Tasmania

DEPARTMENT *of*
PRIMARY INDUSTRIES,
WATER *and* ENVIRONMENT

LAND USE MAPPING AT CATCHMNENT SCALE

TASMANIAN REPORT

By

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Project Outline

The GIS section of the Tasmanian Department of Primary Industries, Water and Environment was contracted by the Bureau of Rural Science to create a land use dataset for Tasmania. Land use data has been identified as essential in managing the range of land degradation issues occurring in Australia. The project ran for 18 months from September 2001 to March 2003. The final dataset will shortly be available for download from www.gisparks.tas.gov.au/landuse. This report incorporates project methodology, validation results and metadata statement.

Methodology

The project brief was to map Tasmania at 2 different scales – 1:25 000 for areas of the state under intensive agriculture, and 1:100 000 for the rest. The northern slopes, northern midlands and southeast IBRA bioregions were mapped at 1:25 000, as were the entire mapsheets overlaying a bioregional boundary. This was a total of 136 1:25 000 mapsheets. The remainder of the state was mapped at 1:100 000 scale, approximately 20 1:100 000 maps, many containing significant sections of water, and large areas of reserves. Time was available to make exceptions to this rule in the Huon Valley and the Scottsdale region, both containing intensive agricultural use necessitating mapping at 1:25 000 (Fig 1).

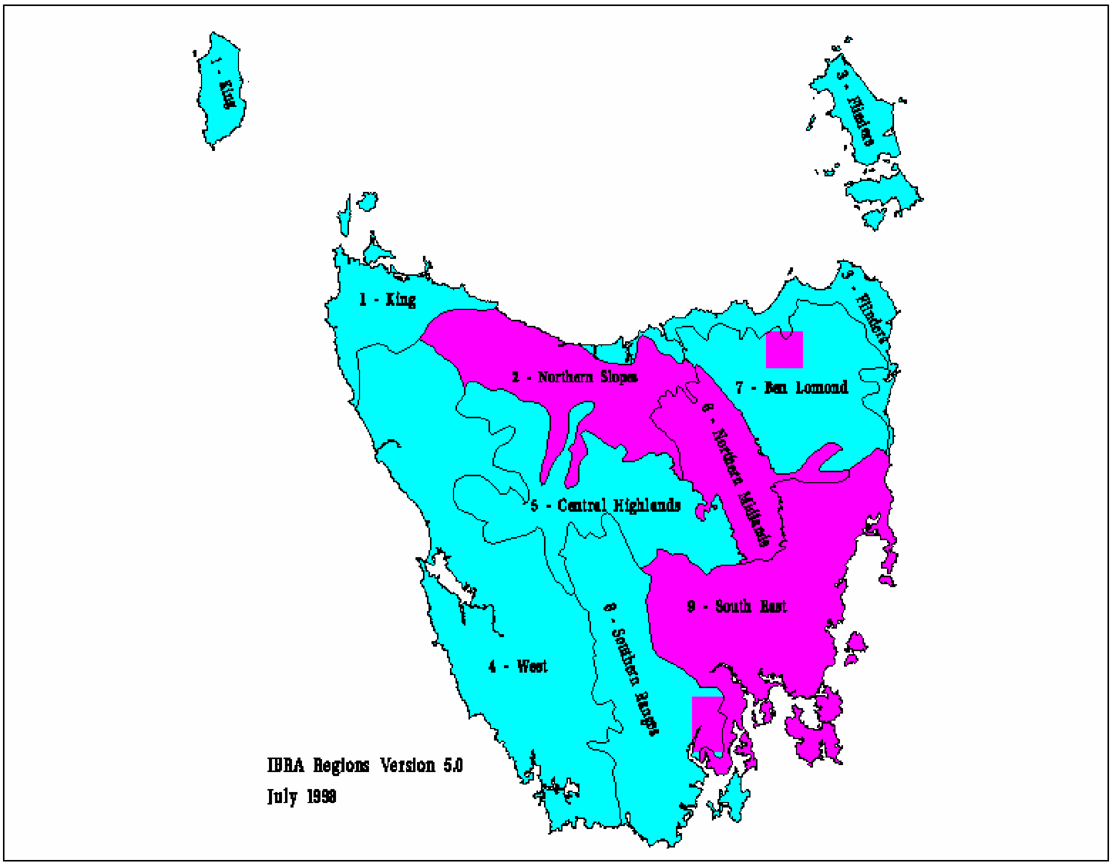

Figure 1. Mapping scales used in Tasmanian mapping. Purple shows areas mapped at 1:25 000, blue areas mapped at 1:100 000.

