Appendix 2 Descriptions of attribute data for aerial surveys of feral animals and waterbirds

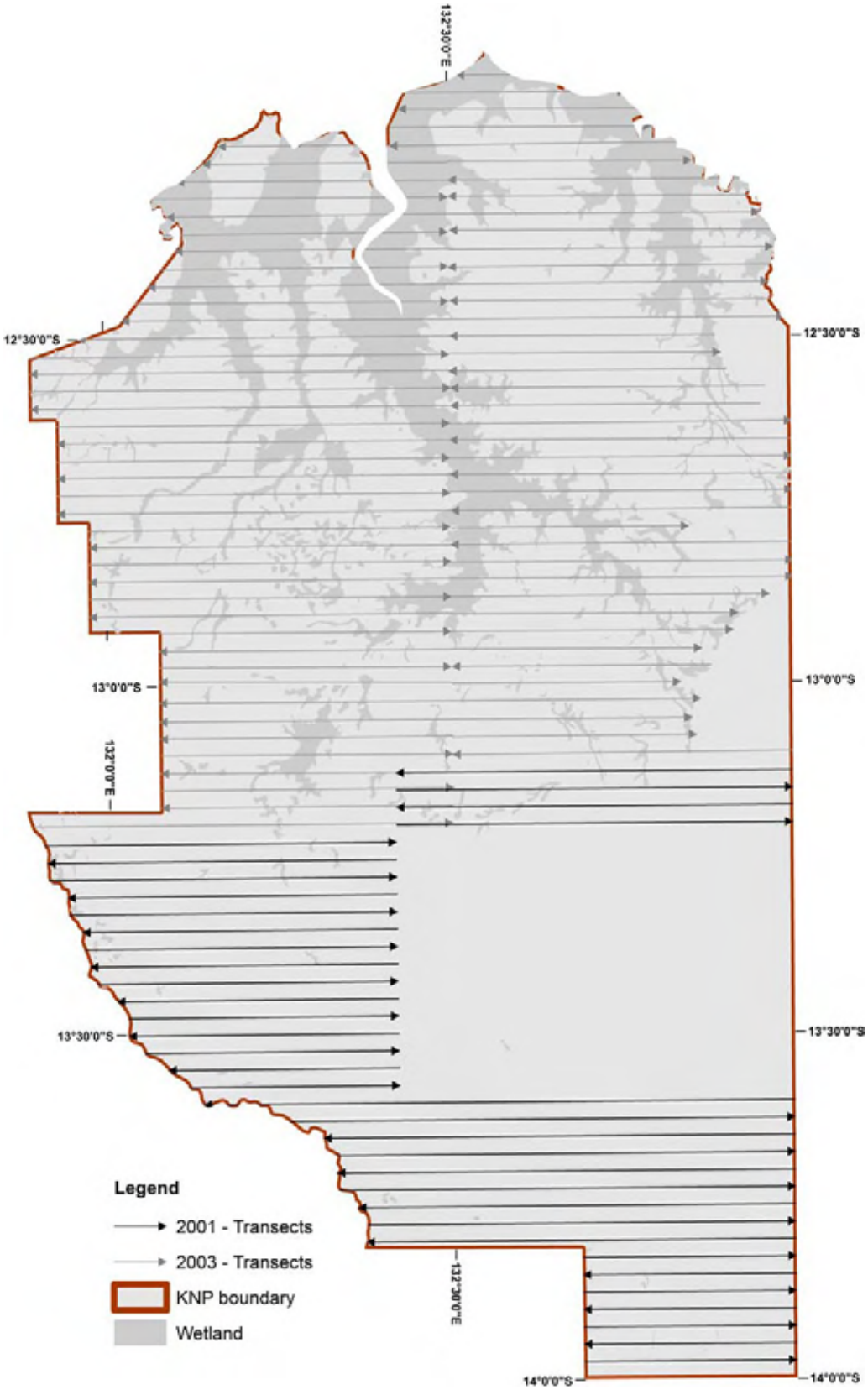


Figure A2.1 Location and extent of transects for aerial survey of waterbirds and feral animals conducted in 2001 and 2003 by Saalfeld and Bayliss

Table A2.1 Field definitions for the shapefile attribute tables for the feral animals and birds aerial survey data, 2003

Field Name	Description
Species	Code for species or primary type of damage (eg pd =pig damage, p = pig) OR description of key locations along flight (eg X track now). Refer to Excel file ' ' for a full list of code definitions.
Survey	Identifies which of the two surveys records are derived from (either Saalfeld_2001 or Bayliss_2003)
Transect	Relevant to 2003 data only. A transect code defined by the waypoint number at the start of the transect on the flight diagram followed by the direction (E= East, W = West).
Date	Date on which the transect was flown (DD/MM/YYYY)
Time	Relevant to 2003 data only. Relative time (MM.SS) along a transect line derived from the minidisk recording. Time zero roughly being the beginning of a transect.
Observer	Observers in the survey (PB = Peter Bayliss, PC = Peter Christopherson, KS = Keith Saalfeld, AF = Anne Ferguson, SO = Simon O'Connor, RS = Ross 'Buck' Salau, SH = Stefanie Hamann, JK = Jason Koh)
Position	The position of the observer in the plane (port or starboard, rear or front)
Seq #	Relevant to 2003 data only. A sequence number allocated to transect.
Number	Either the nominal score given to a level of feral damage (1= LOW, 2= MEDIUM, 3= HIGH) or the number of a particular species counted at one observation.
Type	Relevant to 2003 data only. A secondary description of the type of damage (e.g. wallow, track) or description on type of species count (eg in flight, flying, juvenile etc). This level of detail was not recorded consistently and therefore is incomplete across the entire dataset.
Habitat	A generalised description of habitat at which observations were made. This detail was not recorded consistently and is therefore incomplete across the entire dataset. Refer to Excel file ' ' for a full list of code definitions
Notes	General notes
Lat	Latitude coordinate provided as GDA94 decimal degrees
Long	Longitude provided as GDA94 decimal degrees

