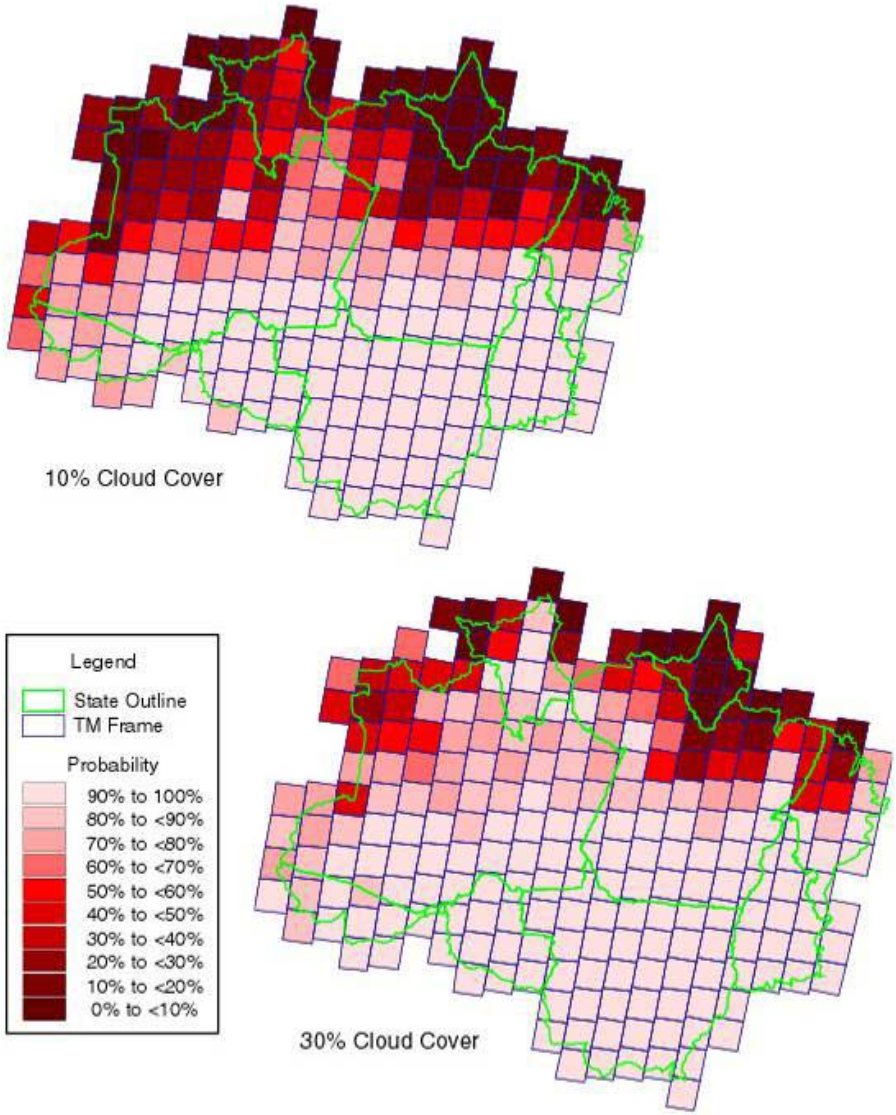
A Difficult Region for Remote Sensing Studies



