

Land Use Tasmania

Technical Report

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ABSTRACT

A technical report outlining the creation of the Draft Tasmanian Summer 2009/2010 Land Use Spatial Layer.

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INTRODUCTION

GOAL

This project developed a 1:50 000 land use digital spatial layer for Tasmania, attributed to ALUM 7 standards (Appendix 4), as at summer 2009/2010.

The 1:50 000 land use dataset was created from fieldwork, consultation with local experts, current 1:25000 vector datasets and 2009/2010 RapidEye imagery. The minimum mappable area was 10ha, which is appropriate for both 1:50 000 scale mapping, and the spatial accuracy of the RapidEye imagery.

ACKNOWLEDGEMENTS

I would like to thank the following people and organisations for their valuable help and assistance during the project:

- NRM North, NRM South, Cradle Coast NRM, especially Andrew Baldwin, James Shaddick, and Aniela Grun
- Tasmanian Dairy Industry Authority
- Galaxo
- Tas Alkaloids
- Ling Liu-Chapman, Rob Moreton, Rhys Stickler, Kiowa Fenner, Mat Webb, Paul Fazackerley, Felicity Faulkner, Stephen Creese, Regan Parkinson, David Lane, David Kruska, Darren Kidd, Mick Sherriff, Dr Bill Cotching, iGIS iPhone app, Geometry Group, Michael Home, Todd Baker, Greg Stewart

I would also like to thank my wife for her patience.

BACKGROUND

Land use maps are a primary dataset used for decision-making in natural resource management projects by planners, land managers, policy developers and researchers. The present land use dataset for Tasmania was created in 2001 as part of a national Bureau of Rural Science (BRS) project.

Land use in Tasmania has changed substantially in the last ten years. Though attempts have been made recently to update the land use mapping, they have only addressed specific regions using information from different years to update specific land use types.

In 2009, Landscape Logic updated a broad set of Land Use codes for their Landscape Logic Tasmanian Retrospective Project 11 for priority catchments. The priority catchments are:

- Ansons Bay
- Black
- Carlton/Pitt Water
- Coal/Pitt Water
- Duck
- George
- Little Swanport
- Meredith
- Montagu
- Pipers
- Rubicon/Port Sorrel

DPIPWE updated the irrigated cropping land use for parts of the midlands in 2009.

The acquisition of statewide RapidEye imagery offered an opportunity to update land use maps at a set time for the entire state. Given that land use trends vary over time, mapping land use during a specific year is a powerful dataset. This project was especially timely given the pending irrigation development in Tasmania.

This project was funded by NRM North, Cradle Coast NRM, NRM South, and DPIPWE. NRM North managed contractual management on behalf of the funding bodies.

This report is not an analysis or breakdown of the land use in the state. It is designed to explain the methodology for the creation of the land use layer.

GLOSSARY

AAM: AAM Pty Ltd is Geospatial group that specializes in remote sensed imagery.

ALUM: Australian Land Use and Management (ALUM) Classification.

ArcGIS: ArcGIS is a suite of GIS software products from ESRI.

ArcMap: The main component of the ArcGIS suite of geospatial processing programs. Used primarily to view, edit, create, and analyze geospatial data.

ArcCatalog: Software that provides an integrated and unified view of all the data files, databases, and ArcGIS documents used in the project.

BRS: Bureau of Rural Sciences. On 1 July 2010 the Department of Agriculture, Fisheries and Forestry merged two Bureaus within its portfolio, the Australian Bureau of Agricultural and Resource Economics (ABARE) and the Bureau of Rural Sciences (BRS).

DPIPWE: Department of Primary Industries, Parks, Water, and Environment www.dpiw.tas.gov.au

DIER: Department of Infrastructure, Energy, and Environment www.dier.tas.gov.au

ESRI: Environmental Systems Research Institute. Creates software used in GIS applications.

FUM: TasVeg 2.0 vegetation code for Extra-urban miscellaneous

FUR: TasVeg 2.0 vegetation code for Urban Areas

GIS: Geographic Information System. A computer system designed to allow users to collect, manage, and analyze large volumes of spatially referenced and associated attribute data.

Google Earth: Google Earth is a virtual globe, map and geographical information program that is provided free of charge by google.

GPS: Global Positioning System, a handheld device that indicates the present location.

IUCN: The International Union for Conservation of Nature and Natural Resources.

Land Use: How our land resources are used. This includes the production of goods (such as crops, timber and manufacturing) and services (such as defence, recreation, biodiversity and natural resources protection).

NRM: The management of natural resources such as land, water, soil, plants and animals, with a particular focus on how management affects the quality of life for both present and future generations. NRM can also mean the three Tasmanian Natural Resource Management Regions of NRM North, NRM South and Cradle Coast NRM.

PDA: A personal digital assistant (PDA), also known as a palmtop computer, or personal data assistant. A handheld computing device that can run programs like a calendar, spread sheet, database and sometimes GPS.

PID: Property Identification Number.

RapidEye: RapidEye AG is a German geospatial information provider focused on assisting in management decision-making through services based on their own Earth observation imagery. The company owns a five satellite constellation producing 5 meter resolution imagery.

Scale: Map scale 1:25, 000 means 1cm on the map equals 25 000cm (250m) on ground.

SPOT: Système Probatoire d'Observation de la Terre is a high-resolution, optical imaging Earth observation satellite system. SPOT 5 launched May 4, 2002 with 2.5 m, 5 m and 10 m resolution.

Spatial Layer: A database of a single theme that has location information. It can help to think of it as a transparent overlay on a map. Examples of layers used: roads, rivers, sign posts, traffic lights, buildings.

Streetview: Google Street View is a technology featured in Google Maps and Google Earth that provides panoramic views from various positions along many streets in the world.

Tasveg: TASVEG is a Tasmania-wide vegetation map, produced by the Tasmanian Vegetation Mapping Program (TVMP). The TVMP use 154 distinct vegetation communities to produce TASVEG at a scale of 1:25,000.