Table A2.2 Description of worksheets within the Excel workbook file 'Aerial survey datat_11_03.XLS', containing complete data for the aerial survey conducted in November 2003

Worksheet name	**Description**
Combined counts	Raw data for counts made by all observers (PB/PC/KS). See Table 1C for field definitions.
Transect summary	Indexed list summarising time, location and data storage source for each transect (Table 1)
Field definitions	Listing of field definitions for the 'Combined counts' and 'Field Definitions' worksheets (Table 1C + Table 1 B)
Species codes	Listing of codes used to describe each species under the 'type' field in the 'combined counts' worksheet
Feral_damage type codes	Listing of codes used for each species in the 'Combined counts' worksheet under the 'type' field in the 'combined counts' worksheet
Habitat codes	Listing of descriptions used to define the 'habitat' type
Keith Saalfeld counts	Raw count data for KS supplied by CC, before it was merged in the 'combined counts' worksheet

Table A2.3 Error corrections conducted on aerial survey data collected for the 2003 dry season for feral animals and waterbirds

Checks for positional anomalies of interpolated results imported into ArcMap shapefile were made against original waypoint and track log files in OziExplorer. A number of errors were found and corrected. The types of errors that arose can be summarised as: – Incorrect location for start and end of transect arising from either ambiguous waypoint information or typo-errors and leading to incorrect position interpolation. – Incorrect time-log transcription from recordings leading to incorrect position interpolation. – errors associated with incorrect configuration of input text files leading to incorrect position interpolation. Note there are four general characteristics that define the role of metadata

Table A2.4 Field definitions for the shapefile attribute tables for aerial surveys of waterbirds on the Magela floodplain conducted by Morton and Brennan between 1981 and 1985

Field Name	Description
Transect	A unique code assigned to each transect on the Magela floodplain which is a cross reference to the transect location file (by a number at the start of the transect on the flight diagram followed by the direction (E= East, W = west).
Observer	A unique ID code assigned to each observer (1= Steve Morton, back-right position; and 7= Kym Brennan, back-left position)
Date	Date on which the survey was conducted (DD/MM/YYYY)
Time_Cat	The adjusted 30 second time category (estimated to be 1.2km ground distance along transect) in which a particular count record was assigned.
Species	Waterbird species name assigned to any particular record (egrets for all white egret species, combined, or MG for magpie geese).
Position	The position of the observer in the plane (port or starboard, rear or front)
Count	The total number of a particular species counted by one observer in a particular 30 second (1.2 km) transect unit.
Long	Interpolated geographic longitude generated as AGD66 decimal degrees
Lat	Interpolated geographic latitude generated as AGD66 decimal degrees

Appendix 2.1 Formatting of aerial survey data for correct transfer to ArcMap

Correct formatting of data was important to ensure all information translated to Arc. The following procedures were used:

a In Aerial survey data_11_03.XLS each field in the sight_ll output worksheet was formatted according to specifications in Appendix 6.1.4

b Missing data (blanks) were given the data tag '-99'. *Note: numeric fields in Excel do not transfer to correct format in Arc-shapefiles unless all cells are filled with a number.*

c Once formatting was completed the entire area of data was selected in Excel then saved in DBF (version IV) format for ArcMap.

Appendix 3 Attribute field descriptions for ESRI shapefiles

Table A3.1 Attribute field descriptions for shapefiles produced for aerial surveys of waterbirds and feral animals

Field Name	Format	Additional notes
SEQ	NUMERIC, integer	
TRANSECT	ALPHA-NUMERIC	Field width was expanded to include all text
OBS	ALPHA-NUMERIC	Field width was expanded to include all text
DATE	DATE	Date
E_TIME	NUMERIC, 2-decimal points	Elapsed time since commencement of transect
SPECIES	ALPHA-NUMERIC	Field width was expanded to include all text
SCORE	NUMERIC, 0-decimal points	Missing data tag = -99
TYPE	ALPHA-NUMERIC	Field width was expanded to include all text
HABITAT	ALPHA-NUMERIC	Field width was expanded to include all text
NOTES	ALPHA-NUMERIC	Field width was expanded to include all text
LAT	NUMERIC, 9-decimal points	Latitude were reassigned a negative sign to ensure data fell in the Southern hemisphere
LONG	NUMERIC, 9-decimal points	Longitude

Table A3.1a Attribute field descriptions for shapefiles produced for aerial surveys of feral animals

Field name	**Description**
SPECIES	Species or ground disturbance code, for example horse, pig, or pig damage (pd)
TRANSECT	Unique code for transect, including suffix noting direction of flight along transect (E)ast or (W)est
DATE_	Date DD/MM/YYYY
TIME	Elapsed time from start of transect
OBSERVER	Observer associated with particular count record (KS = Keith Saalfeld, PB = Peter Bayliss)
POSITION	Position of observer in aircraft (eg starboard rear)
NUMBER	recorded count or damage score (1= low damage, 2= moderate damage, 3= extensive damage)
TYPE	When damage score was recorded the 'type' of damage was sometimes noted (wal = wallow).
HABITAT	Code relating to the type of habitat noted when counting (0w = open woodland, rw = riparian woodland, wet= wetland, cw= closed woodland, rip= riparian)
NOTES	General notes
LAT	Latitude in decimal degrees
LONG	Longitude in decimal degrees
SURVEY	Identifies the survey (eg ‘ Bayliss_Saalfeld_2003’ = the survey conducted by Bayliss and Saalfeld during 2003)

Table A3.2 Attribute field descriptions for shapefiles produced for the para grass airboat survey on the Magela floodplain conducted 5–6 March 2003