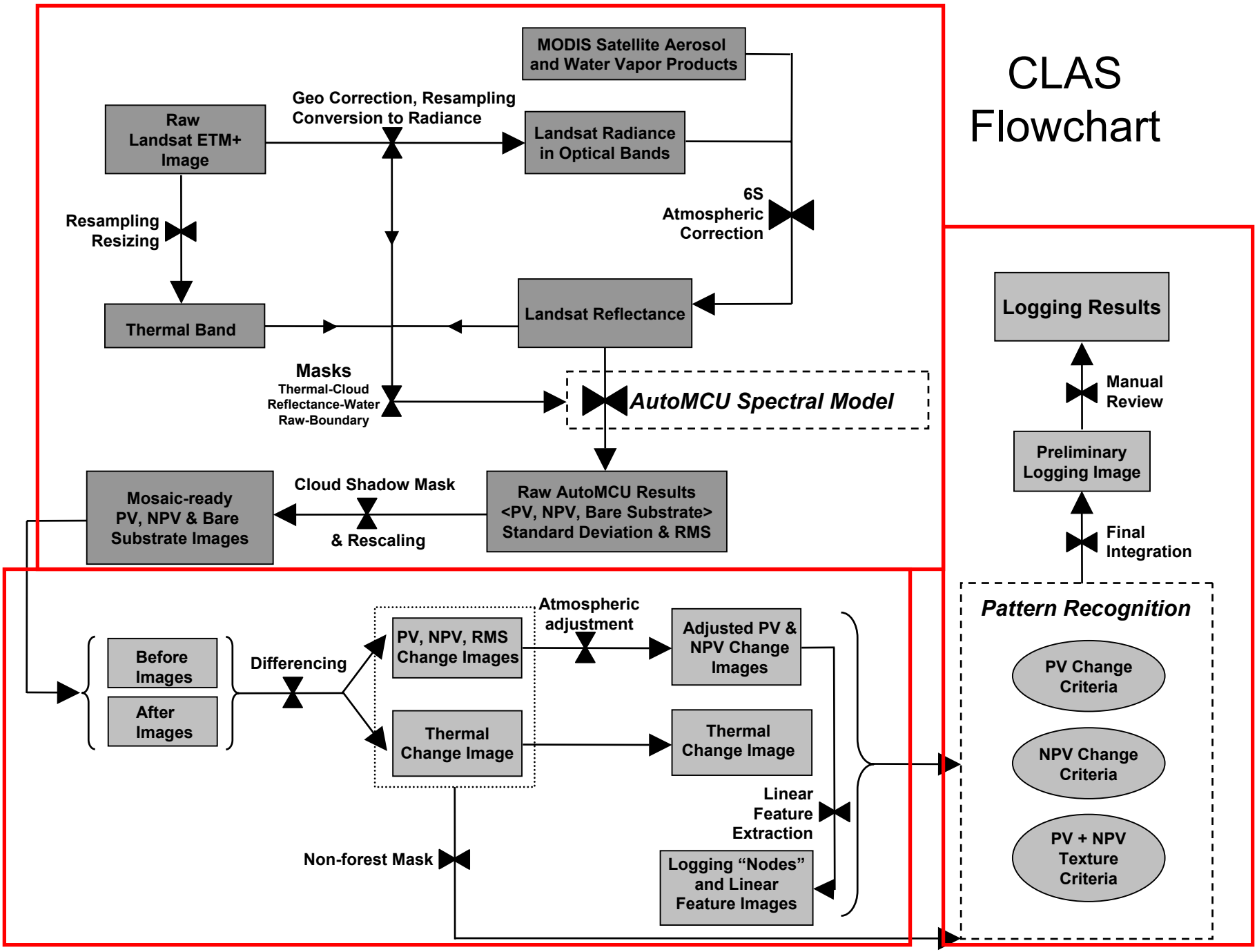
Probability of obtaining a Landsat Thematic Mapper scene over the Amazon River Basin with <= 10% or <= 30% cloud cover for the years 1984-1997.

Probability of imaging the Brazilian Legal Amazon

Once per year…

Probability of Landsat observations from 54,451 scenes

Asner (2001)
Int'l J. of Remote Sensing


CLAS Flowchart
MODIS Satellite Aerosol and Water Vapor Products
Raw Landsat ETM+ Image
Geo Correction, Resampling Conversion to Radiance
Landsat Radiance in Optical Bands
Resampling Resizing
6S Atmospheric Correction
Thermal Band
Landsat Reflectance
Masks
Thermal-Cloud
Reflectance-Water
Raw-Boundary
AutoMCU Spectral Model
Mosaic-ready PV, NPV & Bare Substrate Images
Cloud Shadow Mask
& Rescaling
Raw AutoMCU Results <PV, NPV, Bare Substrate> Standard Deviation & RMS
Logging Results
Manual Review
Preliminary Logging Image
Final Integration
Pattern Recognition
PV Change Criteria
NPV Change Criteria
PV + NPV Texture Criteria
Before Images
After Images
Differencing
PV, NPV, RMS Change Images
Atmospheric adjustment
Adjusted PV & NPV Change Images
Thermal Change Image
Thermal Change Image
Linear Feature Extraction
Non-forest Mask
Logging "Nodes" and Linear Feature Images

