ALGORITHM DEVELOPMENT FOR AUTOMATED CLASSIFIFCATION OF LAND COVER USING MULTITEMPORAL GLI DATA

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GASC Algorithm Version 8.4 (1)

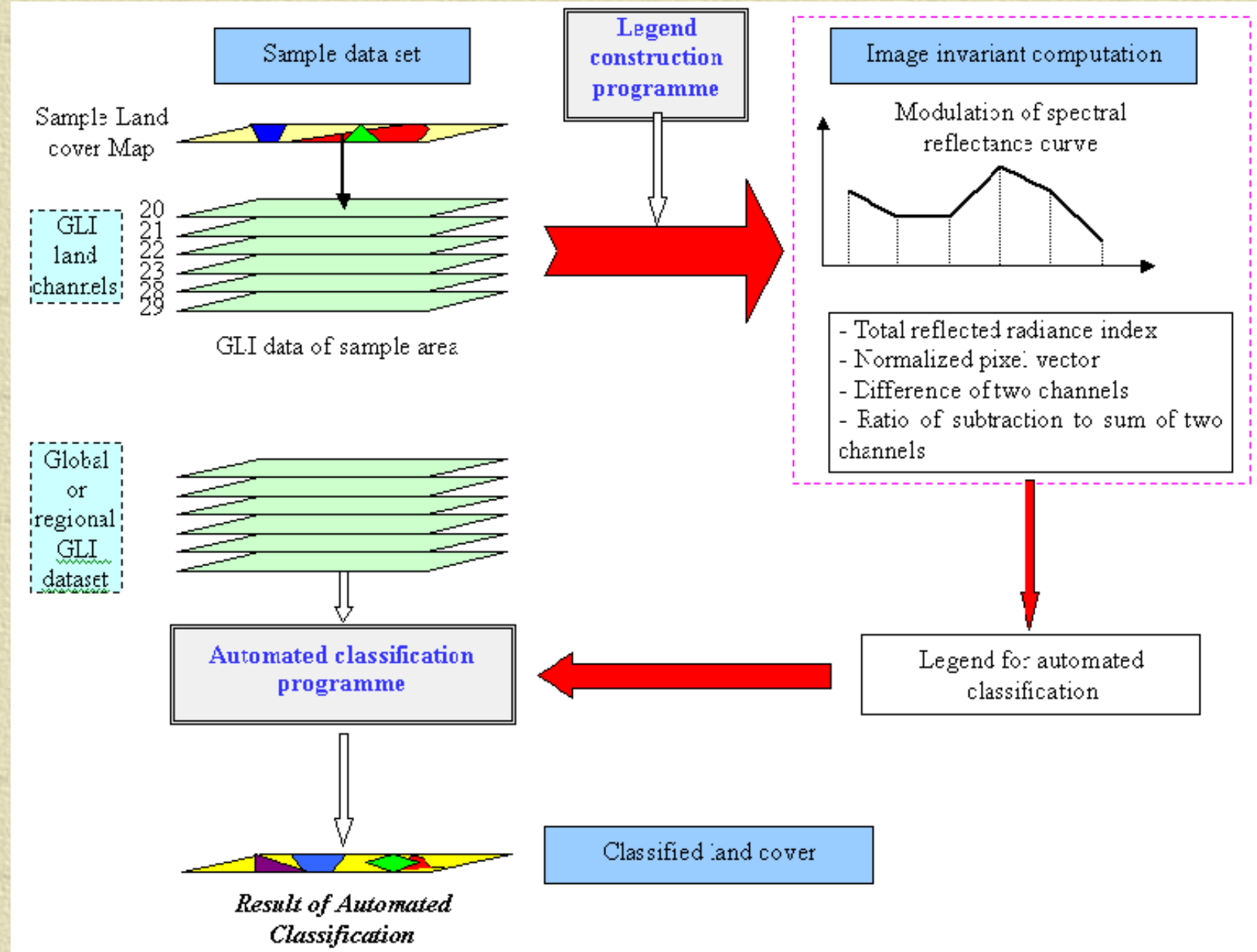
- Improvement of computation efficiency
  - Look up table and integer computing is used whenever possible
- Increase of number of sub-classes of a land cover category
  - One conventional land cover category is further divided into sub-classes according to different modulation of spectral reflectance curve. These sub-classes will be grouped back after classification to create one byte classified image data

