

Section 4 Preparation Forest Inventory book using GIS data

Forest Inventory Book is recording the latest forest situations generally by sub-compartment unit. It may describe various data for the sub-compartment such as area, species, management objectives, age, crown density, type of forest including land use, soil conditions, special flora and fauna existence, community traditional use, some land use right other than forestry authorities, etc.

The Inventory book is used the attribute table of vegetation divided sub compartment (Comp GB Veget Nsemere). The attribute table shall export to Excel as text file. Excel read text file and convert to excel book file.

1. Preparation for converting the vegetation map to a Management Map

Forest Management Map and Forest Inventory Book are the bases to describe the latest forest condition of the reserve. The Management factors are zonation, location, and forest condition. Each parcel of forest (sub-compartment) is categorized into a Forest type, and explained area, location, volume/ha, Number of stands/ha, crown density, planted year (age in case of man-made forest), and if possible, average size of tree, etc. These data shall be inserted on the attribute table of the Forest Management Map.

The Forest management map is defined by three maps (1) Compartment map, (2) Zonation Map, and (3) Vegetation map. Intersect these 3 maps one by one. The attribute table make fields automatically add every files build in the each Map attribute table.

Then arrange the attribute table of the Management map on order of the Forest Inventory Book form (items). The area of each polygon on the attribute table of Management Map shall be recalculated. Then crick order from small to big, if you find polygons “area is 0 m², the management map produced Bag polygons. You have to erase these bags. The erasing Methods are explained on Section 3 of this manual.

Caution:

Before exporting the attribute table to Excel, areas of the polygon shall be recalculated. Never forgot. And author strongly advice you that you have to check the total area of the exported polygons on Excel. If the total area is not same as the total area of the reserve, the Management Map data may not collect, some polygons are missing or duplicated, or you forgot recalculating after the last amendment had done.

Following are explanation step by step bases, in case after check survey had introduced to Arc Map and add to the vegetation map.

Step 1 Combine check survey results to a layer map on Arc Map

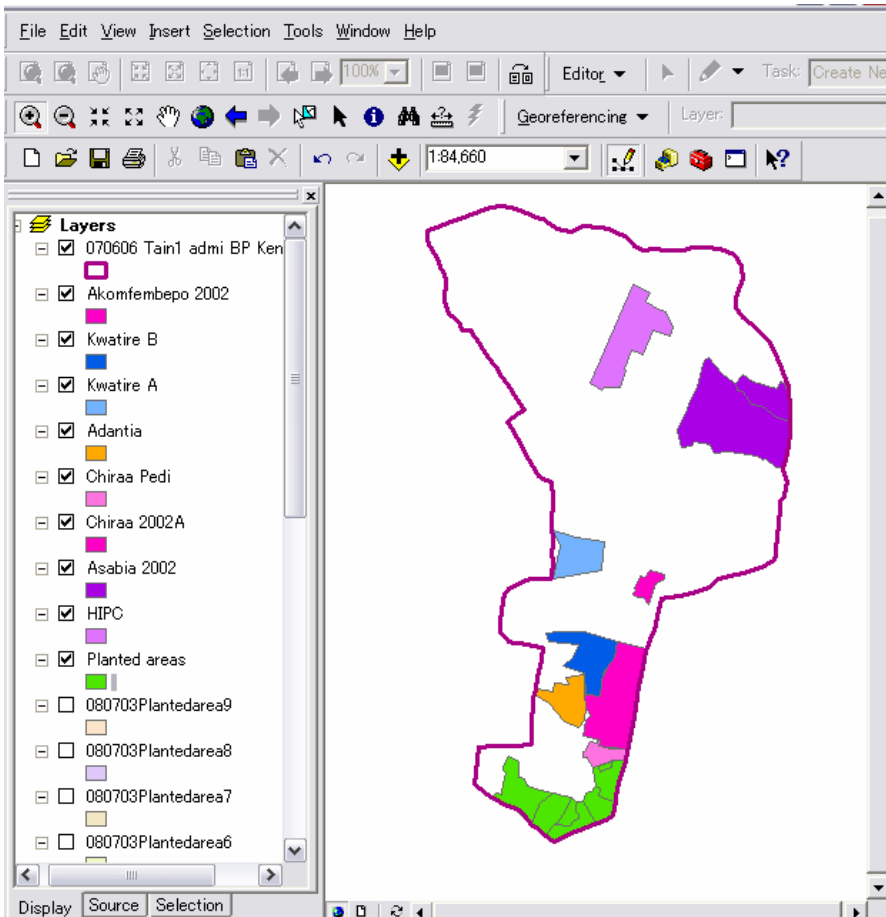
The field survey using GPS shall insert to GIS Map (same coordination system as the coordination of “sunyi river”. How to make GIS map for the survey results (GPS reading DD, MM, SS) to the Arc Map is explained later

in this manual. And to convert the results to shape files. Then every surveyed areas of the newly planted areas can show on a Arc Map as the separated layers shows on the following figure below.

Then you have to observe the layers carefully. Have the layers/polygons adjoined any duplication or space?

If you found the such problem, you have to amend the polygons to harmonize the boundary fix to other polygons.

First figure shows layers automatically made form GPS reading.

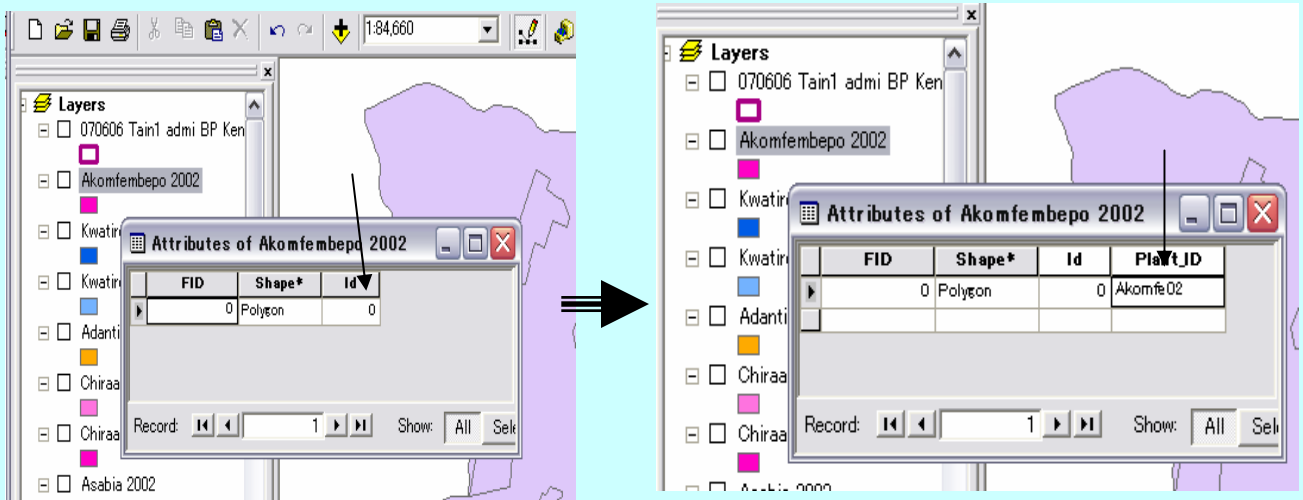


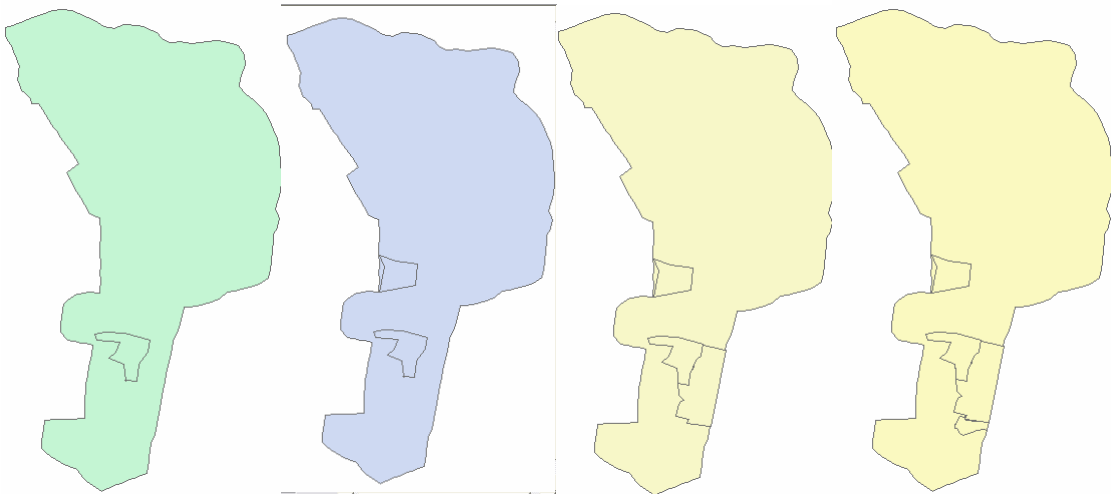
- (a) The surveyed areas are mapped, and converted as shape files.
- (b) The separated shape files shall be combined to a layer using “Union” command on the administration area layer.
- (c) Crick tool box and select Analysis tool-> Overlay -> Union
- (d) Set layer names for Union (Tain 1 admi and a layer of the new planted areas, for example “Akomfembepo 2002”, and file name for output (example “Planted area01)
- (e) new layer unitized

Repeat the same process Union with tow layers (second time is unitize KwatireB and Planted area 01, and output file is “planted area 02”, next unitize Kwatire A and planted area 02 to planted area o3 and so on).

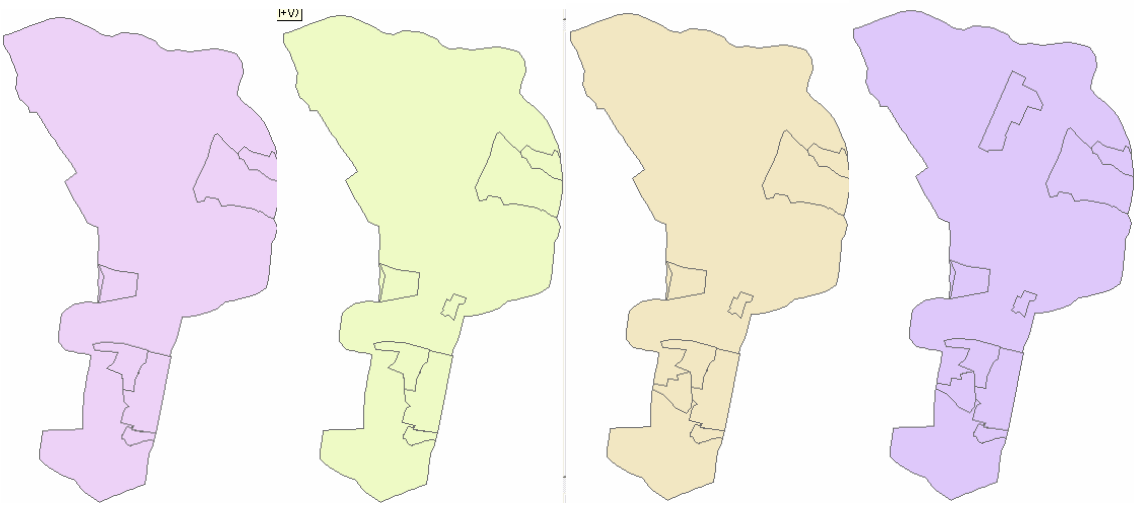
Caution:

Before Unitize the layer, author strongly advice to arrange attribute table of each layer file. Make a field for example give a field name as “Planted ID”, and type in the column some identifiable text such as “Akomf 02” (the place planted by the community akomfembepo at 2002) . If not, you will easy lost the polygons meaning after union command had done. Probably you have to control hundreds of survey data that were carried many FSD staff, the sample case is always simple but real jobs are rather complicated.

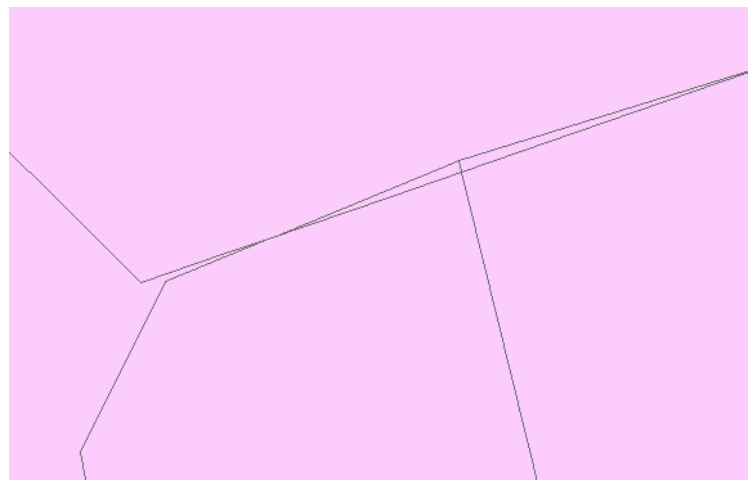
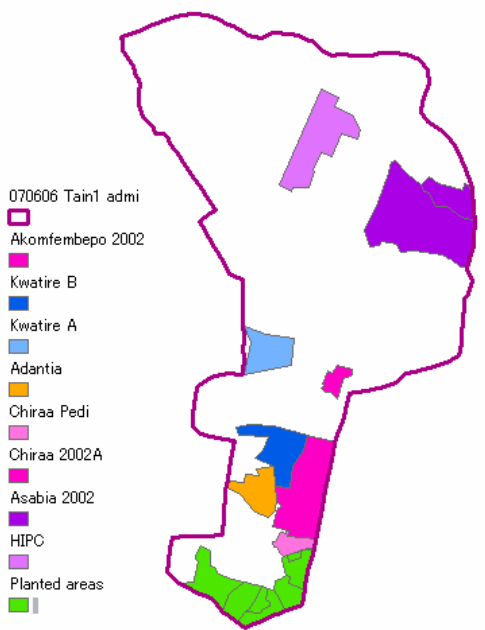




Unitizing process ----->



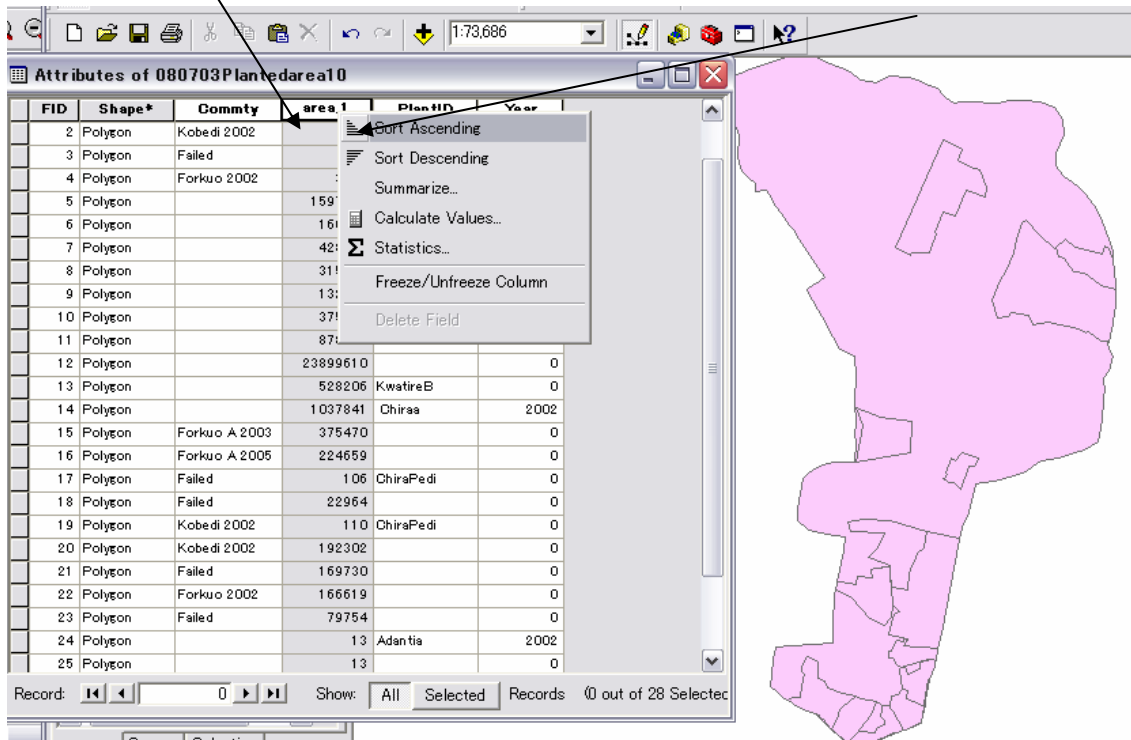
The GPS survey areas layer files combine into a layer, one by one. And finally a map recent planted area



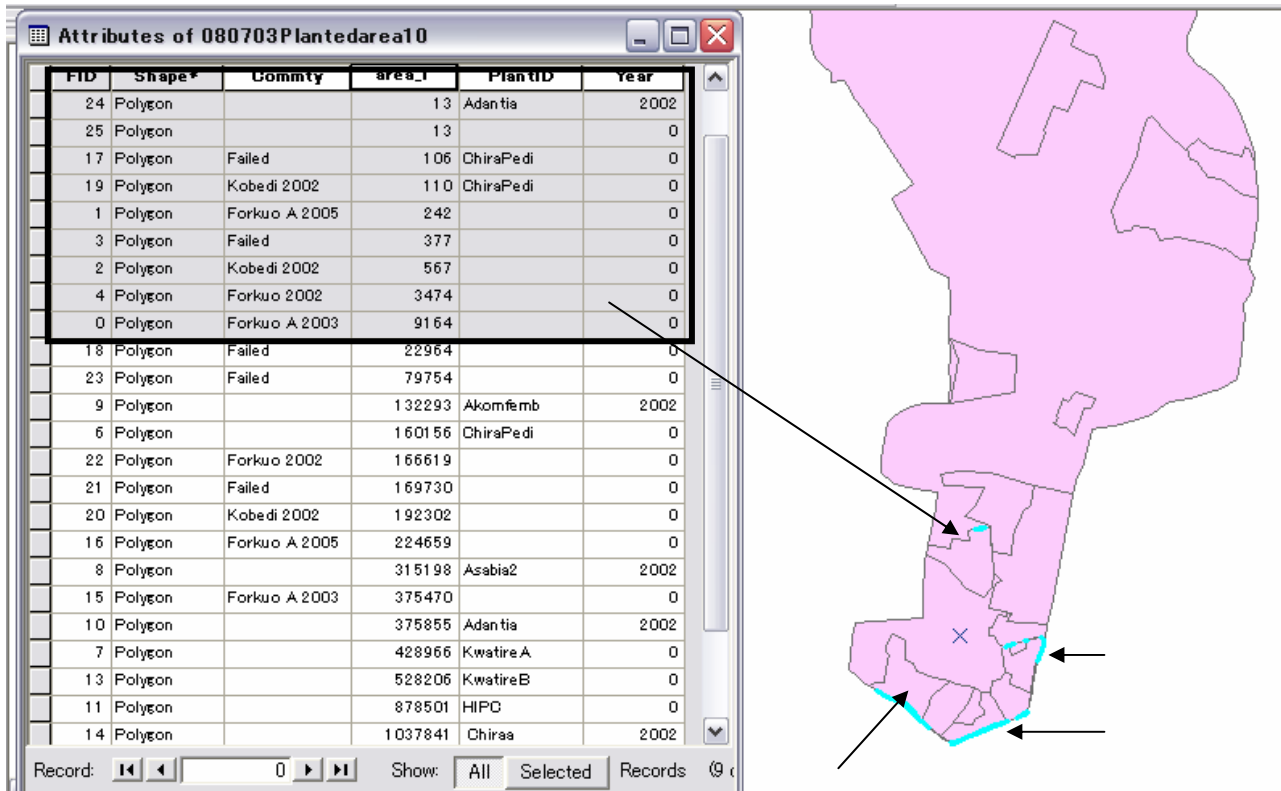
map is formulated as below.

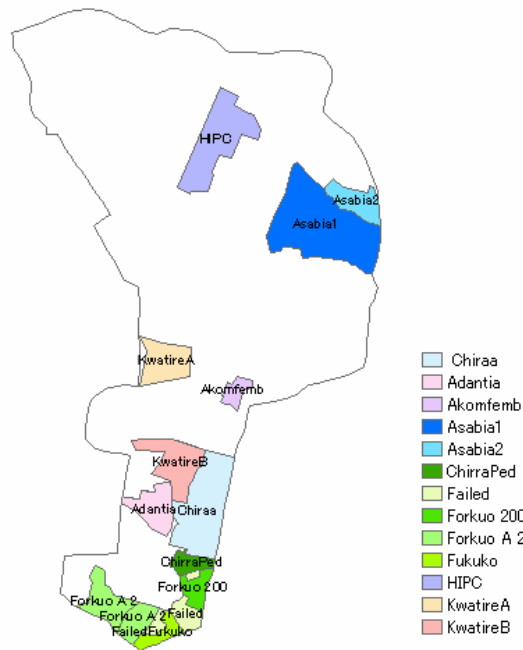
Zooming in, the several polygons are duplicating, you have to clear away these complicated bugs polygons. The method is explained later in this manual.

Open attribute table of the layer of final result above. Calculate area of all polygon using area calculation formulae. And right click area field, and select “Sort small to big”.



Then the attrition table shows small are to large area order. You will find small area polygons. So select these small polygons lines. The arc map shows the selected small polygons. These polygons are bugs.





FID	Shape*	Comnty	PlantID	Year	area
0	Polygon		Asabia1	2002	1594889
1	Polygon		Kwatire A	0	428966
2	Polygon		Asabis2	2002	314825
3	Polygon		Akomfemb	2002	132293
4	Polygon		HIPC	0	878501
5	Polygon		KwatireB	0	528210
6	Polygon		Chiraa	2002	1018015
7	Polygon	Forkuo A 2003	Forkuo A 2	2003	375470
8	Polygon	Forkuo A 2005	Forkuo A 2	2005	225439
9	Polygon	Failed	Failed	0	170637
10	Polygon	Failed	Failed	0	79754
11	Polygon		Adantia	0	375791
12	Polygon	Failed	Failed	0	23088
13	Polygon			0	1636448
14	Polygon	Forkuo 2002	Forkuo 200	2002	193049
15	Polygon		ChirraPed	2002	160000
16	Polygon			2002	22259690
17	Polygon		Fukuko	2002	167606

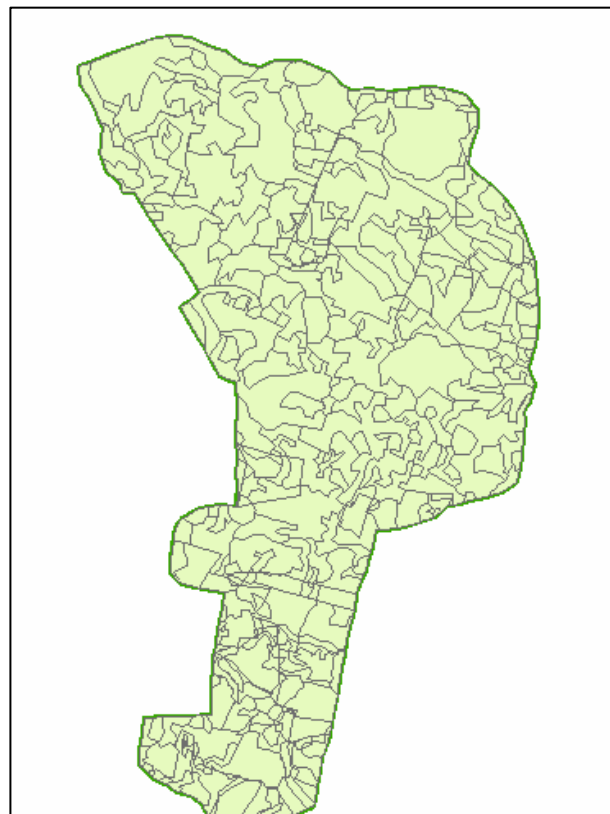
Above Figure: Newly plantation Area Map by Check survey (not yet finalized) and attribute table (The Planted year is under study, crown density is not recorded yet (By the end of June 2008)).

Step 2 Combine Vegetation map and newly planted area map for the amendment of the Vegetation map

The vegetation map was made based on the satellite imagery that was not catch after 2002 or 2003 planted areas, therefore, newly planted areas shall be inserted from other information of field verify.

Over lay the newly planted area map to the vegetation map, and Intersect two maps. New vegetation map with new planted area (temporally call the new layer “Tein Veget 08” is automatically made. Open the attribute table of “Tein Veget 08”, amend F-type field to meet the surveyed condition of the plantation code. And fill the columns of each field to meet the necessity.

If a newly planted area divided into several vegetation types based on the vegetation map, the polygons inside a newly planted continuous areas to a polygon (Marge within Edit command).



Above Figure: After Intersect New planted area and Vegetation map

Open the attribution Table of “Tain Veget 08”.

Start Edit, and select a target layer name as “Tain Veget 08”. Right click on the field “area” and select Calculation

FID	Shape*	FID_080706	area	PlantID	Year	FID_0206	Id_1	Area_1	ID_For	Specie	Age	Crown
713	Polygon	18	0	Other	0	110	0	184274	NFS	Other	0	20
714	Polygon	18	0	Other	0	179	0	881729	GRS		0	0
715	Polygon	18	0	Other	0	191	0	1129597	GRS		0	0
710	Polygon	18	0	Other	0	92	0	84234	NFO	Other	0	8
711	Polygon	18	0	Other	0	186	0	204242	GRS		0	0
712	Polygon	18	0	Other	0	187	0	300768	GRS		0	0
716	Polygon	18	0	Other	0	121	0	128903	NFS	Other	0	20
717	Polygon	18	0	Other	0	164	0	317651	GRS		0	0
718	Polygon	18	0	Other	0	166	0	207765	NFO	Other	65	10
672	Polygon	18	0	Other	0	214	0	95883	NFM	Other	65	65
673	Polygon	18	0	Other	0	262	0	0	NFO	Other	0	9
388	Polygon	8	0	Chiraa	2002	6	0	535803	GRS		0	0
389	Polygon	8	0	Chiraa	2002	12	0	63326	GRS		0	0
546	Polygon	18	0	Other	0	112	0	30055	SHR	Other	0	10
547	Polygon	18	0	Other	0	166	0	207765	NFO	Other	65	10
676	Polygon	18	0	Other	0	243	0	77196	MF3	Teak	29	60
677	Polygon	18	0	Other	0	256	0	508533	GRS		0	0
492	Polygon	18	0	Other	0	96	0	228823	NFO	Other	0	10
493	Polygon	18	0	Other	0	181	0	248968	MFO	Teak	4	65

icon. Call area calculation formula, then calculate new areas on all columns of the area field of the attribution table.

The attribution table ordered area size from small to large shows below.

You may find so many lines/columns show that area “0” or very small. These small areas are almost bags, therefore you have to tackle to erase or combine adjacent polygons. This operation is very troublesome. Even though, you have to carry this patient operation. Original vegetation map has approximately 300 polygons, then after intersect with new planted area, the number of polygons increase more than 700. More than 300 polygons are probably bags.

Advice

The attribution table above includes unnecessary fields. The “area” and “area1” comes from Vegetation map and new plantation map. Computer intersects the two layers into 1 layer and joined all factors of each attribute table to one attribute table. Therefore many fields FID, one of area field are not necessary. First you arrange the fields for erasing unnecessary fields. After arranged the attribution table is like below.

FID	Shape*	area	PlantID	Year	ID_Forest	Species	Age	Crown
0	Polygon	10180	Asabial	2002	NFO	Other	0	10
1	Polygon	9194	Asabial	2002	MFO	Teak	6	50
2	Polygon	49168	Asabial	2002	NFO	Other	0	10
3	Polygon	28222	Asabial	2002	SHR	Other	0	0
4	Polygon	45617	Asabial	2002	NFO	Other	0	10

Step 3 Arranging polygons on the new vegetation map (“Tain Veget 08”).

The polygons within a newly planted area shall be combined.

Click the field Plant ID and sort from big to small. => select lines on the attribution table on same Plant ID => Merge these selected lines/Polygons using Merge command within pull down menu of Edit. => Repeat the process for each different planted organization except others.

Then you have to amend arrowed parts, Id forest to be NF1, Species=Teak, Age=5, crown density=80(%) etc.

