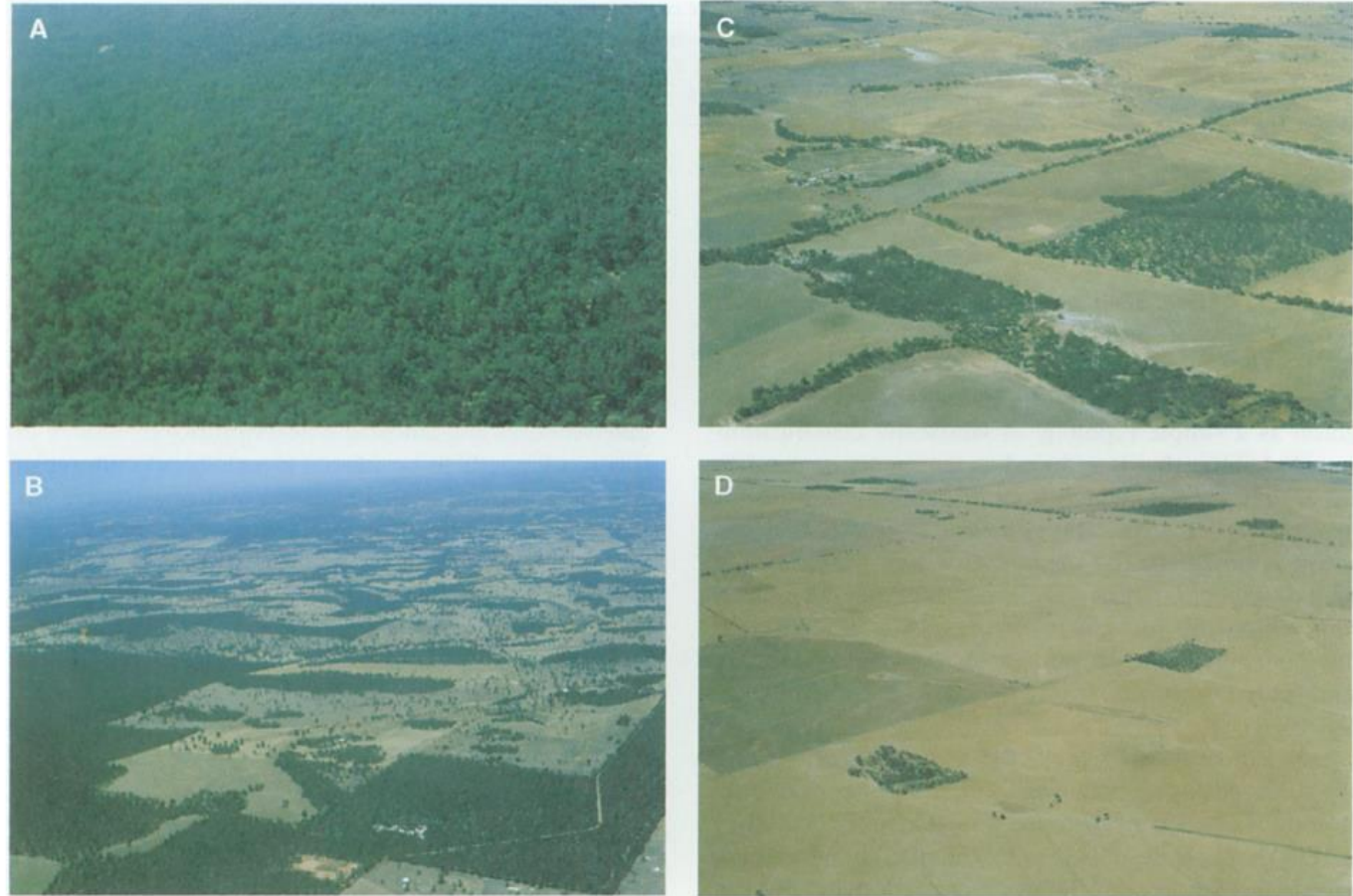
- 4.41 Ha (7 by 7)
- 15.21 Ha (13 by 13)
- 36 Ha (20 by 20)
- 65.61 Ha (27 by 27)
- 225 Ha (50 by 50)



# Landscape alteration

McIntyre and Hobbs 1999

- A: Intact (>90%) (**forest interior**)
- B: Variegated (60% - 90%)
- C: Fragmented (10% - 60 %)
- D: Relictual (<10%)



*Figure 1. Patterns of landscape alteration in southwestern Western Australia seen as gross effects of human activities on tree distribution: (a) intact Eucalyptus marginata forest; (b) E. marginata forest partially cleared for grazing, representing a variegated landscape; (c) fragmented woodland of mixed eucalypt species, mostly cleared for cropping and grazing; (d) relictual mixed eucalypt woodland heavily cleared for cropping and grazing. Photos by R. Hobbs.*