GASC Algorithm Version 8.4 (2)

- Resolving overlap problem among neighboring classes
  - A pixel which is classified into more than one class is reclassified to the class that has the same modulation of spectral reflectance curve and smallest Euclidian distance
- Filling unknown pixels
  - A pixel that remains unknown after the above classification is classified by nearest distance with priority given to modulation of spectral reflectance curve

Automated Construction of Legend

- Manual construction of legend requires deep knowledge of spectral reflectance characteristics of a land cover category, and time consuming
- Automated construction of legend based on existing and accepted land cover dataset is fast and applicable for any dataset including one generated by new sensor



Flowchart of automated legend construction

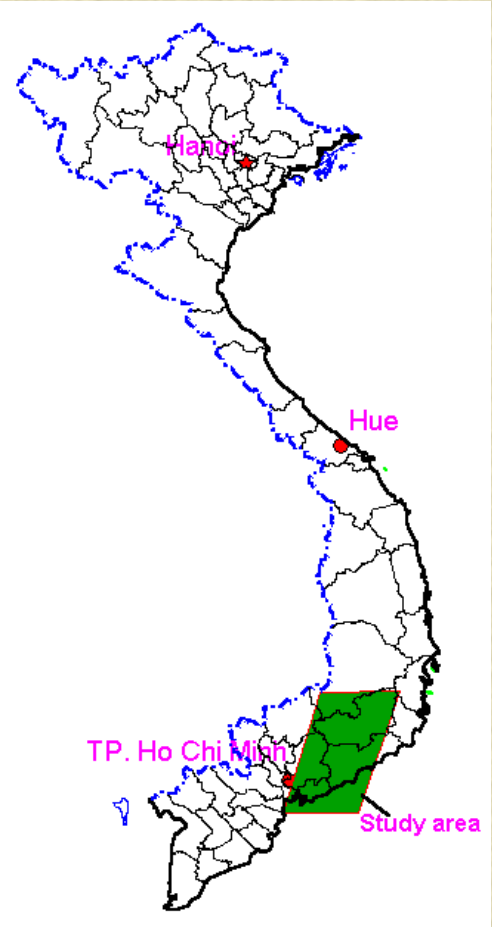
Legend for automated classification of land cover	Explanation
1	Land cover class code
102-1	Short name of the class
102-1	Full name of the class
128 128 128	Color for visualization
M 011100	Modulation computation instruction
63.21 28.32 34.93 46.08 84.53 44.88	Characteristic vector of the class
T 38.07800 61.43700	Range of total reflected radiance index
P1 53.68000 69.91600	Range of normalized value of channel 20
P2 23.05500 33.14700	Range of normalized value of channel 21
P3 25.49300 43.15900	.
P4 34.24600 61.48600	.
P5 59.38200 112.1910	.
P6 30.96500 59.92500	Range of normalized value of channel 29
D12 29.66100 38.60300	Range of difference of channels 20 and 21
D13 22.04900 32.19100	Range of difference of channels 20 and 22
.	.
.	.
D56 25.68000 55.85900	Range of difference of channels 28 and 29
C1212 -+ 0.3420000 0.4197000	Range of subtraction and sum of channels 20 and 21
.	.
.	.
C5656 -+ 0.2382000 0.4060000	Range of subtraction and sum of channels 28 and 29
END	End of legend for class 1