The screenshot shows the ArcGIS interface with a map on the right and an attribute table on the left. The attribute table is titled 'Attributes of 080706_Tain1 Vigit 08 02' and contains the following data:

FID	Shape*	area	PlantID	Year	ID_Forest	Species	Age	Crowndenci
367	Polygon	18305	Adantia	2002	GRS		0	0
368	Polygon	30530	Adantia	2002	SHR	Teak	16	15
369	Polygon	11151	Adantia	2002	GRS		0	0
370	Polygon	31437	Adantia	2002	SHR	Teak	16	15
371	Polygon	4336	Adantia	2002	SHR	Other	0	20
372	Polygon	5081	Adantia	2002	SHR	Teak	26	10
373	Polygon	4518	Adantia	2002	MF3	Teak	24	50
374	Polygon	0	Adantia	2002	MF3	Teak	20	76
375	Polygon	22750	Adantia	2002	SHR	Teak	16	20
376	Polygon	228242	Adantia	2002	GRS		0	0
377	Polygon	19411	Adantia	2002	SHR	Other	0	10
453	Polygon	1	Adantia	2002	SHR	Teak	16	15
455	Polygon	3	Adantia	2002	SHR	Teak	16	20
706	Polygon	22	Adantia	2002	SHR	Teak	16	20
707	Polygon	22	Adantia	2002	SHR	Other	0	10
708	Polygon	1	Adantia	2002	GRS		0	0
709	Polygon	1	Adantia	2002	SHR	Other	0	10
35	Polygon	6973	Akomfemb	2002	NFO	Other	0	15
36	Polygon	7192	Akomfemb	2002	MF3	Teak	28	60

(Crown density shall be imputed based on the field survey results).

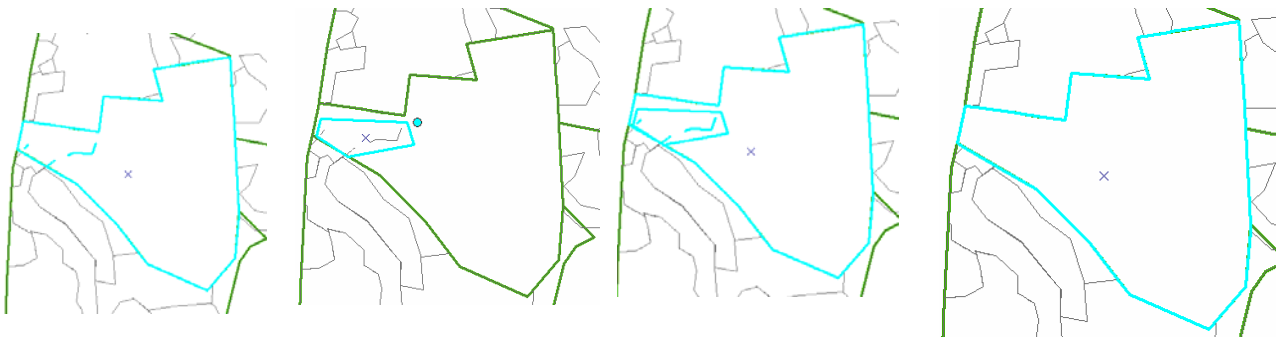
And figure of merged polygon on Arc map also need to amend like below.

The screenshot shows the ArcGIS interface with a map on the right and an attribute table on the left. The attribute table is titled 'Attributes of 080706_Tain1 Vigit 08 02' and contains the following data:

FID	Shape*	area	PlantID	Year	ID_Forest	Species	Age	Crowndenci
367	Polygon	18305	Adantia	2002	GRS		0	0
35	Polygon	6973	Akomfemb	2002	NFO	Other	0	15
36	Polygon	7192	Akomfemb	2002	MF3	Teak	28	60
37	Polygon	2861	Akomfemb	2002	NFM	Other	65	70
38	Polygon	115267	Akomfemb	2002	SHR	Other	0	0
0	Polygon	10180	Asabia1	2002	NFO	Other	0	10
1	Polygon	9194	Asabia1	2002	MFO	Teak	6	50
2	Polygon	49168	Asabia1	2002	NFO	Other	0	10
3	Polygon	28222	Asabia1	2002	SHR	Other	0	0
4	Polygon	45617	Asabia1	2002	NFC	Other	0	10
5	Polygon	152920	Asabia1	2002	GRS		0	0
6	Polygon	63151	Asabia1	2002	NFO	Other	65	10
7	Polygon	34787	Asabia1	2002	NFC	Other	0	10
8	Polygon	69663	Asabia1	2002	GRS		0	0
9	Polygon	139293	Asabia1	2002	NFO	Other	0	10
10	Polygon	26383	Asabia1	2002	NFC	Other	0	10
11	Polygon	105310	Asabia1	2002	NFS	Other	0	25
12	Polygon	123436	Asabia1	2002	GRS		0	0
13	Polygon	107826	Asabia1	2002	NFS	Other	0	20

Arrows in the image point to the 'ID_Forest', 'Species', 'Age', and 'Crowndenci' columns in the table.

After sorted Plant ID, selected for example “Adantia” Arc map shows selected polygons (on right side map). Then Merge, the table and map will change below.



a.

b.

c.

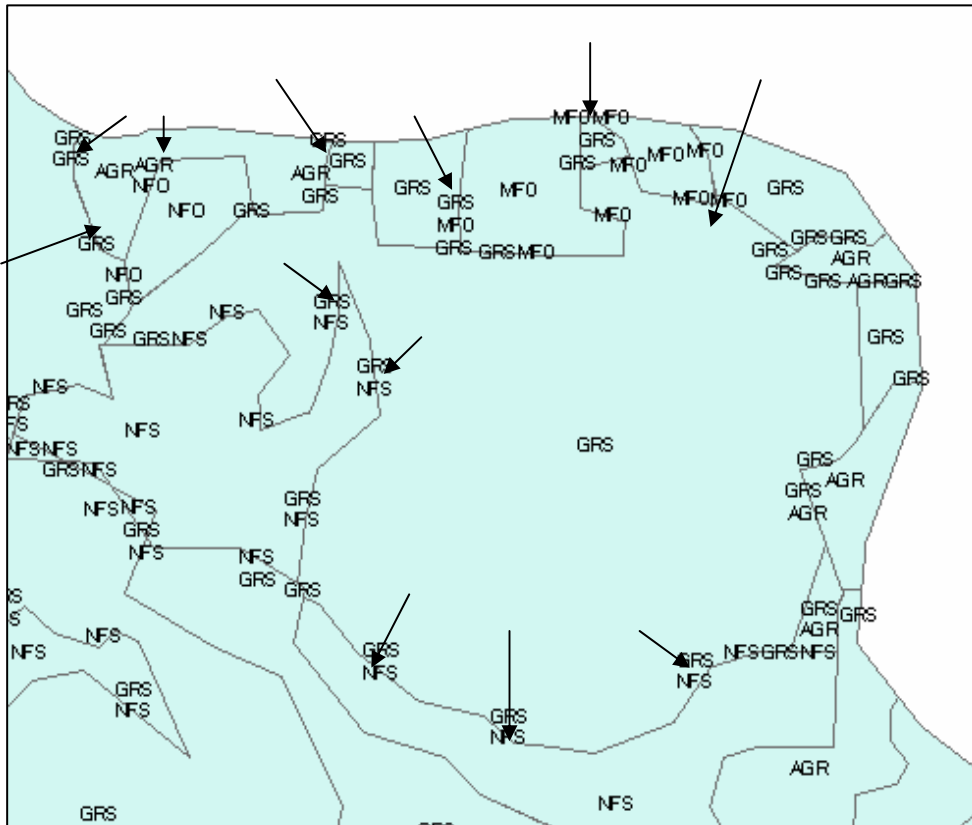
d.

- a. selected merged polygon shows strange lines
- b. make a new polygon covers strange lines
- c. select both polygons a. and b.
- d. Merge the two polygons
- e. The strange parts/lines are combined into a polygon

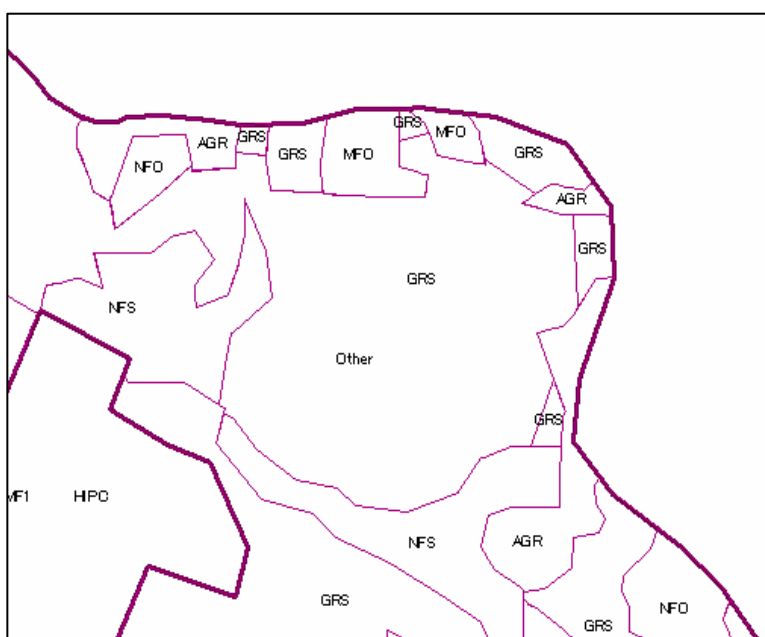
After “Intersect” Tain vegetation 08” is produced. Give each polygon a label (Forest ID). The arc map shows like below. You may found so many strange labels corner of polygons.



Zoom in some part. Arc Map shows like below. ON many polygons outline, you see different ID labels. These labels on lines are almost error or bag polygon, as deprecated. These polygons are very small and generally can not see. If you want to exam, you have to do deep zooming. You have to erase or Joint these bag polygons for preparation of the next step Formulating Zonetion map with vegetation, and export for the Forest Inventory Book arrangement.



Many error polygon had produced. Below figure shows after erased map on same area.



Caution

During this bag polygon erasing, some times, original F type ID change to other ID, Because, to merge to connected small polygon, the jointed polygon is use the all field data of a polygon, therefore, jointed polygon used small polygon that is join to bigger polygon. After merged, Check the ID and other data had not changed, and if changed you have to type in to changed fields data to the collect data again. For this check, Vegetation map before Intersect had done is useful. You set the original vegetation map under the "Tain veget 08", and every merge command had done to show the original vegetation map for comparing the Forest type ID. You can identify the merge is collect or not.

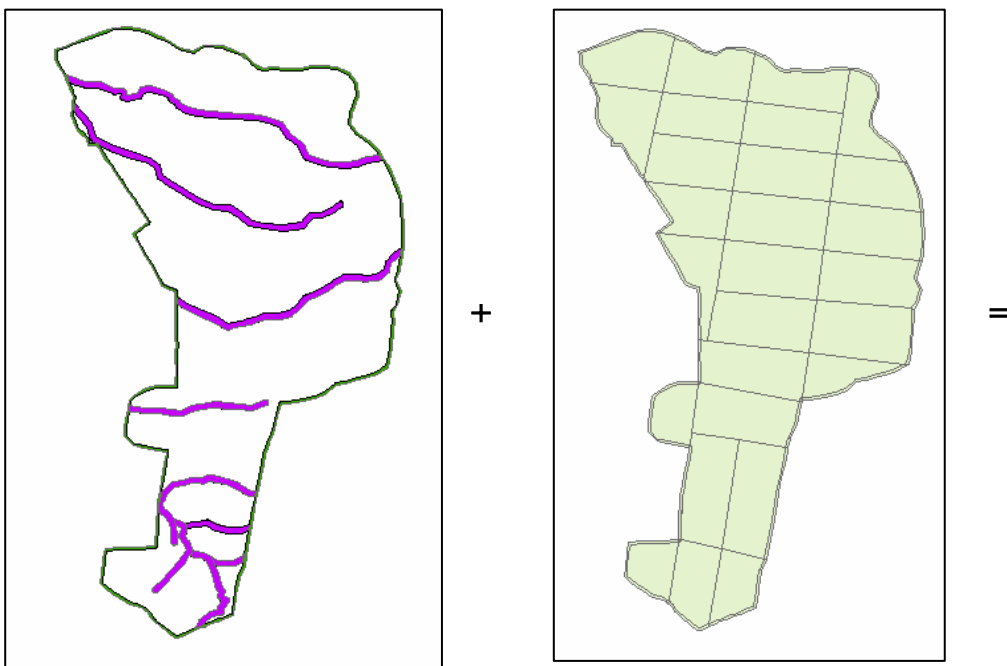
Step 4 Preparation a Zonation map temporally

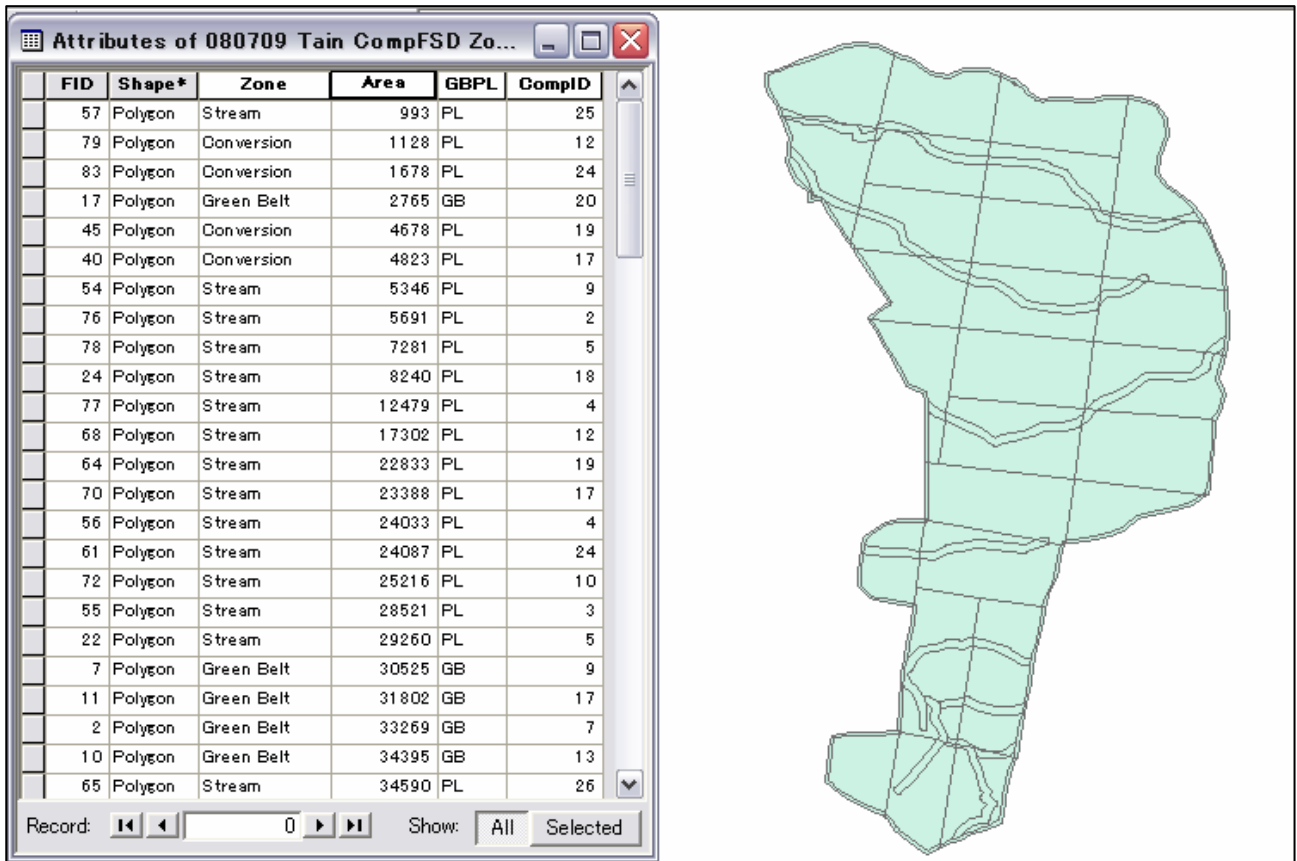
The Tain 1, draft strategic Forest Management Plan said, there are 5 zones such as, (a) Plantation zone, (b) Conversion Zone, (c) Convalescence Zone, (d) Green Belt area, and (e) Stream Protection area.

These areas are needed to delineate on a GIS Map. The zones are defines as:

- (a) Plantation zone is defined new vegetation map as total of Man made forest (MF0 to MF3),
- (b) Conversion Zone is defined as (Total area- (a)-(c)-(d)-(e))
- (c) Convalescence Zone have to decide based on the field observation and surveying,
- (d) Green Belt area is defined Buffering 40m inside from boundary line
- (e) Stream Protection area can fix Buffering technique of GIS from stream line polygon.

So you can make GIS Map on Green Belt, Stream Protection area using GIS techniques. Then unitize this 2 maps with Compartment Map temporary named "Tain zone comp temp08" like below.



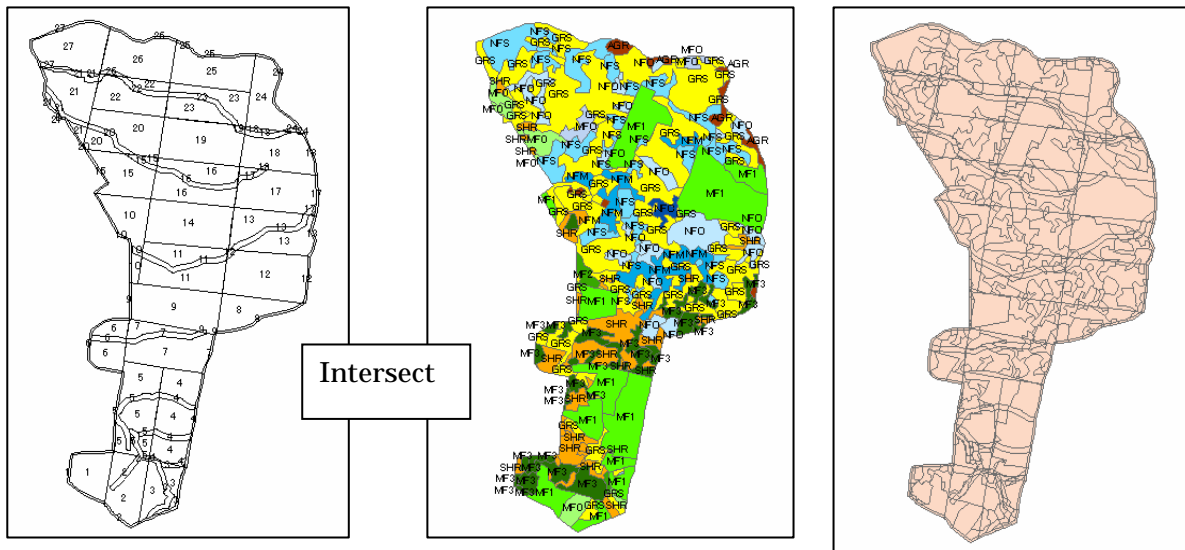


After “Intersect” Zone of Green Belt and Stream protection area had connected or divided into FSD Compartment system. Then reorder the attribute table. Erase unnecessary fields. Calculate area. Check small areas are really needed polygon or bug polygon. The layer “Tain zone comp temp08” is like above figure, and have fields on the attribute table, Zone (Name of Zone), Area, CompID (Compartment ID).

Step 5 Zonatin and vegetation map formulation

Next is making a Map combine with "Tain veget 08" and "Tain zone comp08" for the basis of Forest Inventory Book.

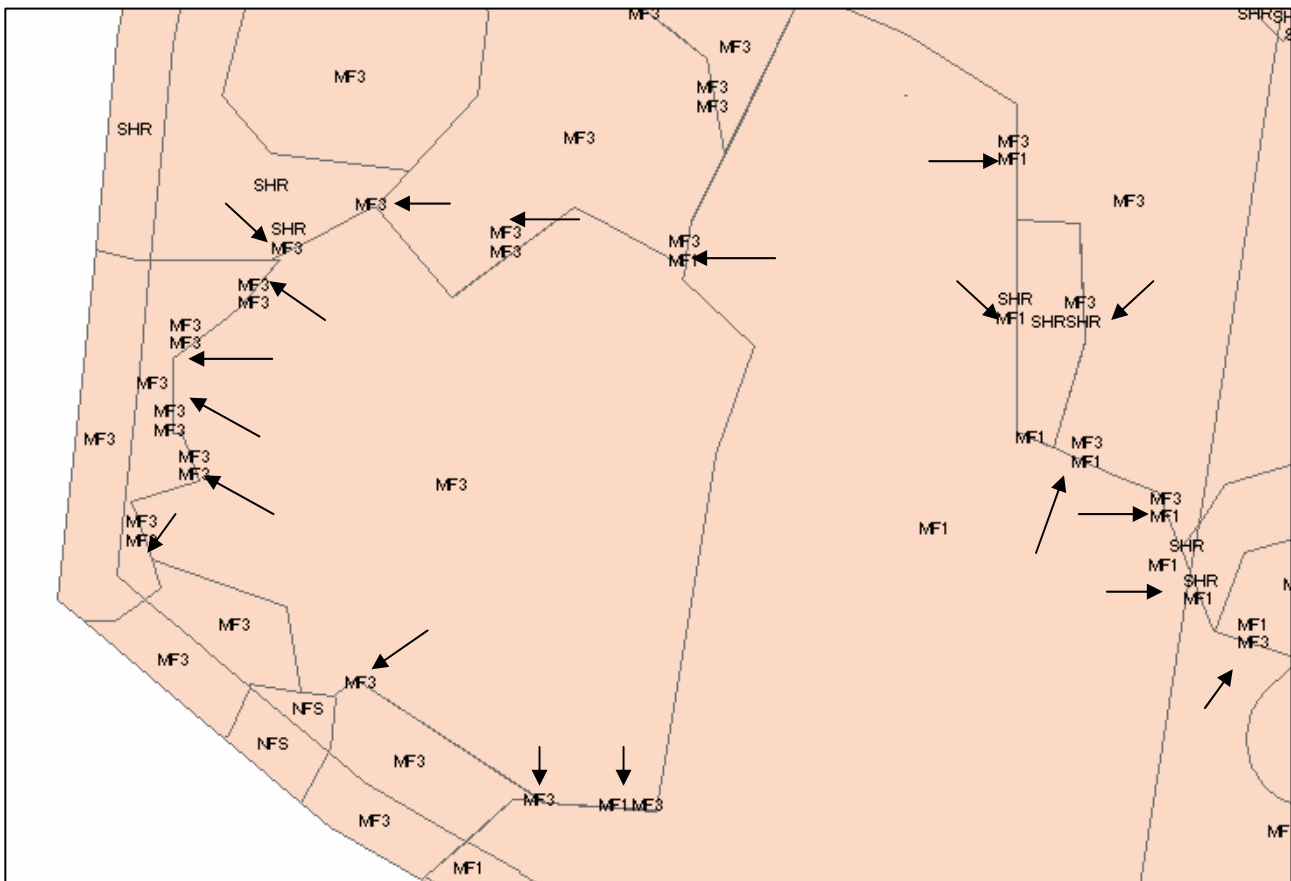
Intersect 2 maps. Check bug layers. Rearrange fields on new map temporally named "Tain F_INV_Book 08".



FID	Shape*	FID_0	Zone	Area	GBPL	CompID	FID_D80706	area_1	PlantID	Year	ID_Forest	Species	Age	Crowdenci
0	Polygon	0	Green Belt	88155	GB	1	6	4161	Other	0	NFS	Teak	24	25
1	Polygon	0	Green Belt	88155	GB	1	9	16997	Other	0	SHR	Teak	16	20
2	Polygon	0	Green Belt	88155	GB	1	10	375655	FukukoA2	0	MF1	Teak	3	80
3	Polygon	0	Green Belt	88155	GB	1	16	36489	Other	0	SHR	Other	0	0
4	Polygon	0	Green Belt	88155	GB	1	17	41484	Other	0	MF3	Teak	26	60
5	Polygon	0	Green Belt	88155	GB	1	18	9796	Other	0	MF3	Teak	24	60
6	Polygon	0	Green Belt	88155	GB	1	19	22637	Other	0	MF3	Teak	24	60
7	Polygon	0	Green Belt	88155	GB	1	162	19483	Other	0	MF3	Teak	24	60
8	Polygon	0	Green Belt	88155	GB	1	163	232027	Other	0	SHR		0	0
9	Polygon	0	Green Belt	88155	GB	1	166	74543	Other	0	MF3	Teak	24	60
10	Polygon	0	Green Belt	88155	GB	1	210	12007	Other	0	MF3	Teak	24	60
11	Polygon	1	Green Belt	84618	GB	6	31	176591	Other	0	SHR	Teak	25	30
12	Polygon	1	Green Belt	84618	GB	6	32	62348	Other	0	MF3	Teak	20	65
13	Polygon	1	Green Belt	84618	GB	6	104	90927	Other	0	MF3	Teak	24	50
14	Polygon	1	Green Belt	84618	GB	6	105	44657	Other	0	MF3	Teak	0	0
15	Polygon	1	Green Belt	84618	GB	6	106	40881	Other	0	MF3	Teak	24	50
16	Polygon	1	Green Belt	84618	GB	6	143	18243	Other	0	GRS		0	0
17	Polygon	1	Green Belt	84618	GB	6	144	69110	Other	0	GRS		0	0
18	Polygon	1	Green Belt	84618	GB	6	145	54239	Other	0	GRS		0	0
19	Polygon	1	Green Belt	84618	GB	6	153	71149	Other	0	GRS		0	0
20	Polygon	2	Green Belt	33269	GB	7	23	164386	Other	0	MF3	Teak	25	75
21	Polygon	2	Green Belt	33269	GB	7	27	20943	Other	0	SHR	Teak	32	40
22	Polygon	2	Green Belt	33269	GB	7	30	28712	Other	0	MF3	Teak	32	80
23	Polygon	2	Green Belt	33269	GB	7	37	130971	Other	0	MF3	Teak	32	50

Record: 3 Show: All Selected Records (0 out of 950 Selected) Options

Un necessary fields of FID_0XXX, FID_0XXX, area1 shall delete. Then calculate area. Sort the data by area size small to Large. You find so many polygons may be bags. Clear the bag polygons. The total polygons became 950. Probably more than 600 polygons are probably bags.

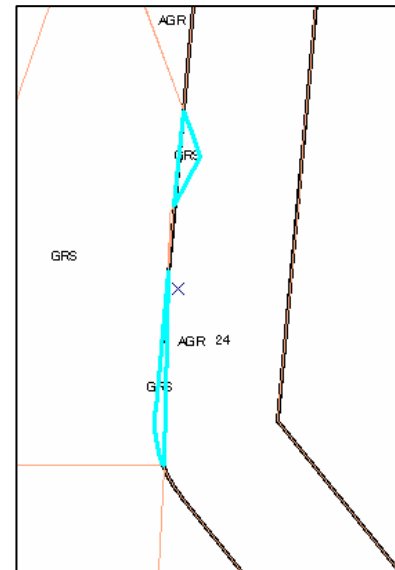


After erase Bag polygons, there are very small polygons steel remaining.

Right figure shows a sample. This small polygon had produced during Intersect Green Belt Line. A Grass area polygon divided by Green Belt area. Therefore, small polygons in Green Belt beside Agri-farm. In this case, The small polygon of grass land shall merge to agri-farm within the Green Belt area.

In many case small polygons that are not exceeded 0.1 ha shall be joined to adjured bigger polygons, but never cross zonation border and compartment boundary.

Then more tan 700 polygons narrow dawn to roughly 650 polygons.



Open the attribute table, and cross check the items of each field of each polygon, one by one. During bags erase work, some times, recorded data of fields are changed to the combined polygons records, or simplily miss typing. Therefore, some strange combination between field and other fiels, check original vegetation map data. For example, if “Forest_ID” is grass, age is “0” and Crown density (CD) is “0”. If F_ID= NFC, age =65 CD= more than75% .

After all data had checked, then give a sub-compartment number by compartment by compartment.