The initial phase of the project involved collection of ancillary data relevant to the project and the selection of suitable SPOT satellite imagery. Key ancillary data sources were obtained and converted for use in Genamap GIS, including vegetation mapping, cadastre, tenure, reserves, planning schemes, irrigation data, and a few sources of agricultural data. The project was strongly equipped to map categories 1, 2, 5 & 6 of the ALUM classification, with there being a dearth of data available to assist with mapping categories 3 and 4. Exceptions to this include adequate plantation data, and excellent dataset of dairy location (useful in identifying irrigated pastures), a vineyard layer containing approximately 50% of vineyards, and several vegetation layers identifying areas without woody vegetation data (approximating modified pastures). A database and dedicated land use GIS interface was developed at this stage by DPIWE GIS staff

Ross Lincoln of the University of Tasmania's Central Science Laboratory undertook selection of SPOT imagery, with my assistance. This proved to be an excruciating process of perusing the existing ACRES catalogue, and waiting for some cloud free weather to enable collection of real time SPOT data. Finally a selection of 15 SPOT scenes were selected. Scenes were chosen to be as recent as possible, with a low viewing angle, high sun elevation (to minimise the effect of shadow), and most importantly low cloud/cloud shadow cover. All but one image was selected from the SPOT 4 platform, containing 20-metre resolution and 4 spectral bands. The exception was the King Island image for which the only available cloud free image was from February 1998, and the SPOT 2 platform with three spectral bands. Unsupervised classifications were carried out on the first 4 images to arrive, and were conglomerated into classes approximating vegetation, water bodies, urban areas, irrigated agriculture and dry agriculture. These were used to assist in identifying land uses, but were never directly incorporated in the final dataset.

I deferred instead to the BRS preferred method of seeking regional expertise to assist in accurately identifying agricultural land uses. With some trial and error, a methodology was formed. Each map in the priority areas was created as a separate 1:25 000 map by using the corresponding Tasveg map as a template to provide a bounding rectangle and projection. A Genamap OVERLAY operation was performed on each map to create a base map containing tenure, private reserves, planning scheme/s, dams, and private timber reserves. Tenure was preferred over cadastre at this base map stage because it provided all the data necessary to map reserves, Production Forestry, Mining, and Rivers, without unnecessary lines representing property boundaries and parcels etc. The OVERLAY operation minimised the amount of linework editing, but each map generally required a significant input of time at this stage to clean up slithers and overlapping polygons between adjoining features on different datasets.

The planning schemes generally provided superb data to map ALUM categories 5 - Intensive Uses. Detail varied considerably between some of the planning schemes, with some of the better one being too detailed and showing every corner store and local park. Some planning schemes were dated, and used with caution. Rural residential areas were obtained both directly from the planning schemes, and occasionally from inspection of cadastre and from field mapping. Urban areas mapped from planning schemes were generally checked against imagery to ensure boundary accuracy.

Reserves were tagged according to the ALUM classification as it relates to IUCN categories. Additional reserves were obtained from the Private RFA program and the Protected Areas on Private Lands Program, and mapped as 1.1.7. Areas in planing schemes identified as protected were also mapped as 1.1.7. Recreation areas were mapped as 1.1.7 if primarily native cover, or else 5.5.3. Areas mapped as Stock Routes 1.3.2 area those areas identified as stock reserves on tenure and topographic maps. Little use was made of the Rehabilitation category 1.3.4.

Reclassifying areas under Hydro Tasmania tenure was problematic. Most of these areas were in parts of the state mapped at 1:100 000 scale, leaving little time for digitising features within these polygons. Generally areas of Hydro tenure containing power stations, spillways, hydro villages and powerlines etc were mapped as 5.6.1 Utilities – electricity generation, and areas without such facilities and containing predominantly vegetation were mapped as 1.2.2 Surface Water Supply.

Private Timber Reserves (PTRs) have become a major feature of Tasmanian land use, and were classified as either production forestry or plantation forestry based on the predominance of vegetation type. PTRs occurring on agricultural areas were presumed to be destined to become plantations, and mapped as such. Large PTR containing both plantation and native forests were sometime manually split into the two separate forestry classes, but only in areas mapped at 1:25 000. Private Forestry Tasmania management requested it be stressed in the data that PTRs are managed under forestry codes of practice protecting significant and vulnerable habitats. They were, however, unable to provide data other than PTR boundaries. The tenure layer provided by Forestry Tasmania provided detailed polygons of MDC Protected Areas within State forests, which have been incorporated throughout Tasmania.