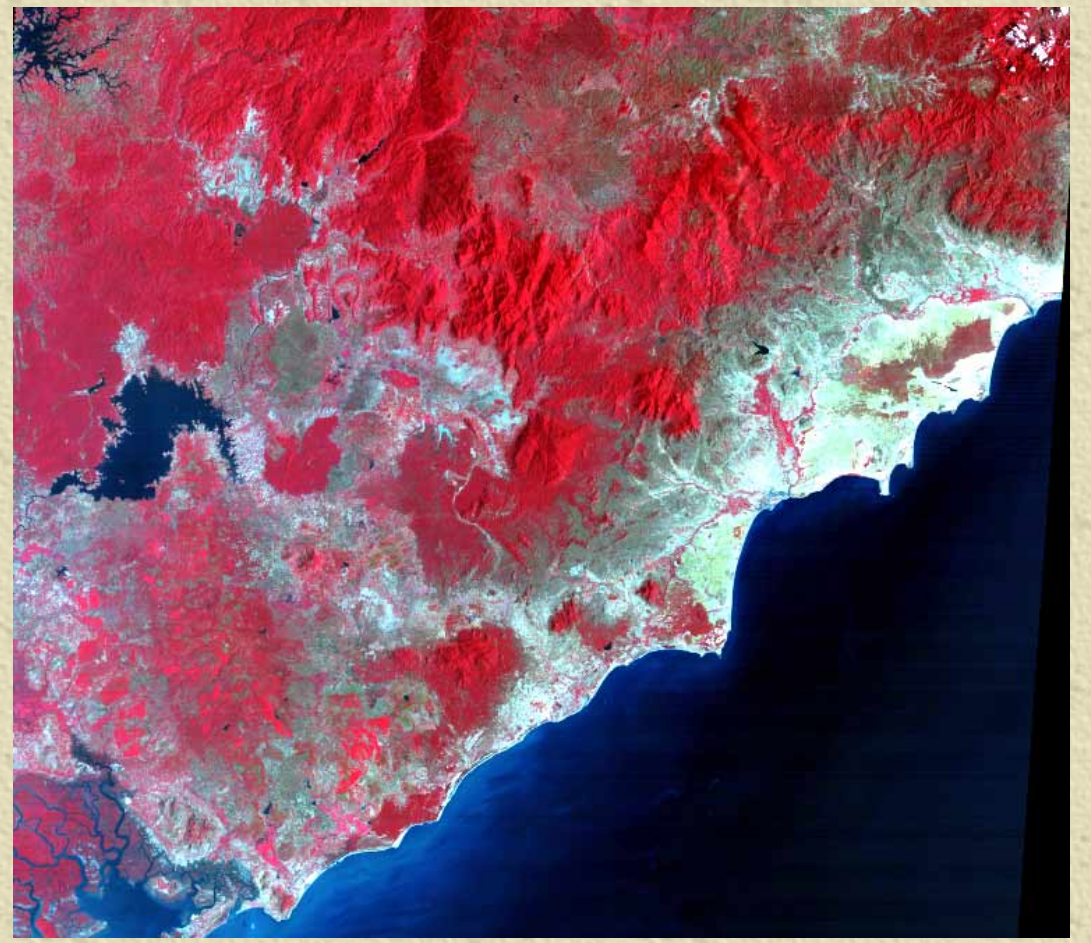
Example of legend constructed automatically