Field name	Description
DATE_	Date of survey record (DD/MM/YYYY)
MAP_ZONE	Map zone of survey record (MGA)
X	Easting map coordinate from Garmin eTrex GPS (WGS84, UTM)
Y	Northing map coordinate from Garmin eTrex GPS (WGS84, UTM)
NAME	Unique name for survey record, number = waypoint code assigned by GARMIN GPS (A prefix indicates record collected on 5/03/2003 while B prefix indicates record collected on 6/03/2003)
CODE	Code indicating the general assemblage of plants observed at any one point in order of decreasing abundance, PA= para grass, H= *Hymenachne acutigluma*, PS = *Pseudoraphis spinecens*, E = *Eleocharis* spp, O = *Oryza* spp, OW= Open water, SE = *Aeschynonmene americana* or *A. indica* originally recorded as Sesbania, NY = Nymphaea & Nymphoides spp, LU = *Ludwigia adscendens*, ; eg PA_H_OW indicates dominant para grass followed by *Hymenachne* and then Open water where a single 'PA' indicated 100% para grass cover).
[1]HYMENACHNE	Notes on *Hymenacne acutigluma* (followed by percentage cover estimate.
[1]PSEUDORAPH	Notes on *Pseudoraphis* (followed by percentage cover estimate).
[1]PERSICARIA	Notes on *Persicaria* (followed by percentage cover estimate).
[1]NELUMBO	Notes on *Nelumbo* (followed by percentage cover estimate).
[1]ORYZA	Notes on *Oryza* (eg 'subdominant' followed by percentage cover estimate).
[1]NYMPHYAEA	Notes on *Nymphaea*/*Nymphoides* (eg 'subdominant' followed by percentage cover estimate).
[1]ELEOCHARIS	Notes on *Eleocharis* (eg 'subdominant' followed by percentage cover estimate).
[1]PARAGRASS	Notes on para grass (eg 'subdominant' followed by percentage cover estimate).
[1]LUDWIGIA	Notes on *Ludwigia* (eg 'subdominant' followed by percentage cover estimate).
[1]LEESIA	Notes on *Leersia hexandra* (eg 'subdominant' followed by percentage cover estimate).
[1]SALVINIA	Notes on *Salvinia* (eg 'subdominant' followed by percentage cover estimate).
[1]OPENWATER	Notes on Open Water (eg 'subdominant' followed by percentage cover estimate).
[1]MELALEUCA	Notes on *Melaleuca* (eg 'subdominant' followed by percentage cover estimate).
[1]SESBIANIA	Notes on *Aeschynonmene americana* or A. indica originally recorded as 'Sesbania' (eg 'subdominant' followed by percentage cover estimate).
NOTES	General notes relating to plant dominance, relative position, and growth form

[1] A zero value indicates species was not present.

Table A3.3 Attribute field descriptions for shapefiles produced for the para grass airboat survey on the Magela floodplain conducted 18–19 March 2003

Field name	Description
DATE_	Date of survey record (DD/MM/YYYY)
X	Easting map coordinate from Garmin eTrex GPS (WGS84, UTM)
Y	Northing map coordinate from Garmin eTrex GPS (WGS84, UTM)
NAME	Unique numeric waypoint name assigned by GARMIN GPS for survey record (A prefix indicates record collected on 5/03/2003 while B prefix indicates record collected on 6/03/2003)
CODE	Code indicating the general assemblage of plants observed at any one point in order of decreasing abundance, PA= para grass, H= *Hymenachne acutigluma*, PS = *Pseudoraphis spinecens*, E = *Eleocharis* spp, O = *Oryza* spp, OW= Open water, SE = *Aeschynonmene americana* or *A. indica* originally recorded as *Sesbania*, NY = *Nymphaea* & *Nymphoides* spp, LU = *Ludwigia adscendens*, eg PA_H_OW indicates dominant para grass followed by *Hymenachne* and then Open water where a single 'PA' indicated 100% para grass cover).
OPENWATER	Notes on Open Water (eg 'subdominant' followed by percentage cover estimate).
MONOCHORIA	Notes on *Monochoria* sp (followed by percentage cover estimate).
SALTWATER_	Notes on salt-water tolerant sedge observed adjacent to Mangrove channels at northern end of Magela floodplain (followed by percentage cover estimate).
PANICUM_TR	Notes on *Panicum trachyrhachis* (followed by percentage cover estimate).
LUDWIGIA	Notes on *Ludwigia* (eg 'subdominant' followed by percentage cover estimate).
PARAGRASS	Notes on para grass (eg 'subdominant' followed by percentage cover estimate).
LEESIA	Notes on *Leersia hexandra* (eg 'subdominant' followed by percentage cover estimate).
HYMENACHNE	Notes on *Hymenachne acutigluma* (eg 'subdominant' followed by percentage cover estimate).
PSEUDORAPH	Notes on *Pseudoraphis* (followed by percentage cover estimate).
ORYZA	Notes on *Oryza* (eg 'subdominant' followed by percentage cover estimate).
ELEOCHARIS	Notes on *Eleocharis* (eg 'subdominant' followed by percentage cover estimate).
PERSICARIA	Notes on *Persicaria* (followed by percentage cover estimate).
SALTWATER1	Empty field
NELUMBO	Notes on *Nelumbo* (followed by percentage cover estimate).
NYMPHYAEA	Notes on *Nymphaea*/*Nymphoides* (eg 'subdominant' followed by percentage cover estimate).
SESBIANIA	Notes on *Aeschynonmene americana* or *A. indica* originally recorded as '*Sesbania*' (eg 'subdominant' followed by percentage cover estimate).
MELALEUCA	Notes on *Melaleuca* (eg 'subdominant' followed by percentage cover estimate).
NOTES	General notes relating to plant dominance, relative position, and growth form

[1] A zero value indicates species was not present.