METHODOLOGY

The project used existing datasets where suitable. Tasmania has a strong set of core environmental spatial data, much of this available at 1:25,000. These datasets defined the boundaries and provided the values for the first draft. The gaps and detail were provided by fieldwork, discussions with local experts, site information, satellite imagery, orthophotos, streetview, and workshops in each region.

Land use is mapped in six categories:

- Reserves
- Natural Environment
- Dryland Agriculture and Plantations
- Irrigated Agriculture and Plantations
- Intensive Uses
- Water

Reserves are well-mapped in Tasmania. The Tasmanian Reserves Estate layer contains all the information about the World Heritage Areas, National Parks, Protected and Management areas. These are identified by IUCN categories and directly match ALUM land use classes. Additional reserves information was obtained from the Public Land Classification and local government. See Appendix 1 for further details.

Natural Environment land uses were primarily grazing on native pastures. The recent drought had caused farmers to reduce their grazing herd size to remain sustainable. In a reversing trend there was significant rainfall in the last year, which created an abundance of growth in ground cover.

All the plantations in Tasmania are dryland. The information about the plantations on public land was supplied by Forestry Tasmania (FT). Forestry Tasmania (FT) provided the plantation boundary as well as the type indicating softwood, or hardwood. The supplied data was as at June 2010. The information about the plantations on private land was supplied by Private Forests Tasmania (PFT). The provision of the plantation information by PFT, similarly to FT, included the plantation boundary and type indicating softwood or hardwood. PFT data is at December 2009.

It was extremely difficult to distinguish between some types of dryland and irrigated agriculture. Advice was sought from farmers, local experts, agricultural companies, and DPIPWE staff in all cropping regions of the state. The old remote sensing interpretation rule that symmetric shape paddocks are likely irrigated, while odd shaped paddocks with crops are dryland, was used, though cropping was only classed as dryland agriculture if confirmed by a knowledgeable source.

Most of the cropping in Tasmania is irrigated. This was confirmed by employees from several Tasmanian horticulture companies. The poppy companies require that poppies must be grown in irrigated paddocks (there are a few rare exceptions). The last ten years of poppy crops was used in combination with location of water offtakes, proximity to dams and rivers, bare ground, presence of centre pivot, and paddock shape, as an indicator to assist with the identification of irrigated cropping.

The intensive uses included the urban, rural residential, roads, airports, industry, and mining. These are the most intensively used of all the land uses. The information from theList, and the Valuer-General's office afforded the most reliable information for this section. Specific details about the classification of these land uses are available in Appendix 1.

The Water land use was classified from theList 1:25 000 polygon hydrology layer. This layer was missing a significant number of farm dams. Ling Liu-Chapman, Felicity Brown, and Mark Brown digitised hundreds of new dams from imagery. These will be superseded by 2009 Dams Update from Geoscience Australia. The land use in

the case where a dam on farm land that has been sold to forestry companies and is now surrounded by trees is treated as a reservoir.

RESOURCES

The following resources were provided for the project:

- NRM Regions - access to NRM coordinators
- NRM Regions - workshops
- DPIPWE
 - Office space
 - PC
 - ArcGIS 10 software
 - Access to DPIPWE staff for field work 1 day fortnight
 - 1 day per week Fox Eradication Program GIS Technical Officer Ling Liu-Chapman
 - Peer-reviewed rules with DPIPWE staff
 - Access to state government datasets

WORKFLOW

1. Review RapidEye Imagery
2. Develop methodology for ArcGIS 10
3. Collate underlying assumptions - identify experts
4. Identify existing information/datasets
5. Attribute land use classes
6. Create the Urban layer
7. Develop methodology for field work
8. Create rough draft of land use
9. Improve the draft through field work
10. First complete draft
11. Write technical report

REVIEW RAPIDEYE IMAGERY

The RapidEye imagery was supplied and compiled into the mosaic by Nils Matthews of the AAMGroup (<http://aamgroup.com>). The colour-balanced mosaic was reviewed by James Shaddick and Mark Brown in May to July 2010. This process was very beneficial, as the final supplied version of the RapidEye mosaic is significantly better than the initial versions. The early versions of the RapidEye imagery had spatial accuracy between 30m to 70m. The final version has a spatial accuracy in the range of 10-20m. The AAMGroup supplied the imagery to a higher accuracy that was required from the 30m stipulated in the contract.

Four versions of the Statewide mosaic were delivered. They were two sets of slightly different colour balanced images, with one high compression and one low compression ecw. The RapidEye imagery was primarily used in the ArcGIS 10 software for the project work; however ArcGIS 10 has some known deficiencies operating with ECW files. ESRI recommend that JPG2 files are used instead of ecw files.

DEVELOP METHODOLOGY FOR ARCGIS 10

The Land Use project used the latest version of ESRI's ARCInfo – ArcGIS 10.

ArcGIS 10 was a major rewrite of ArcGIS 9.3. It had numerous bugs, most of which have now been fixed with software patches. Unfortunately these patches were not available during the development of the land use layer. ArcGIS 10 was very unstable when editing. It was also very slow when more than two layers were displayed with the editing layer and a background image. Additionally, GIS operations failed many times because they exceeded the limits of the software. Critical GIS operations were performed in ArcGIS ArcInfo 9.3 because it was a stable platform.

This project used very large datasets. Large datasets cause the GIS to operate very slowly, so it was more efficient to tile the state into small sections. The spatial layers were split into the tiles, and all operations were executed on these smaller datasets. The tiles were merged together to create one dataset for the state. The model builder was used extensively for repetitive GIS operations.

SPOT 5 imagery became available in the later stages of the project. The Spot 5 imagery was for 2005 and 2009. SPOT has a resolution of 2.5m. This means that four SPOT pixels are displayed in the same position as one 5m RapidEye pixel. The imagery was sharper, and provided information about the land over a range of dates. This time series is useful for determining the land use.