The separation of remnant vegetation from grazed native vegetation was significantly problematic and time consuming. I borrowed my decision rules from the Billabong Creek land use mapping project, and determined remnant areas to be –

- Blocks of trees greater than 25ha in size
- No apparent disturbance of cover
- Crowns of the trees are large and mature
- Very steep broken or rocky terrain, coastal areas
- Absence of constructed dams as watering points for livestock
- No tracks leading within the block

(Source: Keith Emery - Land Use Mapping in the Upper Billabong Creek Catchment, report prepared for BRS)

Tasmanian coastal heaths have generally also been mapped as remnant vegetation, as have some smaller areas surrounded by intense cropping. No 1:100 000 scale vegetation mapping was available for incorporation into this project. Occasionally remnant vegetation at this scale was sourced from Tasveg 1:25 000 mapping, and occasionally was digitised manually at a coarser scale. Grazing native grasslands was extremely difficult to determine from imagery, and was originally put in the too hard basket. Much of the last few weeks of the project has been devoted to adding grazed native grasslands in the priority bioregions, as well as relabelling many areas in the Midlands from remnant vegetation to grazing native vegetation. This is the result of late field inspections identifying that very little vegetation in the midlands is actually protected from grazing.

Mapping of agricultural land uses was without a doubt the most time consuming element of the project. Dairy location and an incomplete vineyard layer were the only useful datasets available at this stage. Databases of livestock tags and tattoos proved to be unsatisfactory, as did a land use valuation database. I sourced skilled DIPWE employees who were willing to attribute satellite imagery for the north west and north east of Tasmania. No body had the time or expertise to assist in the crucial areas of the northern midlands or the southeast bioregion. For the southeast this was not really a problem, as it was predominantly a region of grazing pastures and grazing native vegetation. I attributed the northern midlands myself, and was confident to be able to extrapolate what I had seen mapped in other areas of the state. All crops were mapped as irrigated unless the attributer specifically knew otherwise.

Plotting a large number of 1:25 000 imagery maps was time consuming, there was always a time delay waiting for the plots to be attributed and returned, and then considerable amount of time was needed to manually digitise this data onto the maps. This method also frequently created problems with edge matching between adjacent maps. Overall the technique proved satisfactory, and enabled intensively cropped areas in the north east of Tasmania to also be mapped at 1:25 000 scale. Difficulties also arose in the north west due to cloud contamination of the imagery, and to one crucial imagery being of fairly poor spectral quality and captured in November, a suboptimal time of year. Airphoto orthomosaics were used where required, as was some ‘blind’ mapping of vegetation/pasture boundary relying solely on vegetation mapping. Most features of the November image were reflecting strongly in the infrared bands, presenting difficulty separating crops from pasture. Bare areas were mapped as cropping, as they were most likely recently established crops.

I felt confident at mapping the northern slopes bioregion myself. Much of the cropping in this area is irrigated by centre pivots, which are easily interpreted even by an amateur. There were few irrigated pastures in this region, and those that were present were confirmed by the dairy database. There area also few orchards in this region, so local expertise was not so crucial here.

Summary of Data Used

Colour aerial photography 1:20 000
1:42 000

Dairy location

Digital base maps - Cadastre, Road, Drainage, Rail, Coast, Lakes, Wetlands, Estuaries, Easements

Forest group types

Inland fisheries location

Irrigation sites - From WIMS (Water Information Management System)
Dams associated with irrigation licence
"Take from stream" location
Tailings dams

Irrigation scheme boundaries (Coal River Valley, Cressy-Longford)

Local Government Planning Schemes (except Clarence municipality)

Marine fisheries zones

Mining leases

Orthophoto mosaics

Private reserves (PRFA, PAOPL, FIST)

Private timber reserves

Reserves 2001

RFA forest mapping

SPOT satellite imagery (Table 1)

State of Environment Land Cover Mapping (southeast Tas)

TAPDB - Tas Property Database (Agricultural Commodities)