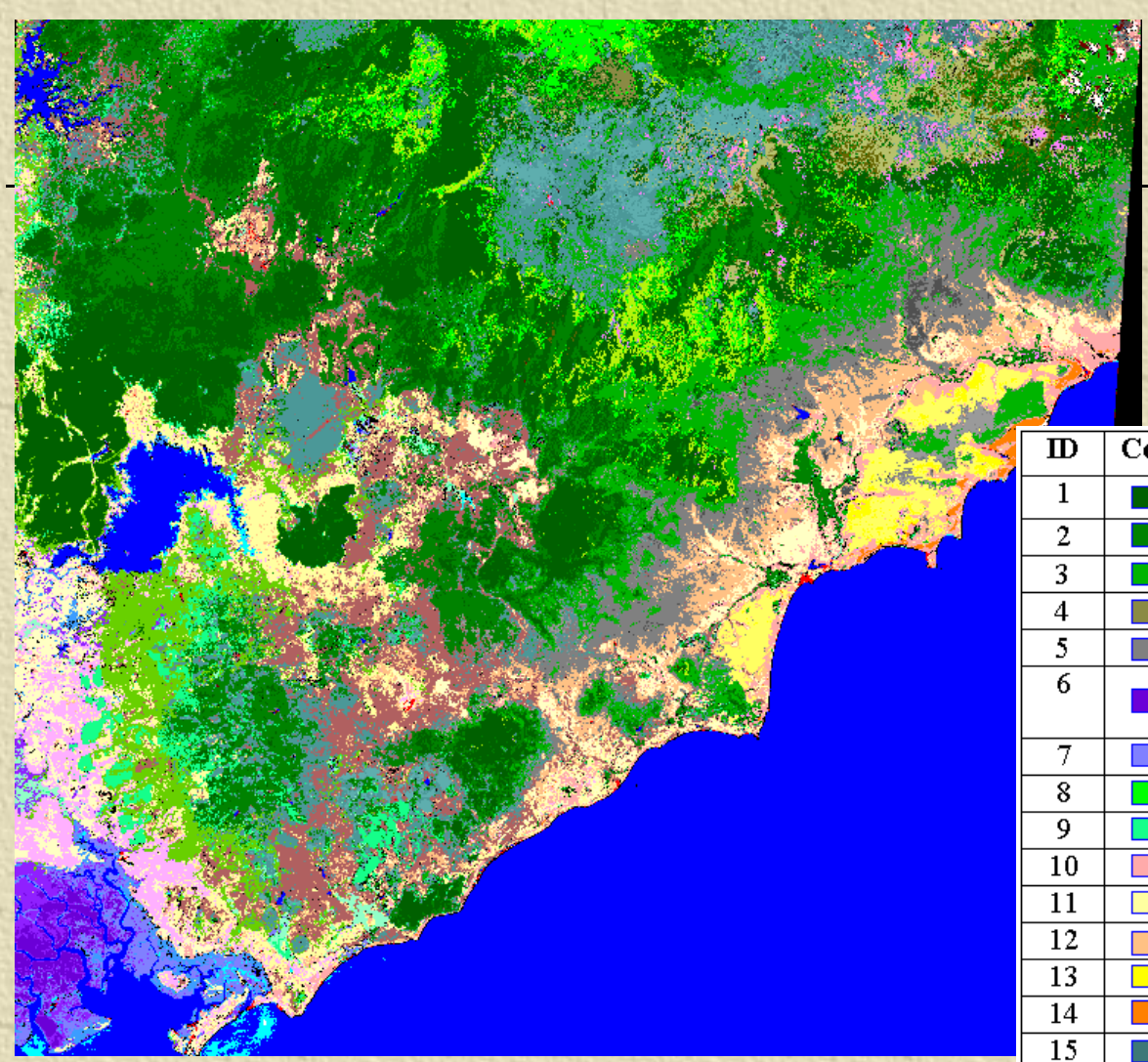
Algorithm Tuning

- The GASC algorithm is tuned using simulated GLI dataset and MODIS data
- Validation has been carried out using field work and Ground photo database
- Comparison study among ML and automated classification