COLLATE UNDERLYING ASSUMPTIONS - IDENTIFY EXPERTS

The following assumptions were assumed considered to be true, and were taken into consideration when classifying the land use:

- A water license is only a right to take water not a guarantee that the farmer did actually use their allocation for irrigation.
- Raised beds but they may not have been in use at summer 2009/10.
- Irrigators are occasionally used as a guarantee that the pasture will get up.
- There is a considerable amount of hay, but the hay paddocks all seem to be grazed when not used for hay making. Would it be more appropriate to attribute them as grazing not hay?
- Assumed that fallow ground is cropping unless it is in a dairy area, or field work shows that it is a fodder crop.
- A paddock frequently used for cropping, may not be in crop for Summer 2009/2010.
- Irrigation machinery (including very large irrigators):
 - do not always stay in the same spot.
 - location from the previous year can appear distinctly on imagery.
 - may not be used at all.
- It is very difficult to tell irrigated cropping from non-irrigated cropping. Only the land owner knows if the cropping was irrigated or non-irrigated.
- All poppy crops are irrigated.
- Fallow land either had been a crop, or was to be a crop.
- Irrigated cropping is more common than dryland cropping.
- Regular-shaped crop paddocks are irrigated, particularly if they are near a water off take, dam or river.
- Corn is grown for feeding cows.
- If unsure use the most frequent land use in the region.

The land use is diverse across the state. The composition of the land use in each part of the state varies considerably across the entire state. Local experts were invaluable in this project, and they provided extensive knowledge about the history of the land. Local experts such as farmers, land managers, agricultural consultants, weed officers, nrm facilitators, were consulted throughout the state.

IDENTIFY EXISTING INFORMATION

Tasmania is rich with detailed core spatial datasets. Many of these were very timely for this project. They contain attribute information that shows the current land use. It is preferable to use land use information from existing sources because it saves time and effort, and it will reduce spatial error when using those datasets with the land use dataset in spatial analysis. Sometimes the data will only offer evidence to a land use and not the specific land use, but this is still useful.

The following spatial datasets were used in the land use project because they either have land use information or assisted in the classification:

- 10 years poppy locations, from Galaxo, and Tasmanian Alkaloids.
- RapidEye Imagery 2009/2010 in the form of the Statewide Mosaic,
- SPOT 2005, SPOT 2009,
- Raster 1:25, 000 Topographical Tasmaps, 1:100, 000 Topographical Tasmaps, 1:500,000, Topographical Tasmap,
- Google Earth Street View (2008 – 2009),
- Roads, hydrology, Contours, Cadastre, easements,
- Transend power lines,
- Land Capability, Soils, Salinity, Acid Sulphate soils,
- Tasmanian Reserve Estate, LGA Reserves, PLC Layer,
- TasVeg 2.0,
- Valuation data from the Valuer-Generals office,
- TapDB,
- Forest Groups,
- Dairy farm location Excel spreadsheet,
- TasBuiltupAreas250k.
- Dam licenses

ATTRIBUTE LAND USE CLASSES

For the layers where there was already information that can be used for land use:

- Identify the existing field and code value and its matching land use code
- Identify any other conditions specific to the layer
- Check and validate

One of the outcomes of this process was a list of the land uses for which there is little or no available information. These remaining land use classes were populated from field work.

CREATE THE URBAN LAYER

The urban and rural residential land use classes show where people live. There has been a substantial growth in residences in the last ten years. None of the available datasets reflected the extent of urban sprawl shown in the RapidEye imagery.

Appendix 1 contains the detailed methodology that was used to differentiate urban and rural residential areas from agricultural and other areas.

DEVELOP METHODOLOGY FOR FIELD WORK

Field work provides information where information is lacking. The field work also validates land use attributed from existing sources.

The field work was conducted with two staff. One member was Mark Brown, and the other officer usually had local expertise in the area. The route was pre-planned to cover as much distance as possible and to pass through the areas with unknown or significant land use classes.

It took several attempts to settle on a suitable method of recording the land use in the field before one method was found that was highly efficient, accurate, and allowed access to a large amount of available information.

The GeTac PDA was used for acquiring the field points directly from the GPS location or offset from the GPS location using ArcPad software. The GeTec has a long-life battery, and used a car charger as a backup power source. The 14 field trips covered 3750km, and gathered 3676 points of observation.

Local experts were used for areas where field work was not done. The validation for Bruny Island was from two Fox Eradication Program field officers who had spent a month walking the island. Flinders Island information was provided by NRM North officer Mick Sherriff.