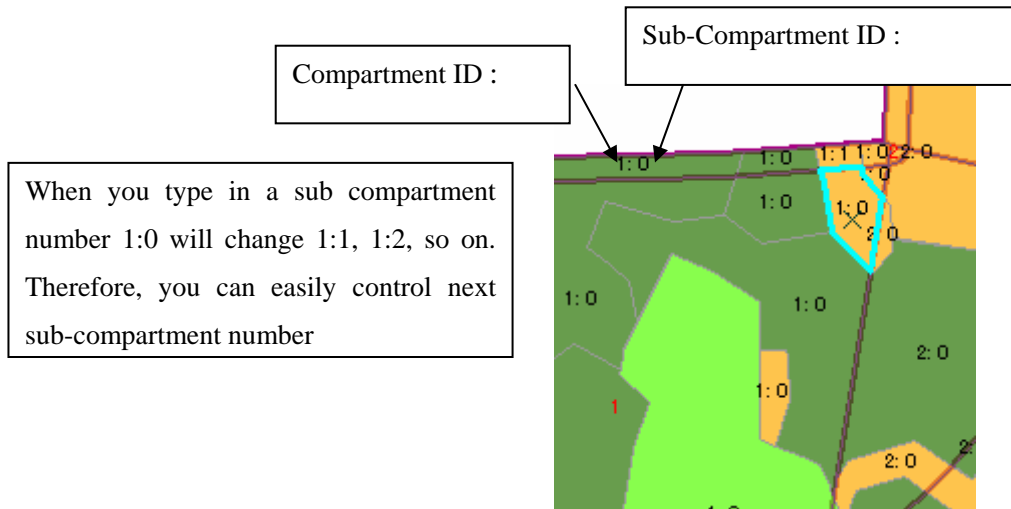
First you need to make a field for sub-compartment name store (“Sub_C” for example).

Stop Editing => Crick Options on the Attribute Table Window => Select Add Field => give field name, data type, and Field property (number of figures) => OK New field “Sub-C.

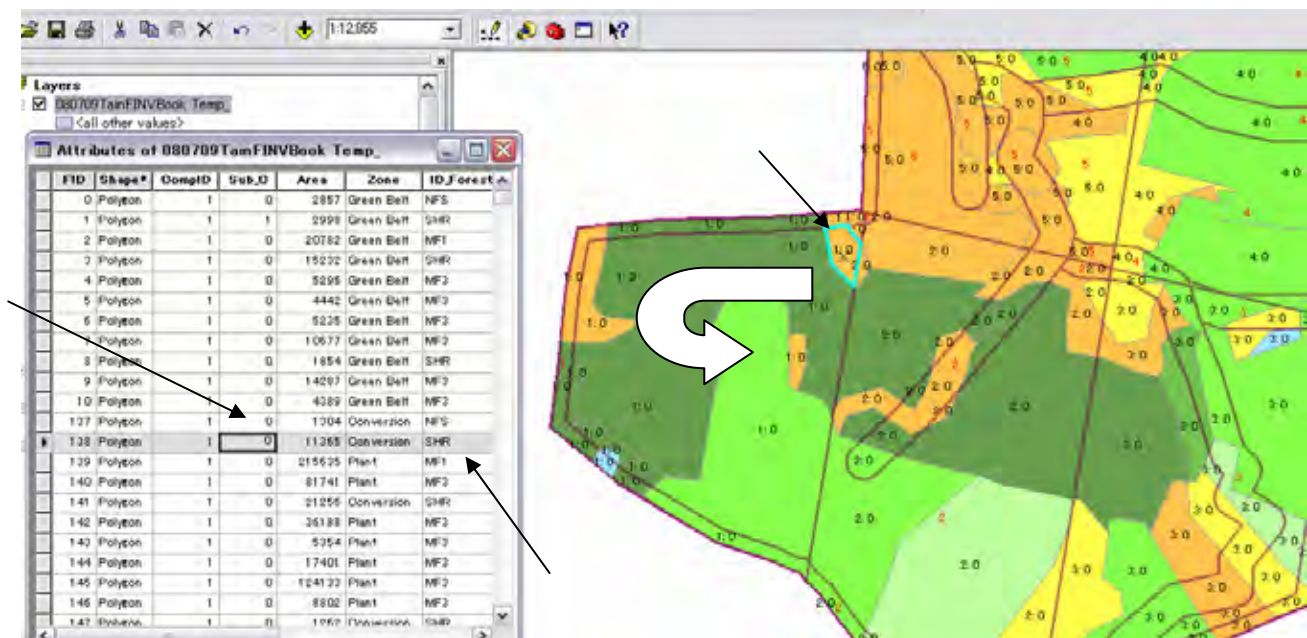
Crick a polygon of compartment 1 and type sub-compartment number on the field of the selected polygon. The sub compartment numbering is generally start right upper portion to right lower portion based on opposite rotation clockwise.

Give sub-compartment number is another patient work. All more than 600 polygons are waiting number ring.

For sub-compartment numbering, prepare the label for each polygon as Comp ID + Sub-comp ID to Arc map is advisable. You can exam your numbering is collect or not forgot the last number. Be careful, there are small polygons, and some polygons are separated places.



Before giving sub-compartment number, you better sort the order by the compartment number order, you can find the selected polygon easily on the attribute table. The sub-compartment polygon will select irregularly appeared



on the order of compartment number on the attribute table.

All polygons are given a sub compartment number, you finished the preparation for making Forest Inventory Book. The attribution table shall be export to Excel file.

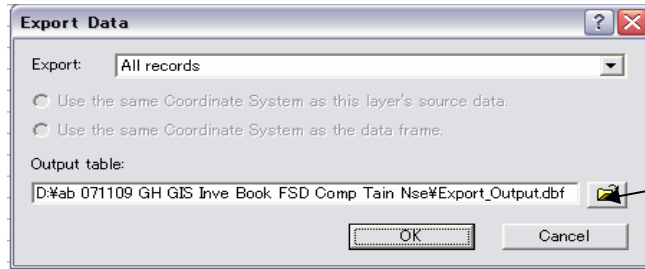
Step 6. Export the attribute table as text file. Click option button on the attribute table => Select Export

The screenshot shows a GIS application window titled "Attributes of 070429NseGBComp vegetInter". The window contains a table with the following columns: FID, Shape*, area, F_Type, SPP, Age, C_dence, Sub_C, GB_or_P, and Comp. The table lists 20 records with various attributes. A context menu is open over the table, with the "Export..." option highlighted. The menu also includes options like "Find & Replace...", "Select By Attributes...", "Select All", "Clear Selection", "Switch Selection", "Add Field...", "Related Tables", "Create Graph...", "Add Table to Layout", "Reload Cache", and "Appearance...". A black arrow points to the "Export..." option, and another black arrow points to the "Options" button at the bottom of the window. The status bar at the bottom indicates "Record: 0" and "Show: All Selected Records (0 out of 341 Selected.)".

FID	Shape*	area	F_Type	SPP	Age	C_dence	Sub_C	GB_or_P	Comp
61	Polygon	330	NFY	Other	8	70	19	PL	5
130	Polygon	364	GRS	Teak	16	60	16	PL	7
304	Polygon	468	AGR		0	0	2	GB	17
325	Polygon	478	SHR		0	0	7	PL	9
73	Polygon	677	GRV		0	0	13	GB	3
120	Polygon	848	NFY	Other	8	70	8	GB	4
330	Polygon	914	SHR		0	0	9	PL	9
158	Polygon	977	SHR		0	0	7	GB	9
157	Polygon	1194	SHR		0	0	24	PL	10
337	Polygon	1255	GRS		0	0	11	PL	4
312	Polygon	1262	GRS		0	0	26	PL	11
101	Polygon	1424	SHR		0	0	1	PL	5
170	Polygon	1481	MF1	Teak	8	70	8	GB	8
255	Polygon	1529	SHR		0	0	4	PL	6
217	Polygon	1549	GRS		0	0	3	PL	15
27	Polygon	1631	GRS		0	0	10	PL	13
292	Polygon	1663	SHR		0	0	2	PL	8
327	Polygon	1937	MF2	Teak	16	50	26	PL	10
20	Polygon	1955	AGR		0	0	11	PL	13
308	Polygon	2039	SHR		0	0	6	PL	14
128	Polygon	2173	GRS		0	0	18	PL	7
295	Polygon	2354	NFY	Other	8	70	6	PL	9

Give a file name and stored data folder for the text file on the Export Data window.

Click folder icon =>

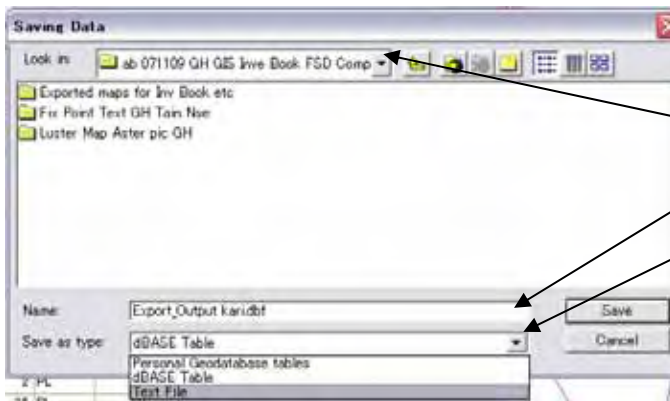


Then the Arc Map attribute Table data was exported by Text file to your folder.

2 Read the data by Excel

Read the saved text file by Excel. The Excel asked data arrangement as following window.

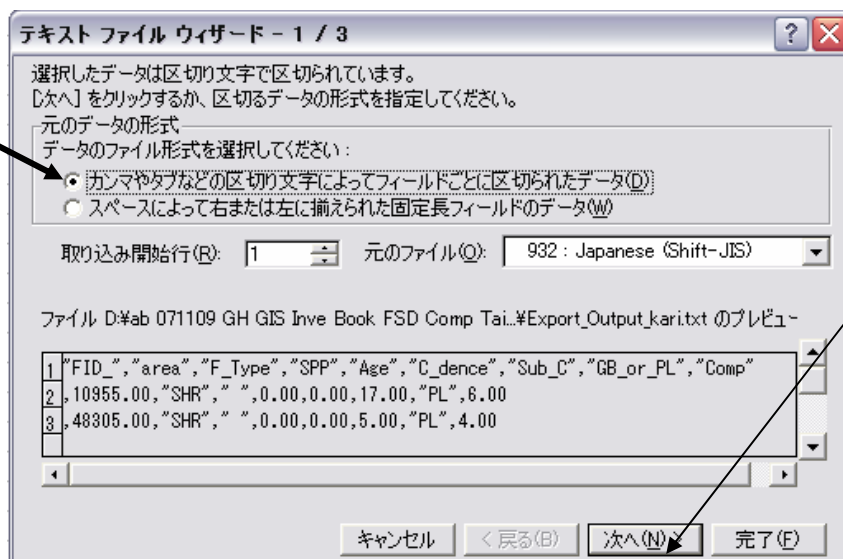
Open Excel and read the stored text file. Excel will ask how the text file convert to Excel as below.



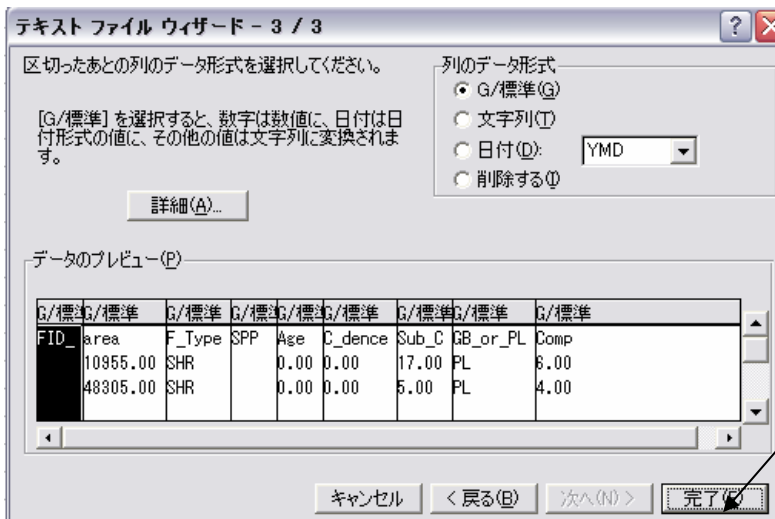
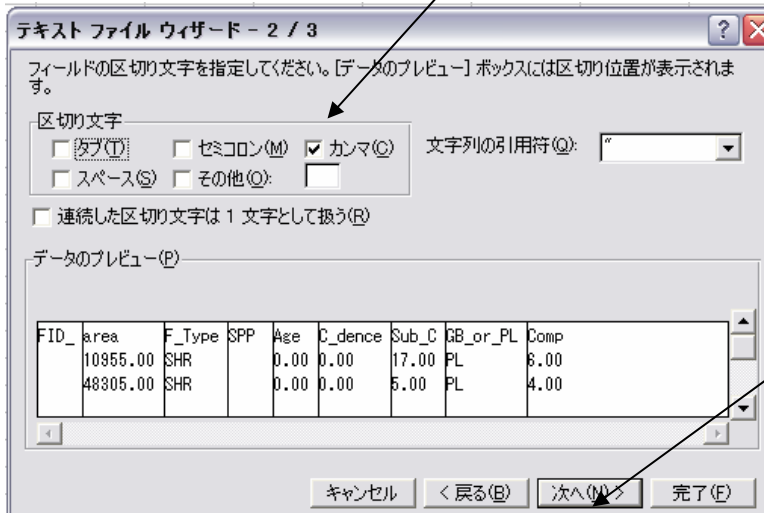
Give folder
Give a file name
Select the data type from dBase to Text => Then OK

A text file wizard window will come.

Mark on circle column "Data that were divided by comer and/or tab" then next.



Give mark to comma (C) then “Next”.



Crick Finish

Crick Finish. Then you will get following Excel table.

Microsoft Excel - 080710_Export_Tain_Zone_Comp_Veget.dbf

	A	B	C	D	E	F	G	H	I	J	K	L
1	Zone	Area	GBPL	CompID	PlantID	Year	ID_Forest	Species	Age	Crown_D	Sub_C	
2	Green Belt	2857	GB	1	Other	0	NFS	Teak	24	25	9	
3	Green Belt	2998	GB	1	Other	0	SHR	Teak	16	20	2	
4	Green Belt	20782	GB	1	FukukoA2	0	MF1	Teak	3	80	12	
5	Green Belt	15232	GB	1	Other	0	SHR	Other	65	0	6	
6	Green Belt	5296	GB	1	Other	0	MF3	Teak	26	60	5	
7	Green Belt	4442	GB	1	Other	0	MF3	Teak	24	60	8	
8	Green Belt	5235	GB	1	Other	0	MF3	Teak	24	60	3	
9	Green Belt	10677	GB	1	Other	0	MF3	Teak	24	60	7	
10	Green Belt	1854	GB	1	Other	0	SHR	Other	65	0	1	
11	Green Belt	14287	GB	1	Other	0	MF3	Teak	24	60	4	
12	Green Belt	4389	GB	1	Other	0	MF3	Teak	24	60	11	
13	Green Belt	13381	GB	6	Other	0	SHR	Teak	25	30	12	
14	Green Belt	18011	GB	6	Other	0	MF3	Teak	20	65	11	
15	Green Belt	4403	GB	6	Other	0	MF3	Teak	20	55	2	
16	Green Belt	13057	GB	6	Other	0	MF3	Teak	24	50	4	
17	Green Belt	5733	GB	6	Other	0	GRS		0	0	3	
18	Green Belt	4203	GB	6	Other	0	GRS		0	0	1	

If your **MS-Office** can read Dbase V file, the excel you can directory read above table to excel. Then save the file as Excel work sheet.

3 Arrange the table

Give the line number from 1 to n (a2=1, a3= a2+1, then copy a3 to a4 to a(n) , copy a1 to a(n), and paste a1 to an as the value) (this numbering order is the same order as on the Arc Map's attribute table and if you want to add data from excel table to attribute table on Arc Map this ordering number is the key for maintaining the relation to the attribute table.),

Copy the table on Excel to other work sheet, and change field order from left b=Comp ID, c= Sub-comp ID, d=Zone ID, e= area, f= ID forest, g=Species, h=Age, i=Year, j=Plant ID, and k= crown density. GBPL is not necessary (Zone ID is mentioned GB). Field a is used for set of polygon number same order as Arc Map attribute table. This number is used linking ID of the Excel table and Arc Map attribute table.

The number is given as below:

	A	B	C	D	E	F	G	H	I	J	K	L	M
1		CompID	Sub_C	Zone	Area	ID_Forest	Species	Age	Year	PlantID	Crown_D		
2	1	1	9	Green Belt	2857	NFS	Teak	24	0	Other	25		
3	2	1	2	Green Belt	2998	SHR	Teak	16	0	Other	20		
4	3	1	12	Green Belt	20782	MF1	Teak	3	0	FukukoA2	80		
5	4	1	6	Green Belt	15232	SHR	Other	65	0	Other	0		
6	5	1	5	Green Belt	5296	MF3	Teak	26	0	Other	60		
7	6	1	8	Green Belt	4442	MF3	Teak	24	0	Other	60		
8	7	1	3	Green Belt	5235	MF3	Teak	24	0	Other	60		
9	8	1	7	Green Belt	10677	MF3	Teak	24	0	Other	60		
10	9	1	1	Green Belt	1854	SHR	Other	65	0	Other	0		
11	10	1	4	Green Belt	14287	MF3	Teak	24	0	Other	60		
12	11	1	11	Green Belt	4389	MF3	Teak	24	0	Other	60		
13	12	6	12	Green Belt	13381	SHR	Teak	25	0	Other	30		
14	13	6	11	Green Belt	18011	MF3	Teak	20	0	Other	65		
15	14	6	2	Green Belt	4403	MF3	Teak	20	0	Other	55		
16	15	6	4	Green Belt	13057	MF3	Teak	24	0	Other	50		
17	16	6	3	Green Belt	5733	GRS		0	0	Other	0		
18	17	6	1	Green Belt	4203	GRS		0	0	Other	0		
19	18	6	7	Green Belt	12198	GRS		0	0	Other	0		
20	19	6	15	Green Belt	13586	GRS		0	0	Other	0		

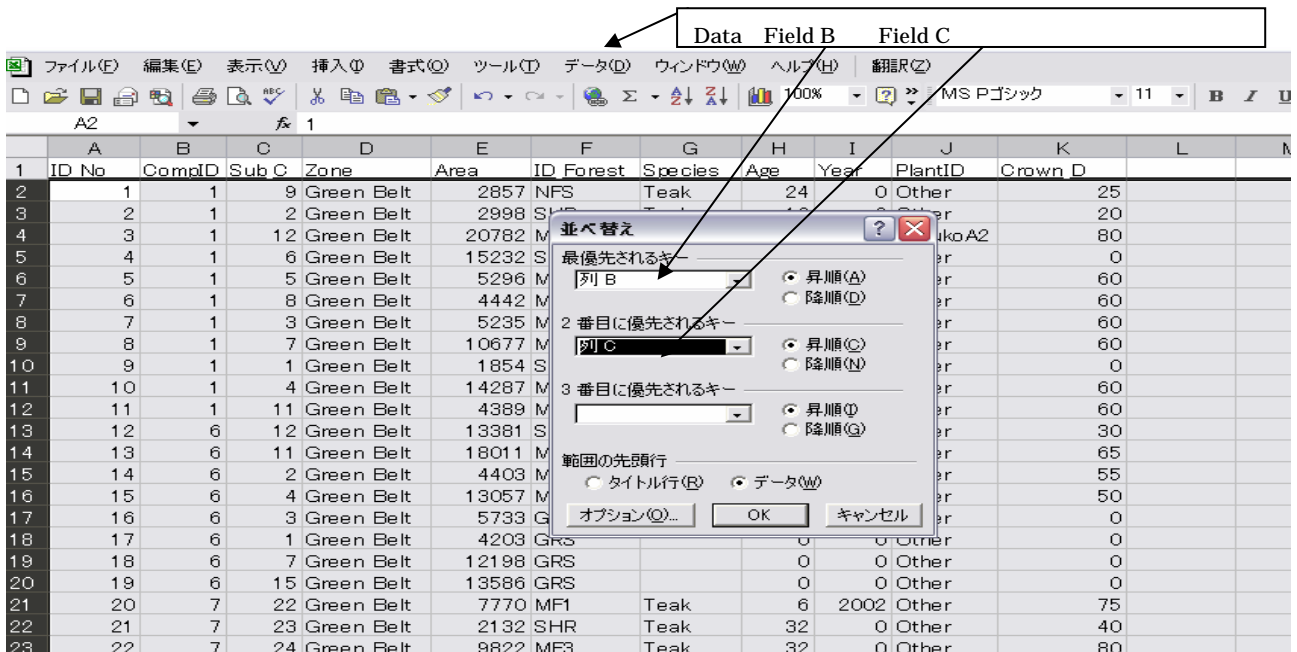
On A2= A1 + 1, Copy A2, Past A2 to An, Copy field a. Past A1 as value. Then all lines of the table is given a series of number.

The excel table form is like below:

The field e= area is m² unit, therefore, the area shall convert to ha unit.

On L1= round(e/10000,2) then L1 copy to L2 to Ln then copy field L and past to L1 as value. Then fiel L shows ha unit area with 2 decimal (XX.XX ha).

Next, sort the Excel sheet in order of compartment and sub-compartment.



The ordering excel table compartment and sub-compartment is completed as below.

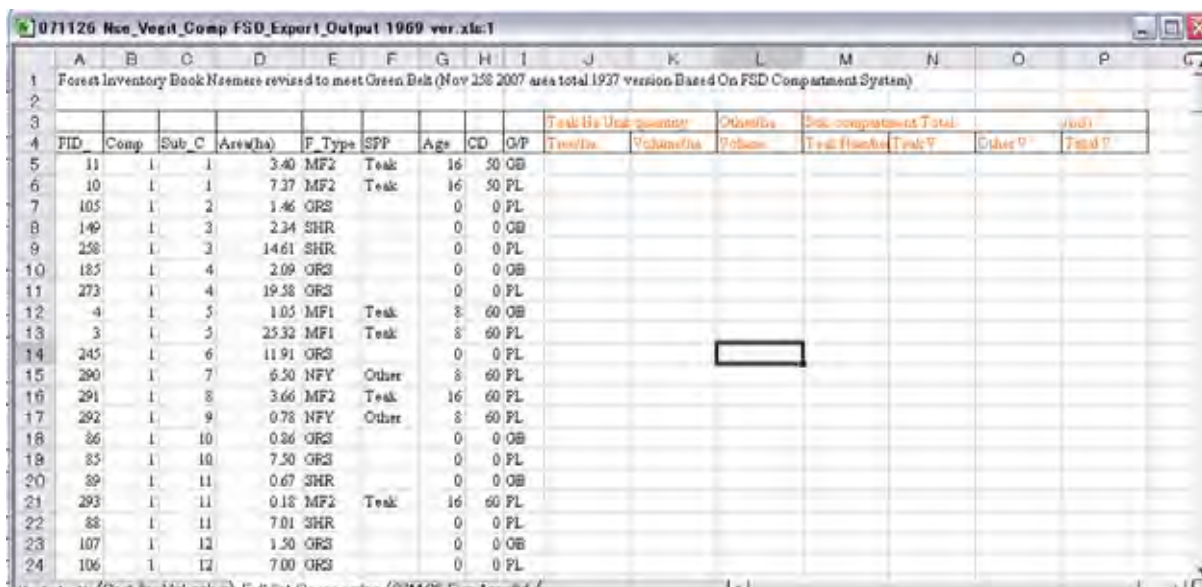
	A	B	C	D	E	F	G	H	I	J	K	L
1	ID No	CompID	Sub_C	Zone	Area(ha)	ID_Forest	Species	Age	Year	PlantID	Crown_D	
2	9	1	1	Green Belt	0.19	SHR	Other	65	0	Other	0	
3	148	1	1	Conversion	0.13	SHR		0	0	Other	0	
4	2	1	2	Green Belt	0.3	SHR	Teak	16	0	Other	20	
5	139	1	2	Conversion	1.14	SHR	Teak	16	0	Other	20	
6	7	1	3	Green Belt	0.52	MF3	Teak	24	0	Other	60	
7	145	1	3	Plant	1.74	MF3	Teak	24	0	Other	60	
8	10	1	4	Green Belt	1.43	MF3	Teak	24	0	Other	60	
9	149	1	4	Plant	6.02	MF3	Teak	24	0	Other	60	
10	5	1	5	Green Belt	0.53	MF3	Teak	26	0	Other	60	
11	143	1	5	Plant	3.62	MF3	Teak	26	0	Other	60	
12	4	1	6	Green Belt	1.52	SHR	Other	65	0	Other	0	
13	142	1	6	Conversion	2.13	SHR	Other	0	0	Other	0	
14	8	1	7	Green Belt	1.07	MF3	Teak	24	0	Other	60	
15	147	1	7	Plant	0.88	MF3	Teak	24	0	Other	60	
16	6	1	8	Green Belt	0.44	MF3	Teak	24	0	Other	60	
17	144	1	8	Plant	0.54	MF3	Teak	24	0	Other	60	
18	1	1	9	Green Belt	0.29	NFS	Teak	24	0	Other	25	
19	138	1	9	Conversion	0.13	NFS	Teak	24	0	Other	25	
20	146	1	10	Plant	12.41	MF3	Teak	24	0	Other	60	
21	11	1	11	Green Belt	0.44	MF3	Teak	24	0	Other	60	
22	151	1	11	Plant	0.76	MF3	Teak	24	0	Other	60	

4 Add data fields on the excel table as same to the form of Forest Inventory Book

Next is projection of volume, stands number of Teak forest and natural forest. For Teak planted volume calculation use a growth prediction table/yielding table and crown density. For natural forest volume and stand number projection, RMSC inventory report is the base if you did not conduct volume and stands number survey on the real field.

The table arranged to meet form of Forest Inventory Book is shown as below.

Add field for Forest Inventory Book form.



Teak Ha Unit quantity		Other/ha	Sub compartment Total		(m3)	
Tree/ha	Volume/ha	Volume	Teak Number	Teak V	Other V	Total V

4. Calculate Number/ha

a. Volume/ha of Teak Man made forest.

Volume projection is carried based on the one assumption. The Teak forest grew almost same as averaged area of the west Africa (Basically used Ivory cost Yielding Table in middle level). On the real field Teak stands are not fully remain in various reason, therefore, crown density reflect in parallel to reduce the volume and stands number.

(a) Prepare Yielding Table.

The above yielding table interpret stand number, volume per ha by age in the case that the man-made forest growing in general condition (not affected fire, illegal cutting, general management of thinning etc.).

Table Teak Plantation Yielding Model

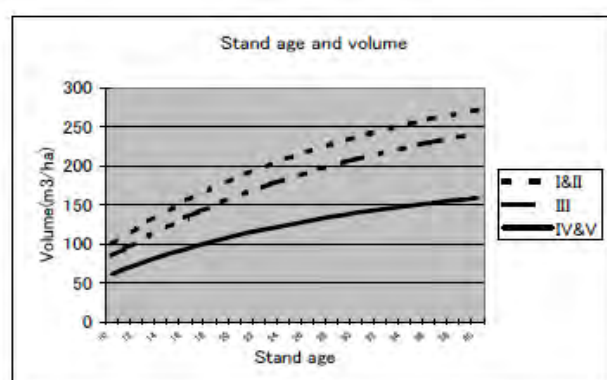
Age	Number/ha			V/ha			Average D H		Growth(%)		Middle(2)	Harvest
	Before	Thin	After	Before	Thinning	After	D/cm	H/m	Rate/year	Vol/stem	Vol/ha	Vol/ha
5	1000		1000	40		40	10	11	-		-	
10	800	300	500	85	32	53	16	15	28	0.106	85	32
15	500	250	250	126	63	63	19	20	31	0.252	126	63
20	250	100	150	160	64	96	21	21	19	0.640	160	64
25	150		150	187			24	24		1.247	187	187
30	150		150				26	26		1.393	209	209
35							28	26				

Note: Following existed data are combined

Growing Pattern (Class II of west Africa)

(2) data Forestry department 1993 (PAFORM Advisory Report 6 Mar. 2005 Annex 10)

Data of Class III (medium) is applied



Source: Forestry Department (1993)
(Progress Report of JICA Development Study)

The above table interpreted to following table (averaged change will be within 5 years term).

Table Volume and Trees number Projection table for Teak Man Made Forest

Age	Vol/ha	Number/ha	Age	Vol/ha	Number/ha	Age	Vol/ha	Number/ha
0	-	1100	10	85	800	20	160	250
1	-	1100	11	93	500	21	165	150
2	-	1100	12	101	500	22	171	150
3	-	1100	13	110	500	23	176	150
4	-	1100	14	118	500	24	182	150
5	0	1000	15	126	500	25	187	150
6	17	960	16	133	250	26	191	150
7	34	920	17	140	250	27	196	150
8	51	880	18	146	250	28	200	150
9	68	840	19	153	250	29	205	150
10	85	800	20	160	250	30	209	150

- (b) The Excel table sort by Species and Age order using sort function of the Excel.
 Manu “Data” select “Sort” give No1 factor “Species (Field F)” and No2 Factor” age (Field G)”.

Calculate Per/ha stand number and volume (Yielding table and crown density) on a column of an aged. Then copy the results to other columns of same age.