Tuning by Simulated GLI Data

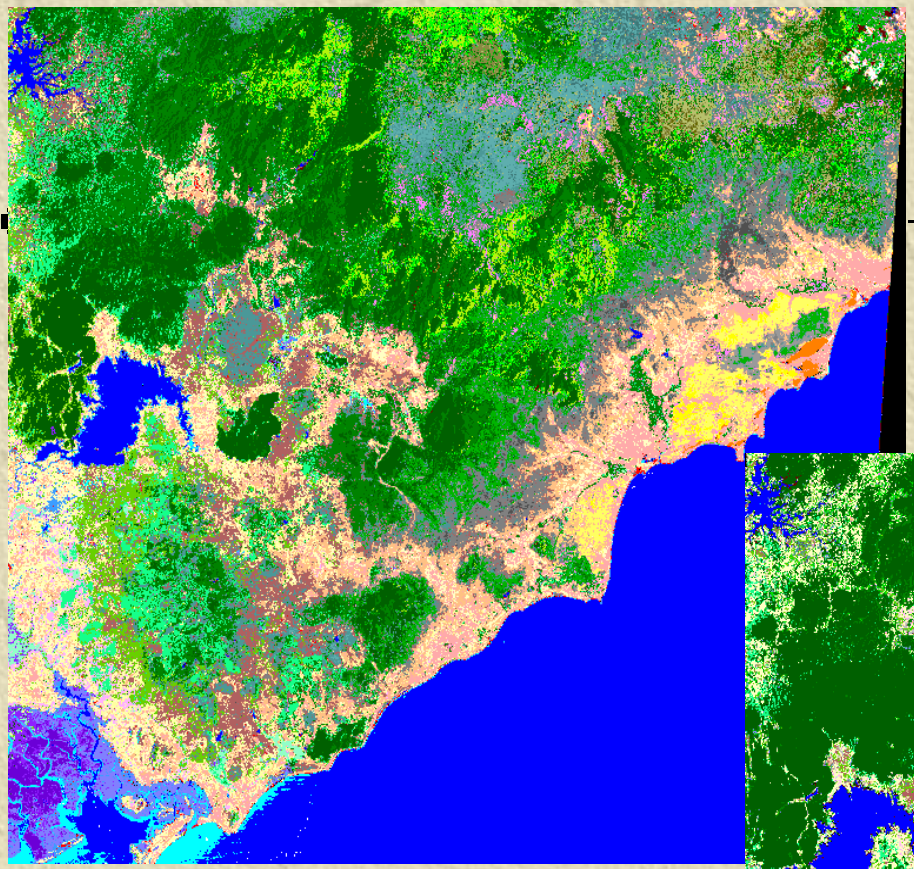




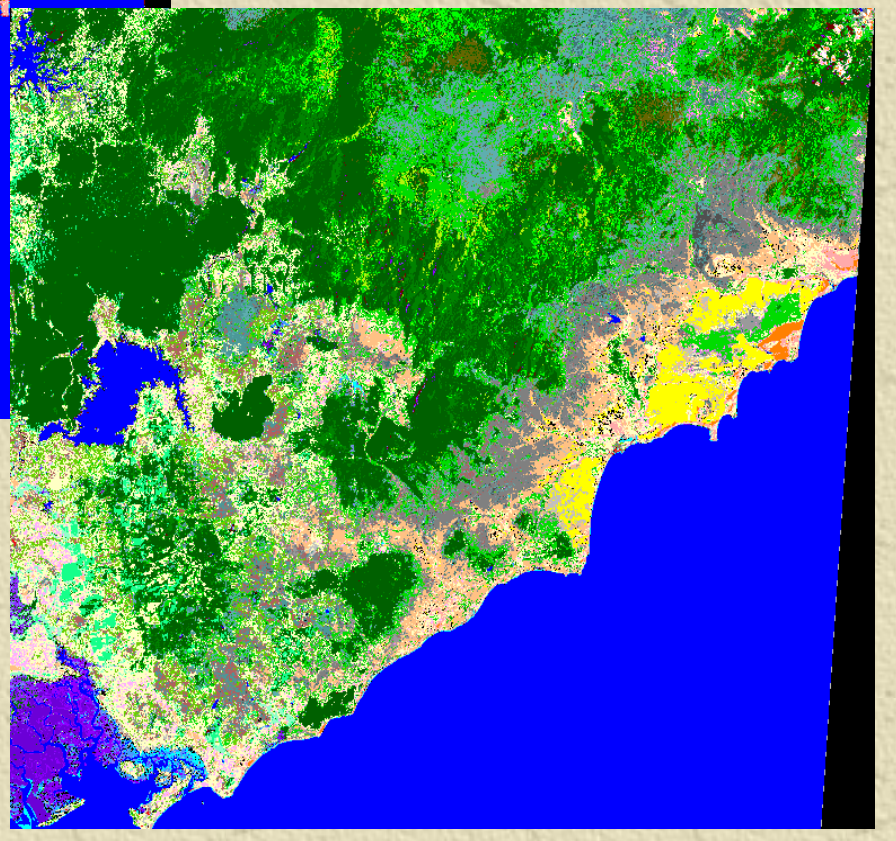


ID	Color	Description
1		Closed evergreen forest
2		Medium evergreen forest
3		Opened evergreen forest
4		Conifer forest
5		Deciduous forest
6		Closed and medium mangrove forest
7		Opened mangrove forest
8		Shrub land
9		Grassland
10		Dry cropland
11		Wet cropland
12		Bare ground
13		Red sand
14		White sand
15		Basalt ground
16		Urban
17		Clear water
18		Turbid water
19		Cloud

