An Evaluation of Quickbird Data for Assessing Woodland Resource in Deciduous Sal Forests in Bangladesh.

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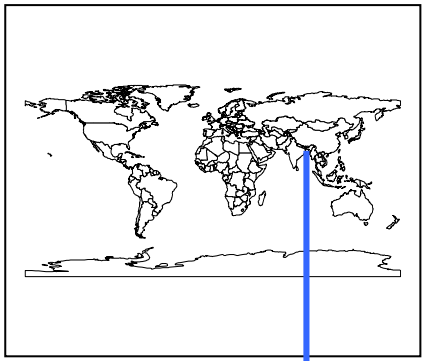
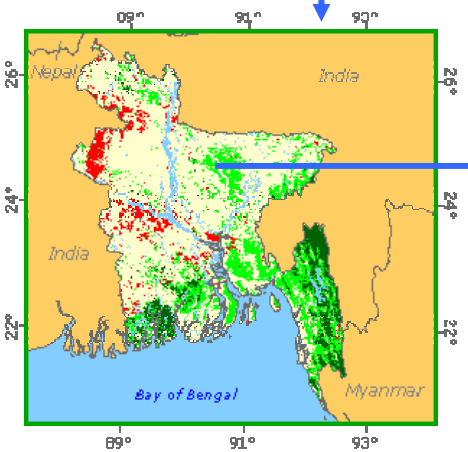
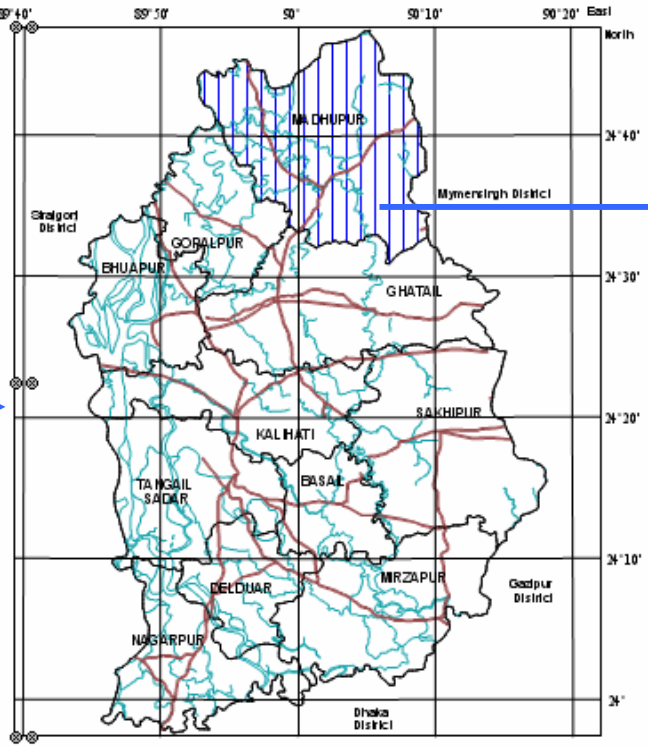
Overview of the presentation

- Importance of the Research.
- Data and methods.
- Data analysis .
- Problems of research.
- Expected Outcome.