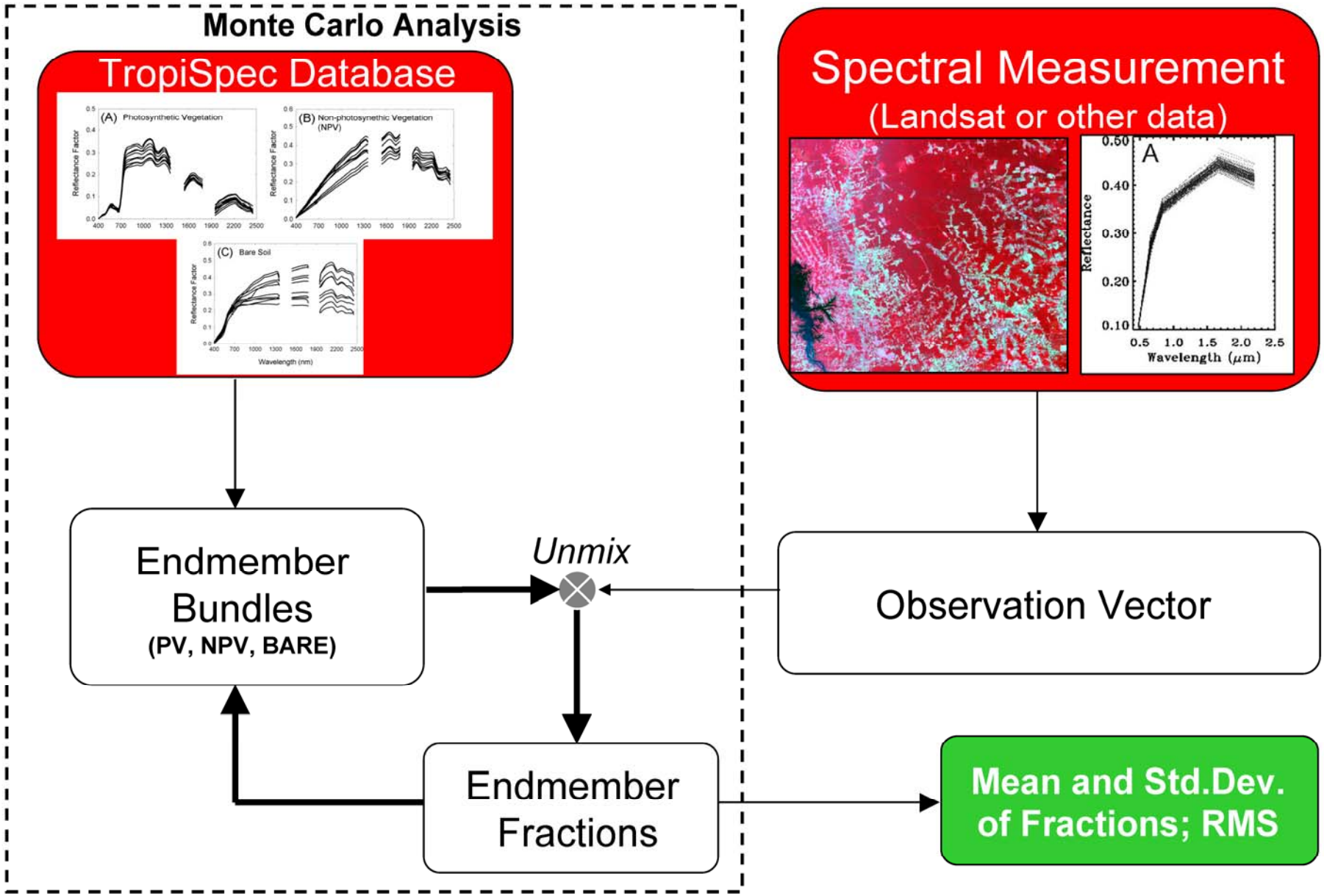

Monte Carlo Analysis
TropiSpec Database
(A) Photosynthetic Vegetation
(B) Non-photosynthetic Vegetation (NPV)
(C) Bare Soil
Reflectance Factor
Wavelength (nm)
Spectral Measurement
(Landsat or other data)
A
Reflectance
Wavelength (μm)
Endmember Bundles
(PV, NPV, BARE)
Unmix
Observation Vector
Endmember Fractions
Mean and Std.Dev. of Fractions; RMS