TASVEG vegetation mapping

Name	Date	Size	Region	View angle Deg	Sun elev. Deg	Area Km2
Deloraine	30/01/2000	Double	Devpt - L Echo	W 1.36	53.6	13000
Launceston	30/01/2000	Double	Tamar - Gt Lake	E 2.56	54.1	13000
St Helens	07/04/2000	Double	St Helens - Swansea	W 4.65	34.4	11050
Swansea	11/03/2001	Double	Frecinet - Tasman Pen	W 2.34	41.9	10873
Smithton	06/02/2002	Half	Stanley - NW tip	E 2.6	51.8	1792
Marrawah	11/02/2002	Double	Marrawah - Conical Rocks	E 4.0	50.7	7670
Waratah	11/02/2002	Double	Wynyard - Zeehan	E 7.9	50.4	10611
Queenstown	16/11/2000	Super	Dvpt - North Hd	E 1.4	57.2	26471
Hobart	04/03/2002	Super	Tooms L - Dover	W 15.0	41.2	20272
Peddar	04/03/2002	Super	Gt Lake - Bathusrt Hbr	15.6	41.2	27140
King Is SPOT2	01/02/1998	Half	King Is	E 17.2	55.4	1782
Midlands	30/03/2002	Super	Flinders - Oatlands	E 4.9	39.9	33280
Killiecrankie	19/09/2001	Qtr	Killiecrankie	E 1.0	41.3	900
Rocky Cape	14/03/2002	Half	Rocky Cape	E 13.6	43.1	1785
Strahan	04/03/2002	Half	Strahan	E 1.9	43.7	1798

Table 1. SPOT satellite imagery used for land use mapping

Tenure June 2001
Topographic maps. Hardcopy and digital
Vineyards
VISTAS- Valuation database containing land use code at time of valuation

Results

The Tasmanian land use dataset includes the following categories from the ALUM v5 classification (Table 2). Areas and percentage of dataset are presented for each category. Estuary and coastal waters have been eliminated from this frequency analysis unless they have a conservation, production or intensive use associated.

Code	Area (ha)	Percentage		Code	Area (ha)	Percentage
1.1.1	25255.64	0.3690		5.5.0	1495.72	0.0219
1.1.3	1410676.46	20.6136		5.5.1	992.89	0.0145
1.1.4	42660.93	0.6234		5.5.2	1731.63	0.0253
1.1.5	175995.90	2.5717		5.5.3	5007.86	0.0732
1.1.6	78627.51	1.1489		5.5.4	23.59	0.0003
1.1.7	249386.19	3.6442		5.5.5	440.87	0.0064
1.2.0	60584.48	0.8853		5.6.0	161.70	0.0024
1.2.1	632356.36	9.2403		5.6.1	4428.46	0.0647
1.2.2	31678.68	0.4629		5.7.0	115.46	0.0017
1.2.5	3196.65	0.0467		5.7.1	2151.56	0.0314
1.3.0	0.66	0.0000		5.7.2	1484.99	0.0217
1.3.1	26066.83	0.3809		5.7.3	466.26	0.0068
1.3.2	178.98	0.0026		5.7.4	418.87	0.0061
1.3.3	699575.60	10.2226		5.7.5	14.96	0.0002
1.3.4	3794.71	0.0555		5.8.0	6681.86	0.0976
2.1.0	277376.84	4.0532		5.8.1	441.14	0.0064
2.2.0	1285586.01	18.7857		5.8.2	319.43	0.0047
2.2.1	708.87	0.0104		5.9.0	189.66	0.0028
3.1.0	214025.56	3.1275		5.9.2	367.41	0.0054
3.1.1	220.92	0.0032		5.9.5	96.73	0.0014
3.1.4	8.76	0.0001		6.1.0	575.75	0.0084
3.2.0	1223935.29	17.8848		6.1.1	759.39	0.0111
3.2.1	117.82	0.0017		6.2.0	95579.23	1.3967
3.3.0	1039.48	0.0152		6.2.1	21.95	0.0003
4.2.0	56666.62	0.8280		6.2.4	70.10	0.0010
4.3.0	74053.83	1.0821		6.3.0	7407.19	0.1082
4.4.0	5003.19	0.0731		6.3.1	6543.07	0.0956
4.4.4	790.20	0.0115		6.4.0	38.06	0.0006
4.4.7	18.25	0.0003		6.4.1	12.94	0.0002
4.5.0	454.49	0.0066		6.5.0	6781.33	0.0991
5.1.0	104.02	0.0015		6.5.1	1069.05	0.0156
5.1.2	3.20	0.0000		6.5.2	11.82	0.0002
5.2.4	9.74	0.0001		6.6.1	43296.25	0.6327
5.2.6	11.57	0.0002		6.6.2	28.79	0.0004
5.3.0	3754.87	0.0549		6.6.3	12099.68	0.1768
5.4.0	3317.89	0.0485				
5.4.1	21984.20	0.3212				
5.4.2	32887.36	0.4806		**TOTAL**	6843440.23	100.0000