Forest cover in Bangladesh





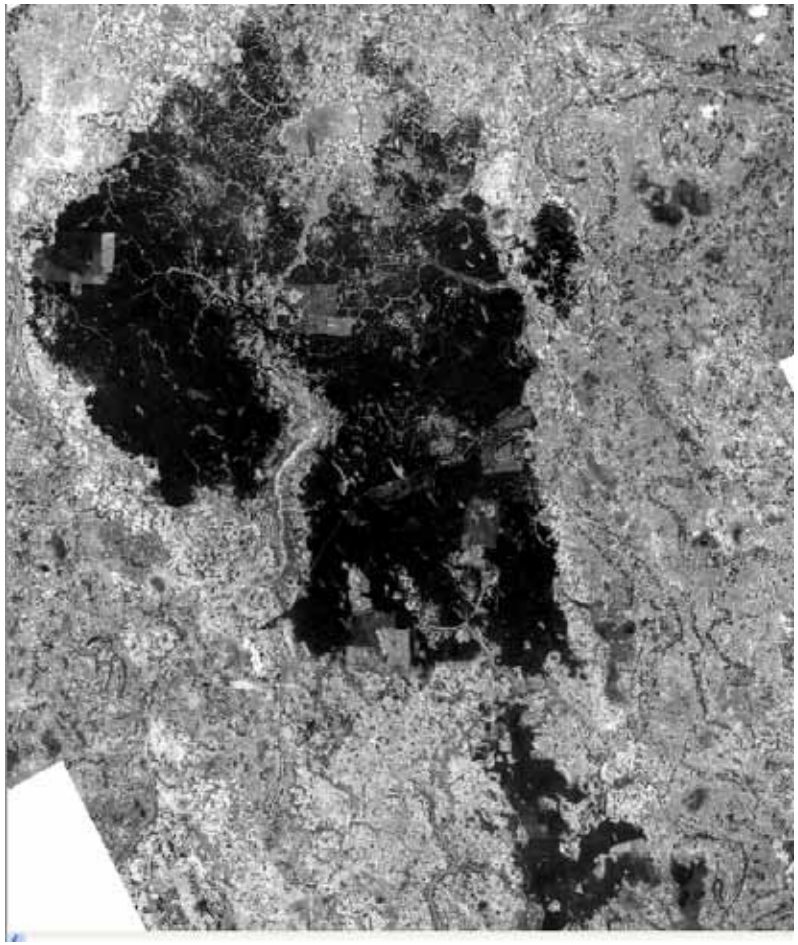


Forest Types	Area (square kilometres)
Evergreen	15,253
Moist Deciduous	1,197
Mangrove	5,992
Total	22,442

Forest Cover Estimates

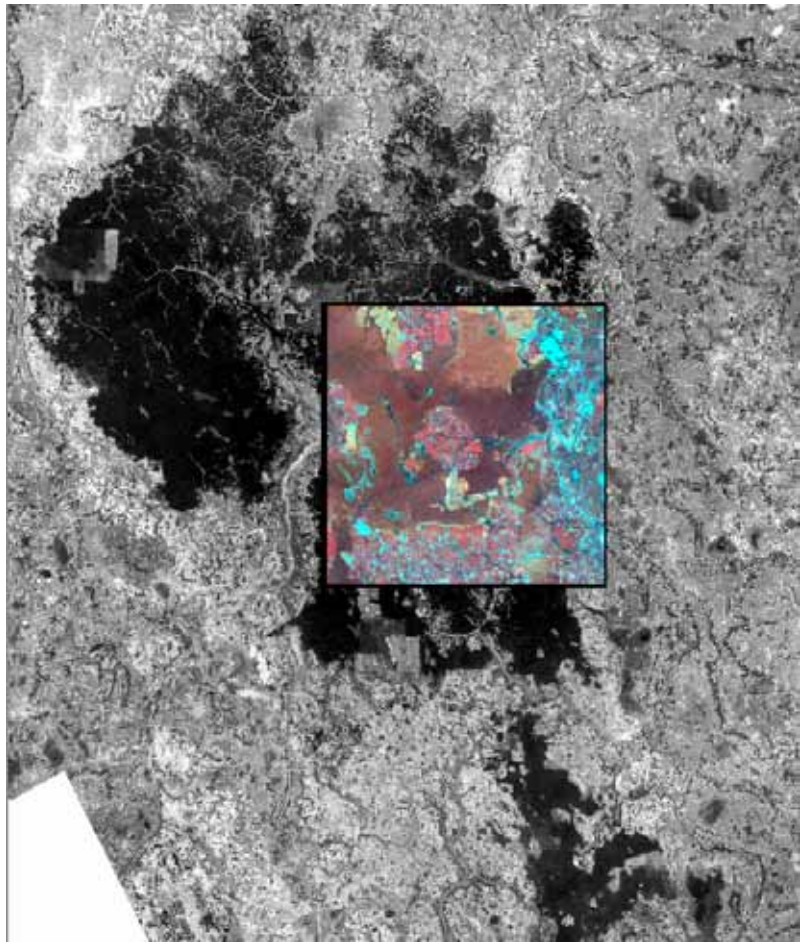
	Forest Cover Change 1990-2000 (%/year)	Distribution of land cover/use % (1996)	
		Forest	Other Wooded Land
Bangladesh	1.33	10.2	.9
Asia	-.05	17.8	4.6
World	-.24	29.4	11.2

