APPENDIX 3:

SATELLITE IMAGE ANALYSIS GUIDANCE

This appendix shows the procedure for analyzing satellite images on GIS. ArcView 8.2 is used, and following process is explained:

1. Preparation
2. Identification of land use zone, and polygon data entry
3. Altitude zone data entry, and overlay with land use zone
4. Measurement of area
5. Cross tabulation between altitude zone and land use zone

Annex

1. Preparation

(1) Data import from ArcView3.x projects

a. Start Arcmap ([Start][Programs][ArcGIS][ArcMap])

b. From pull-down menu, select [File][Import from Arcview project....]

c. Select project to be imported, and check the [views] which are listed

d. From pull-down menu, select [File][Save as], and save the current ArcMap documents.

(2) Create a feature class for landuse typology data

a. Start ArcCatalog, by [Start][Programs][ArcGIS][ArcCatalog]

b. Select folders to save the result (in which project files and other shape files are kept), right click and select [New][Personal GeoDatabase]

c. Choose the created Geo Database with right click, and select [New][Feature Dataset]

d. Import project information from IKONOS data.

e. Set the data area as same as IKONOS data

*In order to check the area on ArcMap, select IKONOS data with right click, and select [properties].

f. Select the created Feature Dataset with right click, and select [New][Feature class]

g. Enter name of landuse typology data, and proceed with witherd.

h. Select [File][End]

i. On ArcMap menu, select [File][Data], and append [Personal Database Name]/[Feature dataset name]. Warnings (if any) can be neglected.

2. Identification of land use zone, and polygon data entry

If preparation is successfully completed, start identification from IKONOS satellite image and editing landuse data. At first, prepare attribute field and start shapes and attributes. These could be processed in pararrel.

(1) Preparation of attribute field

a. Select urban typology data (City) with right click, and select [open attribute table].

b. In the attribute dialog, select [option][field].

c. Enter the field *Name*, and change the *Type* to text.

(2) Editing shapes

a. To select [Editor][Start editing] from *Editor Toolbar*. In order to show *Editor Toolbar*, pull down menu [View][Toolbars] and check *Editor*.

b. Select Personal Geodatabase as target of editing.

c. Select [Editor][Snapping]

d. On the Snapping Environment Dialog, as for Landuse Data (City), check the vertecis,

line (edge).

e. Select [Editor][Option]

f. On the "Editing Option", [General] tab, set the snap parameter. This parameter assigns the diameter for searching snapped objects.

g. Click the [Pencil] button to change the mode Add, choose task as Create New Feature (first polygon only*) from *Task* combo-box, and choose Landuse data (city) from *Target* combo-box.

* Second and following polygons will be created by procedure j. However, if the polygon is needed to be created in the area distant from the first polygon, select Create new feature, as same as this.

h. Using IKONOS satellite image as background, create polygons. Insert vertex by left click, and close the polygon by left double click.

i. Change *Task* to Automatic creation of polygons.

* This is needed for filling the urban area with polygons without gaps.

j. Enter the second polygon. In order to snap to the first polygon, start the first point with left click and click the intermediate points, and come back to the first point, and right click to show the menu, and terminate, by [End Sketch].

k. Repeat j and create the continuous polygon data, without gaps.

l. Select [Editor][Edit][Save]

(3) Editing attributes

a. Set the editor to editing mode, and select a feature by left click and show the attributes by clicking a square shape icon, infilled with short horizontal lines which look like a list, for triggrering it, which is located in the most right position of the editor toolbar. Then a dialog with tree view of data structure in the left plane, and pairs of Property and Value in the right plane. Enter the values to Typology field, which is provided for save the attribute values of the Landuse types prepared in (1).

b. Repeat a. and enter values to all the features. Be careful to enter the exactly same strings to the features which has the same attribute values.

c. Save the data by [Editor][Edit].

d. Terminate by [Editor][End].