- (c) Excel windows arrangement.

Arrange the excel windows shows Yielding data and sub-compartment list on the same screen.

Put on the cursor on the target cell (J266 on the sample sheet below) => Select main menu => refer the tree number (age 6, 1003/ha \$B\$8 on the sample sheet) => arrange formula on the cell J266 like =SUM(Sheet2!\$B\$8)*H266/100 => copy the cell to same age cells. => Repeat same process but referring a deferent but suitable cell to meet age for next Age and Volume cells.

b. Volume/ha of Natural forest

Volume and number of the natural forest is not easy to project. If you have the related data such as RMSC Inventory (Generally reported compartment unit 128ha Volume, Number/ha or total). If you can not find suitable data, you have to conduct field survey (sample plots survey) on each forest type as you defined and delineated using satellite image. And make your table for standards of the volume or stands number.

On Tain 1, RMSC reported total volume by compartment bases. The data shows total natural stands volume in a compartment. This value shall be demarcated to each sub compartment based on the crown density of each sub compartment that are defined Natural forest, in this case NFC, NFM, NGS, and NFO.

- a. Calculate total area covered by crown by compartment.

Sort the Excel table in order Spices “Others” in compartment. (first factor “Spp”, second Factor “Comp”)

Total area covered by crown = (area of sub-compartment x crown density) .

- b. Volume by sub-compartment.

The total volume of a compartment is distributed to sub-compartments based on the proportion of the crown covered area. (This case is applied that total volume of a compartment is given from the data of RMSC Inventory record).

Crown covered area of a sub-compartment

Each sub-compartment V = ----- X (total V of the compartment)

Total area covered crown of a compartment

V : Volume

- c. In case that natural forest including young secondary forest.

The young secondary stands have limited volume, and different stands number from ordinal old natural stands; therefore, young secondary forest shall be calculated separately from ordinary natural forest.

You observe young secondary forest, and possibly to conduct field survey (to measure stand number/ha on sample plots), and use the result for the young secondary forest volume and stands number.

FID_	Comp	Sub	AreaHa	F type	Spp	CD is CrownDensity			Teak/ha		Teak total		Others		V ol Tot m^2
						Age	CD	GBPL	Number	Volume	Number	Volume	V/ha	V/Total	
338	2	1	0.54	GRS		0	0	PL							0
335	2	2	4.32	SHR	Teak	18	20	PL	50	29	216	126			126
371	2	3	0.07	MF2	Teak	19	60	GB	150	92	11	6			6
373	2	3	39.84	MF2	Teak	19	60	PL	150	92	5976	3662			3662
418	2	4	0.29	SHR	Teak	26	20	PL	30	38	9	11			11
212	2	5	4.13	SHR	Teak	26	30	PL	45	57	186	237			237
213	2	6	0.67	SHR	Teak	26	20	GB	30	38	20	26			26
214	2	6	12.26	SHR	Teak	26	20	PL	30	38	368	469			469
230	2	7	0.47	GRS		0	0	GB							0
232	2	7	2.23	GRS		0	0	PL							0
217	2	8	22.8	MF0	Teak	4	80	PL	880	0	20064	0			0
208	2	9	1.14	MF2	Teak	16	50	GB	125	66	143	76			76
210	2	9	2	MF2	Teak	16	50	PL	125	66	250	133			133
215	2	9	1.15	MF0	Teak	4	80	GB	880	0	1012	0			0
Total			91.91								28253	4747	0		4747

5. Arrange the Excel Table in order of Compartment

After calculated Teak forest and natural forest, you sort the table again using key of Compartment, and sub-compartment. Before this sorting, it is advisable that the Volume and Stand number inserted table (worksheet) shall be copied to a new worksheet for totaling works.

5. Totaling for summery of the Inventory Book

For totaling, you use Pivot Table Making function of the Excel within the pull down menu of “Data”

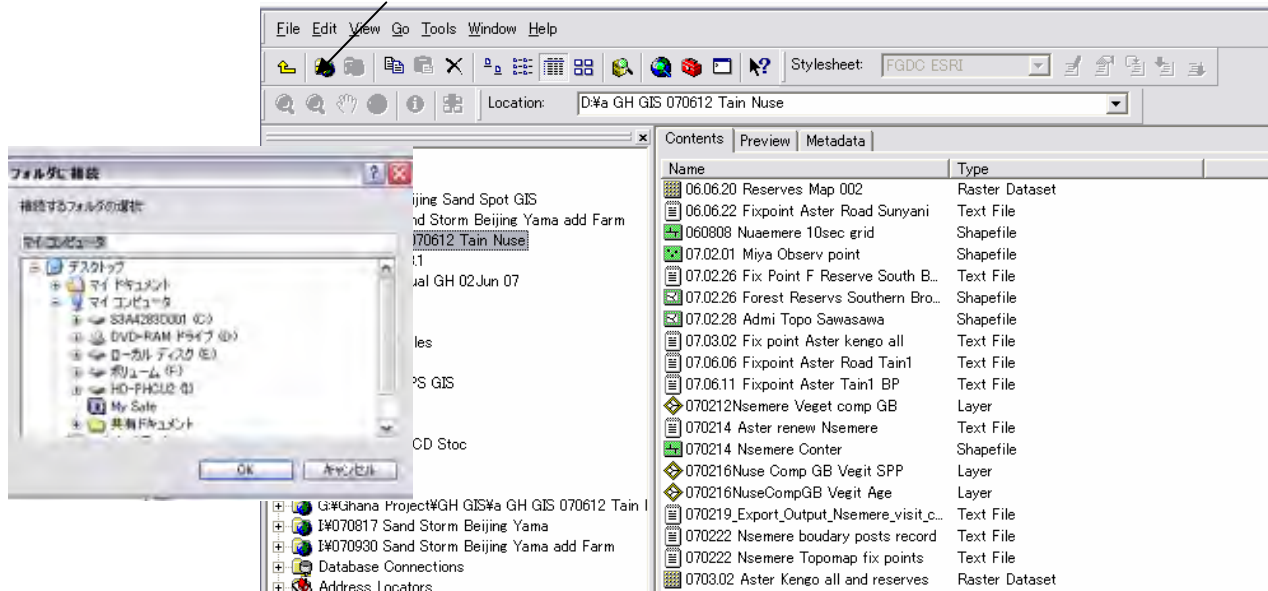
How to use Pivot table you can find Excel Manual.


Section 5 Additional information for understandable Map Arrangement

1. Basic information for Arc Catalog and Arc Map





(1) About Arc Catalog

Start Arc Catalog, you can get following screen on your PC.

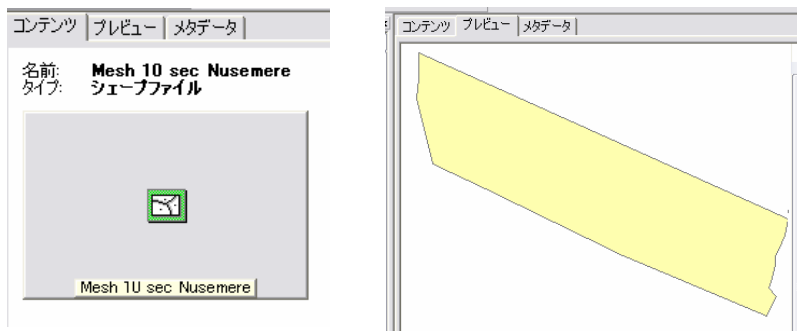


Click  (connect to a folder) for calling set of data.
Select the folder that you stored the related.

Then you can get the list of the related shape files on right side of the screen.

-  shows raster data (like picture)
-  shows vector data (shape polygon)
-  shows vector data (line polygon)
-  shows vector data (point polygon)

Select a polygon (Nsemere Admi 1813 New coordinate), screen shows on right side contents of the shape file like below.



Content View

Preview view

It shows the file is consisted polygon for the area boundary of Nsemere Reserve.

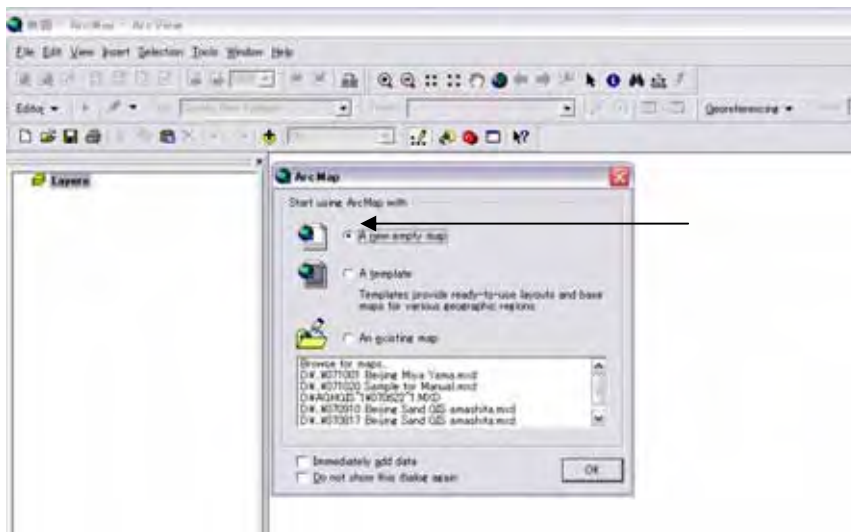
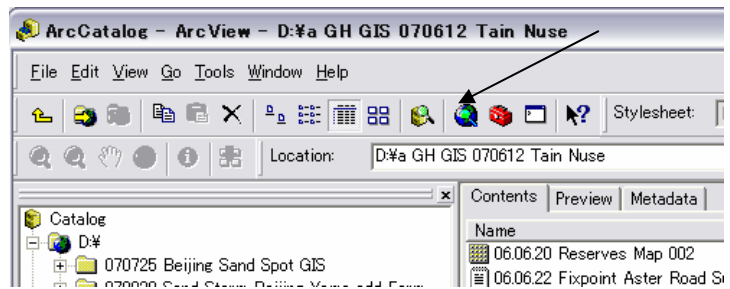
(select a connect to folder, and hit F5, you can call latest file list stored the folder connected.)

(2) About Arc Map

Open Arc Map for a new Map

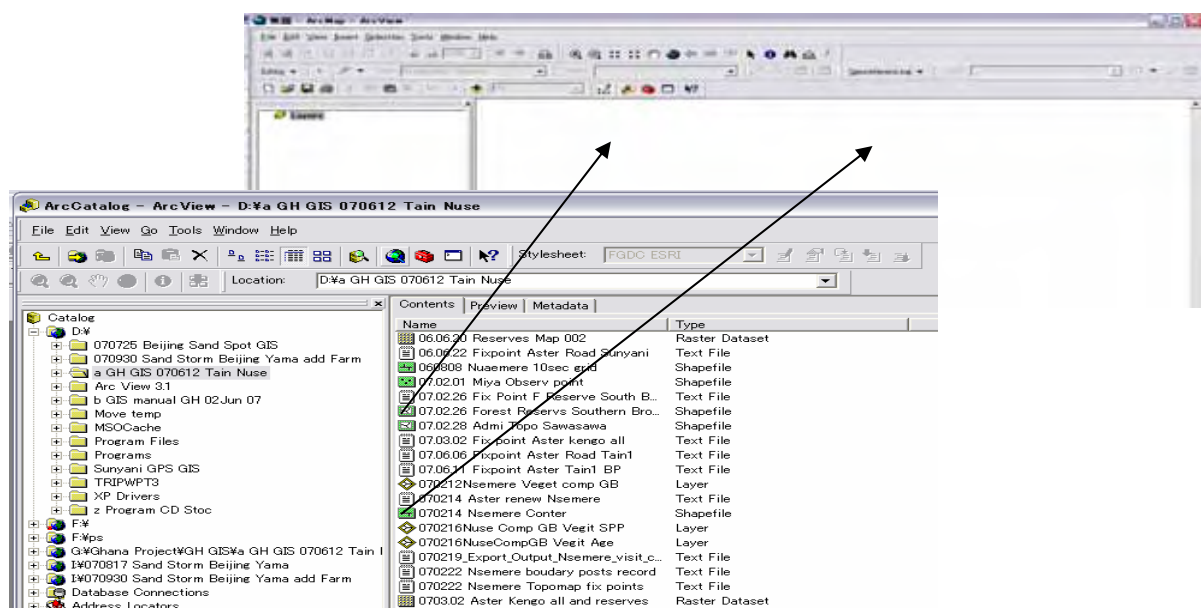
Crick Arc Map icon. => Select New Map =>

Drag an drop files.

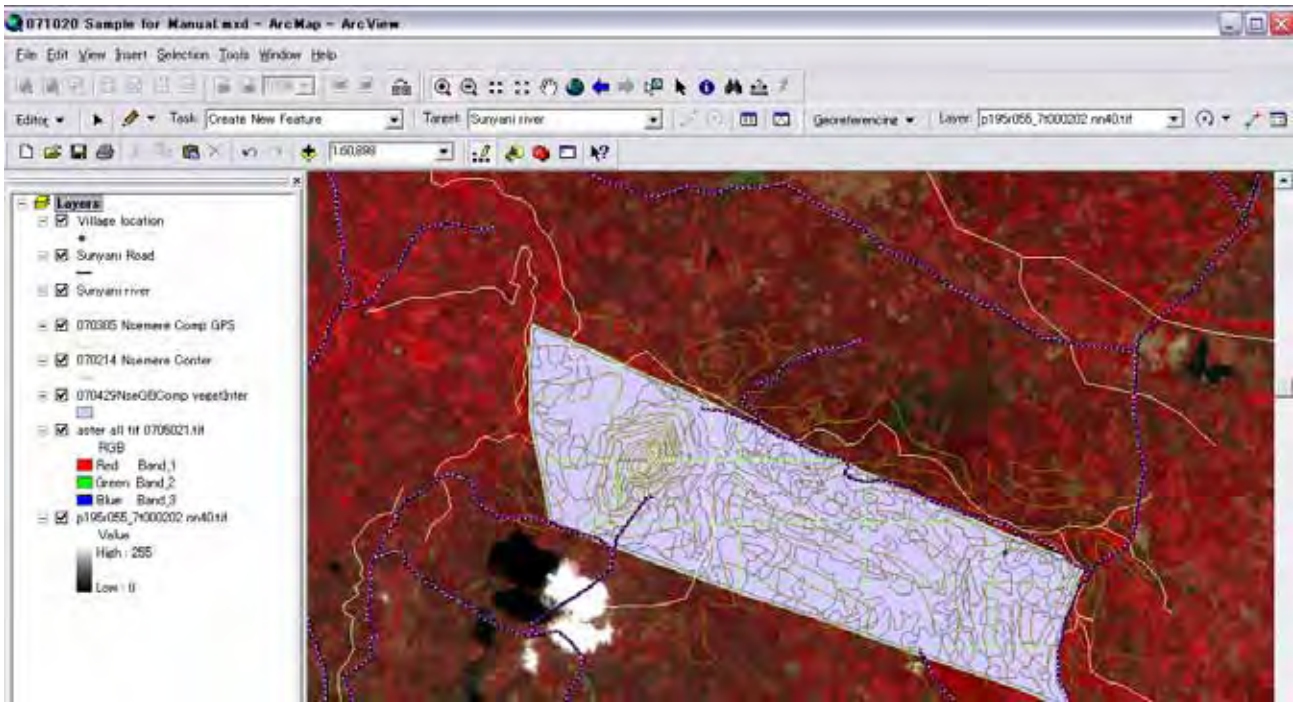


Blank Arc Map will come, and then Files one by one drug and drop from Arc Catalog to Arc Map

Drag and Drop the files from Arc Catalog to Arc Map. Then Arc Map shows each Polygons on deferent Layers.



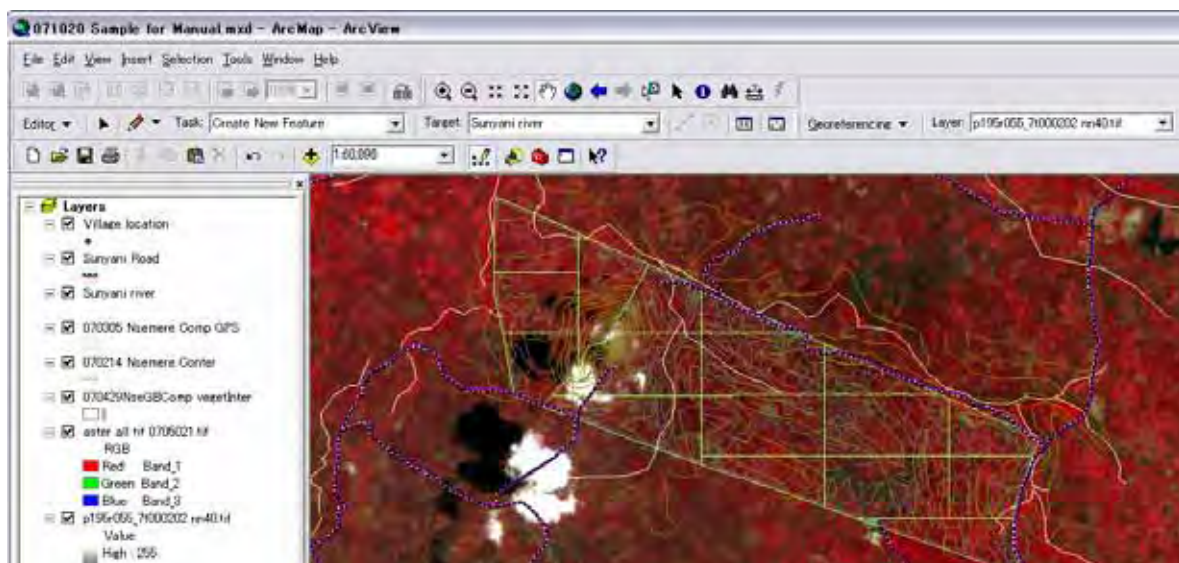
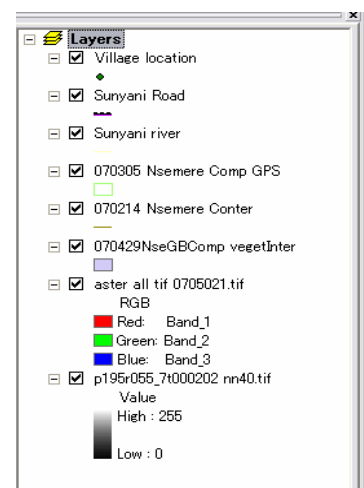
Then Arc Map shows the layers you drug and drop from Arc Catalog to Arc Map. The sample shows on next page.



Arc Map describe shapes on a layer ordered from lower to upper of the layer list on left side of the window.

the checked layers are described on the Arc Map. If upper layer describe filled pattern, the lower layer description is masked by the upper layer. You can select the describing pattern using filled or outline to avoid lower layer's pattern is masked.

On the above sample, layer vegetation hide satellite image, therefore, the legend of the vegetation change from fill type to outline, the screen will change like bellow.

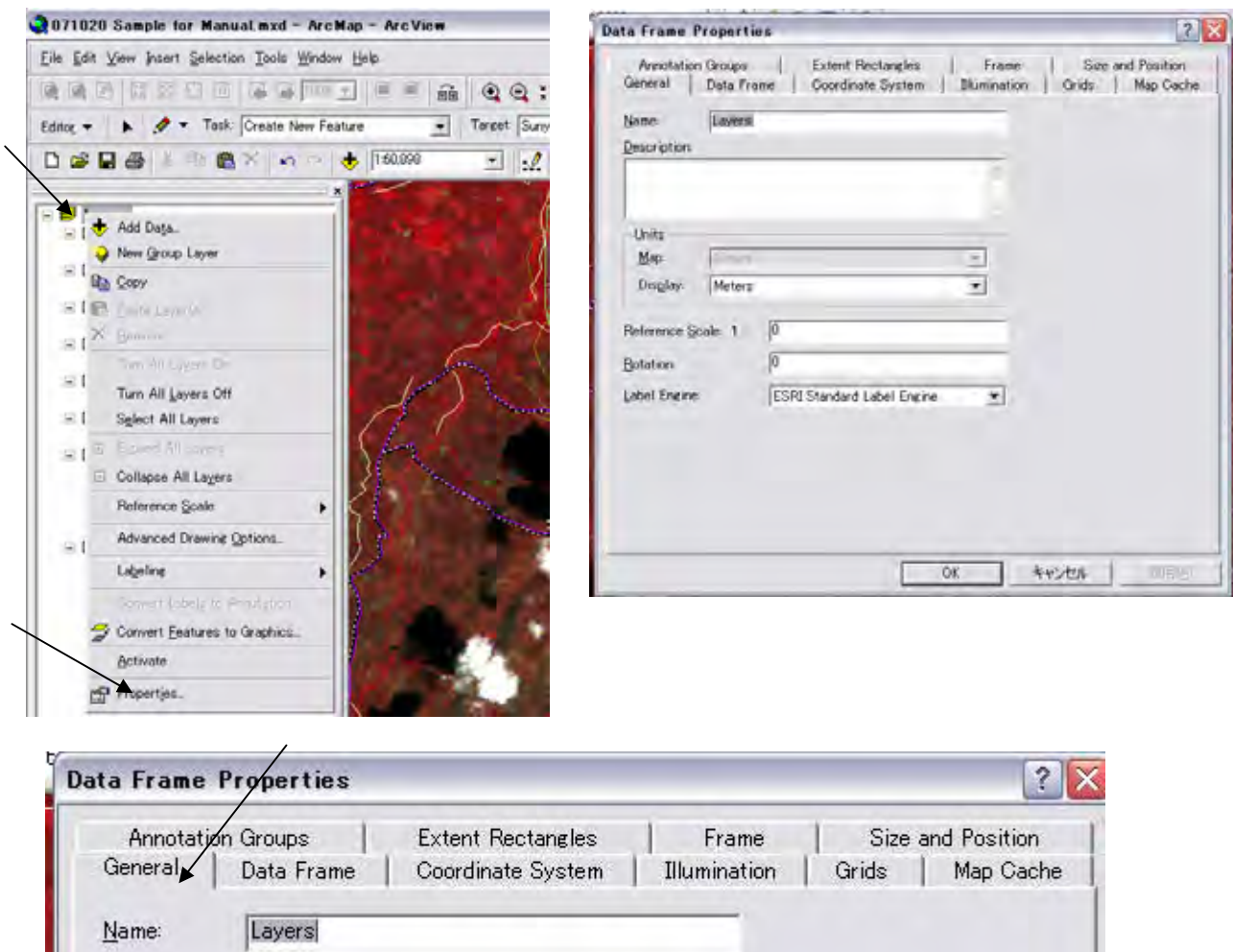


2. Map Property: Set up the map (Meter unit or Latitude and longitude unit)

Map property define the Arc Map unit. If you want to use GPS data, the map unit shall set Degree Munits Second system may need. Generally mater unit is used.

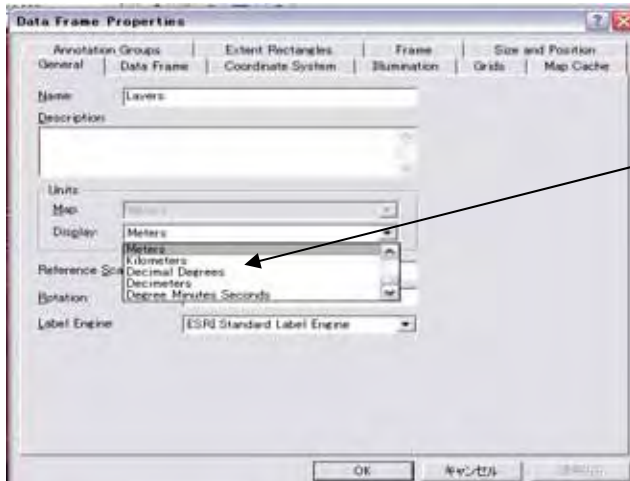
Right Crick  icon => select Property.

(a) General tag and select a unit for delineation (Km, M, Mile, Longitude/Latitude (degree /minutes /seconds or 10 units system)



If you insert GPS data on a layer, you select degree, minutes, second, you can read the carsol position as Longitude and Latitude right bottom of the Arc Map window. Generally, this delineation unit is set as Meter unit.

(b) To use this property window, you can set Longitude and Latitude line (grid) shall write or not on the map Layout window.

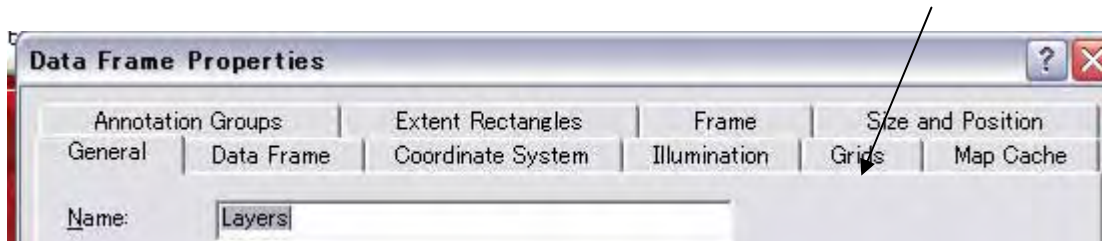


General: map delineation unit (meter or degree of Longitude and Latitude



A sample shows map delineation unit. Left is meter unit, and right is degree right bottom side of the indicator shows the point your cursor put on the map.

(b) Grid tag

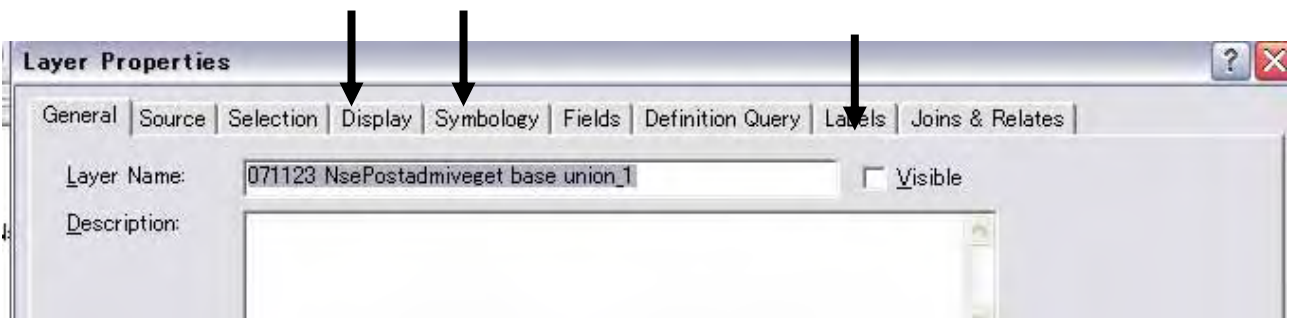


This tag control grid map on the arc map of layout view. The explanations can be seen later.

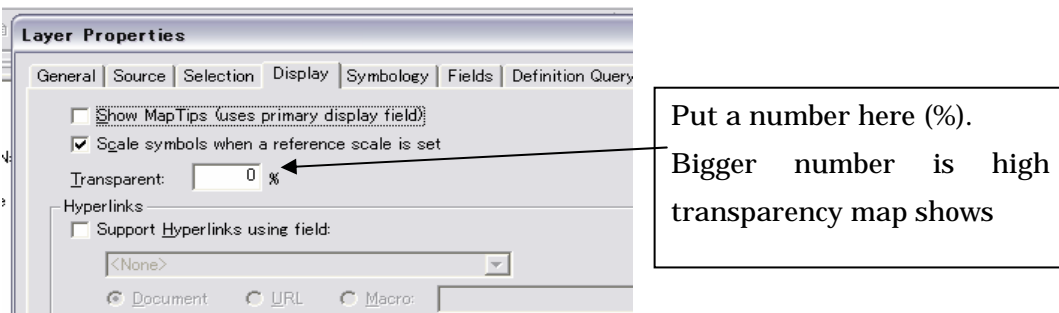
3. Layer property (Defining Symbol/Legend, degree of transparency, Leveling, Grid on Map)

Layer property window control map describing pattern of the Layer such as symbols for deferent characters, add data label on the data table field, transparency level to see the under layer's characters,

Call Layer property (put the casol on a layer file on the left side of the Arc Map. And right crick on your mouse. A following window will come.



To use display, you can control a layer in transparency to show a lower layer masked (to set %).



To use Symbol tag, you can select Legend items related to the data table of this layer.

And if you select Label tag you can select Labels to every polygon related with field of the data table of this layer.