Variation in Forest Estimates (by agencies and year)	Area in million hectares
USAID, 1990	1
FAO/UNDP, 1992	1.5
Bangladesh Country Report to UNCED in 1992	2.33



DECLASSIFIED CORONA SATELLITE IMAGERY (1962),

2-3m SPATIAL RESOLUTION.



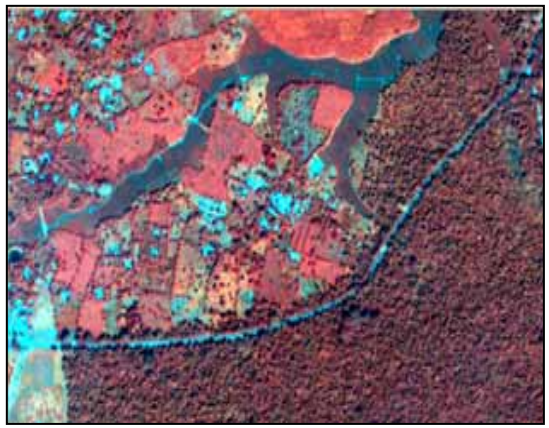
IMAGES SHOW FOREST CHANGE

BACKGROUND: DECLASSIFIED CORONA SATELLITE IMAGERY (1962), 2-3m SPATIAL RESOLUTION.

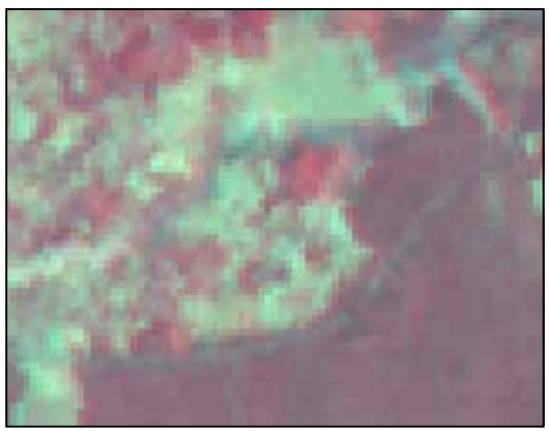
OVERLAID BY: QUICKBIRD IMAGERY (November 2003), 2.4m SPATIAL RESOLUTION.

VISUALIZATION OF SATELLITE DATA AT DIFFERENT SPATIAL RESOLUTION WITH SAME SPATIAL EXTENT.

QUICKBIRD PANCROMATIC IMAGERY (NOVEMBER 2003), 60cm SPATIAL RESOLUTION.



QUICKBIRD MULTISPECTRAL IMAGERY (NOVEMBER 2003), 2.4m SPATIAL RESOLUTION.



ASTER IMAGERY (FEBRUARY 2002), 15m SPATIAL RESOLUTION.

Landsat ETM Imagery (MARCH 2003), 30m SPATIAL RESOLUTION.

QUICKBIRD PANCROMATIC IMAGERY (November 2003),
60cm SPATIAL RESOLUTION.

QUICKBIRD MULTISPECTRAL IMAGERY (November 2003),
2.4m SPATIAL RESOLUTION.