(4) Creating indexes for attributes

Along with (3), creating indexes will help the work.

a. Right click the Landuse/Typology from tree view of the left plane of main window, and choose [Properties] to show the [layer property] dialog box with many tabs.

b. Display the [Symbology] tab of the [layer property], and choose the Typology / Unique values from tree view shown in the left *show:* plane. Then, select Typology

from *Value field* in the right plane. Finally, push the [Add all values] button locatted below.

(5) Combining features with have the same attribute

Sometimes, features containing same attribute will be created separately. They need to be combined after the data entry.

a. Select [Tools][Geoprocessing Wizard] from ArcMap menu.

b. Select [dissolving features by attribute] as method for overlay, and click [Next].

c. Set Landuse data (City) for imput layer, and Landuse attribute (Category) for object of dissolving, assign the name of feature class to be output, and click [Next].

As for the name of feature class to be output, click the button for browsing folders and display the saving data dialog, set the filetype Personal Geodatabase Feature Classes and set the new object name (e.g. Dissolved_typlolgy), by referring existing [Personal Database Name/Feature Dataset Name/].

d. Push [complete] button and add the combined Landuse data (Dissolve_Typology) to ArcMap.

(6) Converting multi-part polygons into single-part polygons

Through combining features (5), features which are not conjunctioned will be collected into a same feature (Multi-part polygon). These should be subdivided into single-part polygons.

a. Select [Tools][Macro][Visual Basic Editor] from ArcMap menu.

b. Right click [ArcMap Objects / ThisDocument] from Microsoft Visual Basic –Project-, and choose [View Code]

c. Copy the source code (annex) to the screen.

* This can be searched by [Start][Program][ArcGIS][ArcObjects Developer Help] and [Explode].

d. Display ArcMap and select the Combined Landuse Data (Dissolved_Typology).

e. Select [Tools]Macro][Macro] from ArcMap menu.

f. Select [Explode] from Macro list, and click [Run].

g. Select shape file to be output(e.g. City_Singular

h. Add subdivided Landuse data (City_Singular) to ArcMap

3. Altitude zone data entry, and overlay with land use zone

In order to measure areas and cross tabulate, altitude zone data (polygon) which is already provided will be overlayed with the created Landuse data (polygon).

(1) Setting projection data to Altitude zone data

a. Start tool box by [Start][programs][ArcGIS][ArcToolbox].

b. Select [Data management tools][projection][projection defining wizard (shape file, geodatabase)].

c. On the intial screen of [Projection definition wizard], click the [folder browsing button] and add the altitude zone data (dem.shp).

d. Click the [Coordinate Selection Button] to display the Property Screen for browsing space, and click [Import] button.

e. On the Dataset Browsing Screen, add the IKONOS data.

(2) Overlay

a. Select [Tool][Geoprocessing Wizard] from ArcMap menu.

b. Select [Dissolve features based on an attribute] as method for overlay, and click [Next].

c. Select (e.g.) [Typology] as 1. *input layer*, select [Landuse data] as 2. *an attribute on whith to dissolbe*, give the name of 3. *feature class* to be output and click the [Complete] button. For giving the name to output feature class, click the folder browsing button and display the filedialog for saving, set the file type to [Personal Geodatabase Feature Classes] and refer the [Personal Database][Feature Dataset Names] and give a new name.

d. Withing the area of Landuse Typology data, overlayed data between clipped altitude zone and full Landuse data will be created and displayed on screen. This overlay data has both attributes of altitude zone and Landuse zone.

4. Measurement of areas

In order to measure the area, use the summary function of attribute table, by using the overlay data of altitude zones and landuse zones. Here we will not use the graph function, but output the result as text file, and process it on Excel to make tables and graphs.

(1) Measurement of areas of landuse zones

a. Open the attribute as shown in 2(1)

b. Right click the Category field and select the summary.

c. Set landuse attribute as the field to be summarized by individual value, and select the [Shape Area] summed value as statistical information to be added to output table. Set the output table as [text format] and click [OK].