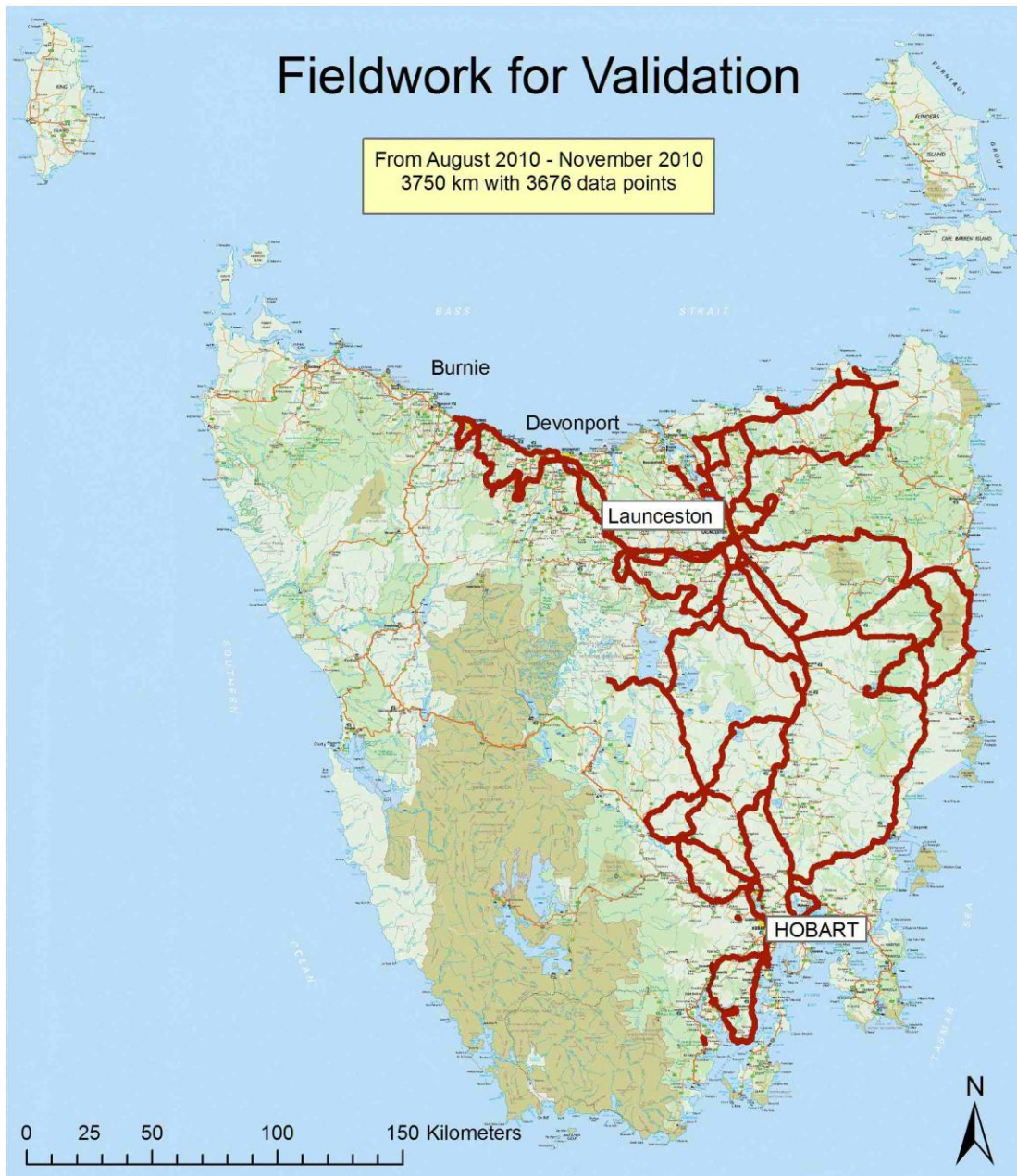


Figure 1 Extent of Fieldwork

CREATE ROUGH DRAFT OF LAND USE

After existing information was gathered, assembly of a very rough first draft spatial layer could begin. Individual land use layers derived from existing datasets were created for each land use type. A number of these layers contained more than one land use classification, such as the valuation data outlined below.

Valuation section from the Office of the Valuer-General supplied a list of PIDs with a tertiary classification of (L) Primary Production or (Q) Quarrying and Mining. The valuation land use codes were used as a guide only for possible land use. The actual land use was verified by knowledgeable field officers or other data sources. Where the valuation land use indicated multiple ALUM 7 land use codes a general ALUM 7 code was applied. General farming was initially assigned the code of 3.6.5, then these all were assigned more specific ALUM 7 codes. PIDs assigned to ALUM 7 codes of 2.2.2 and 3.1.0 were enhanced by other datasets and field officer knowledge.

Some of these layers contain information that overlaps the detail held in other layers. It is very important at this stage to merge the layers in the correct order otherwise detailed information is overwritten and lost. It is also possible for land to have multiple land uses. This can occur because either it is actually used for more than one purpose, or because the process of converting available datasets to a land use code has resulted in the region of land being assigned different land uses from distinct spatial data layers. How do we decide which land use class it should be assigned? The reserves have a legal status, so they have the highest significance. The other choices were made by evaluating the quality of the source of the land use information.

IMPROVE THE DRAFT THROUGH FIELD WORK

The first rough draft was primarily improved by only two methods. Firstly by providing sample maps to local experts for their comments and recommendations and secondly by field work. The Tasmanian Dairy Industry Authority reviewed a large number of maps specifically to validate the location of the dairy farms. Their changes and recommendations were applied to the land use map.

Planning the fieldwork was a multistep process involving a ArcGIS project with the RapidEye mosaic overlaid by layers contributing supplementary information. The workspace was used to search through the region at a scale of 1:12, 500 to:

- Identify where there needs to be more information
- Identify where the field work will validate significant elements
- target land uses that are very difficult to identify, such as vineyards, dairies, and dryland cropping.

The route for fieldwork was optimised for these elements. The PDA was loaded with images and gis layers for the region of the fieldwork (see Appendix 2 for details). After each day of field work, the field work track and data points were used to classify the land use in the region of the survey.

FIRST COMPLETE DRAFT

The rough draft was improved through a continuous process of field work and validation till the entire state had been completed. The draft version had overlaps, gaps, leaky polygons, and slivers that needed to be corrected. The overlapping polygons were removed by identifying the correct polygon from the many with the same spatial coordinates, then using the UPDATE command to replace the multiple polygons with only one. The leaky polygons were identified and corrected. The slivers were removed by dissolving, and merging polygons. The gaps were attributed to the correct neighbouring polygon. The best way to obtain attribute information from surrounding polygons is by using the spatial join tool.

When the field work was complete and all the land had a valid land use classification was taken to the next stage of review. A workshop in each NRM Region was organised, where local experts were invited to comment and review the land use (see Appendix 3). Their comments were recorded so that changes could be made to the land use map.

The workshops were fundamental in validating the draft map. No one knows the land use better than those who live and work upon it.

WRITE TECHNICAL REPORT

This technical report was prepared from notes taken during the process.

SIGNIFICANT FINDINGS

This project made a number of worthwhile findings, and completed tasks that are useful by themselves:

- Updated the Urban Mask of the state.
- Created a statewide layer of rural residential living.
- The average crop size in Tasmania is 5-7 ha.
- The best time to successfully contact agricultural affiliates via phone is on very wet days in the afternoon.
- Provided feedback to the BRS land use mapping program.
- Field testing of GeTAC rugged PDA.
- Conversion of the RapidEye imagery into a dataset optimised for use with the GeTAC rugged PDA.
- Over 500 new dams larger than 3ha were found in the mapping process.
- Forestry land use has changed substantially. New private company plantations are rare. Most sawmills are no longer operating. Land use change from farming to forestry is unlikely in the present time frame.