Major aim

- **Producing up-to-date, accurate and cost effective quantitative information on deciduous sal forests of Bangladesh.**

Objectives:

- **To identify the most important information gaps for sal woodland resource management in Bangladesh.**
- **To establish the most appropriate remote sensing and survey methods to acquire quantitative information about sal forest resources.**
- **To evaluate the quality of forest parameter predictions based on satellite observations.**

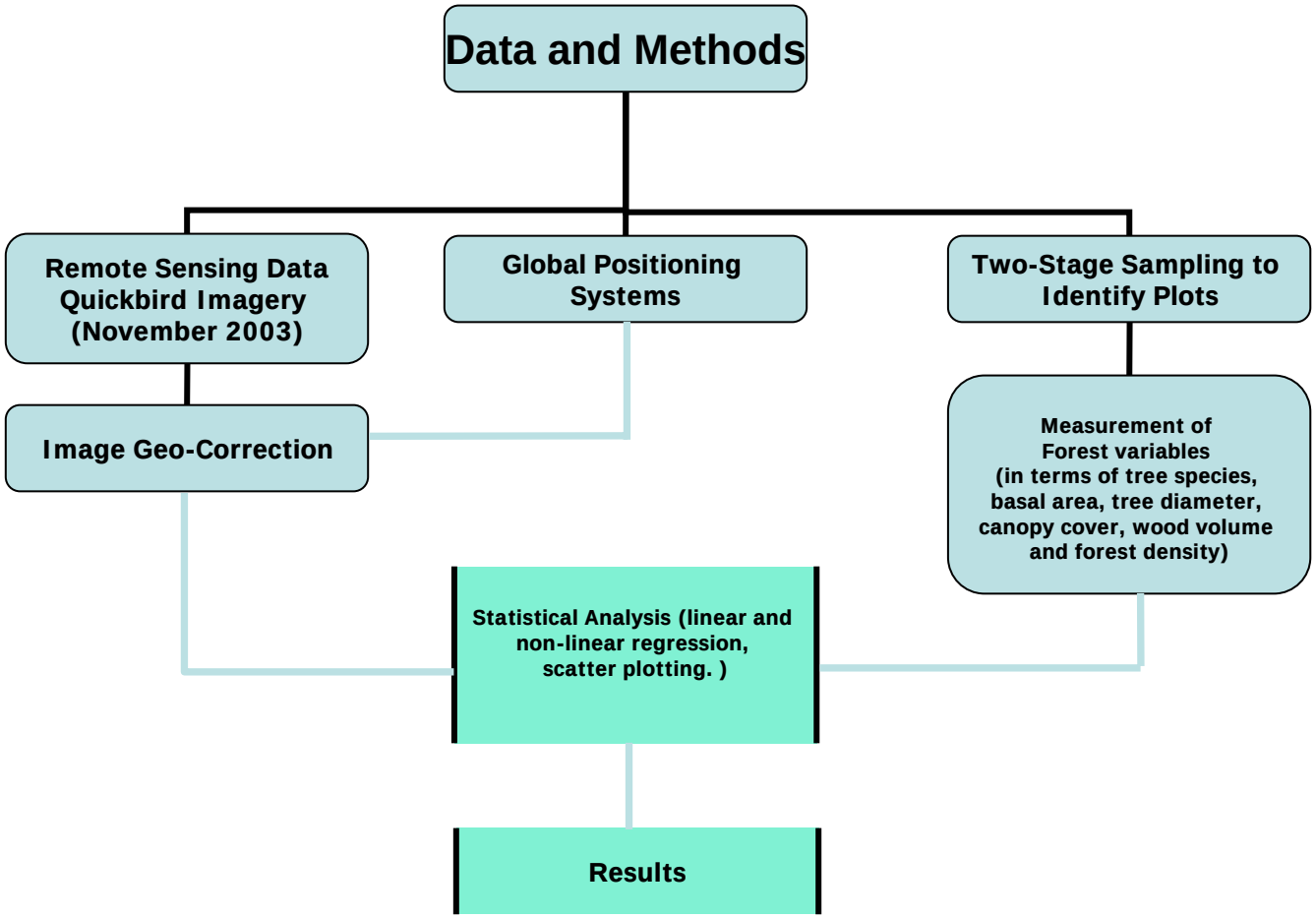
Satellite Data Used

Sensor	Bands	Spectral Characteristics (nm)	Scene Dimensions	Pixel Resolution
Quickbird (November 2003)	Blue	450-520	6,888 X 6,856 pixels	2.44 to 2.88 m
	Green	520-600		
	Red	630-690		
	Near IR	760-900		