Table 2. Area of Tasmanian land use (in Ha)

Validation

Validation was focused on the 3 priority bioregions, and was undertaken separately by three DPIWE regional officers. Darren Kidd, Land Resource Assessment Officer from Launceston, collected validation data for the Northern Midlands and Northern Slopes bioregions. Bill Cotching, Principal Land Management Officer, collected validation data for the western section of the Northern Slopes bioregion. Marcus Hardie, Regional Land Management Officer from Hobart, collected validation data for the South East bioregion. Validation points were collected regularly along routes predetermined to represent all of the major land use classes mapped in Tasmania. A total of 772 validation points were collected over a two week period in January 2003 – Fig 2. GPS points were collected by a Garmin GPS and land use attributes entered in a notebook. Waypoints were downloaded into the GIS and visually compared with the land use maps to prepare the error matrix presented in Table 3.

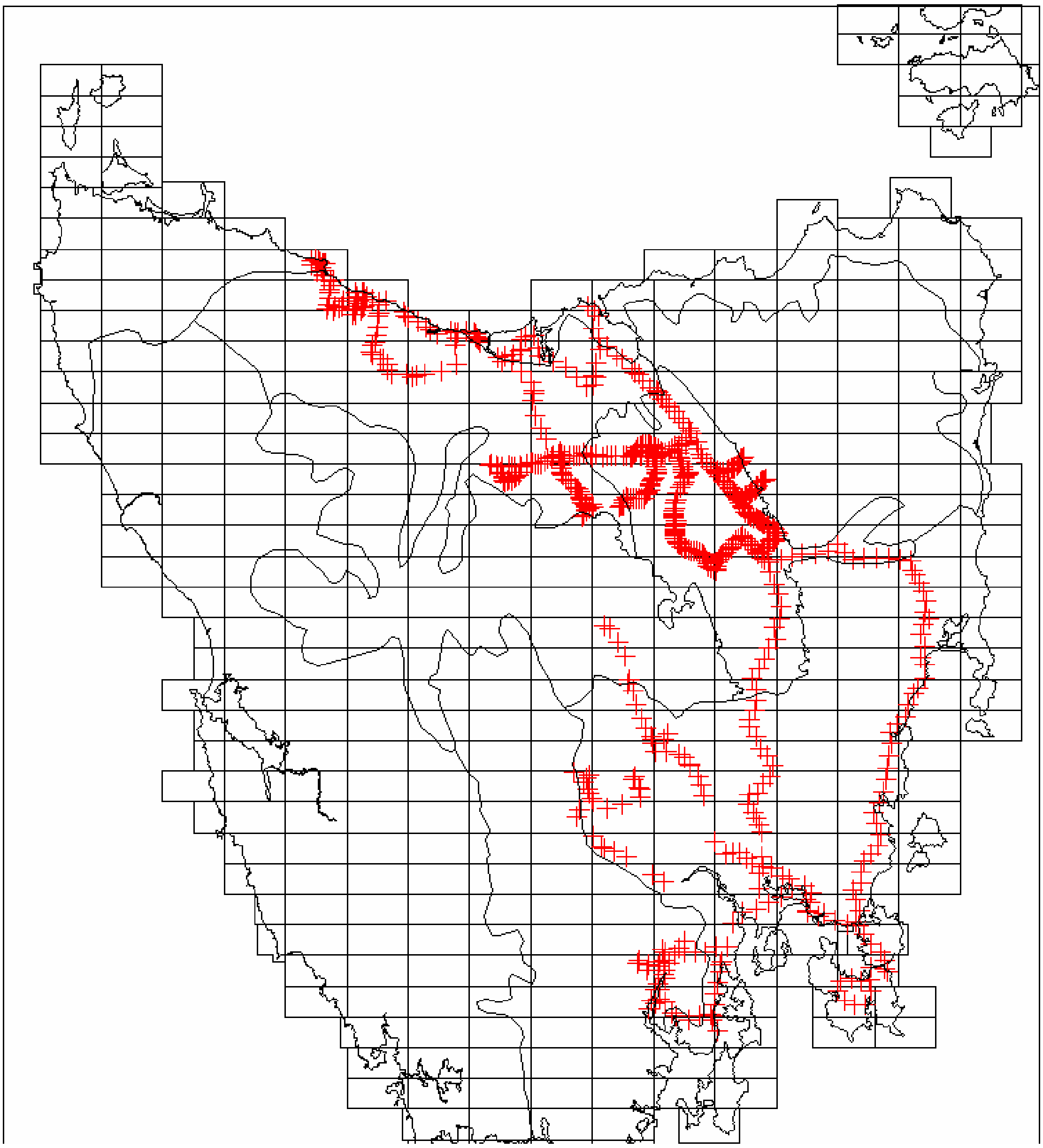

Figure 2. Location of validation sample sites.