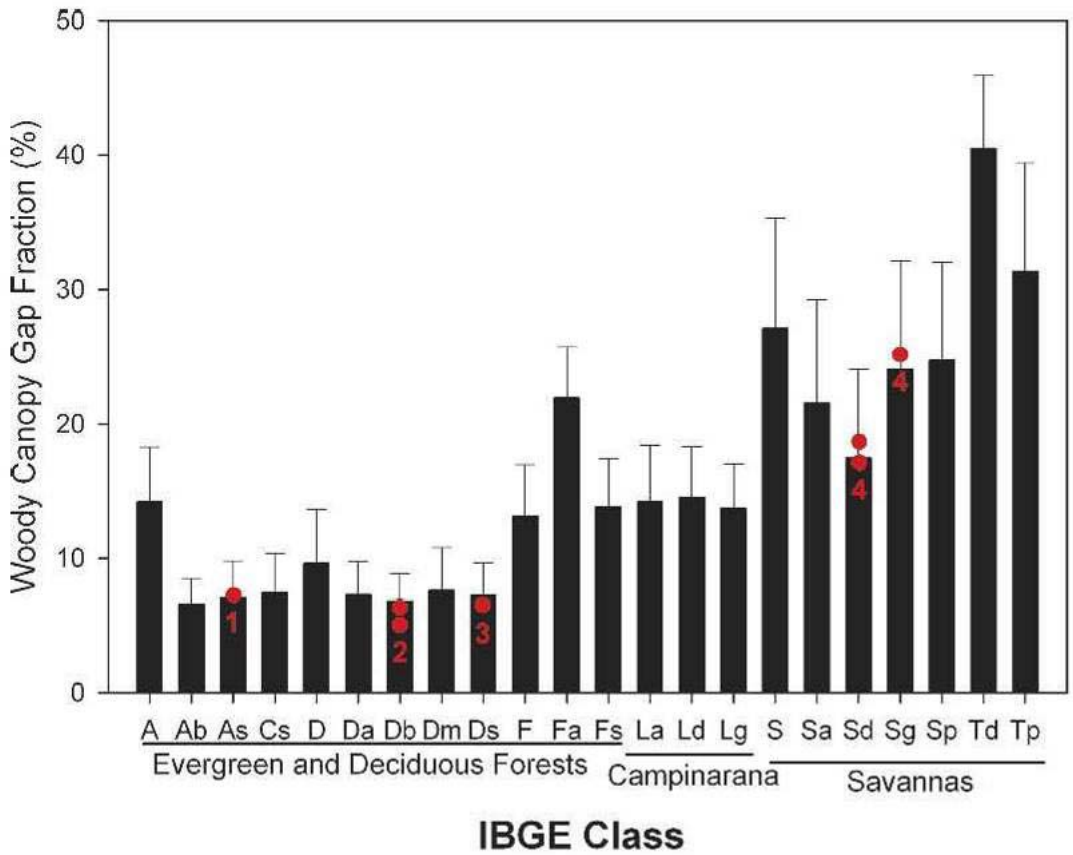
Table 1. Five most common vegetation classes in each Brazilian state studied (Figure 4): Area and fractional cover of PV, NPV, and bare substrate shown. All values within each state are statistically different (*t* tests; $p < 0.001$) unless noted with asterisk (*).