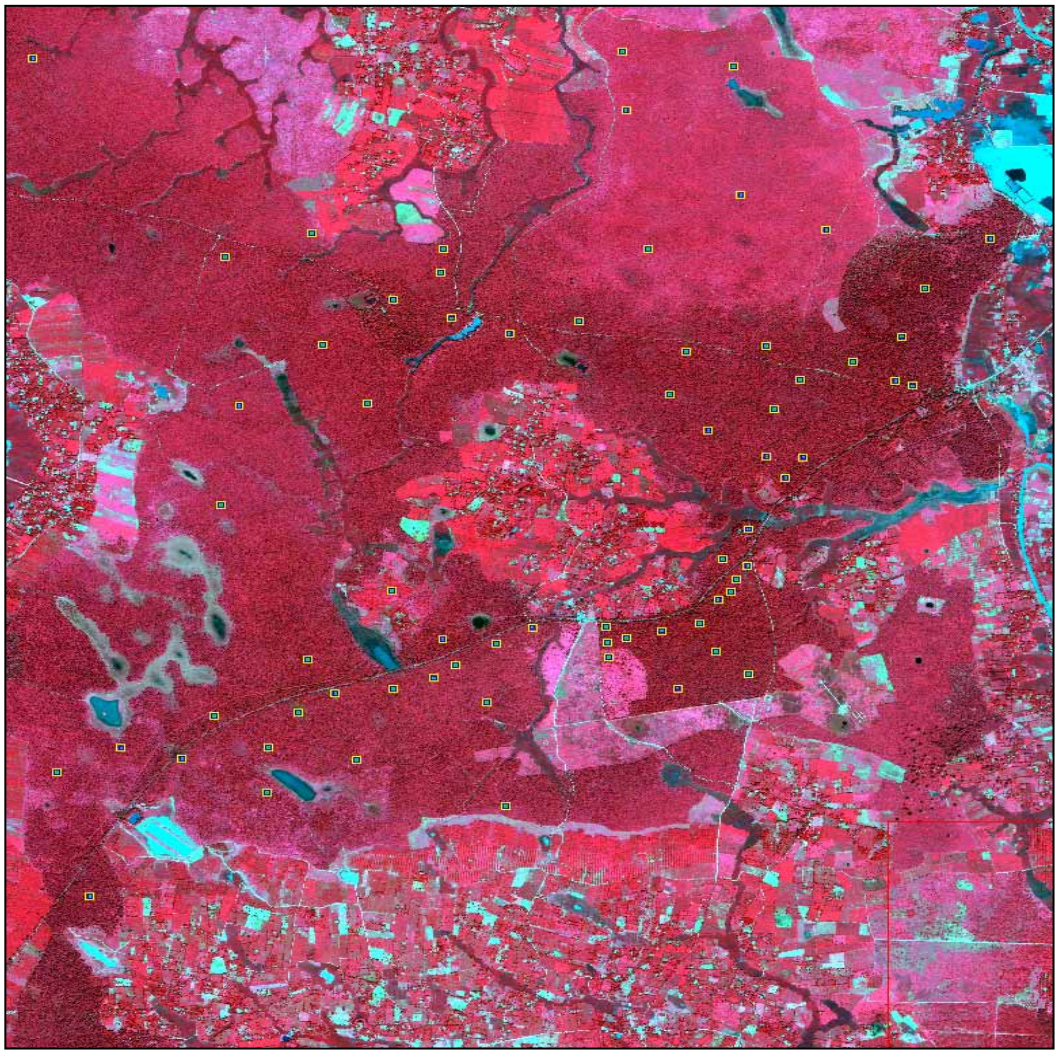
Field Data Collection

- Two Stage Sampling
    - unsupervised classification for detecting major forest classes.
    - Second sets of plots (71) at 5mX5m are picked up from major classes.