Code	1.0.0	1.3.3	2.1.0	2.2.0	3.1.0	3.2.0	3.3.0	4.2.0	4.3.0	4.4.0	4.4.4	5.3.0	5.4.1	5.4.2	5.5.1	5.5.2	5.5.3	5.5.5	5.7.0	5.8.0	5.9.0	**TOTAL**	**Row%**
1.0.0	17																					17	100.00
1.3.3		18	5																			23	78.26
2.1.0			38			1	1															40	95.00
2.2.0				13	1																	14	92.86
3.1.0					22																	22	100.00
3.2.0		1	3		2			9	57				2				1			1		336	77.38
3.3.0							2															2	100.00
4.2.0								16														16	100.00
4.3.0						4			172													176	97.77
4.4.0									1	15												16	93.75
4.4.4											3											3	100.00
5.3.0												5										5	100.00
5.4.1													56									56	100.00
5.4.2														23								23	100.00
5.5.1															6							6	100.00
5.5.2																2						2	100.00
5.5.3																	5					5	100.00
5.5.5																		5				5	100.00
5.7.0																			1			1	100.00
5.8.0					1															2		3	66.66
5.9.0																					1	1	100.00
Total	17	19	46	13	26	265	3	25	230	15	3	5	58	23	6	2	6	5	1	3	1	**772**	
Col%	100	94.74	82.61	100	84.62	98.11	66.66	64.00	74.78	100	100	100	96.55	100	100	100	83.33	100	100	66.66	100		

Table 3. Error matrix for Tasmanian land use dataset. Overall accuracy – sum of diagonals (682)/772 = 88.34%

Discussion

Results from the validation exercise are generally as expected (Table 3). The major types of confusion in the dataset are between grazing/cropping, irrigated/non-irrigated pastures, and remnant vegetation/grazing native vegetation. All other land use categories are quite accurate.

Grazing native vegetation is 82.60% accurate, with three sample sites mapped as grazing improved pastures and five mapped as remnant native vegetation. Such minor confusion between remnant vegetation and grazing native vegetation was inevitable, due to limited time for field inspections throughout the mapping process. Confusion between grazing modified pastures and grazing of remnant vegetation is most likely attributable to difficulty distinguishing between native and modified pastures on imagery, and possibly to accuracy in vegetation mapping incorporated into this project.

Mapping of irrigated pastures is only 64% accurate. This is possibly a product of a relatively small sample number (25), but is also largely a product of the time differential between imagery date, mapping date and field validation survey date. Of areas mapped as irrigated pastures and visited during the validation exercise (16 sites), there was 100% accuracy of attribution. 9 sites were identified as irrigated modified pasture and actually mapped as grazing modified pastures, all of these being in northern Tasmania, and none within areas visited for field mapping. Visual inspection of these sites revealed that almost all appeared non-irrigated at the time of imagery (30/01/2000). Validation was carried out approximately three years later, with irrigation regimes possibly changing in that time, and recent irrigation possibly being a construct of drought conditions in Tasmania at time of validation.

This timing issue is also central to the other major category of error, between irrigated cropping and grazing modified pastures. Irrigated cropping was shown to be 75% accurate, due to 25% of sample sites seemingly being incorrectly mapped as grazing modified pasture. Error in this instance is largely due to difficulty in differentiating between cereal crops and pasture as they appear on imagery.

Of greater importance and also more difficult to substantiate is the effect of cropping rotation on land use change. Most agricultural areas of northern Tasmania are managed on a rotation basis, generally calculated on the quality of the land and its ability to sustain intense agricultural practices. Some parcels will be rotated with one crop every 5 years, while others may be cropped 4 years out of 5. Relatively few areas are continuously cropped. Visual inspection of imagery at points incorrectly mapped as grazing showed that few crops were missed in the mapping process, and that areas carrying crops at time of validation were largely without crops at the time of imagery. This is substantiated by land management experts in northern Tasmania who have observed a greater amount of cereal cropping than in other years, perhaps due to farmers taking advantage of higher commodity prices due to the current drought on mainland Australia. Conversely, 4 areas were mapped as cropping but validation showed they were in pasture, with inspection of imagery proving the original mapping to be correct. These areas are often irrigated by centre pivot irrigation, which is generally very obvious on imagery, and unlikely to be incorrectly mapped in the first place.