Table A3.4 Attribute field descriptions for shapefiles produced for the para grass airboat survey on the Magela floodplain conducted 16 June 2004

Field name	Description
DATE_	Date of survey record (DD/MM/YYYY)
MAP_ZONE	Map zone of survey record (MGA)
X	Easting map coordinate from Garmin eTrex GPS (WGS84, UTM)
Y	Northing map coordinate from Garmin eTrex GPS (WGS84, UTM)
NAME	Unique numeric waypoint name assigned by GARMIN GPS for survey record (A prefix indicates record collected on 5/03/2003 while B prefix indicates record collected on 6/03/2003)
CODE	Code indicates the general assemblage of plants observed at any one point in order of decreasing abundance, PA= para grass, H= *Hymenachne acutigluma*, PS = *Pseudoraphis spinecens*, E = Eleocharis spp., ED= *E. dulcis*, ES= *E. sphacelata*,O = *Oryza* spp., OW= Open water, SE = *Aeschynonmene americana* or *A. indica* originally recorded as Sesbania, NY = *Nymphaea* & *Nymphoides* spp, LU = *Ludwigia* adscendens, LS or L=*Leersia hexandra*; eg PA_H_OW indicates dominant para grass followed by *Hymenachne* and then Open water where a single 'PA' indicated 100% para grass cover).
Depth_M	Water depth in metres at waypoint location measured with a depth stick, nd= no data recorded at waypoint
OPENWATER	Notes on Open Water (eg 'subdominant' followed by percentage cover estimate).
PARAGRASS	Notes on para grass (eg 'subdominant' followed by percentage cover estimate).
HYMENACHNE	Notes on *Hymenachne acutigluma* (eg 'subdominant' followed by percentage cover estimate).
[1]ORYZA	Notes on *Oryza* (eg 'subdominant' followed by percentage cover estimate).
[1]LEESIA	Notes on *Leersia hexandra* (eg 'subdominant' followed by percentage cover estimate).
[1]ELEOCHARIS	Notes on *Eleocharis* (probably *dulcis*) (eg 'subdominant' followed by percentage cover estimate).
[1]ELEOCHARIS_	Notes on *Eleocharis* (probably sphacelata) (eg 'subdominant' followed by percentage cover estimate).
[1]NYMPHYAEA	Notes on *Nymphaea* (eg 'subdominant' followed by percentage cover estimate).
[1]LUDWIGIA	Notes on *Ludwigia* (eg 'subdominant' followed by percentage cover estimate).
[1]MELALEUCA	Notes on *Melaleuca* (eg 'subdominant' followed by percentage cover estimate).
[1]NYMPHOIDES	Notes on *Nymphoides* (eg 'subdominant' followed by percentage cover estimate).
[1]AESCHYNOME	Notes on *Aeschynonmene americana* or *A. indica* (eg 'subdominant' followed by percentage cover estimate).
[1]PSEUDORAPH	Notes on *Pseudoraphis* (followed by percentage cover estimate).
[1]SALVINIA	Notes on *Salvinia molesta* (followed by percentage cover estimate).
NN2	General notes relating to plant dominance, relative position, and growth form

[1]A zero value indicates species was not present

Table A3.5 Attribute field descriptions for shapefiles produced for the para grass helicopter survey on the Magela floodplain conducted 16 June 2004

Field name	Description
NAME	Numeric waypoint code assigned by Garmin eTrex GPS
X	Easting map coordinate from Garmin eTrex GPS (WGS84, UTM)
Y	Northing map coordinate from Garmin eTrex GPS (WGS84, UTM)
N4	Map zone (MGA)
CODE	Code indicating the general assemblage of plants or growth form of para grass observed at any one point: p (lowercase)= para grass present, P (upper case)= para grass on floodplain margins, PP= isolated patch of dense para grass, EH= *Eleocharis* patches surrounded by *Hymenachne*, OW= open water, L = *Leersia hexandra*, LP= *Leersia Hexandra* and para grass,
PARAGRASS	Blank field (not populated)
HYMENACHNE	Blank field (not populated)
NOTES2	General notes relating to plant dominance, relative position, and growth form

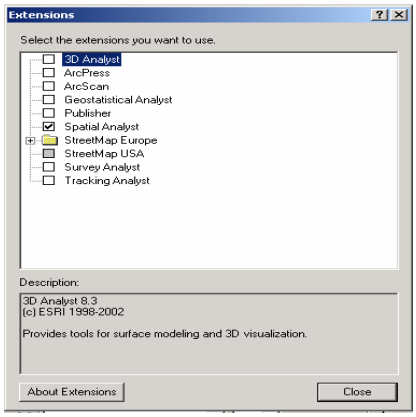
Appendix 4 Methods for developing raster layers in ArcGIS™

The following methods were used to create raster layers from shapefile point data records representing counts made in aerial surveys of birds and feral animals. Raster layers were produced using Spatial Analyst™. Output layers were produced such that any one cell represented the total sum of (point data) counts (for a particular species) falling within the specified grid-cell area (250 m and 500 m resolutions).

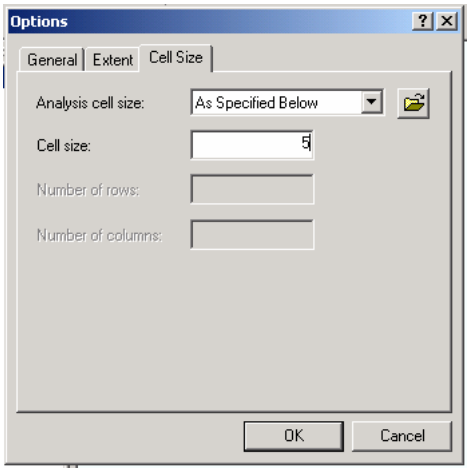
A4.1 Preparation and ArcGIS™ settings

1 Open Arc Map and display the **Spatial Analyst** Toolbar (menus: View>Toolbars>Spatial analyst)

2 If the Spatial analyst menu options are not functional, check that the Spatial Analyst extension has been activated: from the main menu select 'Tool' > 'Extensions' and select 'Spatial Analyst' as specified below.



3 Under the Spatial Analyst menu select '**Option**s' and then the '**Cell size**' tab as specified below.



4 Click on the drop-down list for '**Analysis cell size**' and select the '**as specified below**' option.

5 In the '**cell size**' box add '**5**' to set 5m as the minimum analysis cell size.

6 In **Layer Properties** set the Coordinate display to WGS_1984_UTM_Zone_53S.

7 Add the Shapefile layer containing the bird count data (projected in WGS_1984_UTM_Zone_53S).

A4.1.1 Creating a 'zone' grid for count data (Spatial Analyst™)

1 Open the Attributes Table for the shapefile.

2 From the Attributes Table select '**Options**' (lower right corner).

3 From the options menu select '**Add Field**'.

4 In the '**Add Field**' display, name the field '**ID**' and set '**field properties**' to '**short integer**' then click 'OK'.