- Stand Variables are taken using
    - relascope
    - clinometer
    - ovservation


Data and Methods
Remote Sensing Data Quickbird Imagery (November 2003)
Global Positioning Systems
Two-Stage Sampling to Identify Plots
Image Geo-Correction
Measurement of Forest variables (in terms of tree species, basal area, tree diameter, canopy cover, wood volume and forest density)
Statistical Analysis (linear and non-linear regression, scatter plotting.)
Results

Sample Plots

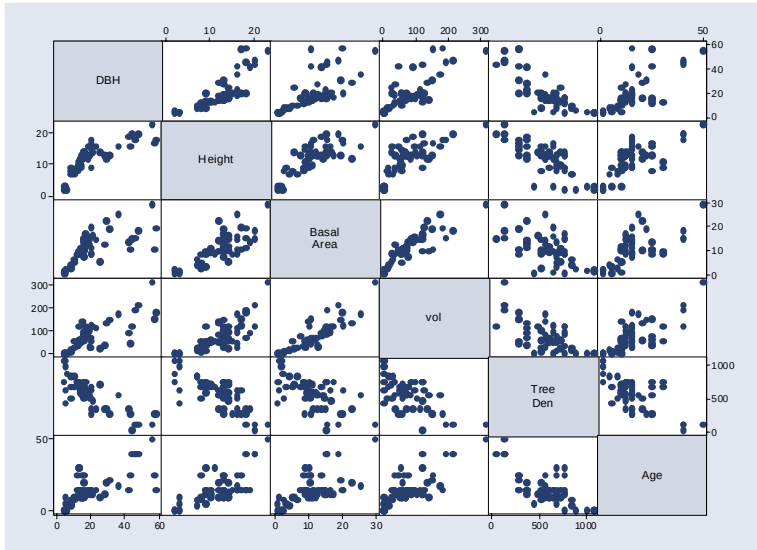


Summary of measured forest parameters.

Forest variables	Mean	SD	Min.	Max.
Dbh (cm)	17.30	10.64	4	56
Height (m)	11.47	4.79	2	23
Basal area (m^2ha^{-1})	10.31	6.05	0.34	29.54
Volume (m^3ha^{-1})	68.09	58.71	1	314.28
Tree Density (trees ha^{-1})	569	231.36	40	1160
Age (years)	14.7	9.8	1	50

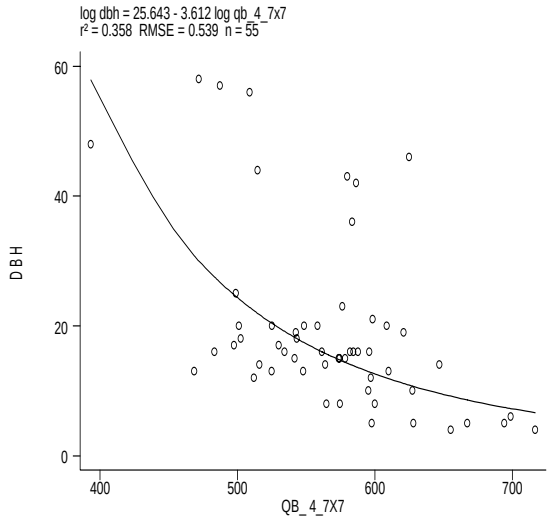
Correlation between various forest biophysical parameters.

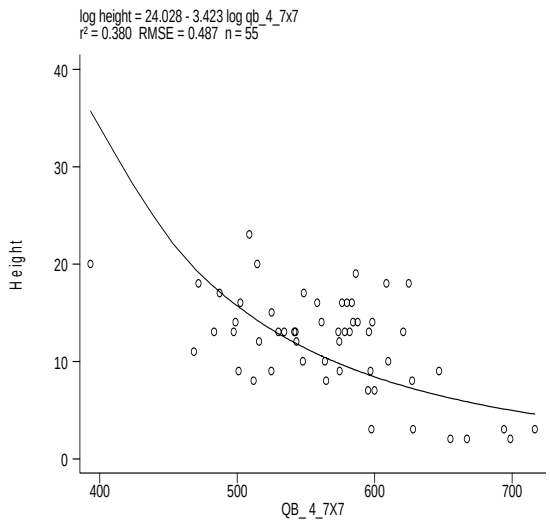
	Dbh	Height	Basal area	Volume	Tree density	Age
Dbh	1.00					
Height	0.80	1.00				
Basal area	0.69	0.82	1.00			
Volume	0.78	0.76	0.87	1.00		
Tree density	-0.78	-0.77	-0.54	-0.64	1.00	
Age	0.69	0.68	0.62	0.72	-0.69	1.00