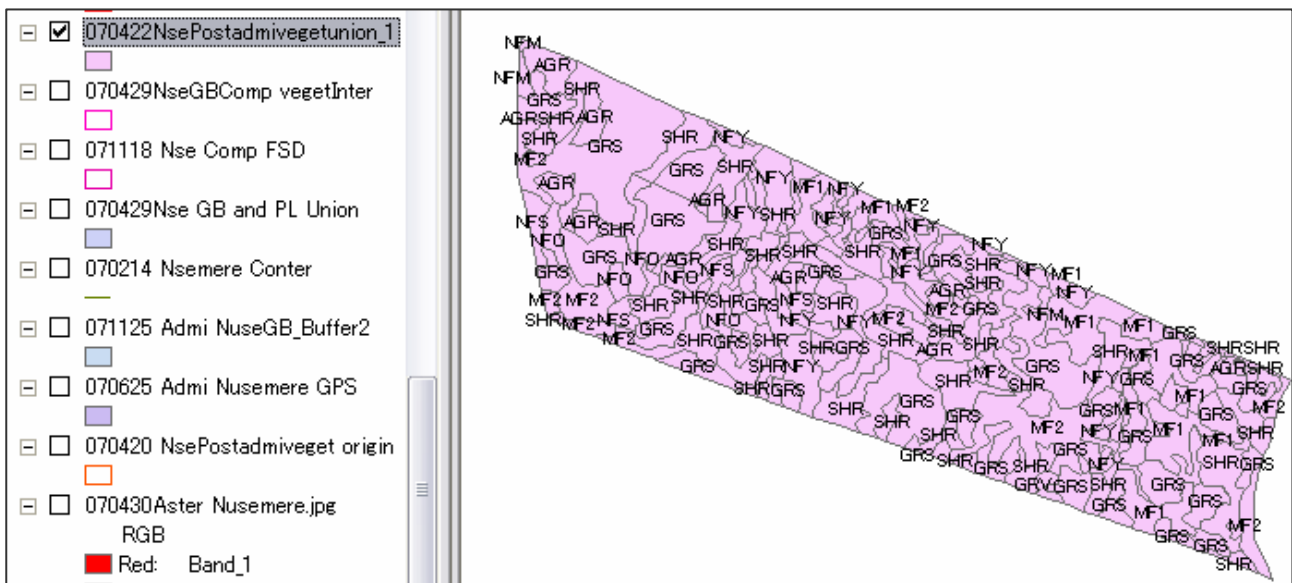
4. Legend/Symbol management

Symbol can set single or categorized on a field on the data table. If you stored for example a column named “Forest type” several codes such as man made forest, natural forest, grass land, farm land, you can show these categorized areas with different colored or patterned areas.

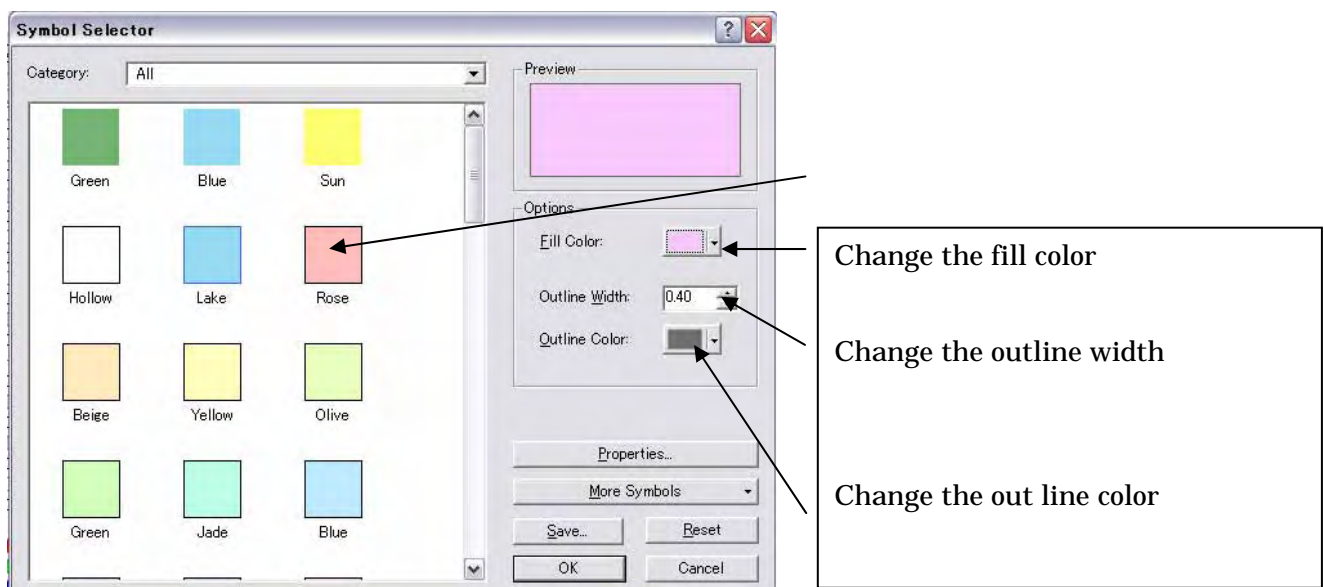
Symbols is generally on first looks below. Color pattern is single.

The single color change is done below process.

Double crick a legend mark => Crick a color pattern within the list of Symbol Selection window.



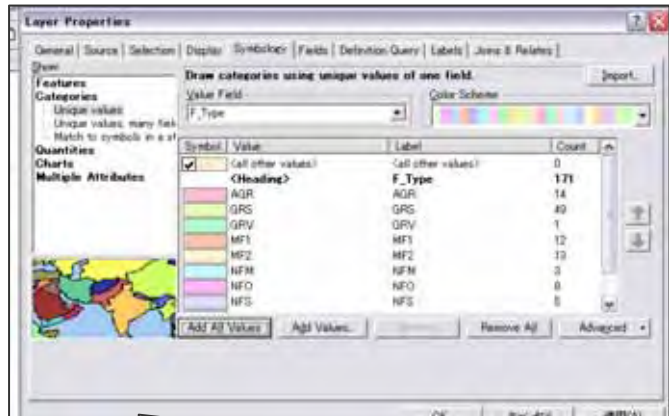
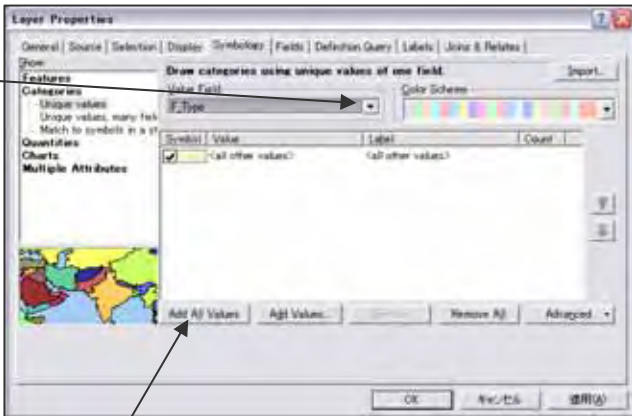
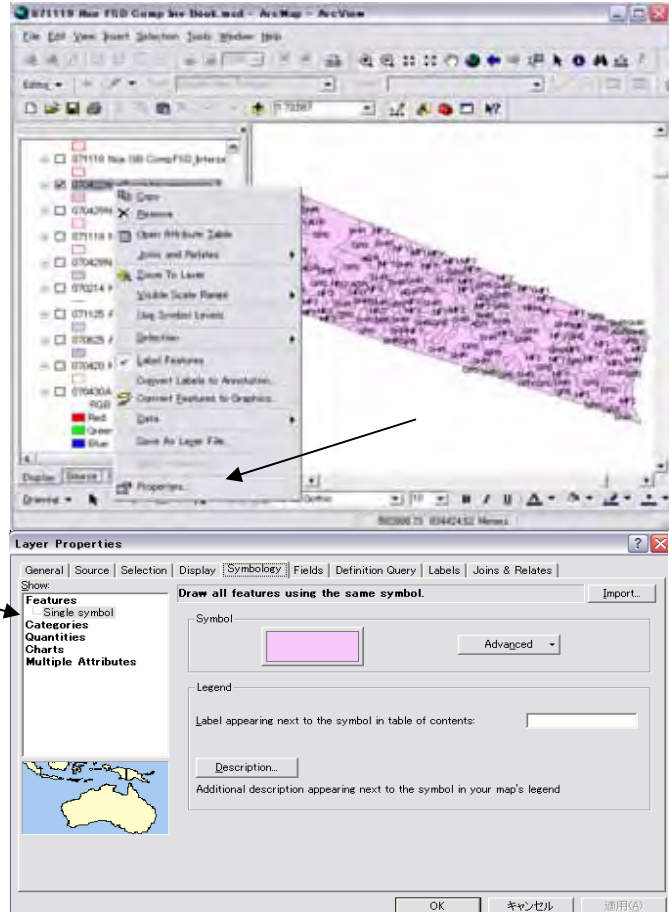
Symbol Selection window.



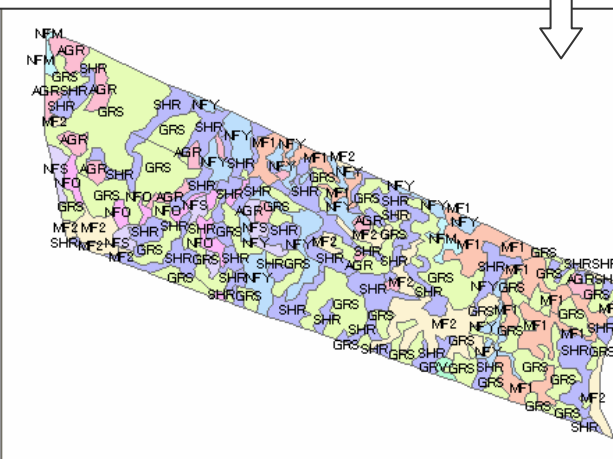
Symbols using multi color

Open layer property => Crick Symbol Tag
 => Crick Category => Set Field (F Type)
 => Crick Add all value

Change symbols one by one on your choice.



- 070422NsePostadmivegetunion_1
 - <all other values>
 - F_Type
 - AGR
 - GRS
 - GRV
 - MF1
 - MF2
 - NFM
 - NFO
 - NFS
 - NFY
 - SHR
- 070429NseGBComp vegetInter
- 071118 Nse Comp FSD
- 070429Nse GB and PL Union
- 070214 Nsemere Center

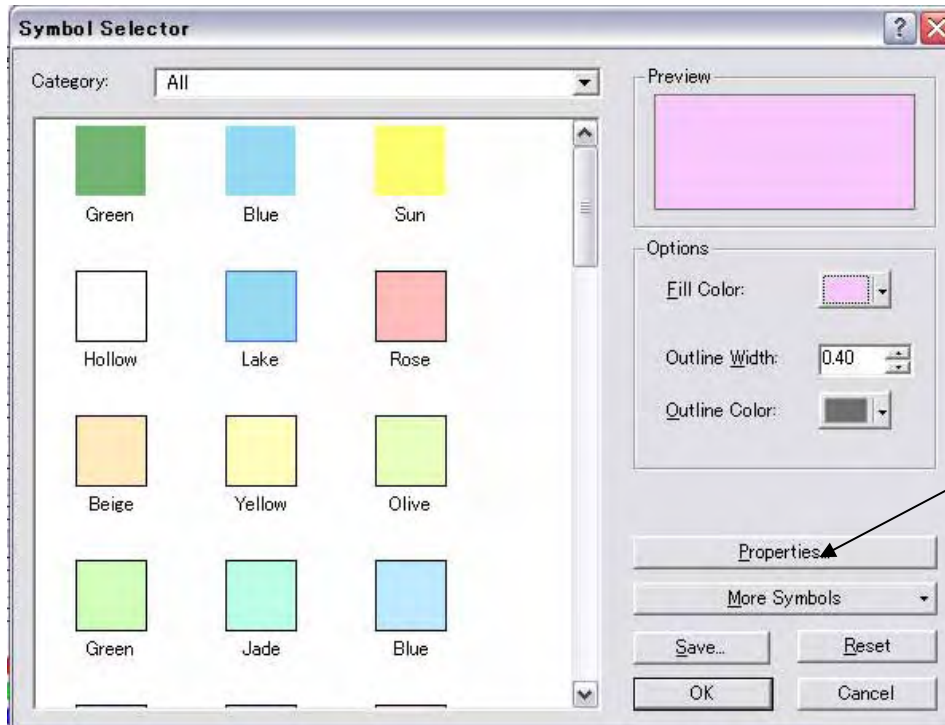


How to make symbols by your special patterns

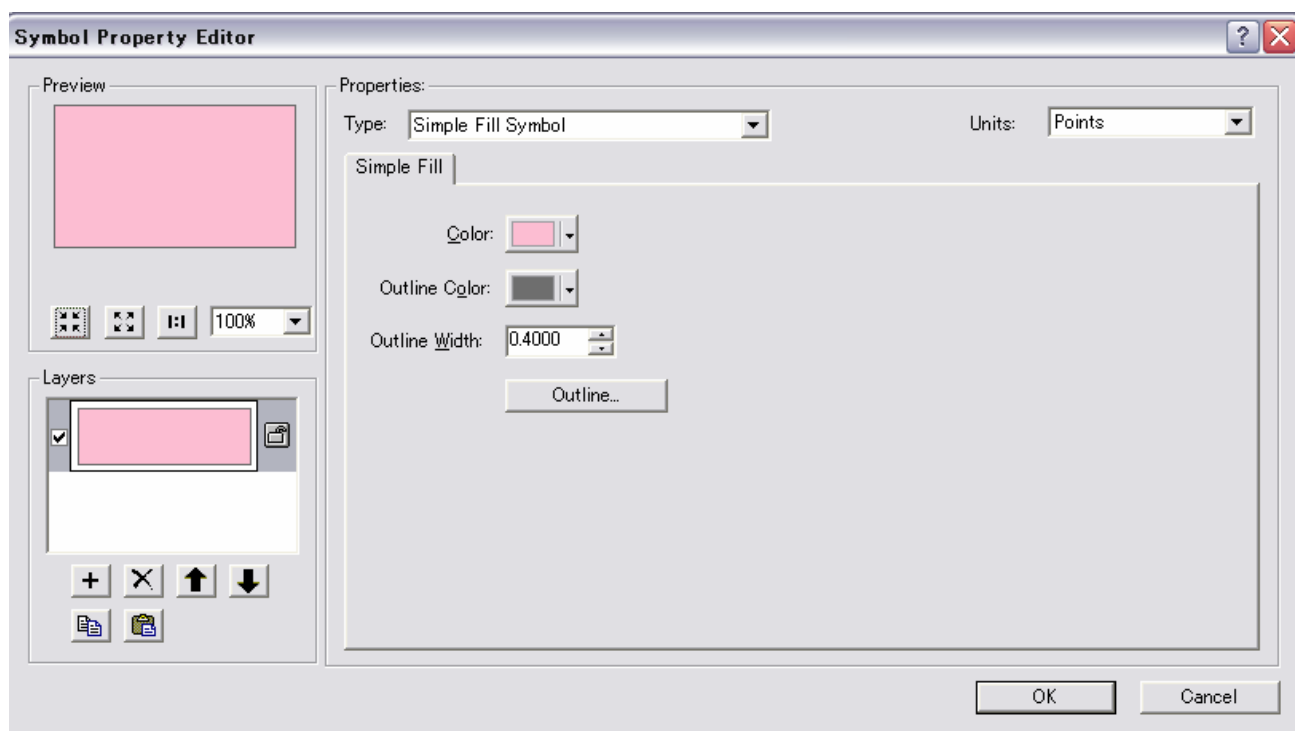


Little complicated pattern making procedures are follows:

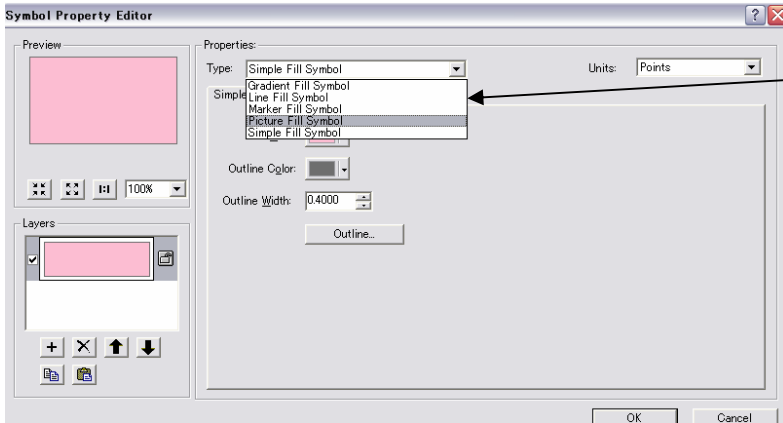
Crick Properties tag on the Symbol Selector window.



“Symbol Editing” window below will come.

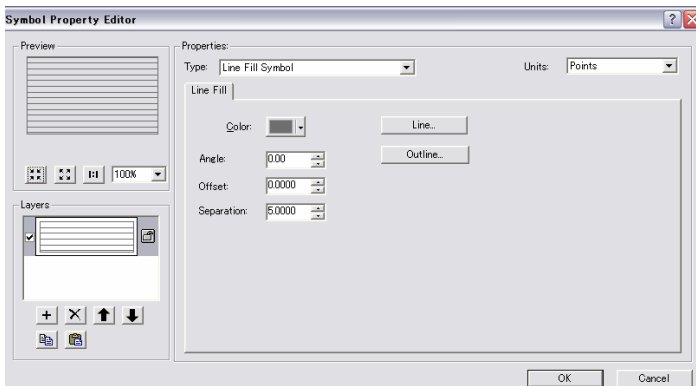


Case on line fill symbol

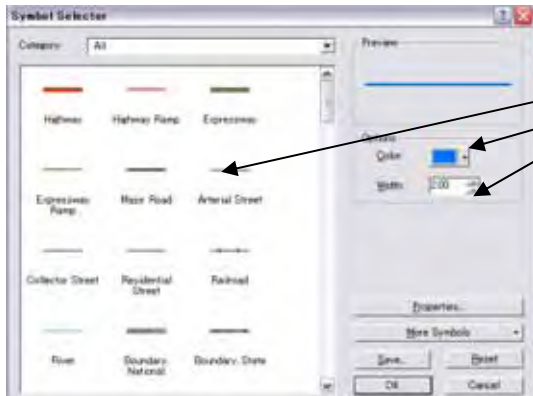


- a. Gradual fill symbol
- b. Line symbol
- c. Marker symbol
- d. Picture fill symbol
- e. Simple fill symbol

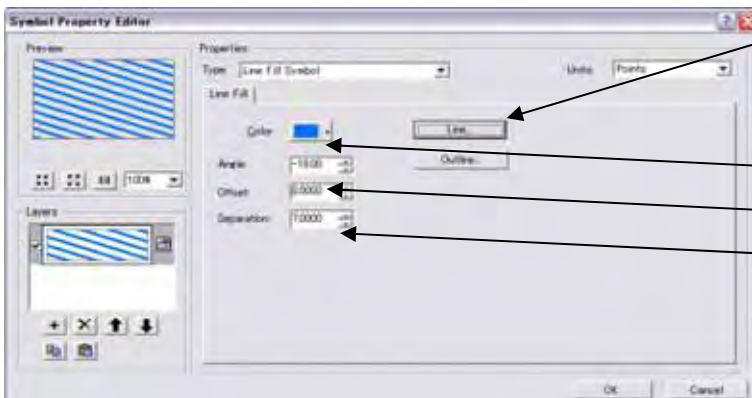
Select Type on line symbol



Line symbol can control line angle, line width, line pattern,



When you click line symbol selection window will come. Select line pattern within the list. Set line color and width.

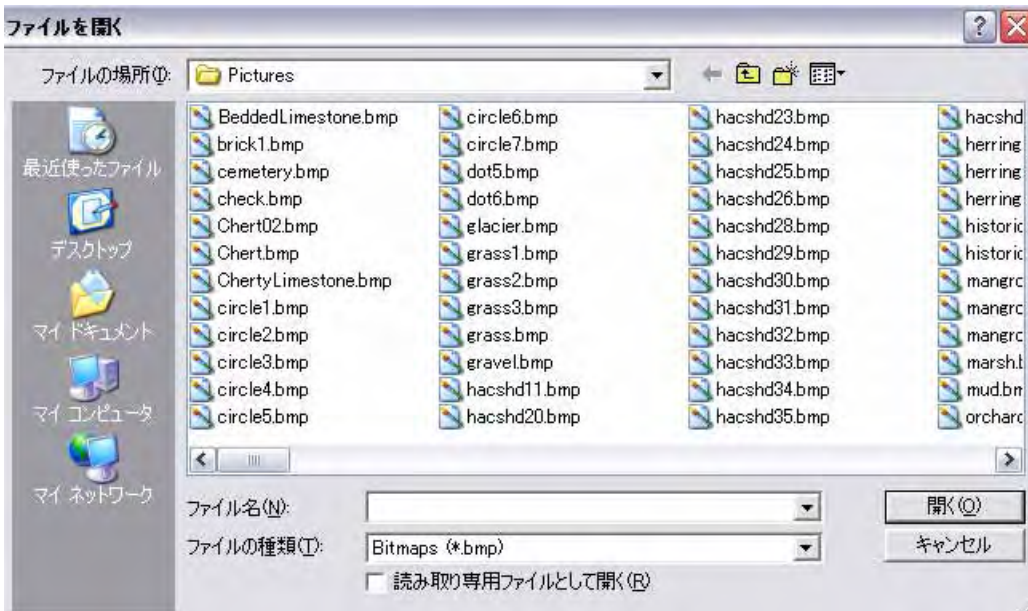


Line -> Set the line pattern (Dot line, Simple line, etc.) and Width of the line.
Color -> Select color of the line
Angle -> Choice the angle
Separation -> Set width between lines

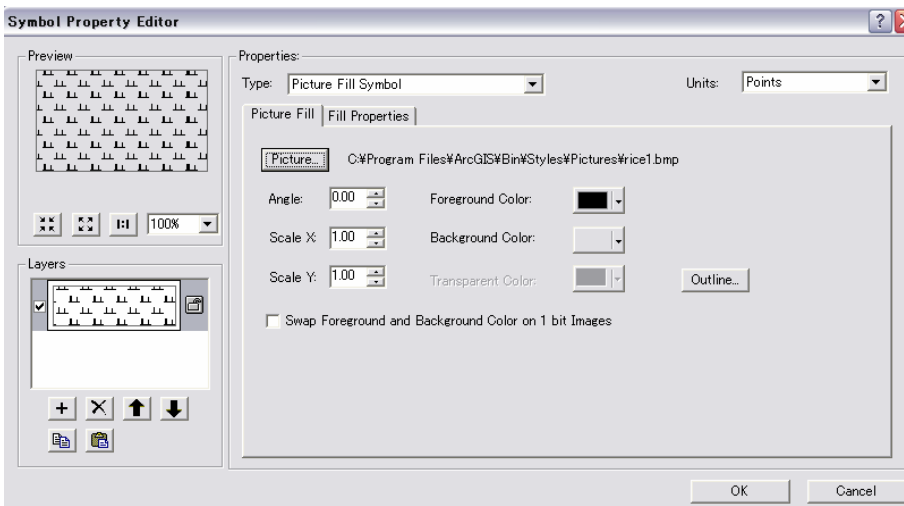
Case on picture symbol



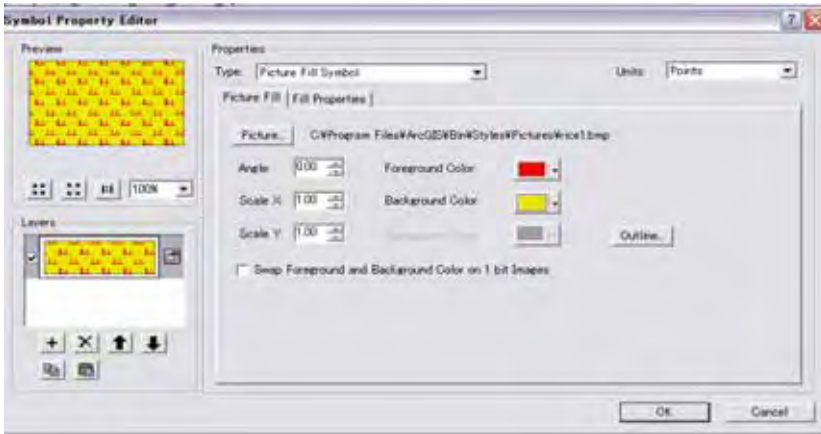
Set type for Picture fill then crick Picture button. Then select a bmp file.



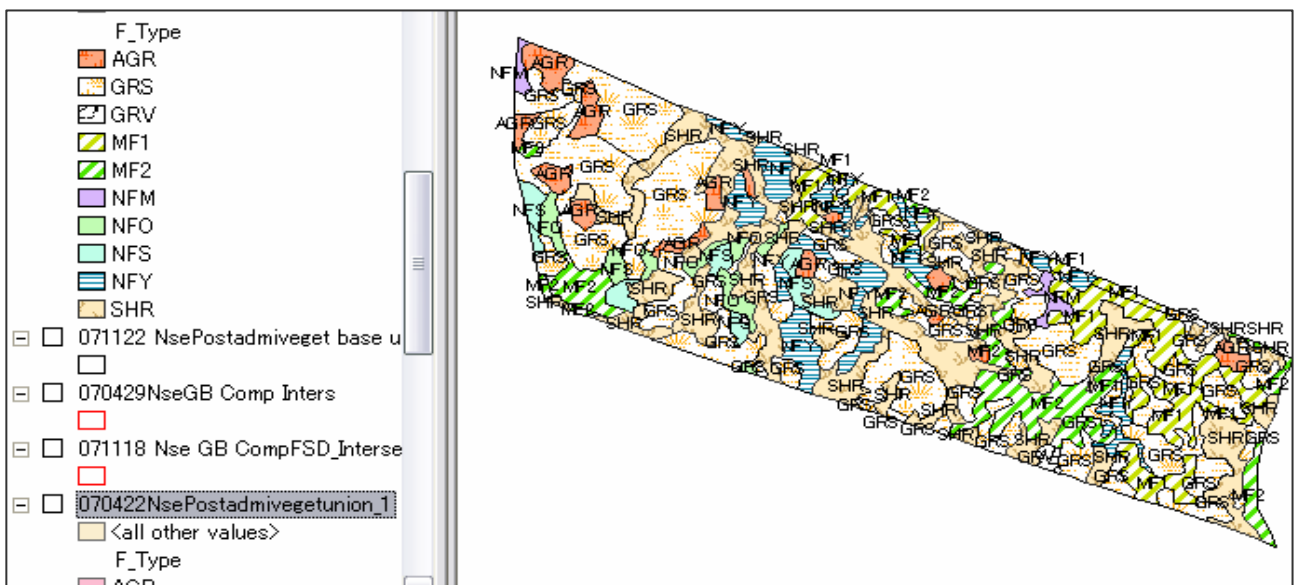
Picture selection window will come, then select a pattern file, then open.



Following pattern was selected, then select picture's color, color of background.

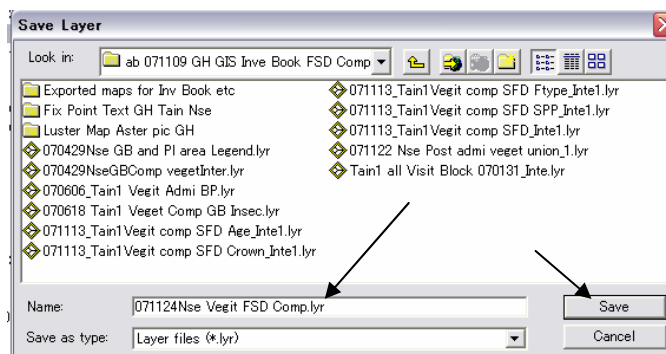
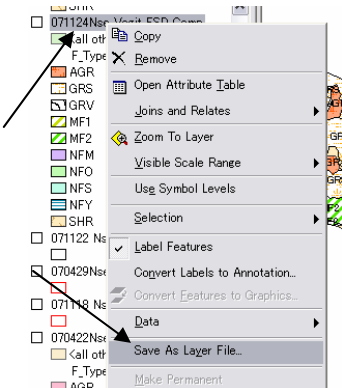


A new pattern sample made is bellow.



Then repeat above processes for every patterns. The final Arc map made is below.