(2) Making tables and graphs using Excel

a. Start Excel, and open the output table text file. Choose adequate selections (comma, tab etc.) and [Next]

b. Choose [comma] as separator, and click [Complete].

c. By using the read Category colums and Sum_Area colums, make graphs etc.

5. Cross tabulation between altitude zone and land use zone

Use the overlayed data between altitude zone and landuse zone, cross tabulate the area. As shown in 4, tabulation will be executed on ArcView, and Excel is used for making tables and graphs.

(1) Cross tabulation of areas

a. Prepare the field (Z_Category) for cross tabulation in overlayed data, with the process shown in 2.(1).

b. Right click the field provided through a., select [Field Calculation].

c. As for formula for calculation, enter "[Z]&"_"[Category] etc. to instruct the AND processing between altitude value(Z) and landuse value (Category), and click [OK].

d. Right click the [Z_Category] field and choose [summary].

e. As for the field summarized by individual value, select the result of AND calculation between altitude zones and landuse zones, and select the added value of [Shape_Area] as additional statistical information to output table. Set the format of output table as [text] and click [OK].

(2) Making tables and graphs by using Excel

Input the output table as shown in 4(2), and make graphs. If needed, show the 2 dimentional matrix of altitude zone and landuse zone.

Annex

Explode source code

(to convert from multi-part polygons to single part polygons)

```
Public Sub Explode()
Dim pClone As IClone
Dim pDataset As IDataset
Dim pFeature As IFeature
Dim pFeatureClass As IFeatureClass
Dim pFeatureCursor As IFeatureCursor
Dim pFeatureLayer As IFeatureLayer
Dim pFeatureWorkspace As IFeatureWorkspace
Dim pFields As IFields
Dim pGeometryColl As IGeometryCollection
Dim pInsertFeatureBuffer As IFeatureBuffer
Dim pInsertFeatureCursor As IFeatureCursor
```

```
Dim pMxDoc As IMxDocument
Dim pNewFeatureClass As IFeatureClass
Dim pPolygon As IPolygon2
Dim pPolygonArray() As IPolygon

Dim strNewFeatureClassName As String
Dim GeometryCount As Integer
Dim lShapeFieldIndex As Long

On Error GoTo ErrorHandler

Set pMxDoc = Application.Document

'Make certain the selected item in the toc is a feature layer
If pMxDoc.SelectedItem Is Nothing Then
MsgBox "Select a feature layer in the table of contents as the input
feature class."
Exit Sub
End If

If Not TypeOf pMxDoc.SelectedItem Is IFeatureLayer Then
MsgBox "No feature layer selected."
Exit Sub
End If

Set pFeatureLayer = pMxDoc.SelectedItem
Set pFeatureClass = pFeatureLayer.FeatureClass

'Don't process point layers, they have no multi-part features
If pFeatureClass.ShapeType = esriGeometryPoint Then
MsgBox "Point layers do not have multi-parts. Exiting."
Exit Sub
End If

strNewFeatureClassName = InputBox("Enter New Shapefile name:", "New
Shapefile")
```

```
If strNewFeatureClassName = "" Then Exit Sub

'Create a new feature class to store the new features
'Create the feature class in the same dataset if one exists - shapefiles
don't have one
Set pFields = pFeatureLayer.FeatureClass.Fields
If pFeatureClass.FeatureDataset Is Nothing Then
Set pDataset = pFeatureClass
Set pFeatureWorkspace = pDataset.Workspace
Set pNewFeatureClass =
pFeatureWorkspace.CreateFeatureClass(strNewFeatureClassName, pFields,