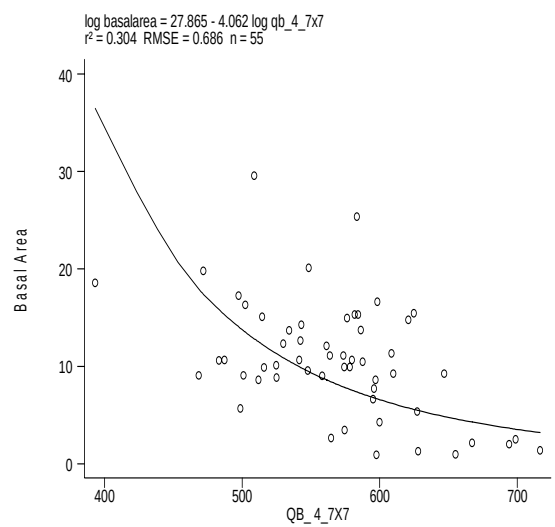


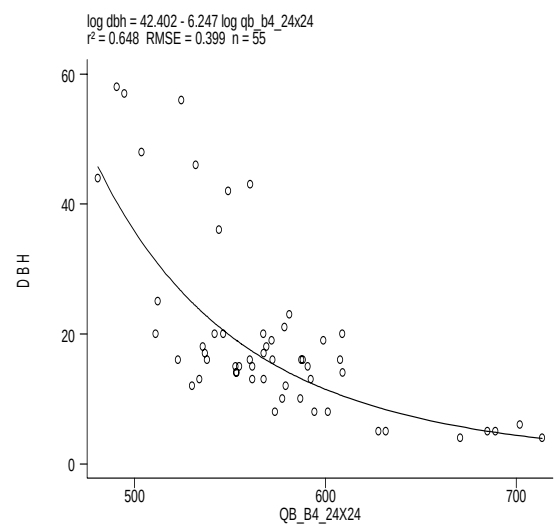
Regression equations and correlation coefficient values.

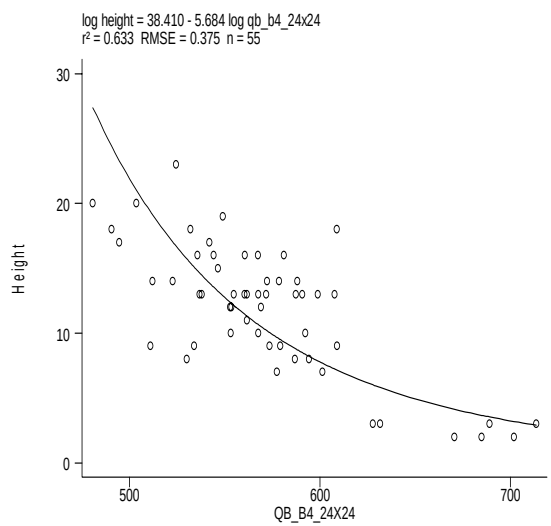
Forest Structure Variables (X)	Equations of Quickbird Bands Reflectance to X	Correlation coefficient (r) values
DBH	Band 1 = $-216.04x^{-0.0111}$	-0.52
DBH	Band 2 = $-295.58x^{-0.0362}$	-0.65
DBH	Band 3 = $136.17x^{-0.03}$	-0.63
DBH	Band 4 = $754.57x^{-0.1008}$	-0.65
Height	Band 1 = $215.5x^{-0.0121}$	-0.52
Height	Band 2 = $294.22x^{-0.0407}$	-0.75
Height	Band 3 = $134.57x^{-0.038}$	-0.65
Height	Band 4 = $739.65x^{-0.1104}$	-0.73
Basal Area	Band 1 = $213.62x^{-0.0091}$	-0.52
Basal Area	Band 2 = $285.41x^{-0.035}$	-0.71
Basal Area	Band 3 = $131.31x^{-0.0303}$	-0.68
Basal Area	Band 4 = $671.47x^{-0.0759}$	-0.61