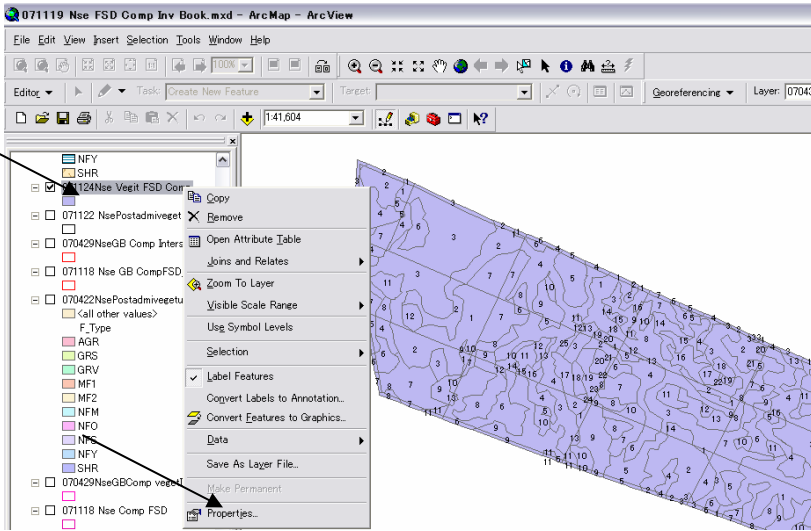
The Legend pattern making process is complicated. Every time you change the Arc Map on a layer (This layer have fields you can make deferent Map using deferent field such as age, species, crown density, etc.) is troublesome, nevertheless, after the Map legend changed, you may want to write F Type again. The pattern can save and recall as layer file. So author advice you to save every legend pattern before changing legend pattern. Process is as follows.



Saving

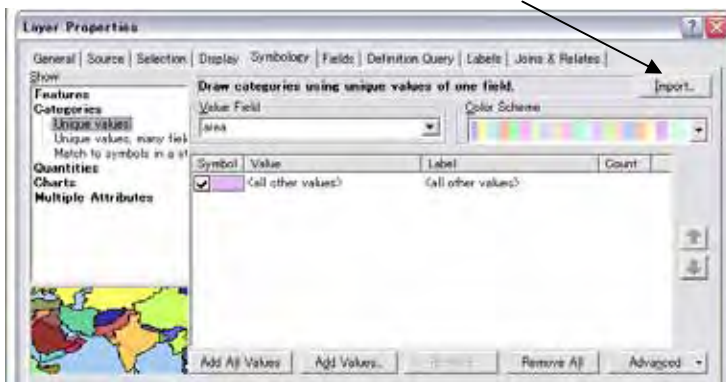
- a. Crick layer name
- b. Select Save the layer file
- c. give a name of the file
- d. Crick Save

Recalling the saved layer file

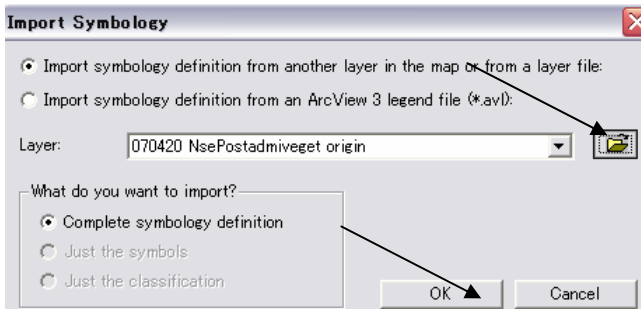


Right Click the name of layer => Crick Property.

Layer Property windows bellow will come.

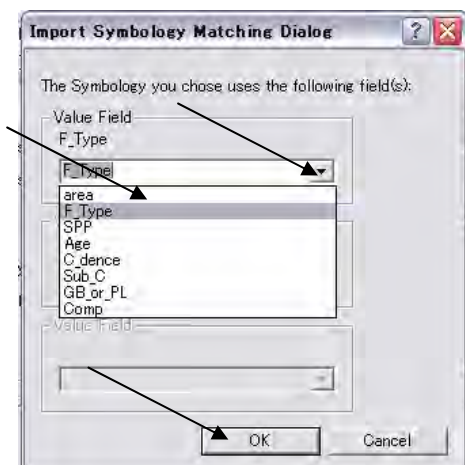
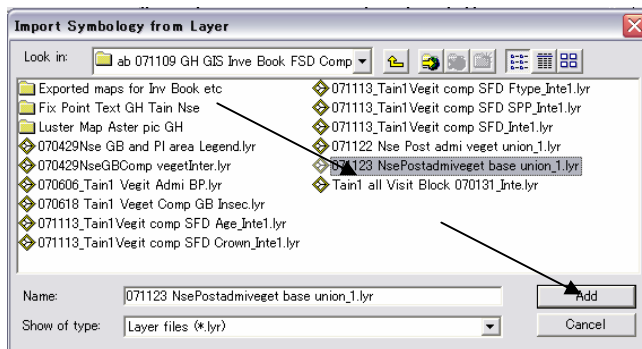


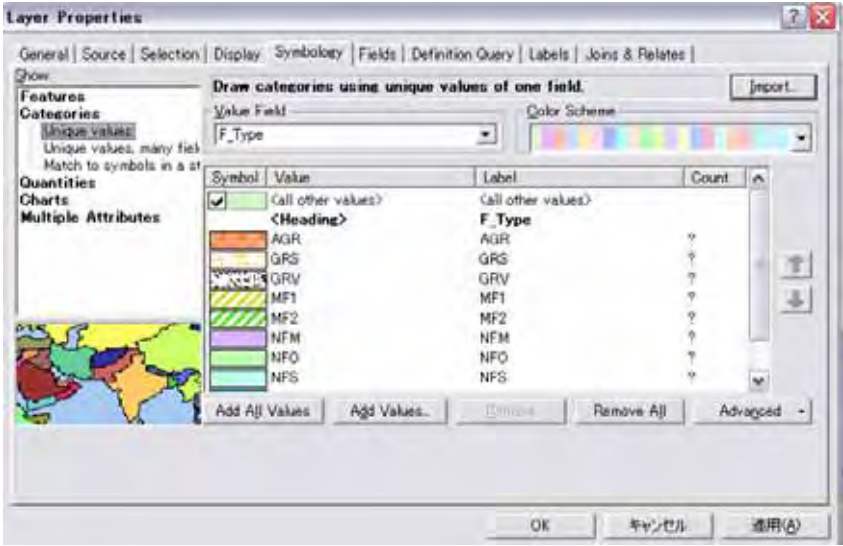
Crick "Import" then next window "import symbology window come.



Crick file open button. And select a layer file that was stored as the "F type" legend and crick "Add".

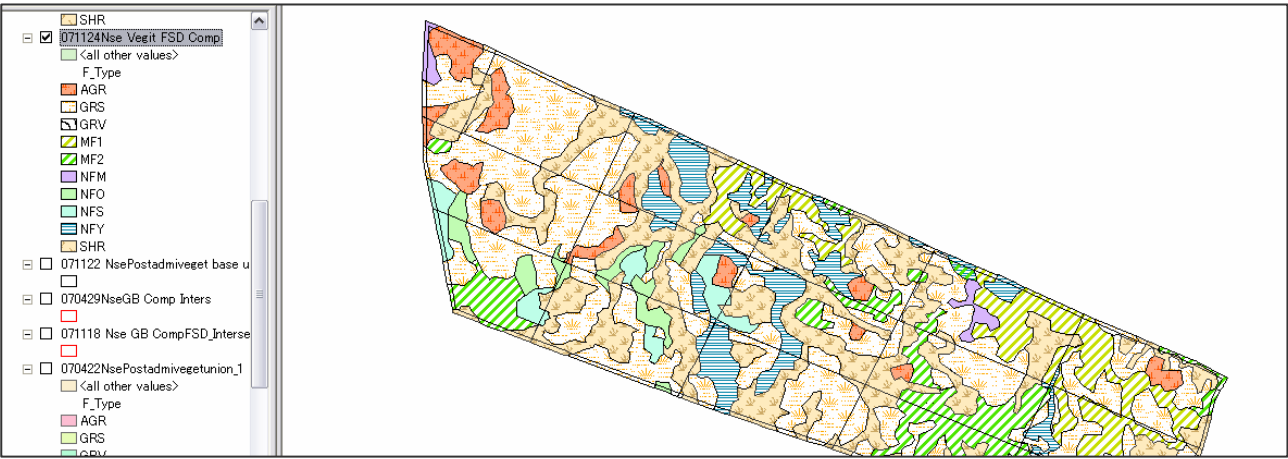
Then select F type on the Import Symbology Matching Dialog window (F Type)" and crick "OK".





The layer property window will change the same pattern that you stored before.

Then Arc Map will recover to the same legend as you made before.

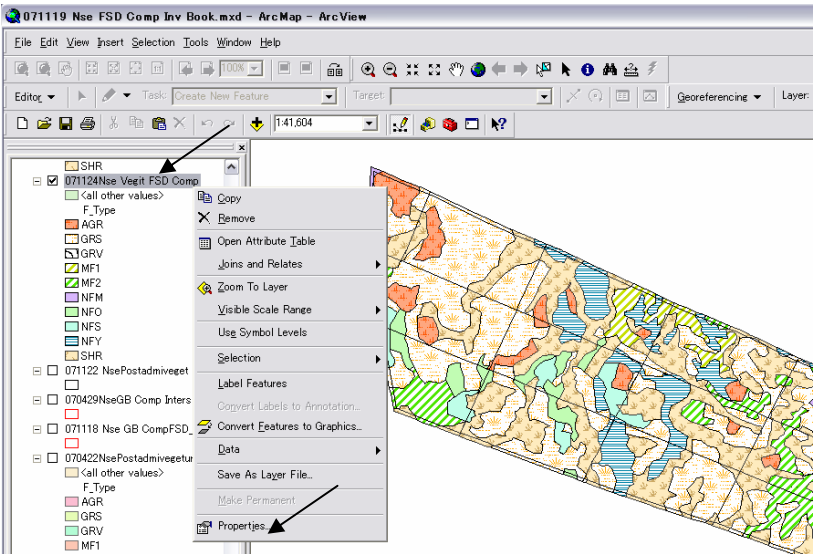


5. Label management

Label for each polygon of the layer can set based on the value/text of a field or fields.

Open layer property window and select label tag.

After cricked the Label tag Layer property window will change to the label page below.

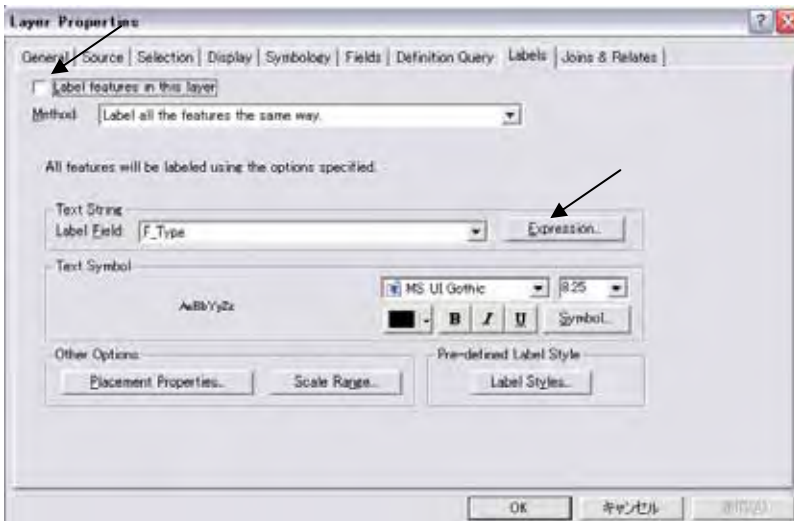


For single label case

Select a field from pull down list on right side of the Target String Label Field column (F_Type).

Decide color, size of Text Symbol.

Then give Mark on the label feature in this layer.



For multi label case

Click "Expression" button on the Layer Property window.

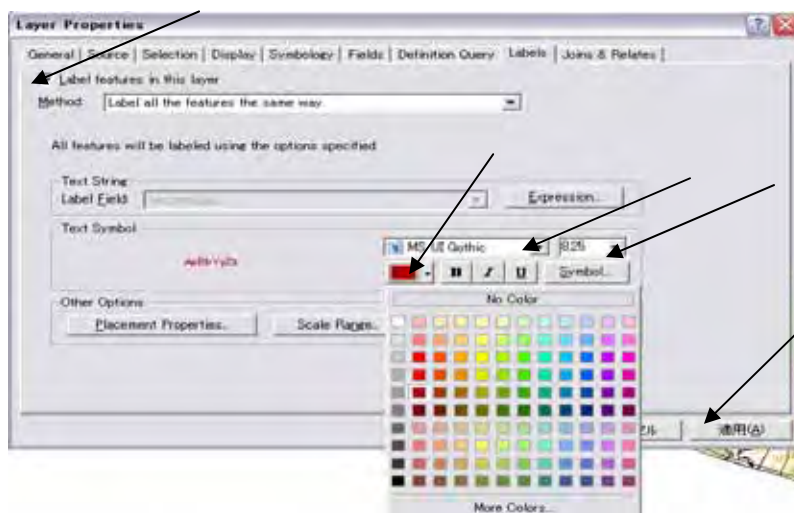
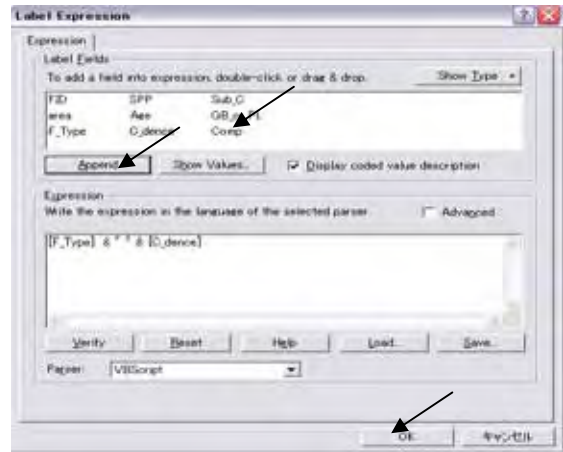
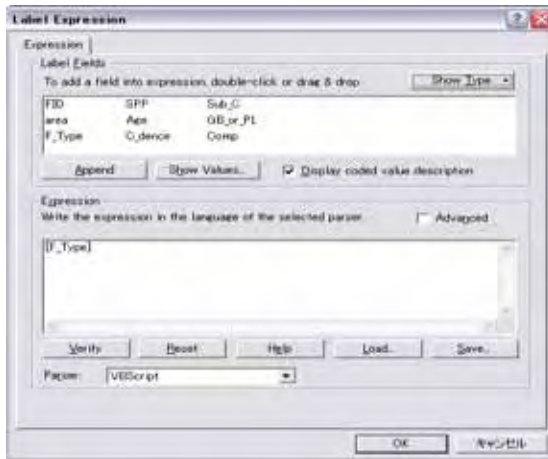
Then "Label Expression window will come.

Select a name of the field add for second label with "F_Type" for example Crown density.

The multi label field names are connected "&" "XX"&" , if you give some mark such as "_#" the label will be written as "MF2_#60" (F type is Man made forest 2, crown density is 60%)

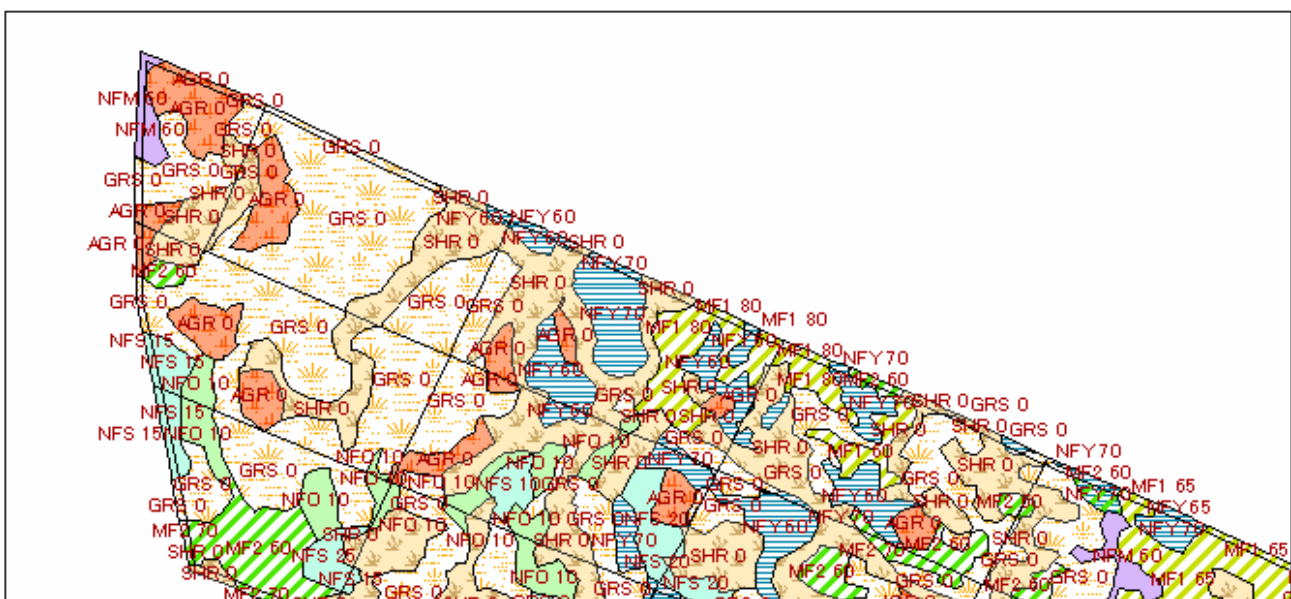
Select label color, text type and size, then give mark on Label features in this layer.





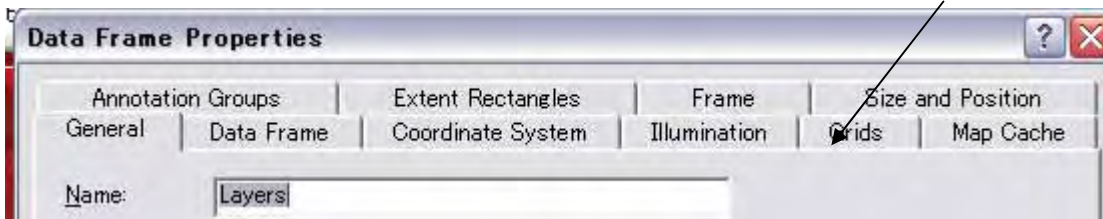
Click apply button.

The Arc Map will change below.



6. Data table management

The layer has data table. Right click your mouse on a layer name.
And click Table icon within the pull down menu.



A table will pop up on your computer.

属性 : 070216NuseCompGB Vegit

FID	Shape*	Area	Com ID	Sub_C	F_Type	SPP	Age	C_dence	GBPL
0	Polygon	12630	5	1	NFY	Other	8	70	GB
1	Polygon	7245	5	7	MF1	Teak	8	60	GB
2	Polygon	1596	5	3	SHR		0	0	GB
3	Polygon	12452	5	2	MF1	Teak	8	60	GB
4	Polygon	3035	5	5	NFY	Teak	8	10	GB
5	Polygon	12395	5	4	MF1	Teak	8	70	GB
6	Polygon	2795	5	6	NFY	Teak	8	10	GB
7	Polygon	11494	9	14	GRS		0	0	GB
8	Polygon	6200	9	15	SHR		0	0	GB
9	Polygon	19177	9	13	SHR		0	0	GB
10	Polygon	11876	9	16	NFS	Other	65	20	GB
11	Polygon	2684	9	11	SHR		0	0	GB
12	Polygon	3731	7	11	GRS		0	0	GB
13	Polygon	12428	7	12	SHR		0	0	GB
14	Polygon	30972	8	8	GRS		0	0	GB
15	Polygon	3764	8	7	SHR		0	0	GB
16	Polygon	8236	8	9	SHR		0	0	GB
17	Polygon	14207	8	2	SHR		0	0	GB

レコード : 1 / 300 選択されました

SID: Polygon's number given automatically by the computer.

Shape: shows the polygon is line, point, or polygon.

Each vertical columns called as "Field". Field store a set of data that defines each polygon character or cord such as area, age, planted year, clown density, etc. You can add any category for defining the polygons, and make maps based on the category divided in a field.

If you want to add a field, first stop the editing condition, then click "option", then select "Add new field" on the pull down menu coming.



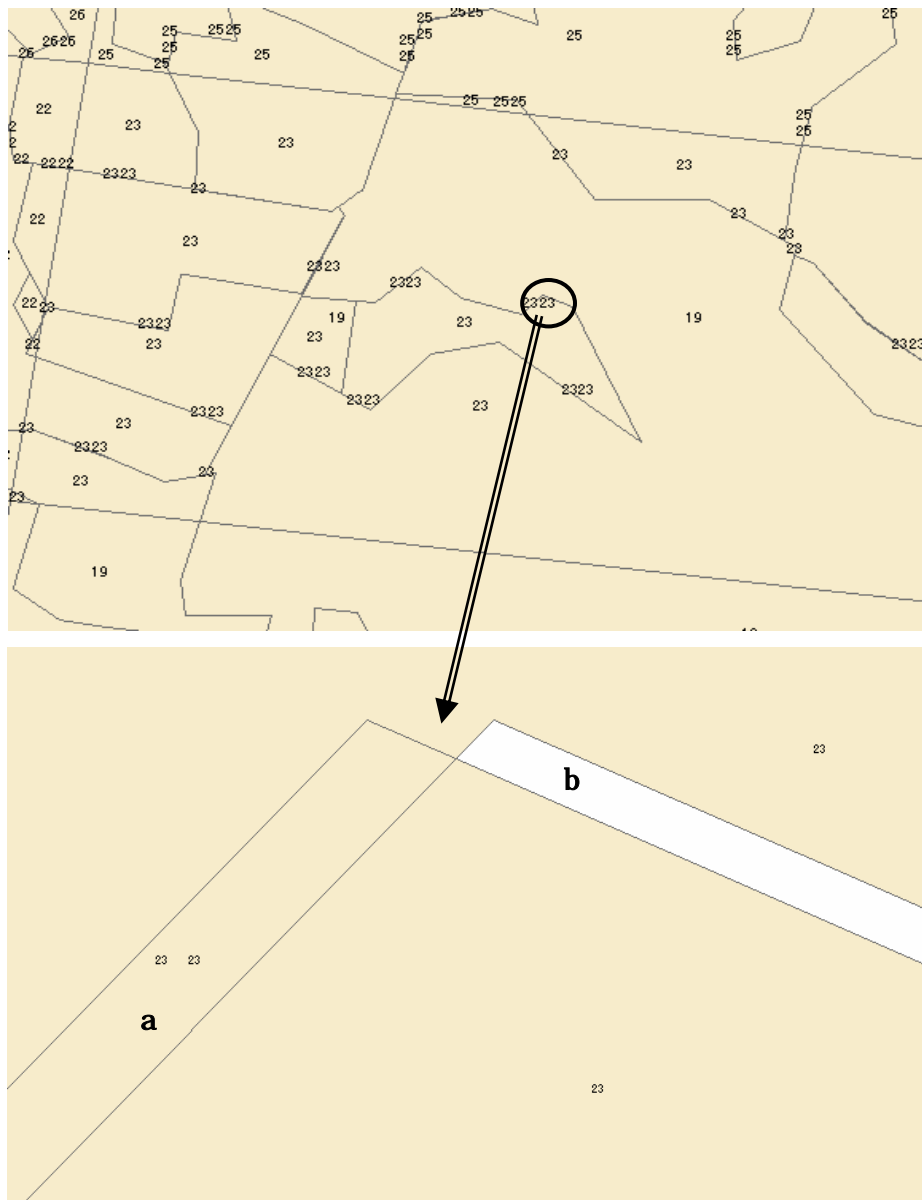
New field defined window come. Type a. Field name, then select the field character within the pull down tag list that text, number (short integer or Long integer), and number of figures.



7. Fight to Bags (Clean up the Gaps and duplicate between polygons)

After the geo-processing (Intersect) compartment layer and vegetation layer you found may found so many small polygons, one polygon separated several parcels lines. Call attribute table of the new layer intersect had done. And calculate area, then, sort from small to big. The table shows so many polygons with area "0". These polygons mean that "Their are Bags". This phenomena occurs in several reasons such as the vegetation polygons and compartment polygons itself having some gaps or duplications (small spaces are remain between adjoining polygons), computer makes small differences rounding the corner of the polygons position the make small position gaps.

Following figure shows bags by giving label to every polygon. This figure shows vegetation polygon intersected to compartment polygon and gives label for compartment number. Compartment numbers arise on several polygons outline. It means there are tow small polygons in visible (too small). Zooming in the place, you can find the hidden polygons as below.

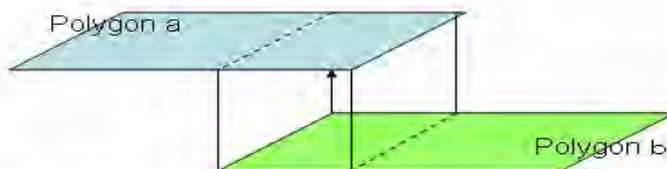


Following attribute table shows so many bag polygon had created through the intersect process.

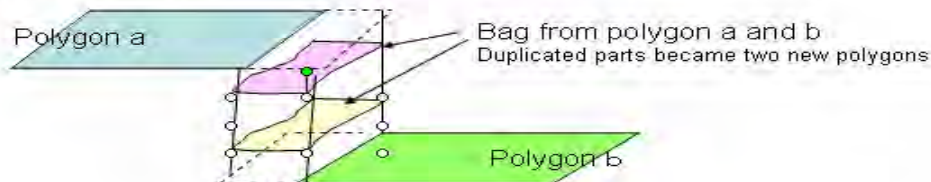
FID	Shape*	area	GBPL	ID.Forest	Species	Age	Crownde
85	Polygon	0	GB	NFS	Other	0	
537	Polygon	0	GB	SHR	Other	0	
540	Polygon	0	GB	NFS	Other	0	
541	Polygon	0	GB	GRS		0	
544	Polygon	0	GB	MFO	Teak	4	
545	Polygon	0	GB	GRS		0	
555	Polygon	0	GB	GRS		0	
556	Polygon	0	GB	MFO	Teak	4	
557	Polygon	0	GB	GRS		0	
562	Polygon	0	GB	AGR		0	
563	Polygon	0	GB	GRS		0	
573	Polygon	0	PL	SHR	Other	0	
579	Polygon	0	PL	GRS		0	
580	Polygon	0	PL	NFM	Other	65	
581	Polygon	0	PL	GRS		0	
582	Polygon	0	PL	MF3	Teak	28	
588	Polygon	0	PL	NFO	Other	0	
589	Polygon	0	PL	NFO	Other	0	
590	Polygon	0	PL	AGR		0	
591	Polygon	0	PL	NFM	Other	65	

In case a., the polygons of vegetation layers have small duplication between tow adjured one. The compartment polygon had divided into tow vegetation polygons and small space as a polygon for each; therefore, duplicated part had recognized a polygon divided from right side vegetation polygon and from left side vegetation polygon just on the same place.

Original situation



After intersect

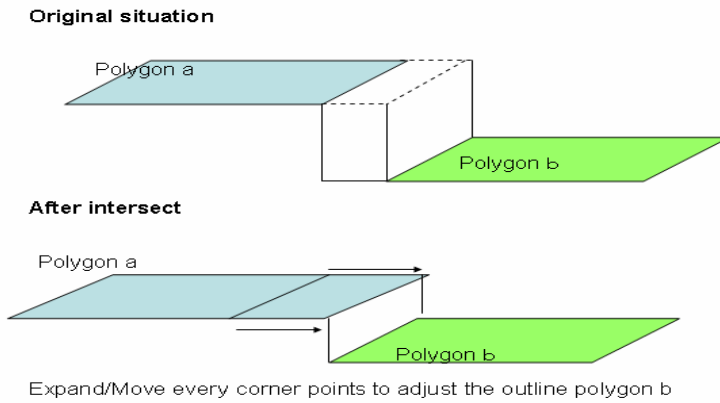


The clean up procedures are follows:

- a. Under the editing condition, and target set to the new layer created after the intersect command had done.
- b. Calculate areas for the field “area”.
- c. Give label to every polygon using a layer property command (label) (compartment number).
- d. Zoom in the arc map on the place probably bag polygon existing.