Conclusion

The project has reached its objective of mapping land use to a minimum of 80% accuracy. Various land management experts identified correctly at the projects commencement that there would be difficulties separating the various agricultural land uses, especially in the north of Tasmania. In hindsight it might have been wise to reinstate a land use category for land in a cropping/pasture rotation. The expenditure of significant amounts of time mapping crops which are likely to be in different locations one year later was valuable in obtaining area figures for these agricultural land uses.

The value of validation carried out in Jan 2003 on areas mapped largely from imagery taken in January 2000 is questionable. The validation exercise does not really identify whether errors are the result of crop rotation and other forms of land use change, or the result of sloppy mapping. Also of concern was the wide time difference between satellite image dates provided, with crucial areas of the midlands, for example, being mapped from adjoining imagery up to 26 months apart.

Lack of time to for field inspection was a significant problem, with only an estimated 40% of the priority bioregions visited during the mapping stage. This is likely to result in errors in the dataset, particularly in regard to new plantations and orchards. Similarly, difficulty in sourcing regional expertise with sufficient local knowledge and willingness to commit significant time to attributing land use data has degraded the dataset in some regions.

Overall I am happy with the dataset. It would have been of better quality given more time for field inspection at the time of image collection, better input from regional experts in the northern midlands, and real time collection of ground truth and validation data for at least some selected regions of Tasmania.

Acknowledgments

The project has benefited immensely from the input of skills of many DPIWE staff, especially those from the GIS section and Land Resource Management section. From the GIS section I would like to thank David Peters for project supervision, Colin Reed, Simon Pigot, John Corbett, Wengui Su and Ruiping Gao for GIS support. Kristy Boon, Lindsay Millard and Helena Nermut also provided technical assistance that was most appreciated. The Tasveg section provided access to topographic maps, stereoscopes, GPS and binoculars, and advice on land use as it pertains to vegetation. From the Land Resource section I would like to thank Bill Cotching, Marcus Hardie and Darren Kidd for assistance with field mapping and validation, and Chris Grose for facilitation of land management expertise. Robin Thompson from Extensive Agriculture also provided valuable assistance with map attribution. I would finally like to thank all those who provided data for use in the project, especially Forestry Tasmania, Private Forests Tasmania, and Paul Hastie and Steve Sellers from cadastral Information Services at DPIWE. Ross Lincolne did a superb job with selecting the best available imagery from a vast ACRES catalogue of cloudy and otherwise unusable imagery, and for performing unsupervised classifications of much of the selected images.

Metadata **Category**	**Statement** **Element**	**Description**
Data Set	Title	Land Use, Tasmania
Custodian	Custodian	D.P.I.W.E. GIS Section
	Jurisdiction	Tasmania, Australia
Description	Abstract	A statewide coverage land use of Tasmania. Mapping priorities have been determined by diversity of land use. The areas of Tasmania most heavily used for agriculture are mapped at 1:25,000 scale, comprising the Northern Slopes, Northern Midlands, and South East IBRA5 Bioregions. The remaining areas are mapped at 1:100,000 scale. Version 5 of the Australian Land Use and Management (ALUM) is used to attribute the land uses.
	Search Word	Land Use, Land Use Mapping, Agriculture
	Geographic Extent Name	Tasmania
	GEN Category	Tasmania
	GEN Custodial Jurisdiction	Tasmania
	GEN Name	Land Use, Tasmania
	Geographic Extent Polygon	
	Geographic Bounding Box	
	North Bounding Latitude	-39.0
	South Bounding Latitude	-56.2
	East Bounding Longitude	165.2
	West Bounding Longitude	136.2
Data Currency	Beginning Data	2001
	Ending Date	2003
Dataset Status	Progress	Complete
	Maintenance and Update Frequency	Undetermined
Access	Stored Data Format	Genamap vector, Oracle database
	Available Format Type	Genamap, ArcInfo export
	Access Constraint	To be determined