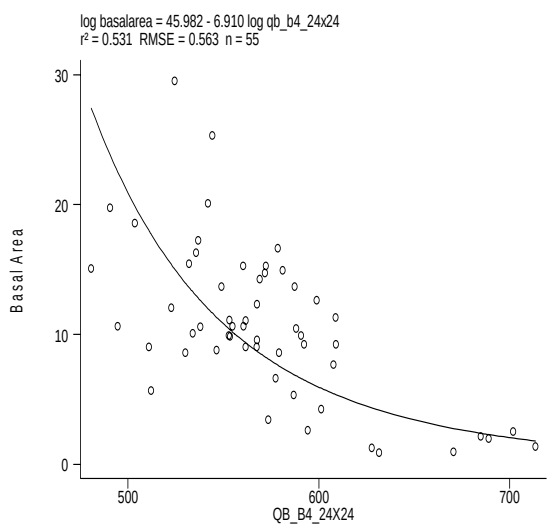

log dbh = 25.643 - 3.612 log qb_4_7x7
r² = 0.358 RMSE = 0.539 n = 55
DBH
QB_4_7X7


log height = 24.028 - 3.423 log qb_4_7x7
r² = 0.380 RMSE = 0.487 n = 55
Height
QB_4_7X7


log basalarea = 27.865 - 4.062 log qb_4_7x7
r² = 0.304 RMSE = 0.686 n = 55
Basal Area
QB_4_7X7


log dbh = 42.402 - 6.247 log qb_b4_24x24
r² = 0.648 RMSE = 0.399 n = 55
DBH
QB_B4_24X24


log height = 38.410 - 5.684 log qb_b4_24x24
r² = 0.633 RMSE = 0.375 n = 55
Height
QB_B4_24X24


log basalarea = 45.982 - 6.910 log qb_b4_24x24
r² = 0.531 RMSE = 0.563 n = 55
Basal Area
QB_B4_24X24

Conclusion

- **Most of the bands of Quickbird imagery show strong correlation with forest parameters, specially with dbh, height and basal area.**

- **Comparatively low-cost, easily available satellite data like Landsat TM, ASTER may not give good estimates on forest structure due to its coarse resolution.**


Thank you

The moist deciduous sal forests

- Central region- 104,616 hectares (87%)
- Northern region- 15,639 hectares (13%)

The tropical moist deciduous sal forests are classified as:

Moist sal forests	Sal (*Shorea robusta*).
Sal scrub forests	Sal (*Shorea robusta*), bahera(*Terminalia belerica*), sil koroi (*Albizia procera*), ajuli (*Dillenia pentagyana*), haldu (*Adina cordifolia*), kumbhi (*Careya arborea*), jam (*Syzugium cumini*), haritaki (*Terminalia chebula*) and arjun (*T. arjuna*).

Projects implemented in sal forest areas by government agencies

No.	Project name	Cost involved (in taka)	Cost in Pound Starling at current rate (£1=90 taka)	Period of execution
1.	Softwood Plantation	1492000	16577	Planned to execute in 20 years from 1960-61
2.	Plantation of Rauwalfia Serpentina	125000	1388	1960-61 to 62-63
3.	Afforestation of Uncultivable Government Waste Land in Mymensingh	2649200	29435	1961-62 to 1969-70
4.	Establishment of Madhupur National Park	-	-	1961-62 to 1964-65
5.	Establishment of Bhawal National Park	-	-	1974-75 to 1979-80
6.	Afforestation of Recovered and Encroached Forest Land	-	-	1973-74 to 1977-78 1980-81 to 1984-85
7.	Development of Mulberry Plantation in Bangladesh	25000000	277777	1980-81 to 1984-85
8.	Community Forestry Project	-	-	1980-81 to 1986-87
9.	Thana Afforestation and Nursery Development Project	1597000000	17744444	1987 to 1999