State and IBGE vegetation	Area (km^2)	PV	NPV	Bare
Acre				
Open lowland tropical forest	82 275	89.7*	9.7*	2.7*
Dense lowland tropical forest	13 748	89.9*	8.5	3.5
Dense alluvial forest	7316	89.3	9.5*	2.8*
Dense tropical forest with secondary vegetation	4505	87.3	8.6	5.7
Open tropical forest with secondary vegetation	3343	86.8	7.8	7.0
Amapa				
Dense submontane tropical forest	61 423	91.0	10.9*	2.5
Vegetation with fluvial influence	6413	85.5	13.1	5.0
Savanna	2284	86.6	11.1*	4.6
Dense alluvial tropical forest	2317	87.8	8.9	6.1
Dense lowland tropical forest	2284	91.3	9.2	3.2
Amazonas				
Dense lowland tropical forest	514 499	90.1*	9.9	1.8*
Open lowland tropical forest	185 858	90.1*	10.1	1.9*
Dense alluvial tropical forest	168 712	89.4	9.3	3.2
Dense submontane tropical forest	172 703	90.4	9.8	2.1
Contact area: Campinarana—Dense forest	115 180	89.5	10.4	1.6
Mato Grosso				
Contact area: Dense tropical—seasonal forest	150 222	90.4	9.6	2.0*
Open submontane tropical forest	101 790	90.0	9.0	3.7
Contact area: Savanna—Seasonal forest	70 760	88.8	11.3	2.1*
Savanna, wooded	19 147	84.9	14.4	2.1*
Savanna	6292	86.8	13.6	1.6
Para				
Dense submontane tropical forest	385 171	90.8	10.0*	2.3
Open submontane tropical forest	254 453	90.0*	9.8	2.7
Dense lowland tropical forest	154 185	89.9*	9.1	3.2*
Dense tropical forest with secondary vegetation	82 429	89.0	8.2	6.4
Contact area: Savanna—Dense tropical forest	50 399	87.7	10.0*	3.3*
Rondonia				
Open submontane tropical forest	73 147	90.7*	9.2*	2.1*
Open lowland tropical forest	39 804	90.6*	9.4	1.8
Open tropical forest with secondary vegetation	13 595	87.0	7.5	7.1
Dense submontane tropical forest	15 030	91.1	9.8	2.2*
Savanna, woody	8700	86.9	9.2*	3.5
Roraima				
Dense submontane tropical forest	72 499	90.7	9.2	2.8
Dense montane tropical forest	5846	90.5	11.0	2.6
Savanna, grassy-woody	1191	83.8	11.5	5.7
Campinarana, forested	10 109	88.1	13.3	0.9
Savanna steppe	8177	82.3	14.7	5.2

Asner et al. 2005
Earth Interactions

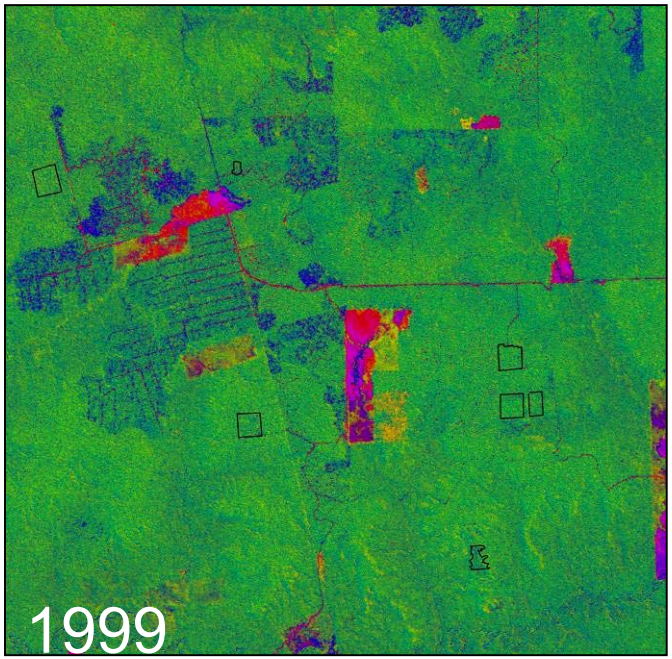
if $PV_{CLAS} < 0.85$, $GAP = (PV_{CLAS} - 90.0)/(-0.4)$