Maximum likelihood classification

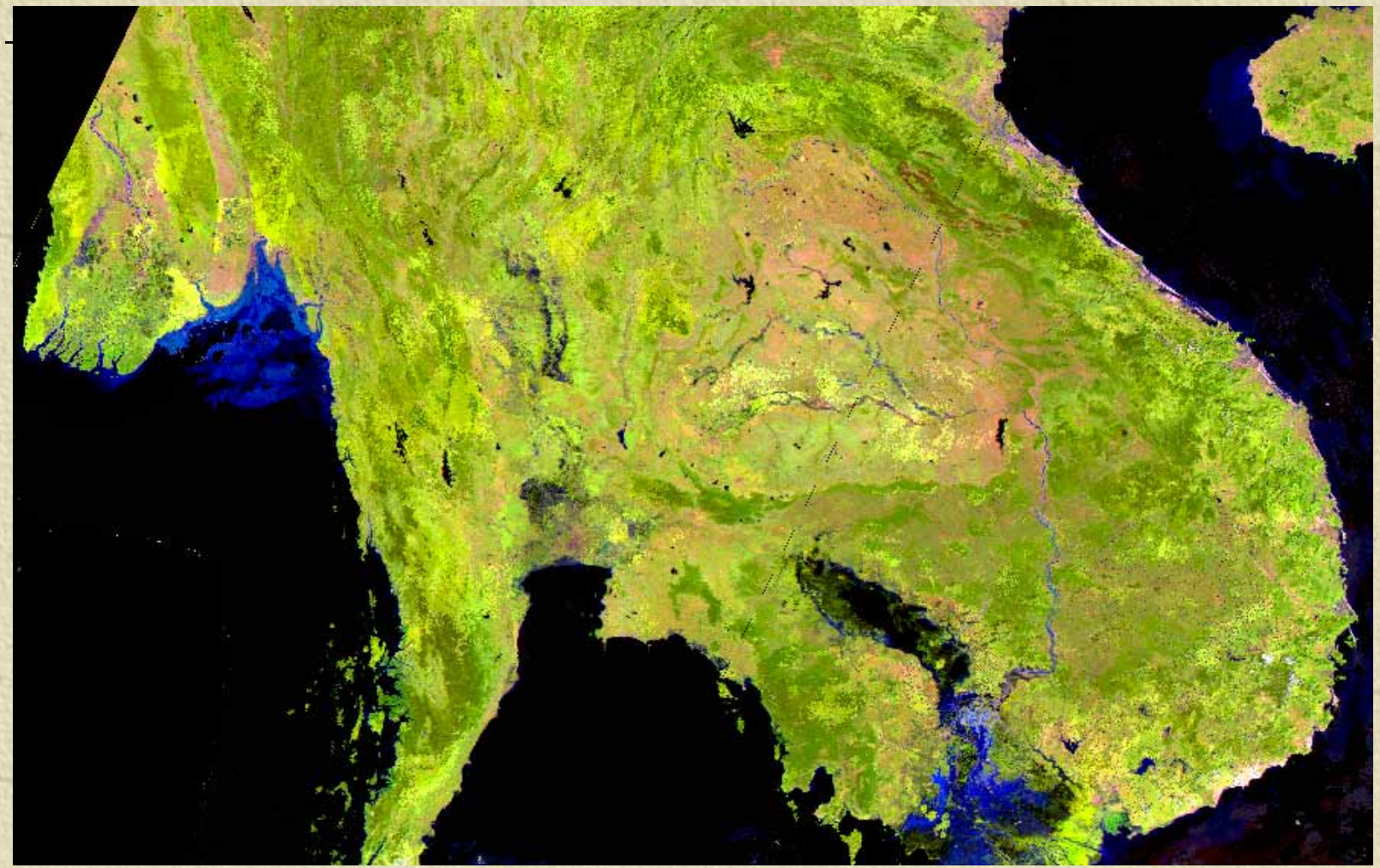


Classification by automatically constructed legend



Classification by manually constructed legend

Automated Classification of MODIS Data