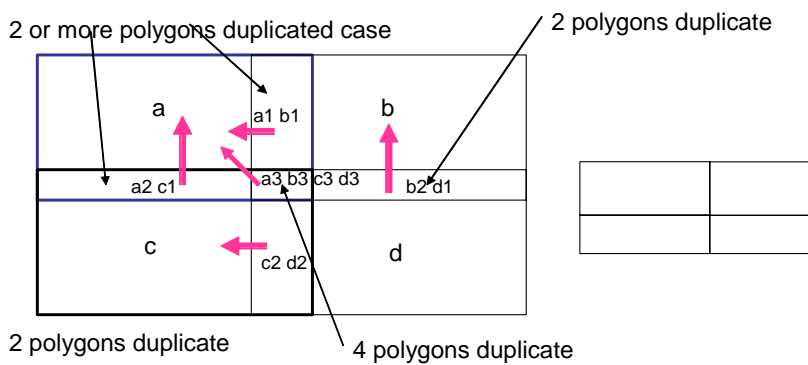
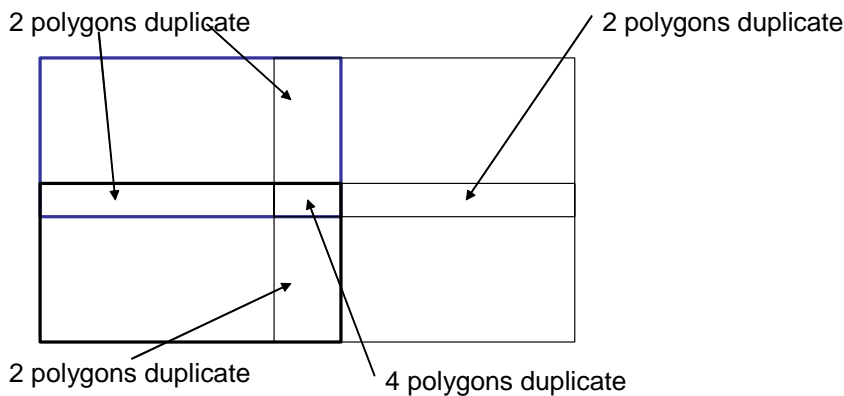
- e. Select a small polygon and an adjoined polygon (The out line color will change showing selected condition).
- f. Click Edit => click Merge => OK on merge control window.
- g. Zoom out the arc map and move to next (repeat d. to g. Be patient for complying the work for fighting to bags).

In case of **b.**, the polygons of vegetation layers have small gap (vacant place) between tow adjoined one. After the intersect, the vacant place remaining as vacant place.

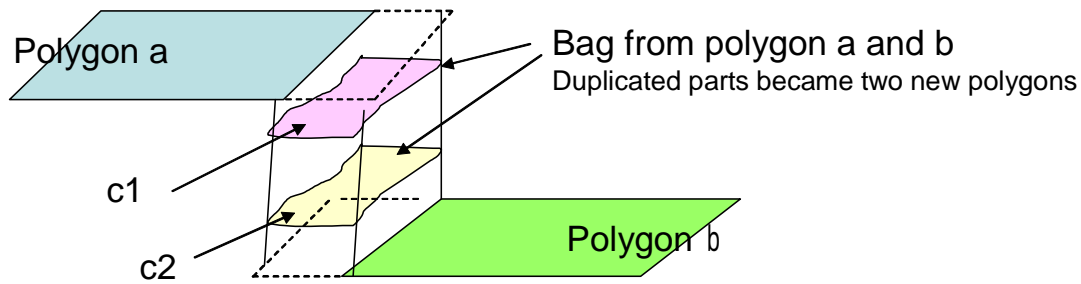


How to treat some more complicated case?

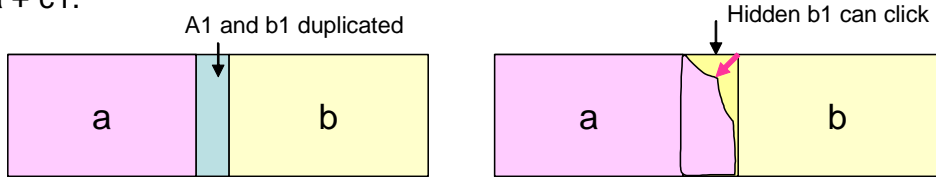
Complicated pattern for bag clearance



1. Select a and a1 then merge
2. Select b1 and a+a1 then merge
3. Repeat to b c d for 2 duplicated parts
4. Select a3 and a+(a1+b1)+(a2+c1) then merge
5. Repeat for b3, c3, d3

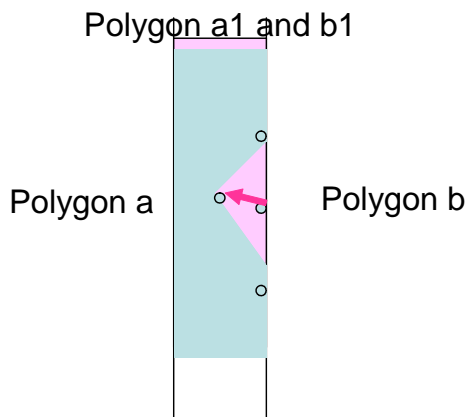


After the polygons a and c1 selected and merges, you field difficulty how to select Polygon c2 because the polygon c2 located just under the merged polygon a + c1.



Corner of the polygon of a+a1 shall move inside area of B1. Then select a+a1 and b1, merge the tow

In case you can not find a corner, you make new points on a+ a1 outline. And move the new point to inside area of b1, you can select b1.



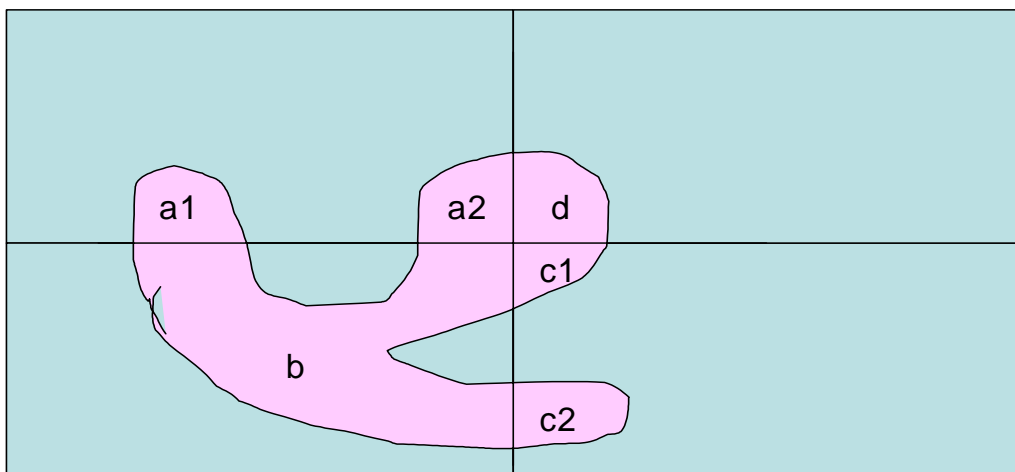
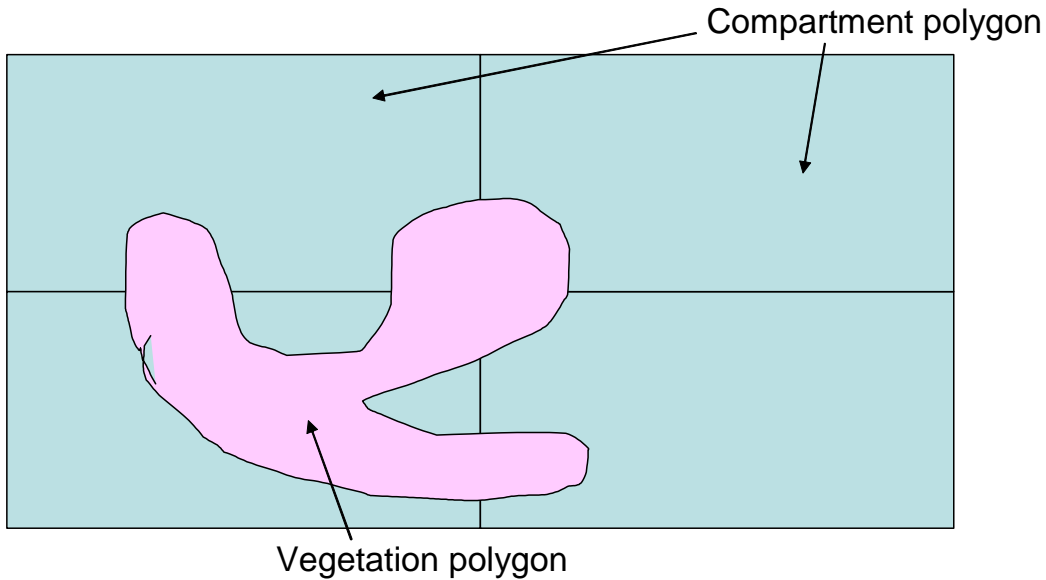
New point making

- a. Under the editing condition
- b. Takes to be selected "modify the feature"
- c. Select the polygon a
- d. Put cursor on the outline of the selected polygon
- e. Push right button of mouse
- f. Select "Insert vertex"

Make new 3 points on the outline of polygon a+a1
 Move the middle point to insert area of polygon b1
 Select b1 and a+a1, then merge the two polygons

Case a polygon separated several parts

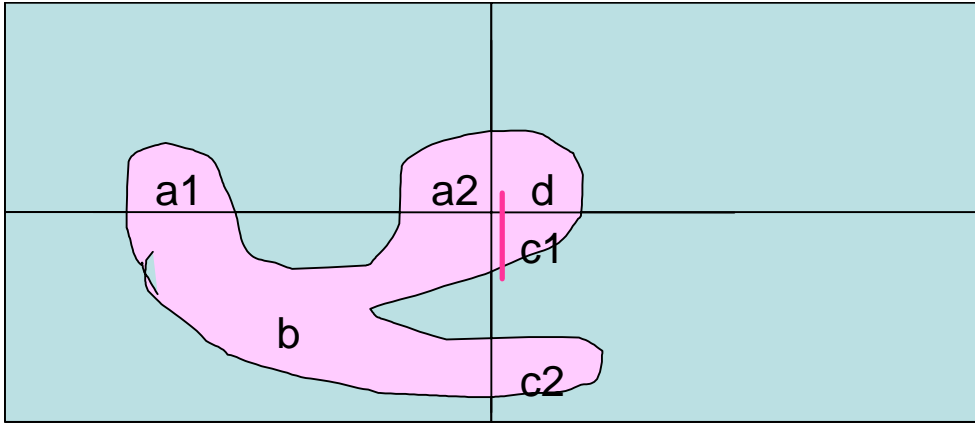
After the intersect, you select a polygon to give the some identification coad such as sub-compartment and find selected polygon arise several places. This occur a polygon vegetation cross compartment boundary on more than 4 points. following situation



The polygon will divided into 6 parts but a1 and a2 are recognizing a polygon. Same as c1 and c2.

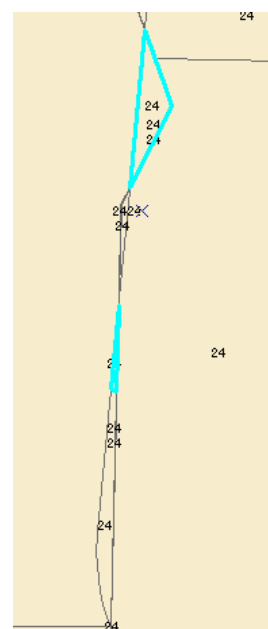
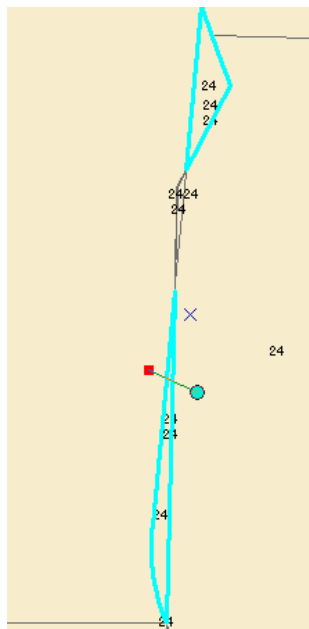
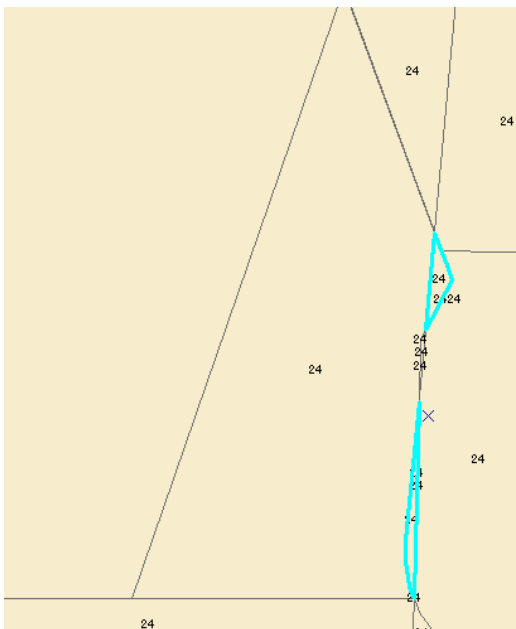
Solution Methods for separation a1 and a2 are

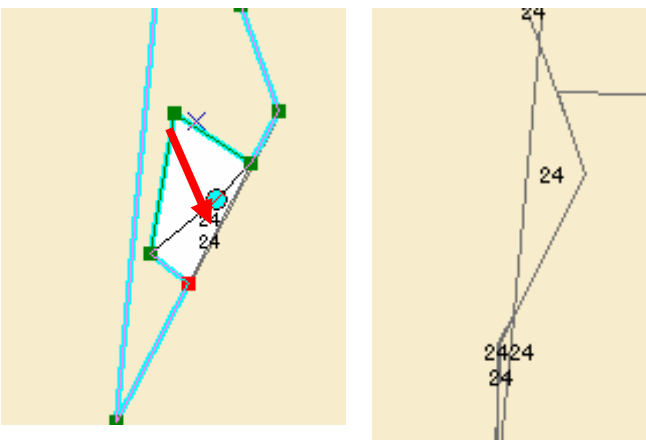
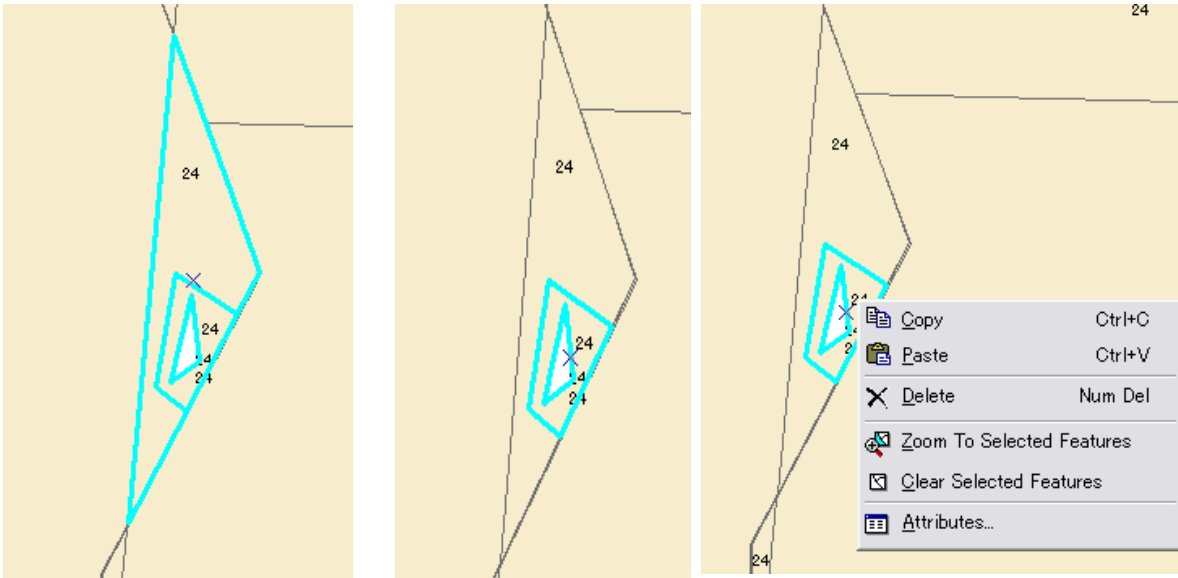
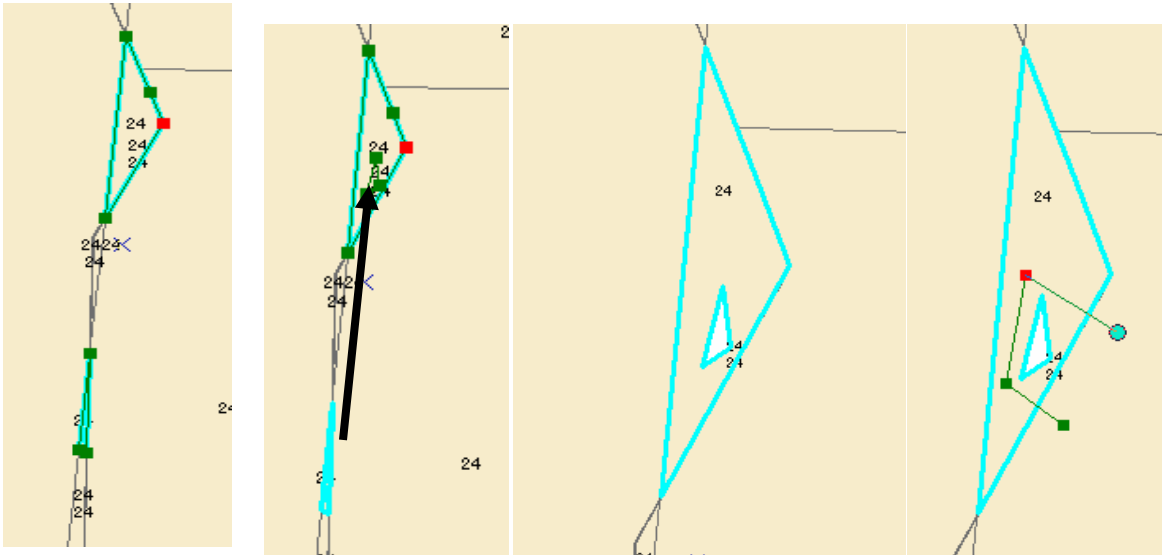
- a. Maerge a1 a2 and b
- b. Divide a merged polygon using edit command "cut polygon"



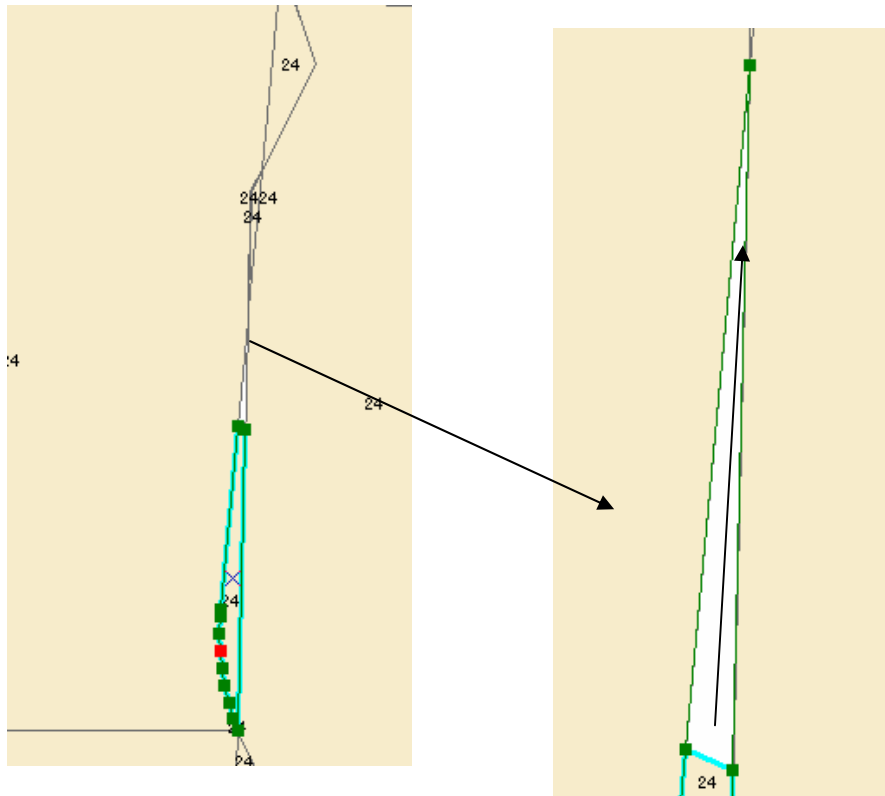
Case C1 and c2 is little bit complicated as follows:

- a. Select c1 (and c2)
- b. Cut the selected polygon then the polygon separated 2 polygons
- c. Change task on edit menu to modify the polygon
- d. Move the points remaining part in old c1 polygon into c2 area
- e. Change task to cut polygon
- f. Cut polygon c2 surrounded part of moved polygon from c1
- g. Click outside point for dis-selection
- h. Click cut area where the moved polygon is
- i. Delete the selected polygon
- j. Change the Task to modify the polygon
- k. Move the point to original position



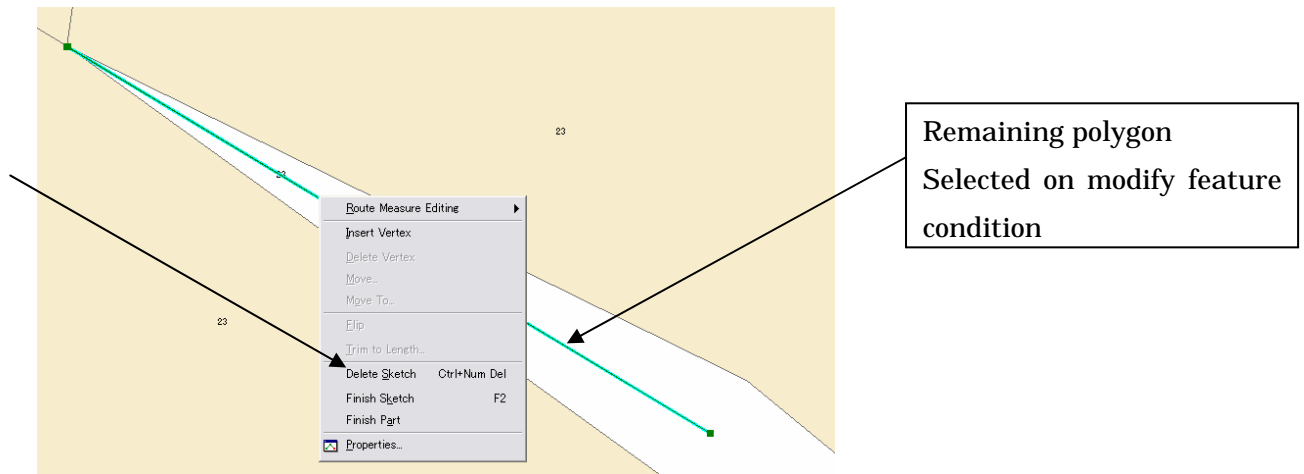


Finally polygon outline of the oposit side also arranged to adjust to filled the moved polygon's space under edit task on modified feature.

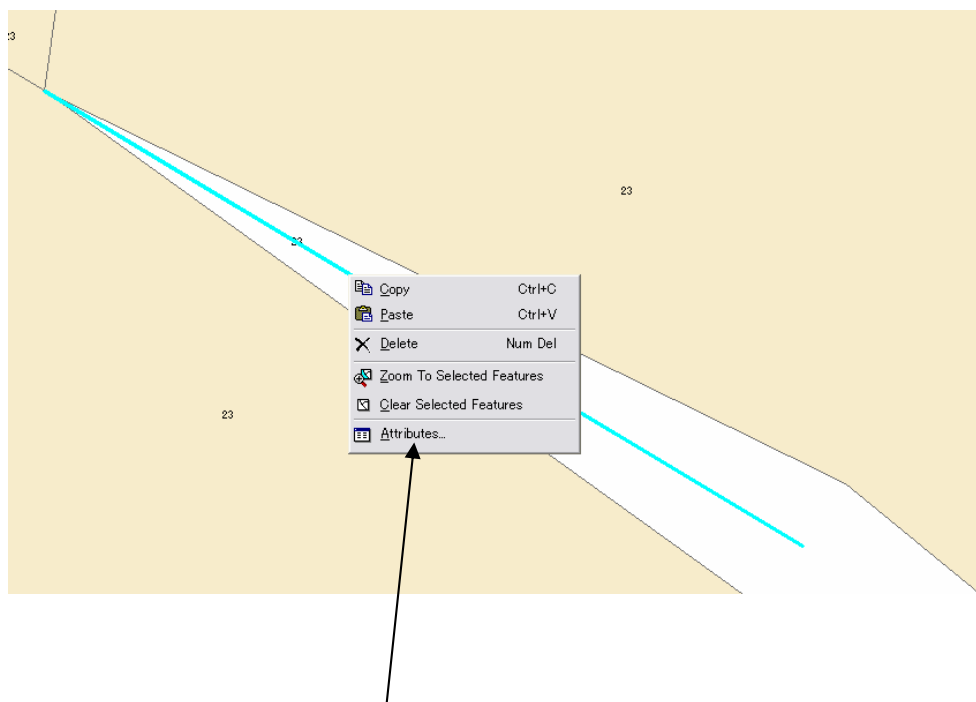


In Case small polygon remaining between two polygons

In some case a small polygon remaining between two polygons like below.

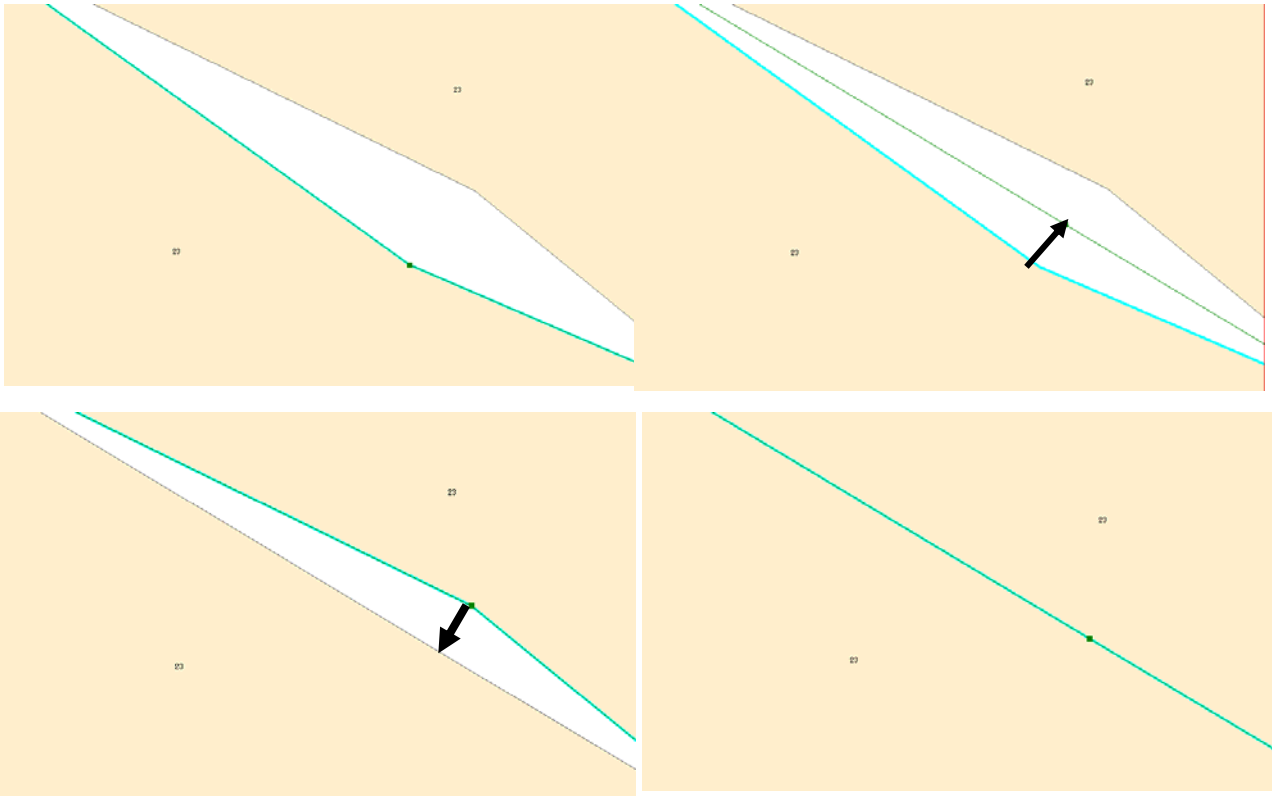


Select “Delete sketch” then arc map automatically change editing task command to create feature and change the map for next figure.



Right click the small polygon and select “delete” within pop-up menu.

Select a polygon under the modify feature task menu. Put cursor on a middle corner point and move it to center position. Repeat same to other side of the polygon.