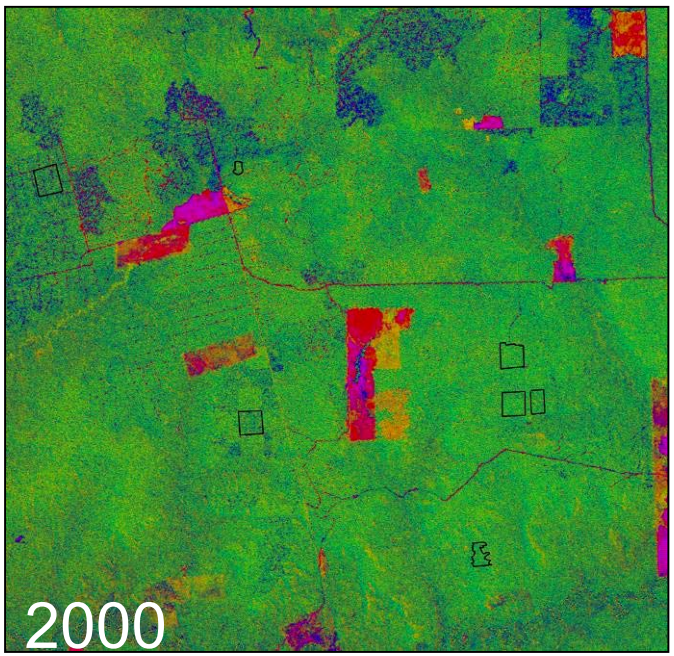
if $PV_{CLAS} \geq 0.85$, $GAP = (PV_{CLAS} - 90.0)/(-0.8)$.