Data Quality	Lineage	The dataset was constructed by satellite image interpretation, air photo interpretation, and incorporation of ancillary data. SPOT satellite imagery was the primary spatial data source for most of the study area, mostly from the SPOT4 platform, providing 4 spectral bands with 20m resolution. A selection of 15 images was chosen for low cloud/haze, low sensor viewing angle, currency, and season. Cloud conditions necessitated the selection of images from a variety of dates, with most being more recent than January 2000. The exception was King Island, for which the most recent useable image was from February 1998, and from the SPOT 2 platform (3 bands). Air photos and orthophoto mosaics were used in a few areas where satellite imagery was cloudy. 1:20,000 or 1:42,000 high-resolution colour photos were used with caution, as many were from 1996 - 2000. Key ancillary data used in the project include - • Tasveg vegetation mapping, comprising detailed forest and non-forest mapping at 1:25,000 scale no older than 5 years throughout Tasmania, and regularly updated. • Forest group type mapping from Forestry Tasmania and Private Forests Tasmania. • Local government planning schemes, except Clarence municipality • State cadastre. • State tenure. • Digital planning schemes. • Reserves mapping – August 2001. • Private Reserves • Digital topographic maps. • Mining lease maps - October 2001. • Marine farm location maps. • Viticulture location map. • Drainage digital map. • Road digital map. • Irrigation licence location, point data. • Dairy location, point data. • Tasmanian Agricultural Product Database (TAPDB) of grazing animals point data. The project used the ALUM version 5 classification system, which was developed for land use mapping throughout Australia. Most features were only mappable to the "minimum level of attribution". Mapping guidelines stipulated that - • Prime land use is determined on the basis of the primary management objective of the land manager • Land use classes should be allocated at a particular point in time (date of satellite imagery) • Areas should be assigned to irrigation if permanent infrastructure for irrigation is present. • Areas of vegetation likely to be grazed should be assigned to 2.1.0 (grazing natural vegetation) or 3.2.0 (grazing improved pasture) **Methodology** Each land use map was created from pre existing digital data, with additional agricultural data added from satellite imagery The usual method was to create a new map from digital tenure layer and reclassify features within this map – Reserves, Rivers, State Forest, Hydro features etc. Add areas appropriate to ALUM category 5 (INTENSIVE USES). These are generally sourced form local government planning schemes. Add private timber reserves (PTR), private reserves (PRFA, PAOPL), vineyards, marine fishing zones and land based aquaculture sites, mining areas (either from visual inspection of imagery or from Mining Lease dataset), major vegetation features (remnant vegetation, grazing natural vegetation, from Tasveg and RFAforest mapping) and water features including rivers and dams (from drainage layer and imagery analysis). Finally additional plantations not represented as PTRs are added to each map. Initially maps were created with all these elements at the outset via the overlay operation in Genamap, generally resulting in significant time lost to data cleaning. Most maps were subsequently created by an overlay of tenure, PTRs, plantation and dams, and planning schemes, with vegetation and agricultural features digitised in last Satellite imagery for many mapsheets was plotted and sent to regional land management experts, who identified agricultural land use for ALUM categories 3 & 4. This data is then digitised onto each map and, voila, a land use map is completed. <u>Limitations</u> Only major highways have been mapped, unless they appear in Tenure layer or planning scheme. Only farm dams greater than 0.25 ha have been added, and only in areas mapped at 1:25 000. Rural residential areas have been added from planning schemes and occasionally from cadastre, and override any other land use features. Agricultural features have been mapped at the time of satellite imagery. Some fuzzy edge matching was required where adjoining satellite scenes were from different dates. The most recent scene was always used, unless its data was vastly inferior to an overlapping scene. Agricultural mapping is dependent on skills and experience of those attributing the images. Very little time has been available for additional field checking. Most cropping and horticulture has been mapped as irrigated, unless those doing the attributing specifically remember areas of dryland agriculture. Irrigated pastures are largely mapped as they appear on imagery. All areas of State Forest are mapped as either 2.2.0 (Production Forestry) or 3.1.0 (Plantation Forestry). Plantations within State Forests are poorly delineated, if at all, especially at 1:100 000 scale Separation of cropping from vegetable growing (perennial or seasonal horticulture) proved to be very difficult. Where difficulty occurred, they were mapped as cropping. (Such areas are likely to be in a rotation pattern anyway). Many orchards, especially new ones, are likely to have been missed.

	Positional Accuracy	Generally within 20 metres. Satellite Images have been resampled to within 20m accuracy. Tasveg mapping has been estimated to be within 20m accuracy.
	Attribute Accuracy	Overall accuracy is 88.34%. Validation results based on 772 sample points collected in January 2003. Confusion mainly occurs between grazing improved pastures/grazing native grasses/grazing irrigated pastures/irrigated cropping/
	Logical Consistency	All lines and polygons are tagged. Adjoining mapsheets are systematically edge matched for attribute consistency and line connection
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