TRENDS

Several trends were noticed during the project:

- Hop farms are in decline. One Hop Farm was being removed by an excavator as we drove past during the field work, and Gunns Plains Hop Farm is now irrigated farming.
- Vineyards seem to be on the increase. Many new vineyards were found during the fieldwork
- Dairies have changed trend from large numbers of small dairies to medium numbers of large dairies. There used to be 1700 dairies statewide, now there are 440. The average dairy herd has grown from 80 to 340. This trend is evidenced by an 800 head dairy that is planned for 2011 near Perth.
- Most dairy farms have a small cropping component to complement their income; they also have some grazing for non-dairy animals. Because of this it is very difficult to accurately determine the extent of irrigated pasture on a dairy farm. Some use neighbouring properties to graze their herd.
- Rural residential living appears to be on the increase.
- General farming regions seem to follow good farming practice by rotating cropping paddocks. It is often the case that air photos of sequential years of a region show regular cropping on the same property but in a different location.
- There is a large increase in the number of irrigation pivots.

BARRIERS

There were a number of barriers that prevented this project from being completed as quickly or as accurately as possible:

- It is essential to receive the Forestry Tasmania data at the very beginning of the project. Forestry land use is determined by Forestry Tasmania and Private Forests Tasmania. These companies produce a spatial data layer called Forest Groups which contains the state of the plantations. This information is considered a static snapshot, and should be used in the first cut of land use. It is useful because it helps to identify the boundary for farming land. It also shows which areas of private land are dedicated for plantation. These areas are deemed not used for other farming land uses.
- Errors in data provided to the project.
- Errors in the Statewide RapidEye mosaics. Two of the mosaics have errors in parts of Tasmania.
- Lack of backup field gear.
- The first version of ArcGIS 10 had numerous software errors, and did not work well with large datasets.

LESSONS FOR NEXT TIME

When this project is next undertaken in five years' time, I recommend that the following suggestions are considered as these key points would have made the project more efficient and effective:

- Plan the project over a 12 month period.
- Forestry Tasmania and Private Forests Tasmania data **must** be available before starting the project.
- The software platform must be stable. Do not use a new version of software at the start of the project.
- Start project before the start of acquisition of the imagery.
 - These elements can be undertaken before the imagery is acquired:
 - collect available datasets
 - coordinate planning
 - scheduling
 - fieldwork
- Many datasets that people think should exist – do not exist!
- Need timely data delivery. Do not underestimate how long data will take to be supplied.
- Need data in the correct formats.
- Need the latest version of data sets.
- Use town planning schemes.
- The best land use resource is the expert knowledge stored in people's heads.
- Confirm access to local experts early in the project.
- A bare ground index has great potential to improve the attribution efficiency.
- Simple test showed that Infra-red imagery bands are of no real benefit.

RECOMMENDATIONS

The draft of land use has been handed over to the Land Conservation Branch of DPIPW to update the changes from the workshops and map validation.

AAM provided four Statewide RapidEye mosaics in ecw format. All four have errors in some parts of the image. They all cause errors when displaying in both ArcGIS and MapInfo. It is recommended that these four ecws are rebuilt, and reprovided to the NRM regions.

The following state government projects are creating timely information that directly translates to land use classes. These datasets, when complete, should be directly updated to the land use spatial layer. The projects are:

- 2009 Dams Update
- Grasslands Mapping
- Dairy Effluent Project
- Planning schemes review

The 2009 Dams Update is a layer of dams as at 2009. These dams will have existed at summer 2009/2010, so this information can be updated directly to the spatial layer. They should all be attributed as 6.2.2 Water storage – intensive use/farm dams.

The Grasslands Mappings spatial layers should be attributed for land use code 2.1.0 Grazing Natural Vegetation.

The Dairy Effluent Project by the Tasmanian Dairy Industry Authority is an 18 month project to develop effluent management plans for dairies in Tasmania. The project officer will visit every dairy farm in the state during this project. Any GPS information gathered during this project will point to the location of a dairy farm.

The Planning Schemes Review, when complete, has the potential to provide detailed information about the land uses for rural residential, urban, and services.

RESULTS

There are 191 unique land uses in the ALUM 7 land use classification. It would not make sense to produce a map showing all these classes. It is much more useful to combine the land use into logical categories. The map below shows the land use gathered into twenty land use groupings.