Color composite of MODIS data on November 2000

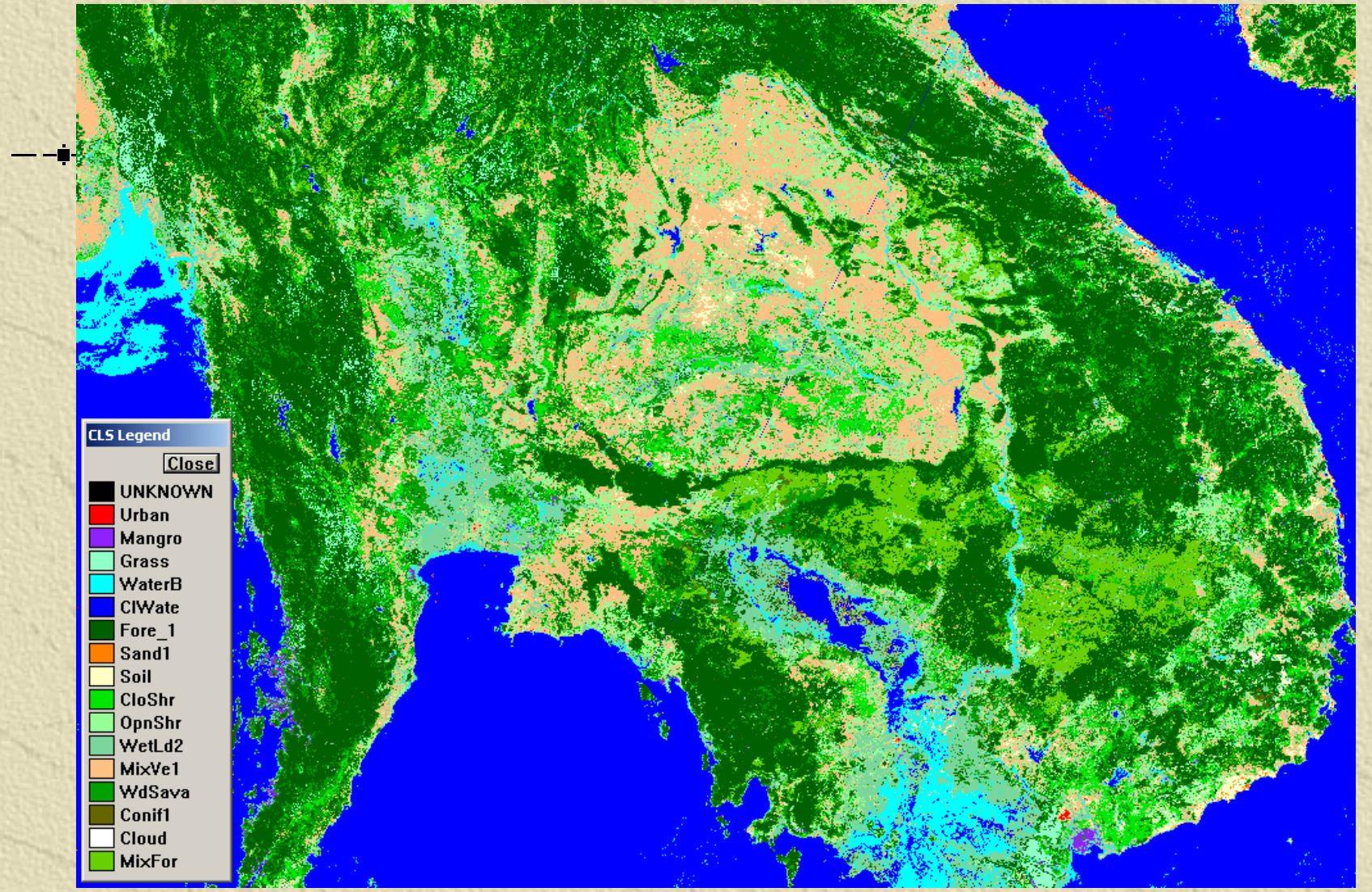
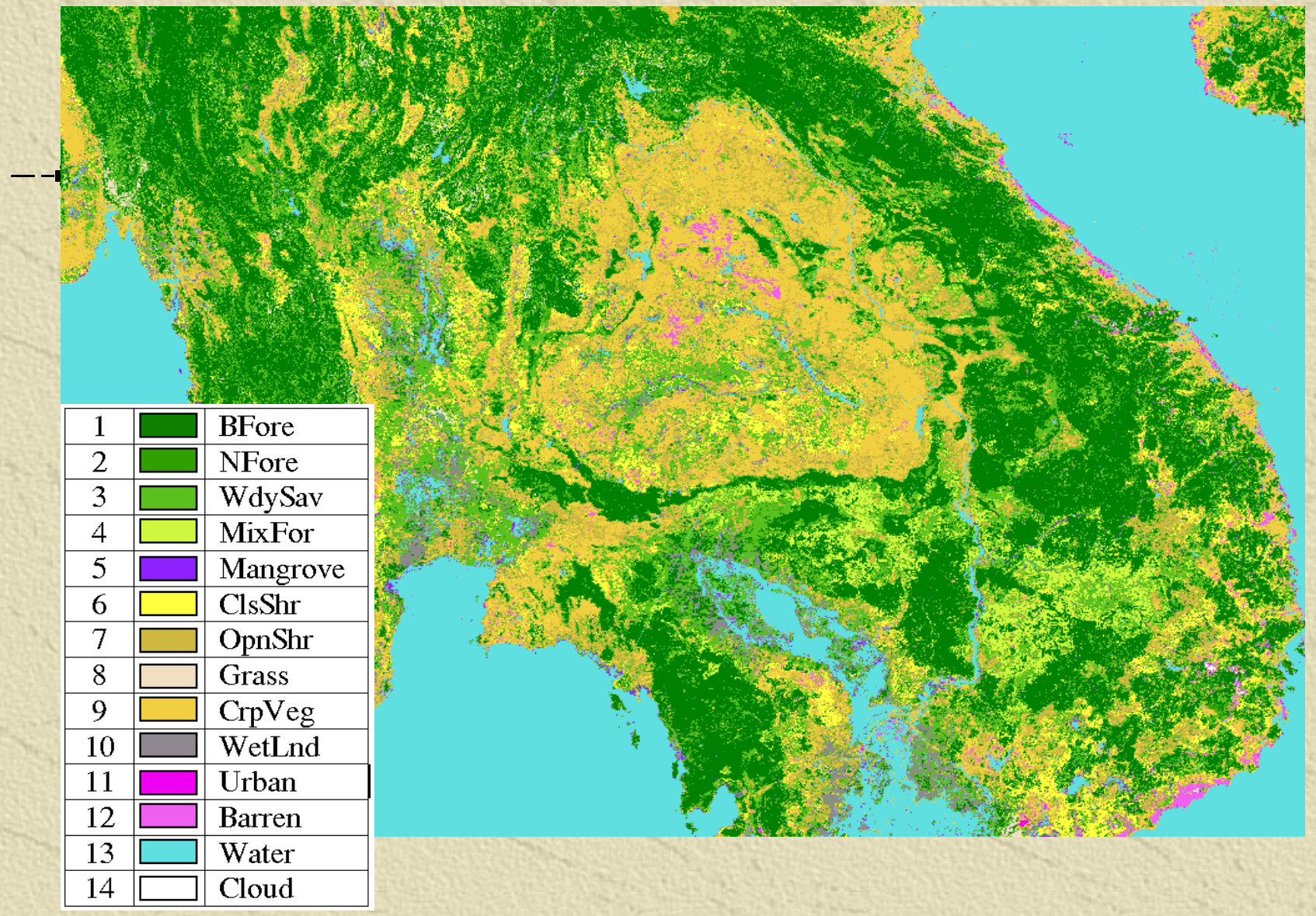


Image classified using automatically constructed legend



IGBP Land cover map by automated classification

Future Direction

- Research will be focused on analysis of temporal dataset
- Problem of Sun-Satellite geometry normalization
- Cloud coverage removal
- Optimal temporal resolution for land cover mapping