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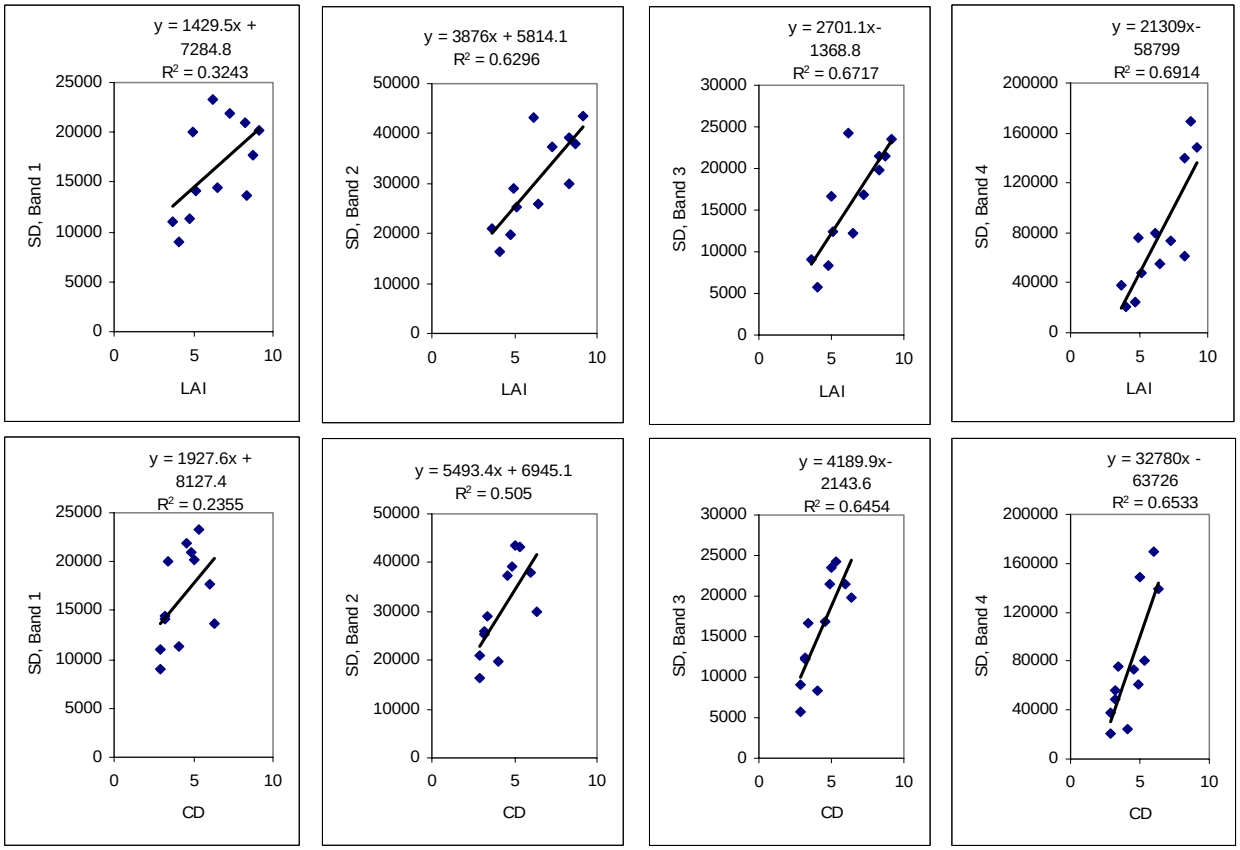
Geog 577 Advanced Remote Sensing, Spring 2007
Due: 5pm Friday, April 27, 2007

Lab 6 Use of Image Spatial Information to Extract Canopy Structure

1) *Include the StandStructure.xls as a table with PID, LAI, CD, Var(bands 1-4). Report the eight scatter plots with regression equation, trend line and R^2 shown in the graph in two groups, one for LAI and the other for CD. Discuss how well the relationships are.*

PID	LAI	CD (m)	Var Band 1	Var Band 2	Var Band 3	Var Band 4
1	5.115992	3.21	14125.12	25288.74	12463.19	48362.97
2	8.284911	4.86	20898.34	39127.55	21422.44	61356.17
3	4.088829	2.92	9007.766	16413.22	5680.241	20814.35
4	6.478986	3.22	14459.4	25889.57	12229.54	55714.39
5	3.658306	2.88	10968.37	20921.07	9051.614	37772.89
6	7.249602	4.61	21935.75	37228.7	16782	73776.03
7	6.203952	5.35	23275.58	43319.22	24171.85	80278.35
8	4.741687	4.06	11283.61	19633.21	8311.882	24303.14
9	4.961208	3.41	20087.53	29084.46	16631.6	75509.06
10	8.70996	5.99	17703.59	37856.54	21455.79	169194.8
11	8.324386	6.33	13612.87	30022.3	19837.38	139478.9
12	9.168936	5.01	20115.02	43388.81	23485.06	148377.3

Top: Image variance vs. LAI for Ikonos bands 1-4. **Bottom:** Image variance vs. CD (m).



The R^2 values for the image variance-LAI relationship increase with higher band numbers (shorter wavelengths), with band 4 having the highest R^2 (0.6914) and band 1 having the lowest (0.3243). The R^2 values for the image variance-crown diameter relationship also increase as the band number of the Ikonos image increases, with Band 4 again having the highest R^2 (0.6533) and Band 1 the lowest (0.2365).

Band 3 has similar but slightly lower R^2 values than Band 4 for both relationships. However, Band 4 consistently has much higher variances for each PID than the other bands, indicating that Band 4 carries a lot more spatial information than the other 3 bands.

These results show that spatial information can be reasonably well-related to both LAI and tree crown diameter, but only for Bands 3 and 4. It would have been better to see higher R^2 values (0.8 or higher), but values around 0.65-0.7 are probably good enough for these relationships to be used to extract LAI or tree crown diameter from an image.

2) *Compare the R^2 value of LAI in this lab with those in Lab 5, and discuss the potential of spatial information in extracting LAI compared to spectral information.*

In Lab 5, we used 3 spectral vegetation indices (NDVI, SR, TC Greenness) and field measurements of LAI to find how variable the LAI/SVI relationship was for the same 12 stands used in this lab. All three spectral vegetation indices gave gave roughly equal R^2 values, from 0.4795-0.496. These values are much lower than the R^2 values obtained in this lab for the LAI/image variance relationship using bands 2 (R^2 = 0.6296), 3 (R^2 = 0.6717) and 4 (R^2 =0.6914), indicating that LAI can be extracted more accurately using the spatial information in these bands. However, the spatial information in band 1 does not provide an improvement over the spectral vegetation indices for extracting LAI, considering the low R^2 of 0.3243 for band 1 compared to the 0.4795-0.496 R^2 values for the three vegetation indices.

For the most accurate determination of LAI, band 4's spatial information should be used, followed by that of band 3 and then band 2. All three spectral vegetation indices require using two or more bands but have lower R2 values, so I think using spatial information is an easier and more accurate method of extracting LAI (at least for this study area). It may be that in other study areas, such as those with low spatial variability, spectral information might outperform spatial information in extracting LAI.

In Lab 5 we didn't look at how the 3 spectral vegetation indices were related to crown diameter, so we couldn't compare how well spatial and spectral information performs when extracting crown diameter from an image. However, given the performance of the spatial information in extracting LAI, spatial information might also outperform spectral information at extracting crown diameter. When using spatial information, the clumpiness of various reflectances is probably strongly linked to LAI, but I imagine the same clumpiness might also be an indicator of tree crown size.