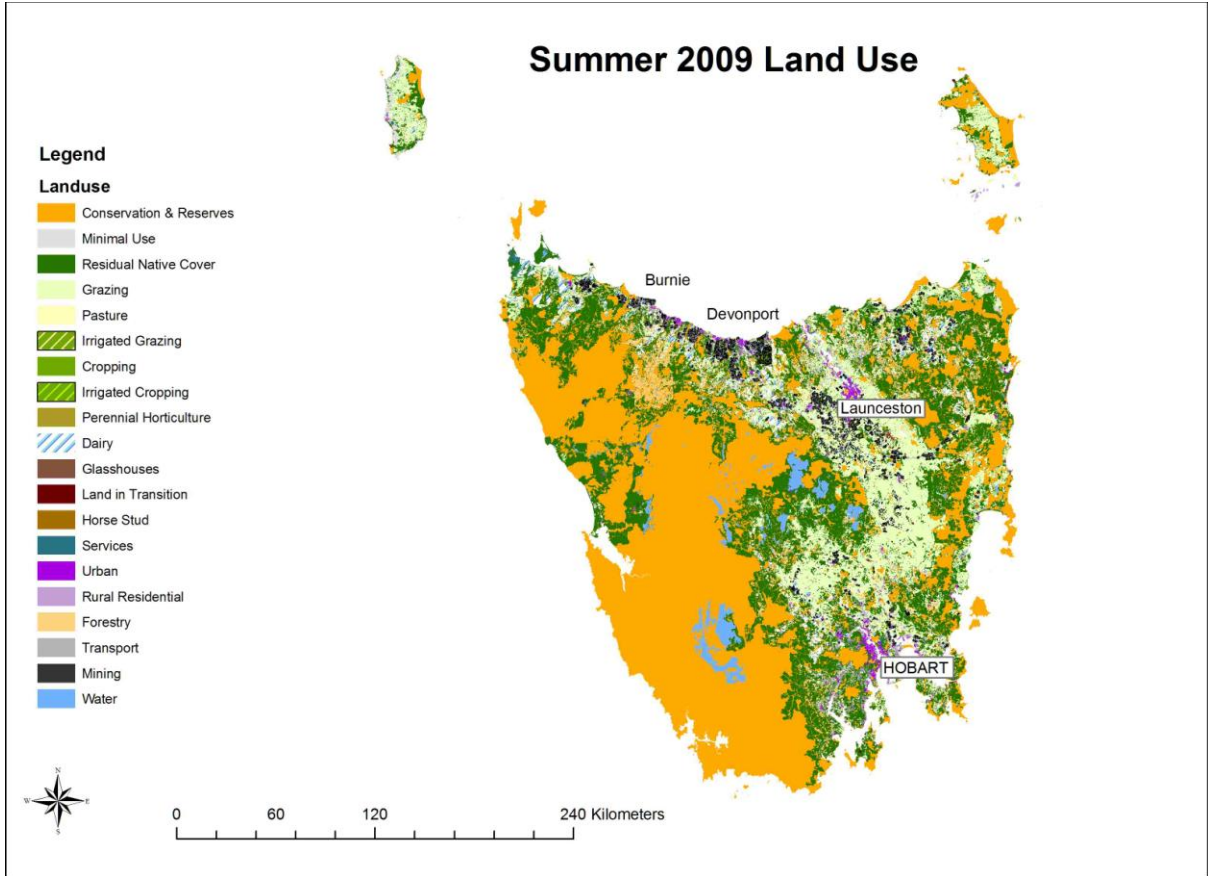


Figure 2 Draft Land Use Map

COMPLETE LIST OF THE LAND USE CLASSES, THEIR AREA, AND PERCENTAGE OF TOTAL

Land Use Code	Land Use Description	Area (m2)	Percentage
1.1.1	Strict nature reserves	266693116	0.391
1.1.3	National park	14448970799	21.194
1.1.4	Natural feature protection	290469398	0.426
1.1.5	Habitat/species management area	2341752296	3.435
1.1.6	Protected landscape	857723588	1.258
1.1.7	Other conserved area	3840076873	5.633
1.2.0	Managed resource protection	7610341776	11.163
1.2.1	Biodiversity	121424	0.000
1.2.5	Traditional indigenous uses	444527519	0.652
1.3.0	Other minimal use	418358191	0.614

1.3.2	Stock route	349597	0.001
1.3.3	Residual native cover	17637967337	25.872
133..320	Residual Native Cover with Grazing	2471718710	3.626
2.1.0	Grazing native vegetation	40526645	0.059
3.1.0	Plantation forestry	4845077	0.007
3.1.1	Hardwood plantation	2435009484	3.572
3.1.2	Softwood plantation	776707880	1.139
3.2.0	Grazing modified pastures	7652467297	11.225
3.2.1	Native/exotic pasture mosaic	1035704987	1.519
3.2.2	Woody fodder plants	209297	0.000
3.2.3	Pasture legumes	246070	0.000
3.2.4	Pasture legume/grass mixtures	3888525	0.006
3.2.5	Sown grasses	3617408	0.005
3.3.0	Cropping	128095919	0.188
3.3.3	Hay & silage	2279022	0.003
3.6.0	Land in transition	77638109	0.114
3.6.1	Degraded land	106460757	0.156
4.2.0	Grazing irrigated modified pastures	6545950	0.010
4.2.1	Irrigated woody fodder plants	2680573	0.004
4.2.2	Irrigated pasture legumes	206966	0.000
4.2.4	Irrigated sown grasses	6048277	0.009
4.3.0	Irrigated cropping	918386260	1.347
4.3.1	Irrigated cereals	1124245	0.002
4.3.3	Irrigated hay & silage	136138	0.000
4.3.4	Irrigated oil seeds	741211	0.001
4.3.7	Irrigated alkaloid poppies	14725299	0.022
4.4.0	Irrigated perennial horticulture	44281854	0.065
4.4.5	Irrigated shrub nuts, fruits & berries	116478	0.000
4.4.6	Irrigated perennial flowers & bulbs	647467	0.001
4.4.9	Irrigated grapes	13166128	0.019
5.1.0	Intensive horticulture	83431	0.000
5.1.2	Glasshouses	91203	0.000
5.2.1	Dairy sheds and yards	722585681	1.060
5.2.2	Cattle feedlots	1554825	0.002
5.2.7	Horse studs	261423	0.000
5.2.8	Stockyards/saleyards	964866	0.001
5.3.0	Manufacturing and industrial	1429007	0.002
5.3.2	Food processing factory	204838	0.000
5.3.3	Major industrial complex	3905636	0.006
5.3.5	Abattoirs	14714	0.000
5.3.7	Sawmill	1975746	0.003
5.4.1	Urban residential	411567112	0.604
5.4.2	Rural residential with agriculture	8214298	0.012
5.4.3	Rural residential without agriculture	1053378709	1.545
5.4.4	Remote communities	12466830	0.018
5.4.5	Farm buildings/infrastructure	375058	0.001
5.5.0	Services	2197463	0.003
5.5.1	Commercial services	4397015	0.006
5.5.2	Public services	1803631	0.003
5.5.3	Recreation and culture	54220894	0.080
5.6.0	Utilities	1150075	0.002
5.6.3	Wind farm electricity generation	33114564	0.049
5.6.4	Electricity substations and transmission	4548593	0.007

5.6.6	Water extraction and transmission	8613	0.000
5.7.0	Transport and communication	442066	0.001
5.7.1	Airports/aerodromes	16842886	0.025
5.7.2	Roads	331136178	0.486
5.7.3	Railways	23412251	0.034
5.7.4	Ports and water transport	318896	0.000
5.8.0	Mining	32566690	0.048
5.8.2	Quarries	961460	0.001
5.8.3	Tailings	526077	0.001
5.9.0	Waste treatment and disposal	1206958	0.002
5.9.5	Sewage	64524	0.000
6.1.0	Lake	1265962013	1.857
6.2.0	Reservoir/dam	61421594	0.090
6.2.1	Reservoir	828474	0.001
6.2.2	Water storage - intensive use/farm dams	6831958	0.010
6.3.0	River	61737242	0.091
6.4.0	Channel/aqueduct	1781339	0.003
6.5.0	Marsh/wetland	103085286	0.151
6.5.4	Marsh/wetland - saline	39388315	0.058

Estuary and coastal waters have been eliminated from this frequency analysis unless they have a conservation, production or intensive use associated.