Nothing, Nothing, esriFTSimple, pFeatureClass.ShapeFieldName, "")
Else
Set pNewFeatureClass =
pFeatureClass.FeatureDataset.CreateFeatureClass(strNewFeatureClassName,
pFields, Nothing, Nothing, esriFTSimple, pFeatureClass.ShapeFieldName, "")
End If

'Create an insert cursor
Set pInsertFeatureCursor = pNewFeatureClass.Insert(True)
Set pInsertFeatureBuffer = pNewFeatureClass.CreateFeatureBuffer

'Copy each feature from the original feature class to the new feature class
Set pFeatureCursor = pFeatureClass.Search(Nothing, True)
Set pFeature = pFeatureCursor.NextFeature
Do While Not pFeature Is Nothing
Set pGeometryColl = pFeature.Shape
If pGeometryColl.GeometryCount = 1 Then
'Single part feature, straight copy
InsertFeature pInsertFeatureCursor, pInsertFeatureBuffer, pFeature,
pFeature.Shape
ElseIf pFeature.Shape.GeometryType = esriGeometryPolygon Then
Set pPolygon = pFeature.Shape
ReDim pPolygonArray(pPolygon.ExteriorRingCount)
pPolygon.GetConnectedComponents pPolygon.ExteriorRingCount, pPolygonArray(0)
For GeometryCount = 0 To pPolygon.ExteriorRingCount - 1
```

```
InsertFeature pInsertFeatureCursor, pInsertFeatureBuffer, pFeature,
pPolygonArray(GeometryCount)
Next GeometryCount
Else
'Multipart feature, create a new feature from each part
For GeometryCount = 0 To pGeometryColl.GeometryCount - 1
InsertFeature pInsertFeatureCursor, pInsertFeatureBuffer, pFeature,
pGeometryColl.Geometry(GeometryCount)
Next GeometryCount
End If

'Get the next feature
Set pFeature = pFeatureCursor.NextFeature
Loop

Exit Sub 'Exit sub to avoid error handler

ErrorHandler:
MsgBox "An error occurred. Check that the shapefile specified doesn't
already exist."
Exit Sub
End Sub

Private Sub InsertFeature(pInsertFeatureCursor As IFeatureCursor,
pInsertFeatureBuffer As IFeatureBuffer, pOrigFeature As IFeature,
pGeometry As IGeometry)
Dim pGeometryColl As IGeometryCollection
Dim pFields As IFields
Dim pField As IField
Dim pPoint As IPoint
Dim FieldCount As Integer

'Copy the attributes of the orig feature the new feature
Set pFields = pOrigFeature.Fields
For FieldCount = 0 To pFields.FieldCount - 1 'skip OID and geometry
Set pField = pFields.Field(FieldCount)
```

```
If Not pField.Type = esriFieldTypeGeometry And Not pField.Type =
esriFieldTypeOID _
And pField.Editable Then
pInsertFeatureBuffer.Value(FieldCount) = pOrigFeature.Value(FieldCount)
End If
Next FieldCount

'Handle cases where parts are passed down
If pGeometry.GeometryType = esriGeometryPath Then
Set pGeometryColl = New Polyline
pGeometryColl.AddGeometries 1, pGeometry
Set pGeometry = pGeometryColl
ElseIf pGeometry.GeometryType = esriGeometryRing Then
Set pGeometryColl = New Polygon
pGeometryColl.AddGeometries 1, pGeometry
Set pGeometry = pGeometryColl
ElseIf pOrigFeature.Shape.GeometryType = esriGeometryMultipoint Then
Set pGeometryColl = New Multipoint
pGeometryColl.AddGeometries 1, pGeometry
Set pGeometry = pGeometryColl
End If

Set pInsertFeatureBuffer.Shape = pGeometry
pInsertFeatureCursor.InsertFeature pInsertFeatureBuffer
pInsertFeatureCursor.Flush

End Sub
```

ANNEX 2:List of Satellite image, analyzed

Type	City	Date	Band
LANDSAT	Semarang	1999/08/13	9
LANDSAT	Makassar	1999/09/20	9
SPOT	Banjarmasin	2001/08/21 02:40:36GMT	4
IKONOS	Semarang	2001/05/06 02:48GMT	1
IKONOS	Jakarta	2001/07/06 03:11GMT	1