5 Save the ArcMap project, close, and then open Excel.

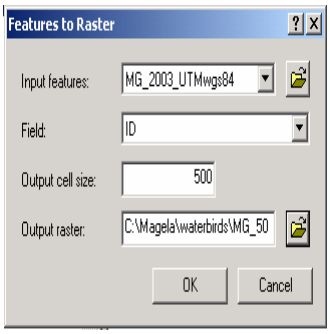
6 In Excel open the DBF spreadsheet associated with the Attributes Table, above.

7 In Excel add a sequential reference number to the '**ID**' field in the **DBF** spreadsheet.

8 Save the **DBF** file, exit Excel, and then re-open the ArcMap project file.

9 Under the Spatial Analyst menu select '**Convert**' then select '**Features to Raster**'. *Warning: ensure that the correct resolution has been set in Spatial Analyst options (step 4 in A2.1).*

10 In the '**features to raster**' box specify the **input features** shapefile, the values **field** (ID), **output cell size** (500m) and output raster location as shown below.



11 Under the Spatial Analyst menu select '**Raster Calculator**…' and double-click on the new 500 m raster zone layer to add it to the Raster Calculator window then click on '**Evaluate**'. *This produces a new layer in ArcMap called 'Calculation'.*

Note: The output files produced in this Section produces a grid layer where every 500m grid cell is assigned an Identity code (ID). The field named 'ID' in the shapefile is, by default, renamed to 'Values' in the output raster file.

A4.1.2 Create a 5 m count-values raster layer

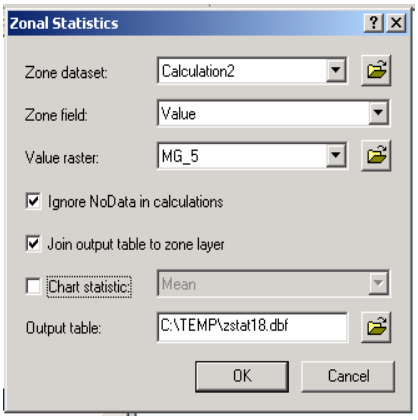
1 Under the Spatial Analyst menu select 'Convert' then 'Features to Raster'

2 In the 'features to raster' box define the input features shapefile, the count values field (eg. 'SCORE'), and set the output cell size to 5 m. Then click OK.

Note: This creates a grid containing the values for individual counts at 5 m raster resolution from which total counts may be summed at 500 m resolution. The field originally named 'Score' in the shapefile is, by default, renamed to 'Value' in the output raster file.

A4.1.3 Calculate 'zone statistics' for the 500 m zones to derive bird count summation

1 Under the Spatial Analyst menu select 'Zonal Statistics' dialogue box (displayed below)



2 In the Zonal Statistics box select the 'Zone dataset' from the drop-down list by adding the 'calculation' layer produced from the 500 m raster zone layer in Step 12 of section 4.

3 Set the 'zone field' to 'Value'

4 Select the Value raster file from the dropdown list. This will be the raster layer produced in section 3, above.

5 Ensure that the options- 'ignore No Data in calculations' and 'Join output Table to zone layer' – are both selected, and deselect the 'chart statistics' option.

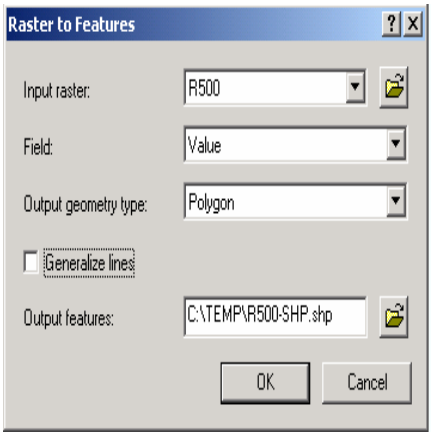
Note: The output statistics produced above are placed in a temporary 'zstat.DBF' Table (C:\Temp|Zstat.dbf).

A4.1.4 Embedding zone statistics (sum of point values) as the raster grid value

Note: The 'sum' value field from the Zstat Table must now be embedded in a 500 m raster grid as the value by linking the relational field from the Zstat Table ('Value') to the identical field in the 500 m zones raster zones Table. First the 500m raster zone Table must be converted back to a shapefile.

1 Convert the 500 m raster zones back to a shapefile: In Spatial Analyst select 'Convert' then select 'Raster to Features'.

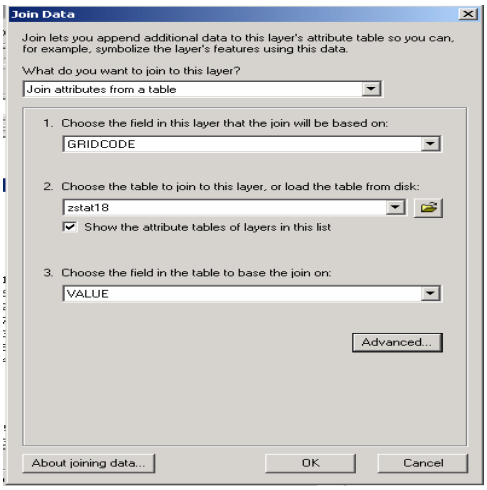
2 Complete the dialogue box settings as shown below, ensuring that the '**generalized lines**' option has been **de-selected**, then click 'OK'.



Note: The field called 'GRIDCODE', in this case, is the same as the original shapefile 'ID' field created in Section 2.

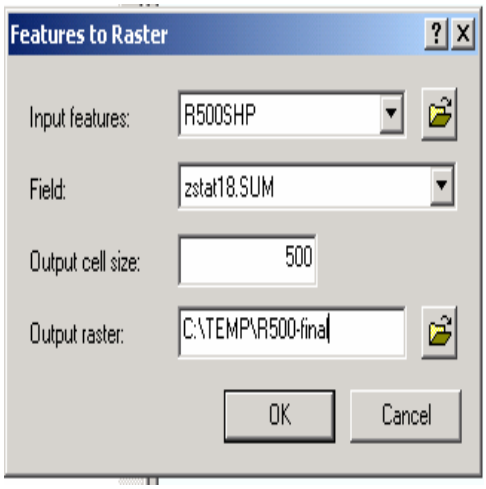
1 Now Right-click on the new shapefile and from the menu select ‘Joins and Relates’ then select ‘Join’.