TOP 25 LAND USES

The table below shows the top 25 land uses by area. No analysis of the land use has been conducted.

Land Use Code	Land Use Description	Contribution %
1.3.3	Residual native cover	25.87
1.1.3	National park	21.19
3.2.0	Grazing modified pastures	11.22
1.2.0	Managed resource protection	11.16
1.1.7	Other conserved area	5.63
133..320	Residual Native Cover with Grazing	3.63
3.1.1	Hardwood plantation	3.57
1.1.5	Habitat/species management area	3.43
6.1.0	Lake	1.86
5.4.3	Rural residential without agriculture	1.55
3.2.1	Native/exotic pasture mosaic	1.52
4.3.0	Irrigated cropping	1.35
1.1.6	Protected landscape	1.26
3.1.2	Softwood plantation	1.14
5.2.1	Dairy sheds and yards	1.06
1.2.5	Traditional indigenous uses	0.65
1.3.0	Other minimal use	0.61
5.4.1	Urban residential	0.60
5.7.2	Roads	0.49
1.1.4	Natural feature protection	0.43
1.1.1	Strict nature reserves	0.39
3.3.0	Dryland Cropping	0.19

APPENDIX 1 – METHODOLOGY DETAIL

RESERVES

There are three layers of reserves that contribute to attributing the land use classes.

- Thelist_lgareserves_gda94 Reserves in municipalities.
- tas_reserve_estate_gda94 The Official State Reserves Layer.
- The PLC layer

Dissolve Thelist_lgareserves_gda94 on FEAT_Name so that neighbouring reserves are merged together, as all are classified as **5.5.3 Recreation and culture** Parks, sportsgrounds, camping grounds, swimming pools, museums, places of worship, etc.

The Tas Reserve Estate layer includes all categories in the List_Privatereserves_gad94 layer

Dissolve tas_reserve_estate_gda94 on IUCN as the Landuse Classifications are directly determined by IUCN category.

IUCN GUIDELINES FOR PROTECTED AREA MANAGEMENT CATEGORIES

BRS comments: from Guidelines. Confirmed independently by Felicity Faulkner, DPIPWE.

IUCN Category	Description	ALUM Code
Ia	Strict Nature Reserve: Protected area managed mainly for science	1.1.1
Ib	Wilderness Area: Protected area managed mainly for wilderness protection	1.1.2
II, II/Ib	National Park: Protected area managed mainly for ecosystem conservation and recreation	1.1.3
III	Natural Monument: Protected area managed for conservation of specific natural features	1.1.4
IV, Ia/IV	Habitat/Species Management Area: Protected area managed mainly for conservation through management intervention	1.1.5
V	Protected Landscape/Seascape: Protected areas managed mainly for landscape/seascape conservation and recreation	1.1.6
VI, Ia/VI, IV/VI	Managed Resource Protected Areas: Protected area managed mainly for the sustainable use of natural ecosystems	1.2.0

Clarification for direction for Complexes of IUCN categories was sought from Felicity Faulkner.

LGARESERVES

1. Dissolve the LGAReserves on the field feat_Name so that adjacent reserves that accumulate to greater than 10ha are not ignored.
2. Drop out the reserves that are covered by the Tas_Reserves_estate layer. The easiest way to do this is by using the Select by location tool. It is necessary to use the centroid method because the boundaries are not the same for the reserves and there are lots of sliver issues confusing the intersection queries.
3. Remove all reserves within towns by classifying the remaining reserves as Recreation and culture.

THE PLC LAYER

Most of the PLC is in the Tasmanian Reserve Estate. However category of “Public Reserves” is not part of the Tasmanian Reserve Estate.

This includes the Prior_type of school reserves, church reserves, railway reserves, etc.

Many are tiny and in Urban areas. Only use those of area_size > 6ha

Prior_type	ALUM 7 Lu_code
Coastal Reserve	1.1.7
Gravel Reserve	5.8.2
Not Applicable	43
Plantation Reserve (Actually Grove Research Station)	3.4.0
Public Reserve (CL Act)	Check each one
Quarry Reserve	5.8.2
Railway Reserve	5.7.3
Recreation and Amusement Res	5.5.3
Recreation Reserve	5.5.3
Refuse Disposal Reserve	5.9.0
River Reserve	1.1.7
Road Trust Reserve	1.1.3
School Reserve	5.5.2
State Recreation Area	5.5.3
Stock Reserve	1.3.2
Timber Reserve	1.1.7
Tramway Reserve	5.7.3
Wildlife reserve	1.2.1

URBAN LAYER

URBAN RESIDENTIAL & RURAL RESIDENTIAL

All Residential, Commercial, Public areas, or services in the Urban area are grouped as Urban Residential. These are unique coded where they exist outside the Urban Zone.

There are three available sources for data for urban land use classes:

1. TasBUILTUPAreas250k_mga.shp from Geoscience Australia at 250k
2. Tasveg 2.0 Vegcode = FUR, and
3. Valuations Landuse code = Residential and Landuse Code = Commercial

None of these layers is ideal on its own. Merging a combination of Valuation and Tasveg produces a result better suited to the scale of the mapping project.

Valuation data includes PIDs that are not urban.

Remove these records from the dataset where *Cad_type 2* is:

'Department of Environment Parks Heritage and the Arts',

'DIER'

'DPIW'

'Hydro Electric Corporation'

'Forestry Tasmania'

Then Union the remainder with records selected from Tasveg 2.0 where Vegcode = FUR. The result will contain all the Urban Residential, most of the Rural Residential, and Services(5.5.?). Call this Urban_Union.