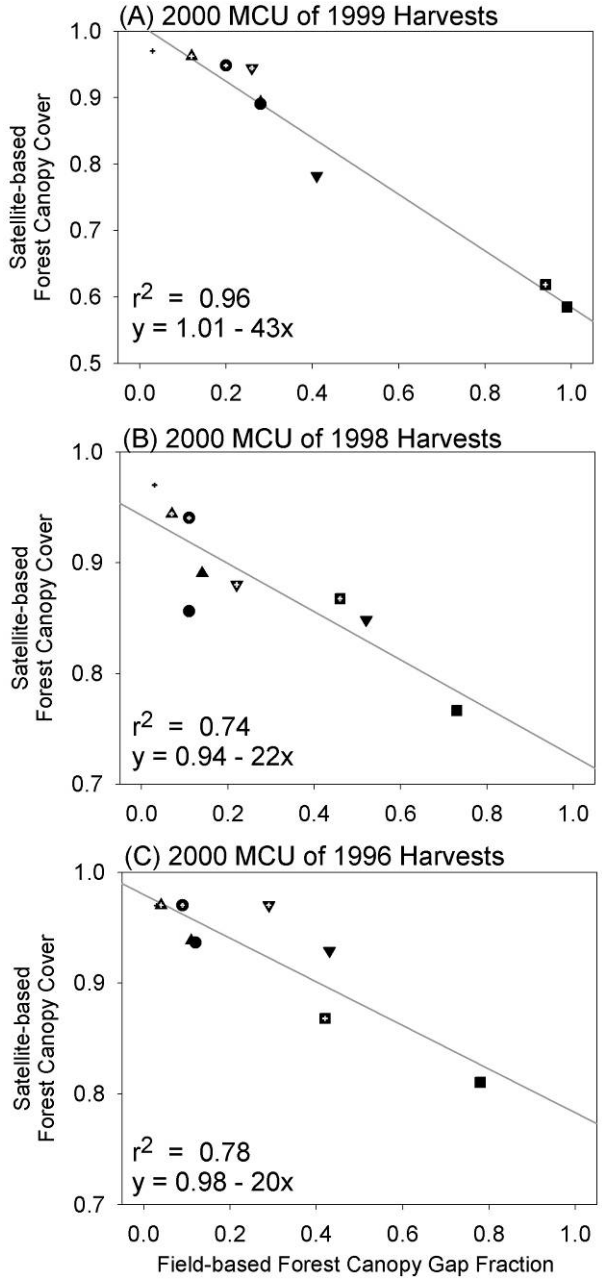


Asner et al. 2005
Earth Interactions

Photosynthetic Vegetation Fractional Cover (PV) and Canopy GAP

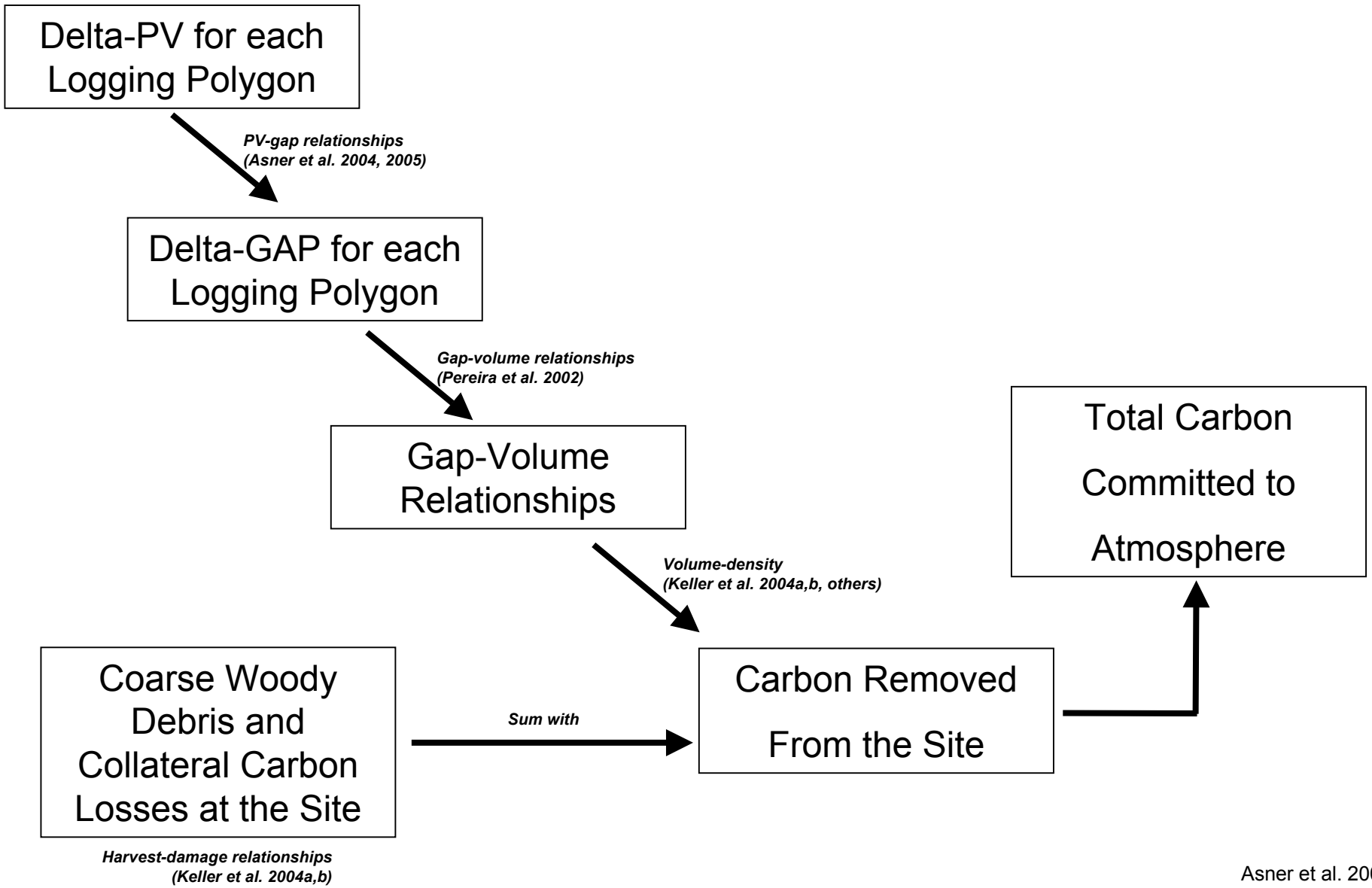






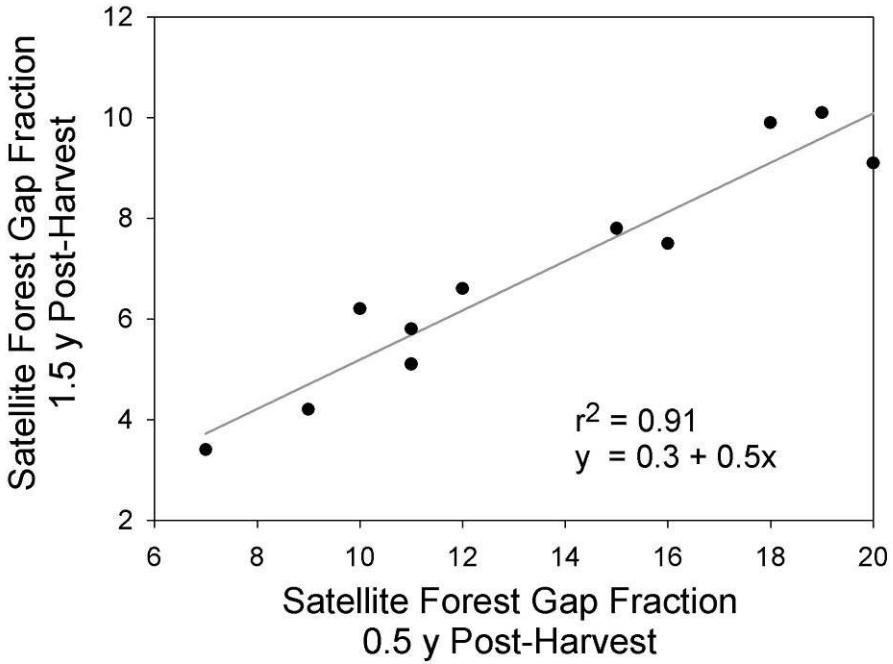