2 Complete the dialogue box as shown below, choosing the Zstat Table to link to 500 m zone shapefile. Note that ‘GRIDCODE’ (in the 500 m zone file) must be linked to ‘VALUE’ in the Zstat Table. Click OK.



Warning: *When fields are incorrectly joined between tables the result will be incorrect*

3 Under the Spatial Analyst menu convert this file back to a Raster grid by selecting ‘Convert’ then ‘Features to Raster’. Complete the dialogue box (below) ensuring that the Zstat.SUM is the field designated to the raster value. Also ensure the Output cell size is set correctly.



4 Ensure that the values in the output raster files are checked against original point data to confirm a correct result.

Appendix 5 Error checking procedures

Table A5.1 Summary of error checking procedures

Error type	Checking/correction method
Unclear audio-recordings	• Uncertain records were tagged with a 'X' suffix. These records were removed from final outputs.
Typo errors in manual data entry of counts data to Excel:	• Data were sorted by 'species' and 'score' to look for outlier values in the 'score' field.
	• Possible errors were then corrected against written transcriptions
Typo errors in manual data entry of spatial coordinates for transects used in interpolation of position of counts.	• Coordinates were imported to ArcMap and checked against waypoint data for transects
Errors produced in VB-Macro output from incorrectly formatted data:	• Format of input files was checked against a template file with correct format.
	• Output positions were then visually checked in Arc-Map
Position outputs from VB-Macro are positive numbers:	• Latitude was changed to a negative sign so that data were projected in the Southern hemisphere
Incorrect field formats in final shapefiles:	• Ensure fields are correctly formatted in Excel before saving as a DBF input file for Arc
	• Ensure that missing data (blanks) are tagged with a missing data value (-99)
	• Check field formats of shapefiles in ArcCatalog
Incorrect values in raster outputs generated from original shapefile data (This type of error arose when incorrect fields are assigned in rasterisation procedure):	• Check several raster cell values against original point data values

Appendix 6 Description of attribute fields associated with the vegetation and land unit classification maps

Table A6.1 Description of attribute fields associated with the Vegetation classification map for KNP produced by Schodde et al 1987

Field name	Description
Area	Area in hectares calculated for individual map polygons
Perimeter	Perimeter in kilometres calculated for individual map polygons
Shoveg_ID	A unique numeric code assigned to each vegetation map class
Veg_Type	A brief written description of the vegetation map class. A full description of map class units is proved in Schodde et al 1987.

Table A6.2 Description of map codes associated with the land unit classification of Magela Creek catchment (Wells 1979)

Surface features	Land unit code	Slope	Description	Typical vegetation	Distinguishing features
Plateau surface	1a	<10%	Massive sandstone outcrop, rare shallow lithosols, sparse grassland with low shrubs	Sparse grassland with low shrubs	Mainly rock outcrop, minor soil occurrences
Escarpment/ plateau side slopes	2a	>40%	Slopes greater than 40%, shallow lithosols and rock outcrop, grassland to low open woodland	Grassland to low open woodland	Includes scarps and cliff faces
	2b	15-40%	Slope 15 to 40%, shallow lithosols and rock outcrop, grassland to woodland	Grassland to woodland	Large boulders and scree debris common
	2c	5-15%	Slope 5 to 15%, shallow sands and skeletal soils with rock outcrop, low scrub to open forest	Low scrub to open forest	Common rock outcrop
	2d	<5%	Discrete areas of rock pavement on gently sloping rock outliers, rare shallow sands	None recorded	Rock pavement areas
Undulating upland terrain	3a1	<1%	Deep sandy red massive earths and minor gravelly red massive earths, tall open woodland to open forest	Tall open woodland to open forest	Tall open woodland to open forest
	3b	<2%	Moderately deep to deep red earth soils, tall open woodland to open forest	Tall open woodland to open forest	Tall open woodland to open forest
	3c1	<3%	Moderately deep to deep gravelly red massive earths, tall open woodland to open forest	Tall open woodland to open forest	Upper wash slope areas
	3c2	<1%	Shallow to moderately deep gravelly red massive earths and minor red earthy sands, woodland to open forest commonly with dense scrub under-storey	Woodland to open forest community with dense scrub under-storey	Lower wash slope areas, less well drained

Surface features	Land unit code	Slope	Description	Typical vegetation	Distinguishing features
Undulating upland terrain	4a	<2%	Shallow to moderately deep gravelly yellow massive earths and minor brownish sands, open forest	Open forest	Open forest on gentle colluvial slopes
	4b1	<3%	Shallow to moderately deep gravelly yellow and brown massive earths and minor brownish sands, woodland to low open woodland	Woodland to low open woodland	Woodland to low open woodland
	4b2	<4%	Shallow gravelly yellow and brown massive earths, dense scrub with emergent trees	Dense scrub with emergent trees	Dense scrub with emergent trees
	4c1	<3%	Moderately deep to deep sandy yellow massive earths and minor brownish sands earthy sands and pale sands with colour B horizons, open forest	Open forest	Wash slopes and flats near drainage lines
	4c2	<3%	Shallow sandy yellow massive earths and minor brownish sands, earthy sands and pale sands with colour B horizons, woodland to low open woodland	Woodland to low open woodland	Generally closer to drainage lines than 4c1
	4d	<3%	Shallow to moderately deep loamy yellow massive earths commonly on upper wash slopes, woodland	Woodland	Upper well drained wash slopes
	4e	<2%	Moderately deep to deep loamy yellow massive earths commonly on upper wash slopes, woodland.	Woodland to low open woodland	Lower, less well drained wash slopes
Low lying drainage floors, slopes and creeks	5a	<2%	Deep earthy sands, brownish sands and pale sands with colour B horizons, woodland to open forest	Woodland to open forest	Generally associated with upland terrain
	5b	<2%	Variable depth siliceous sands, pale sands with a colour B horizons and brownish sands, woodland intermixed with areas of grassland	Woodland intermixed with areas of grassland	Lower wash slopes commonly beneath 5a