Section 6 GIS analysis practice for OJT Program

Sample on Nsemere Forest Management Planning

This part shows an example of the GIS training program for GIS Operational training for Forest Management Planning on some Forest Reserve grasping latest forest condition using Satellite Aster Data. Training participants can use sample shape files and can get experiences how the GIS move. The training shall be implemented step by step bases following this chapter shows. Each step details are explained on the previous related chapter.

1. Target of the practice

Make Forest type/vegetation map of the Nsemere forest reserve, and calculate areas of the forest type by compartment.

Data you can use are:

- Satellite TM band 4 on Sunyani area (Luster data)
- Hardcopy topographic map (1/50,000) (Luster data)
- Satellite Aster digital picture (luster data, no mentioned latitude and longitude) (Luster data)
- Hard copy of Compartment system (Luster data)

For shortening the practice time, following additional data in digital data (vector data) are given for you.

- River sunyani (line polygon)
- Road sunyani (line polygon)
- Location and outer boundary line of Nsemere Forest Reserve (shape polygon)
- Contour lines in Nsemere (line polygon)
- Latitude and longitude lines (line polygon)

2. Preparation for your PC

- (1) Make a folder on your PC Hard disk C:¥Jon GIS practice Nsemere 070204 for example.
- (2) Copy files below from CD attached this manual by Auther to your own folder on your PC.

- 060808 Nsemere 10sec grid.dbf Longitude and Latitude line
- 060808 Nsemere 10sec grid.prj
- 060808 Nsemere 10sec grid.sbn
- 060808 Nsemere 10sec grid.sbx
- 060808 Nsemere 10sec grid.shp
- 060808 Nsemere 10sec grid.shx
- 07.01.03 Nsemere kengo image.aux Aster satellite image on Nsemere
- 07.01.03 Nsemere Kengo image.jpg
- 07.02.01 Miya Observ point.dbf Observed points by Mr. Miya on Feb.1st
- 07.02.01 Miya Observ point.prj
- 07.02.01 Miya Observ point.sbn

07.02.01 Miya Observ point.sbx	
07.02.01 Miya Observ point.shp	
07.02.01 Miya Observ point.shx	
50000 topomap Nsemere.aux	1/50000 topographie map Luster Map
50000 topomap Nsemere.jpg	
50000 topomap Nsemere.rrd	
Area culculation Expression.cal	Area caruculation formuler file
Conter Nsemere.dbf	Conter line on Nsemere Vector Polyline
Conter Nsemere.prj	
Conter Nsemere.sbn	
Conter Nsemere.sbx	
Conter Nsemere.shp	
Conter Nsemere.shx	
FSD Comp Map Nsemere.jpg	Picture of compartment system Luster Map
Nsemere Admi 1813 New cordinat.shp	Area of the forest reserve Nsemere
p195r055_7t20202 40.aux	Satellite Landsat TM bande 4
p195r055_7t20202 40.rrd	
p195r055_7t20202 40.tif	
Sunyani river.dbf	river line surrounding Nsemere (Used as Base Map)
Sunyani river.prj	
Sunyani river.sbn	
Sunyani river.sbx	
Sunyani river.shp	
Sunyani river.shp.xml	
Sunyani river.shx	
Sunyani Road.dbf	road line surrounding Sunyani (Used as Base Map)
Sunyani Road.prj	
Sunyani Road.sbn	
Sunyani Road.sbx	
Sunyani Road.shp	
Sunyani Road.shx	

Note: One shape (shape polygon, line polygon, point polygon) file is consisted by several files (same name and different extensions (dbf, prj, sbn, sbx, shp, shx, etc.)), If you want to make copy the shapes to another folder, you have to copy all files same file name to same folder. The extensions stores deferent data such as table data, location data, polygons shape data, amended records, etc.

3. Contents of the Training

The training shall carry step by step base on the practices operation GIS (Arc View 9.1) .

Step 1 Base map arrangement from Satellite Land Sat TM

Training coordinator is requested to download a set of Satellite TM covering the target area (Forest reserve) from “GLCF” before the training starts. The training uses Nsemere Forest Reserve, training participants can use the data from attached CD on this manual.

Step 2 How to adjust a Luster map, Aster data to GIS Map on Arc Map.

Step 3 How to draw outer boundary (admi Nsemere) of the Nsemere Forest Reserve.

Skip Please use the shape prepared by Miya.

Step 4 How to draw Latitude and Longitude line on Arc Map

Change Arc Map to map view => click layer icon for calling layer property window => select grid tag
=> give grid unit (10 sec by 10 sec) => give check mark on grid 1 => apply => OK
Save the map as jpeg file (luster data) to your holder under a name “LL map Nsemere”

Step 5 How to make a new shape file for Parcel (10 second mesh) .

Add LL map Nsemere to arc Map (to adjust the position).

Make a new vacant file name “Parcel Nsemere”.

Copy the “admi Nsemere” to Parcel Nsemere => insert a luster data exported from map view.

Divide “admi Nsemere “ to parcel shapes tracing the LL line on the LL map Nsemere.

Step 6 How to make compartment shape (Merge the parcels to compartment)

Make a vacant shape file on Arc Catalog under the name of “Compartment Nsemere” as shape polygon.

=> Drag and drop the above file to Arc Map => copy

Merge 10 second parcels for Compartments => give compartment name (Number) to the table.

Step 7 How to delineate vegetation/forest type from Aster data

Make a vacant shape file “Veget Nsemere” on the Arc Catalog => drag and drop the file to Arc Map

=> copy admi Nsemere to Veget Nsemere => divide the copied “admi nuseme” to similar patterned areas tracing the Aster picture as tentative vegetation map.

Go to field to verify your demarcation, and find the needed parts for amending, and collect information forest condition such as tree spp. age, diameter, height, crown density, etc (These information is the base for forest inventory book preparation).

Amend the “Veget Nsemere” (divide a polygon, merge polygons, give the vegetation codes to the Table (field).

Step 8 Geo-processing “vegetNsemere” and “compartment Nsemere” (intersect).

Vegetation/Forest condition and Forest management unit (compartment, sub-compartment, Parcel etc.) shall

be connected and stored to Forest Inventory Book.

Step 9 Area calculations by vegetation type by compartment.

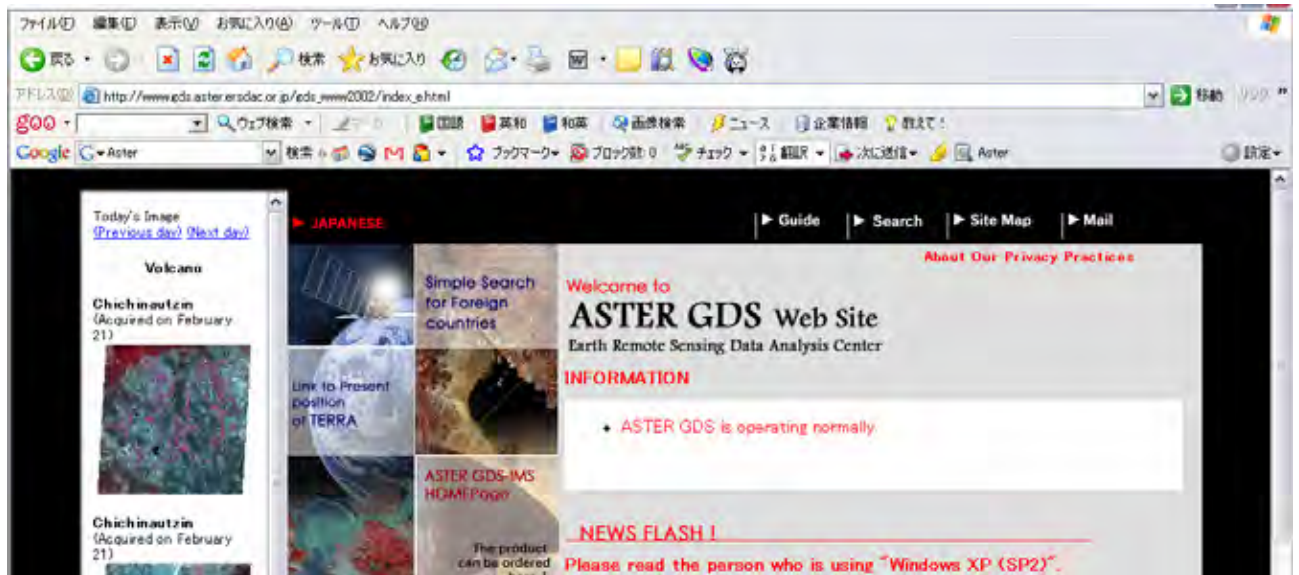
Step 10 Labeling and Legend arrangement

Arranging techniques for beautiful and easy understanding map arrangement measures for training participants to play up the job to Boss.

Additional Information

1. How to buy and Use Aster satellite imagery.

From Internet, “ASTER” on Google search; you can find the Home page of ASTER.



 http://www.gds.aster.ersdac.or.jp/gds_www2002/index_e.html

Follow the home page instruction on right bottom column “Product search”.



2. How to convert Aster Original file to processed satellite imagery (RGB color for vegetation analysis).

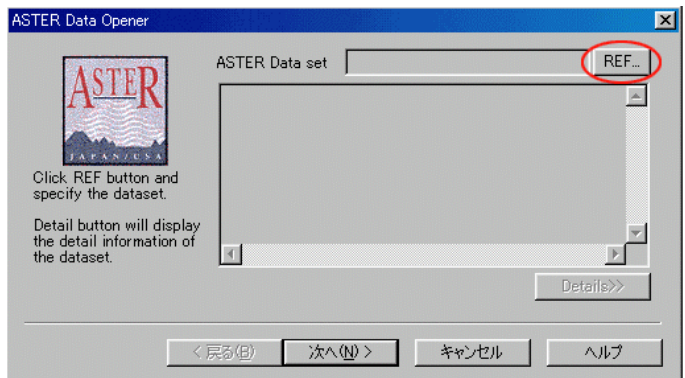
The “Aster Product” supply by CD for you. To use vegetation analysis, you have to convert the CD files to Luster picture RGB color pattern.. For this process you have to done 2 steps. The first step is open the CD stored file to Aster imager on your computer. The needed soft wear of step 1, you can down road from internet free ware “Aster Dater Opener” from home page bellow. Then the second process is over lay 3 pictures into a BW to 3 channels RGB color pattern picture (jpeg format) using “Adobe Photoshop”

http://www.gds.aster.ersdac.or.jp/gds_www2002/Opener/ASTERDataOpener.lzh

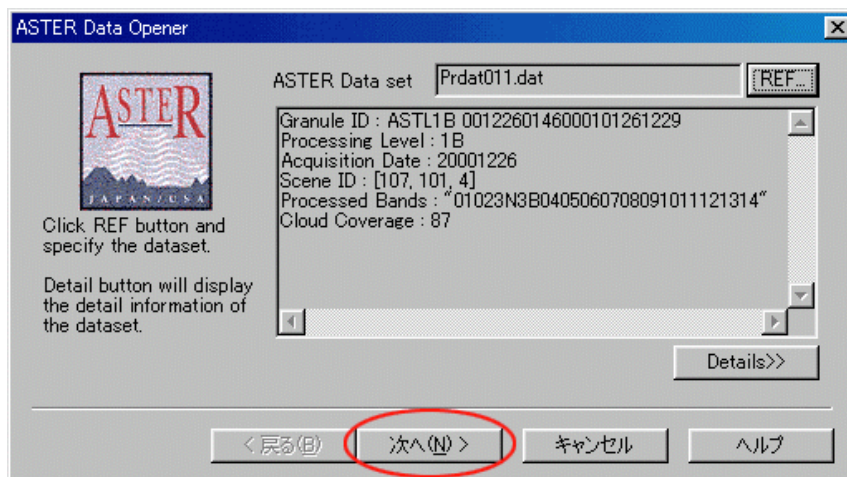
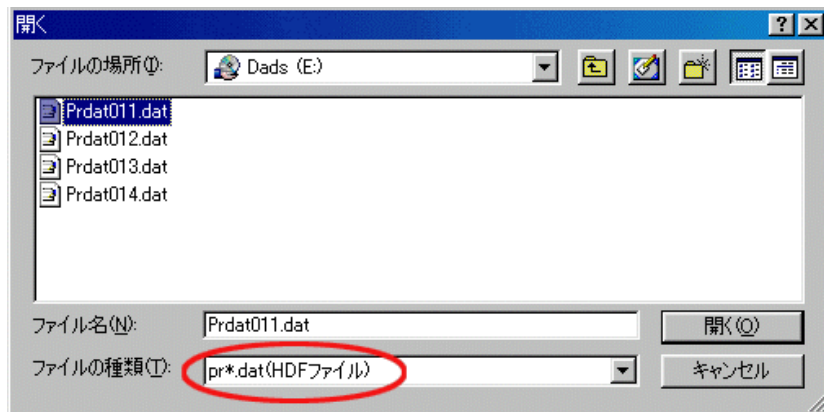
Note: Professionally company use a expensive software for the above processing, nevertheless, ordinal forestry government office can not use such expensive software. Therefore, this manual will introduce more simple and use popularized soft ware measure. If you have the enough budgets, it is advisable to ask this process to the professional company available.

Step 1 Operational Manual for Aster Opener is follows.

Run the AsterDataOpener.exe then crick REF button on screen shows below

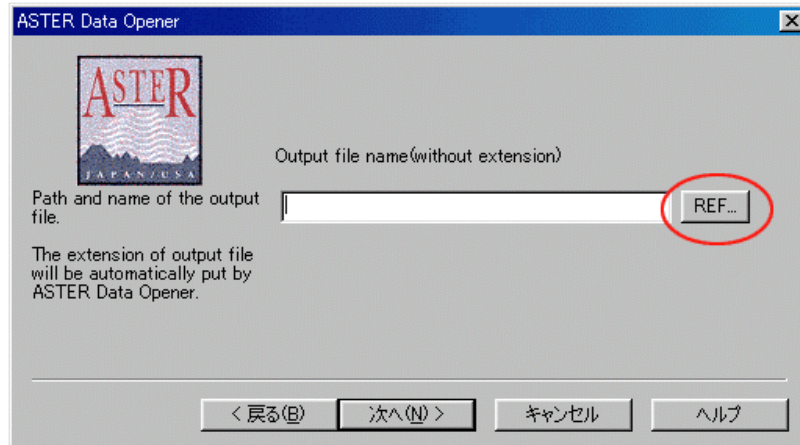


Type in the folder name where the Aster data stored. Then Next, windows will come. Check the file list name as Pr*.dat . Then select the file that you want to use and crick open.

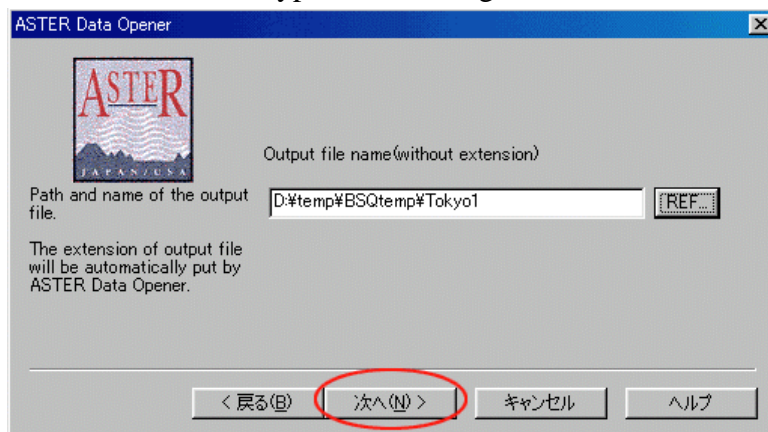


The data's detailed explanation screen will come, then "Next".

Request for you to decide a file name that you save the processed file as below.

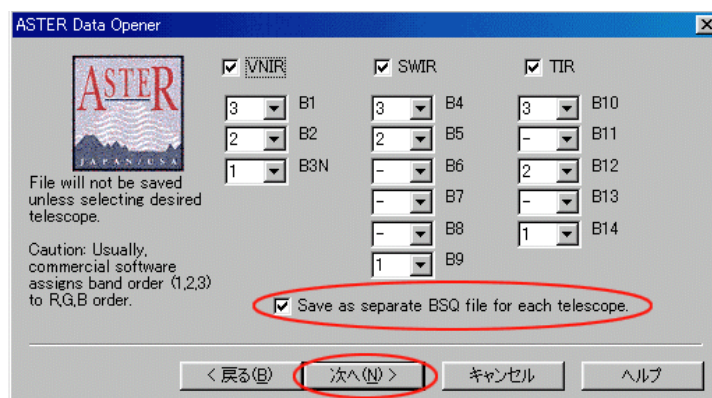


Click “REF” button, and type in the saving folder name and file name.



· Select a censer type

Select censer and Bands (Aster has 3 kind of censer (VNIR,SWIR,TIR))



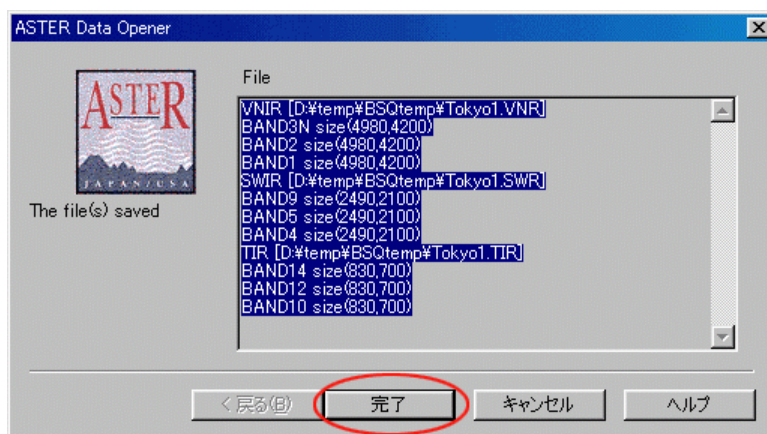
Check mark to VNR and select the band (B1=3(Red), B2=2(Green), B3N=1(Blue))

Give check mark to 「Save as separate BSQ file for each telescope」 Then the Aster data are changed

to BSQ format files (3 different files for RGB color making).

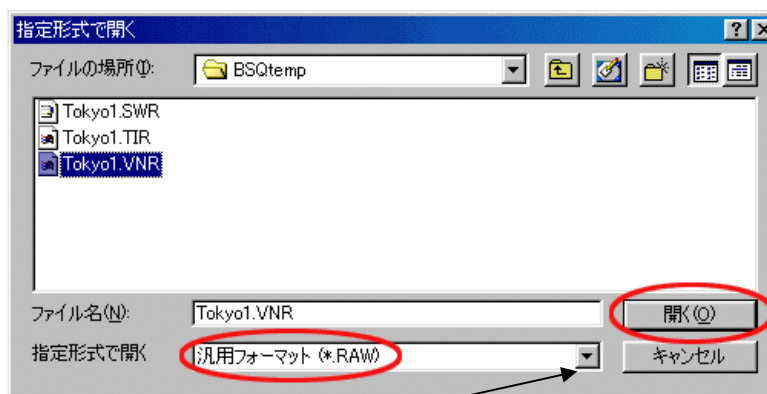
The RGB color photo is made using “Adobe Photoshop”.

When the conversion finished, Aster data opener shows below. You make note the image size (for example VNIR BAND 3N は、4980,4200). This figure is need for the next step “Photoshop” procedure.



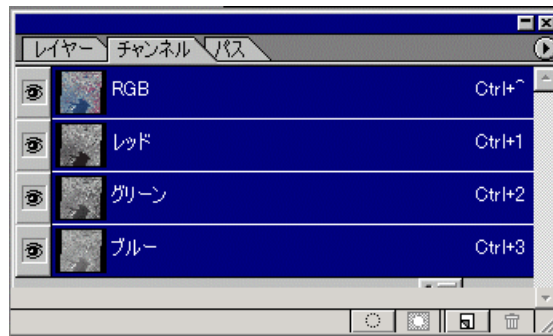
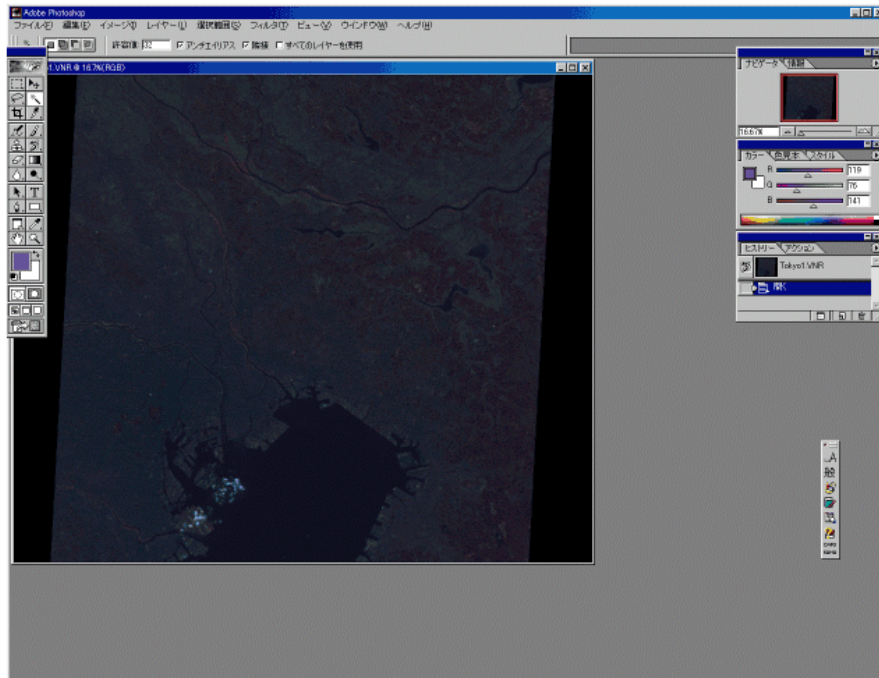
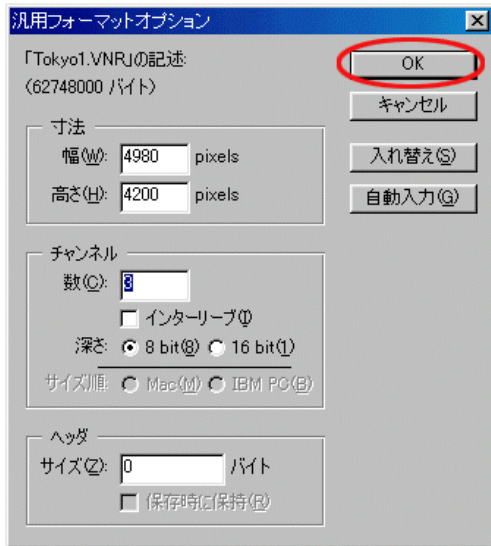
Step 2 Process by “Photoshop”

Run Photoshop, select the files on your folder that BSQ files stored. The open format shall be *.RAW (General format) (In this case VNR)

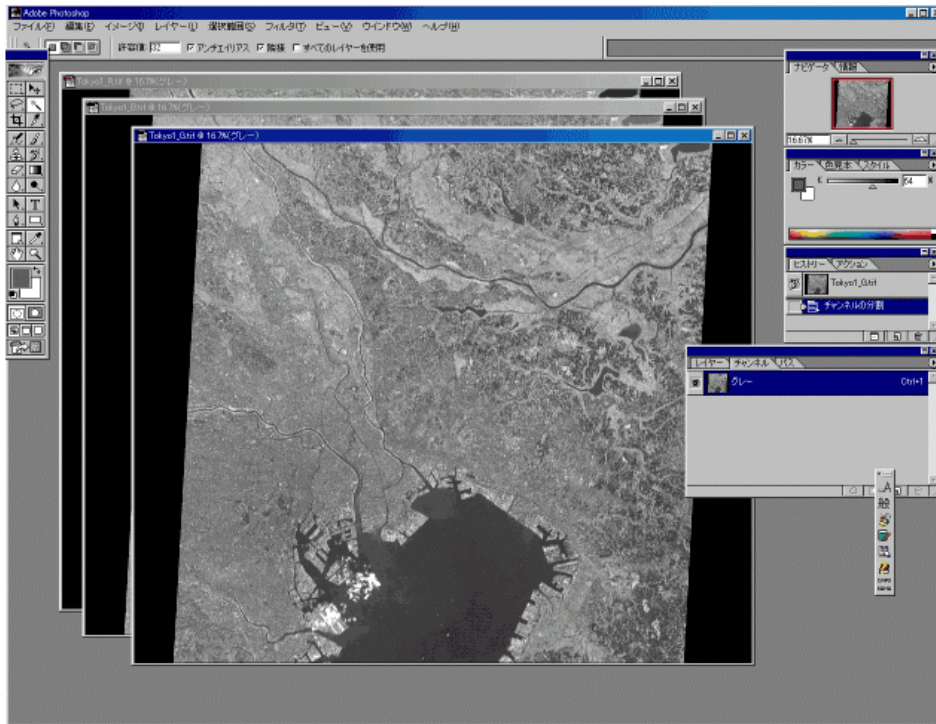


(Define file format for opening the “vnr” file, so, select RAW within the pull down menu above.

- Parameter for picture size that you memorized above (BSQ data size)

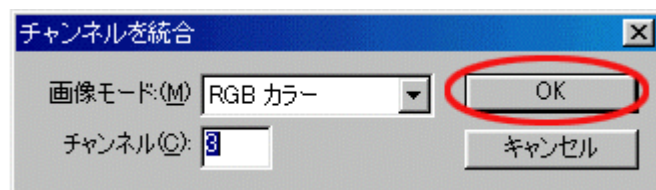
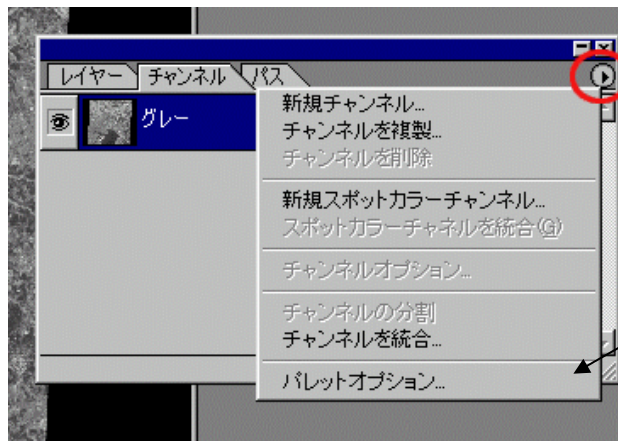


「Channel Palette」



3 BW pictures for Red, Green, and Blue (RGB) are come to the Photoshop screen.

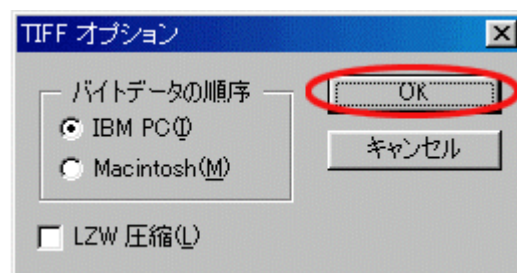
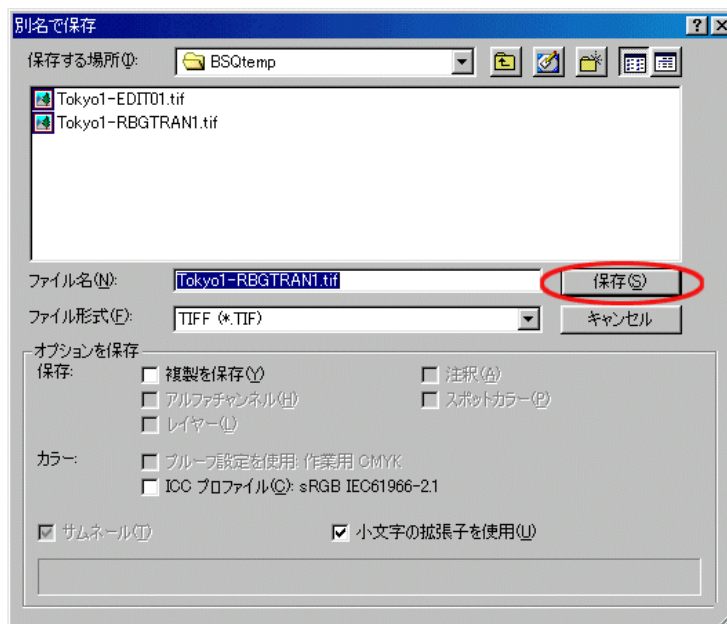
Convert to RGB color (Integration for 3 Pictures to 1).



Select the files for each cooler Red, Green, Blue



Save the RGB pattern



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