Asner et al. 2004
Ecological Applications

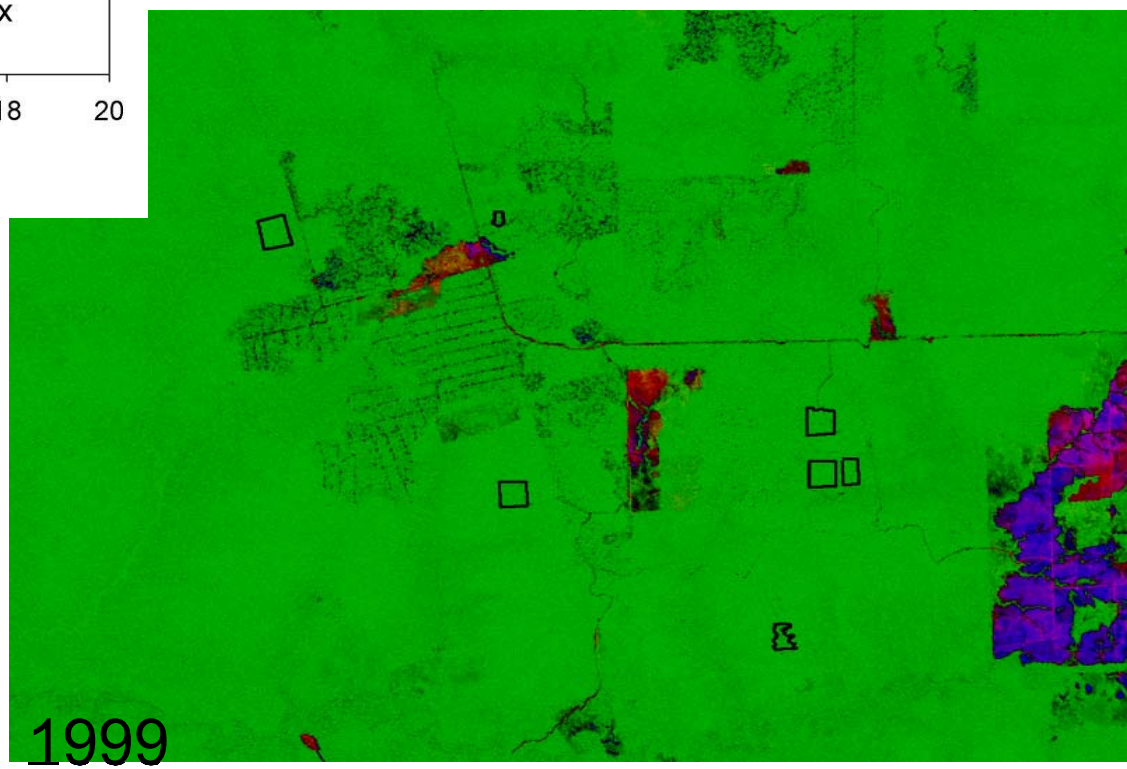
Estimating Gross Carbon Flux from Selective Logging



Asner et al. 2005
Science

Rates of Canopy-Foliar Closure





Asner et al. 2004
Ecological Applications