Surface features	Land unit code	Slope	Description	Typical vegetation	Distinguishing features
Low lying drainage floors, slopes and creeks	5c	<1%	Moderately deep to deep brownish sands or earthy sands and alluvial soils (clay loams over sand), grassland with patches of low open woodland	Grassland with patches low open woodland	Very low lying poorly drained areas
	5d		Deep colluvial siliceous sands and brownish sands with minor pale sands of colour B horizons, tall open woodland to scrubland	Tall open woodland to scrubland	Colluvial slopes adjacent to sandstone plateau outliers
	5e	<4%	Alluvial soils (sand over clays) siliceous sands and minor brownish sands, grassland with scattered trees	Grassland with scattered trees	Drainage line areas
	5f3	<2%	Alluvial soils siliceous sands and earthy sands frequently occurring on upland margins to alluvial clay plains, closed Melaleuca forest with areas of grassland	Closed Melaleuca forest with areas of grassland	Melaleuca forest areas adjacent to the clay pans
Alluvial plains on freshwater sediments	6a2	<4%	Grey cracking clays, grassland	Grassland	Grassland
	6b2	<1%	Hard pedal and apedal mottled yellow duplex soils and gley duplex soils (solodized solonetz solodic soils and gleyed podsolics) rare structured earths with rough ped fabric, grassland with scattered trees.	Grassland with scattered trees	Grassland
Alluvial clay plains	7a1	<1%	Black cracking clays and hard pedal black duplex soils (acid swamp soils) with minor mottled yellow duplex soils, grassland with emerging Melaleuca occasionally in clumps	Grassland with emergent Melaleuca, occasionally in clumps	Grassland with emergent Melaleuca, poorly drained
	7a2	<1%	Black cracking clays, non cracking clays (acid swamp soils) and alluvial soils, closed Melaleuca forest	Closed Melaleuca forest	Closed Melaleuca forest, less poorly drained than 7a1

Surface features	Land unit code	Slope	Description	Typical vegetation	Distinguishing features
	7a3	<1%	Black cracking clays, non cracking clays and hard pedal black duplex soil, grassland	Grassland	Grassland, more poorly drained than 7a1
	8b	<1%	Alkaline black and grey cracking clay, grass and sedgeland	Grass and sedgeland	Grass and sedgeland, seasonally dry
Alluvial clay plains	8d	<1%	Alkaline black and grey cracking clay in ill-drained areas, sedge and grassland	Sedge and grassland	Sedge and grassland, lower more & poorly drained than 8b
	9a	<1%	Grey gleyed saline clays, saltwater mangroves.	Saltwater mangroves	Saltwater mangroves
Littoral areas		<1%			

Appendix 7 Procedure used to geo-register and reproject the land units classification for the Magela catchment

The Magela Land Units map was re-registered in ENVI™ to a standard Landsat TCC scene (Datum: AGD 1966; projection AMG zone 53) as visual inspection of the original file against registered base images indicated a spatial error-shift of about 400m (in both AGD66 and GDA94 datums'). The aim was to develop a method that delivered a product with optimal accuracy whilst also retaining the complete coverage area.

Using two different methods in ENVI™, triangulation, and RST (rotation, scaling an translation) the map was re-projected twice to produce two output files. Triangulation produced the most accurate result, however, an artefact of this process is that peripheral areas of the image are clipped. The second method, RST, reproduced a complete coverage, however, the resulting registration is not as accurate (although better than the original).

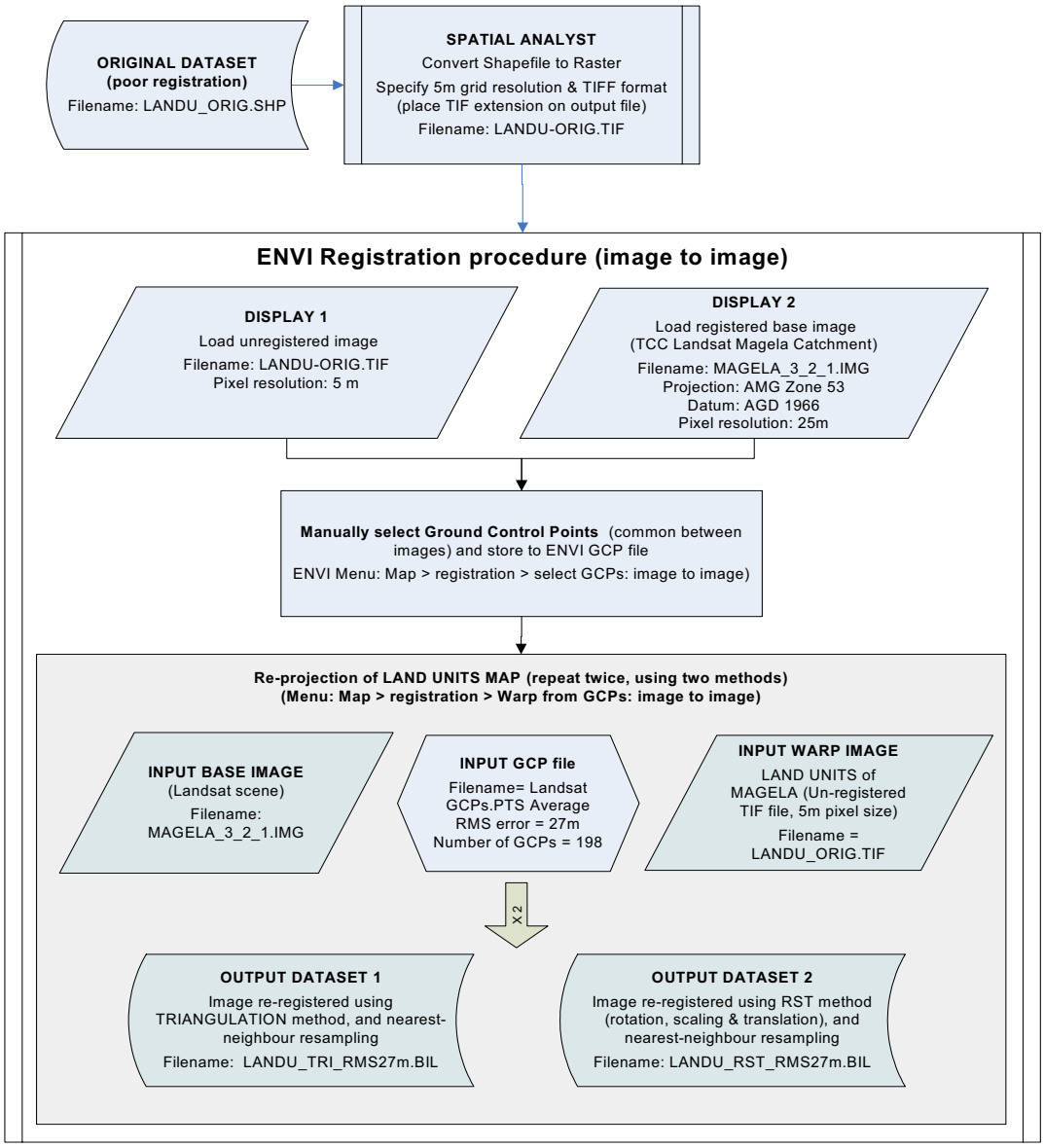


Figure A7.1 Procedures used in ENVI™ to re-project the land unit classification of the Magela catchment

The file produced using triangulation was used as a core dataset. The deleted peripheral zones in this dataset were then substituted with the same spatial zones produced from the RST re-projection. The following flow diagram (Figure A7.2) describes the methods used to amalgamate data produced from the two re-projections (Figure A7.1), resulting in a complete coverage with optimal accuracy.

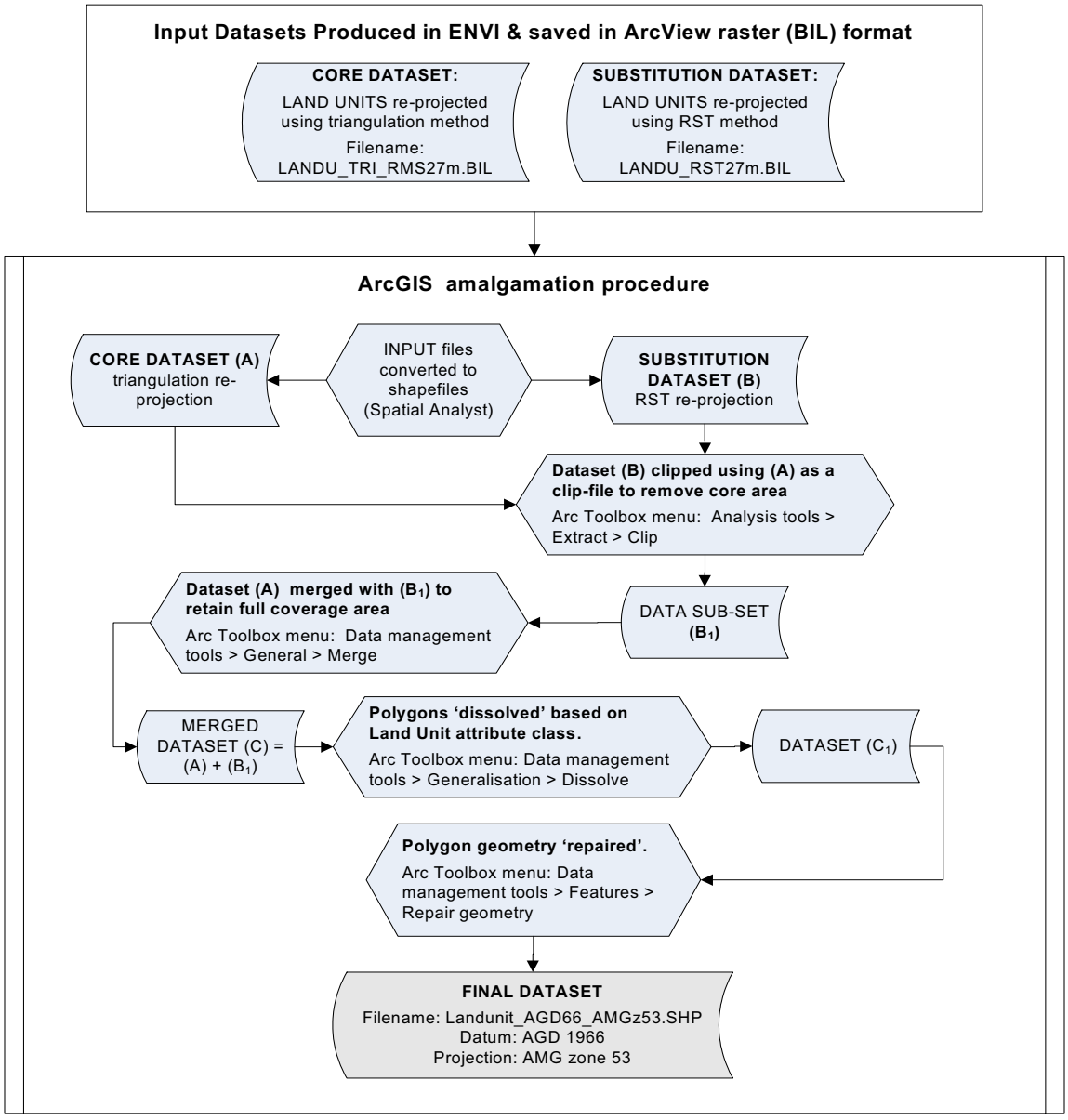


Figure A7.2 Procedures used in ArcGIS™ to amalgamate re-projected data files produced in ENVI™ (Figure A7.1)