Information and Land Services (ILS) created a temporary layer of Built Up Areas at 1:250 000 scale to assist in the development of the Tasmanian Towns Street Atlas. This temporary layer is not available for general use, and it is too rough to use for the urban mask in this project. However it can be used to assist to delineate between Urban and rural areas. After much visual evaluation of this layer against the RapidEye imagery, it was decided to select all inside and crossing this layer from the Urban_Union layer above, as Urban Residential.

Following on from above: Switch selection to identify those not considered urban, save this layer as Urban_Union_not_541. These will be Rural Residential, and Services (5.5.?). The fieldwork will add Rural Residential properties not found by this method.

The ALUM classification separates Rural Residential with Agriculture from Rural Residential without Agriculture.

The majority of Rural Residential properties are below the minimum mappable area, however in some areas they exist as significant size clusters. Thus there is a need to keep the contiguous regions of Rural Residential polygons including services (attributing services before this point will further fragment rural residential. Attribute services at the end of this process.) Need to create two layers of Rural Residential. The dissolved layer will determine the limit/boundary/extent of Rural residential. This will then be used to create another layer that will contain the date attribute information.

Detailed checks show that a number of the records in this layer that are originally sourced from Tasveg are problematic.

Select out and remove the tasveg records that are less than 75% of the minimum mapable area

("CAD_TYPE1" = '' AND "Shape_Area" < 75000)

Set the Lu_code = 5.4.3, then dissolve on lu_code save as Urban_Union_not_541D_Clip.

Clip Urban_union_not_541 to Urban_Union_not_541D_Clip

This will select the individual polygons that make up the Rural_Residential layer.

Classify this layer using the Valuation Landuse field to Alum 7 codes as per the table below.

Valuation LandUse Code	ALUM 7 Lu_code
<<NULL>> (these are polygons from Tasveg 2.0) Need to be classified individually as they may be services, utilities, Food Processing plant, or farm buildings. There are maybe 50-100. Code as 5.4.3 if unsure.	5.4.3
R – Residential	5.4.3
R1 - House or Cottage	5.4.3
R2 - Flat/s	5.4.3
R3 - Unit/s	5.4.3
R30 - Villa units	5.4.3
R31 - Conjoined units	5.4.3
R4 - House & Flat/s	5.4.3
R5 - Rural Residential	5.4.3
R5L - Rural Resid with Rural Classfn	5.4.3

R6 - Institution Residential Accom	5.4.3
R7 - House & Rooms other use	5.4.3
R9 - Holiday home / Shack	5.4.4
R91 - Holiday home / Shack Priv Land	5.4.4
R92 - Holiday home / Shack Crown Lnd	5.4.4
R93 - Holiday home / Shack HEC Land	5.4.4

These records need to be identified as Rural Residential With Agriculture or Without Agriculture. Intersect this layer with the DPIPWE Tail Tag database (Tapdb) records to indicate which properties had sheep or cattle. About 5% were identified with tapdb records. Detailed checks show that it becomes evident that the records in this layer that are originally sourced from Tasveg are problematic. The Tasveg records often show the farm buildings, but the intersection attributes the animals from the property to the polygon. This means that some small polygons are shown to have 15000 animals. It makes no sense to attribute these polygons as Rural Residential with Agriculture as they are very clearly not hobby farms. In these cases the residential polygon should be incorporated into the main land use for the property. This action matches the suggestion in the ALUM 7 classification document. **Only those Tasveg records larger than the minimum mappable area need to be attributed.**

The intersection with Tapdb produces multiple records for each PID.

The Tasveg records will not have values in the pid field. Need to populate the PID field from the tapdb record information in fields PID_1, PID_12, PID_12_13, or PID_12_14. Select "PID" = 0 AND "PID_1" > 0, then use the field calculator to add the value of pid_1 to PID. Do the same for the other PID fields. The PIDs remaining with no value will be tapdb records where there is no PID value. Delete these records.

Then Dissolve on pid, s_animals, and cb_animals to produce a clean layer of Rural Residential properties with sheep and cattle.

Urban_Union_not_541_I_tapdbD2 is a Urban_union_not_541_I_tapdb(Rural residential intersected with tapdb records) dissolved on PID cadtype1 s_animals, and cb_animals.

Need to set a limit on the number of animals that determine whether a rural residential is a hobby farm or merely residential. Default is to set all these as Rural Residential with ag.

5.4.2 Rural residential **with agriculture**

There are many properties that are still not included in the Rural Residential layer even though fieldwork shows that they exist. All of these properties are Private Cadastral Parcels that are less than 10000sqm. I selected all private cadastral parcels less than 10000sqm and added these to the Rural Residential layer. This action worked very well to identify the rural residential properties that were missing from the rural residential layer.

METHOD TO FILL THE GAPS IN THE URBAN MASK

Some areas of land within townships are not recognised as urban because they do not have buildings. They are vacant blocks that are considered part of the township. These gaps need to be assigned with an Urban Land Use class. The following procedure identifies the gaps and attributes them as Urban.

1. Buffer the Urban by the Width of the widest Roadway (50m).
2. Clip the road polygons using the result of 1

3. Union the road polygons from 2 with the Urban layer
At this point the island polygons are null polygons. The next step is to create polygons in these null regions.
4. Create a box around all extent of the Urban and convert it to a feature class
5. Union the box with the result from step 3
6. Edit the result from 5 and delete the outer polygon
7. Dissolve

The result is urban areas with no gaps.

METHOD TO ADD ROADS IN RURAL RESIDENTIAL AREAS INTO THE RURAL RESIDENTIAL CLASS

[This may well be over written by a later stage as the roads are their own lu_code and exist as a unique layer to be added to the land use map at a later stage.

1. Buffer all the existing Urban by 2/3 width of road(or the 1:50 000 map limit of 27m)
2. Dissolve
3. Buffer the result from above to the inside buffer only by the same buffer used in step 1.

The result groups the roads into the mask.

Run this procedure for all 5.4.2, and 5.4.3 grouped together.

This procedure only works when creating a mask. Urban areas are a mask.

Reason is because the internal polygons are also buffered, thereby moving the linework by the buffered amount and creating a layer full of overlapping polygons. The result should be updated to the present version of the Land Use layer.

COMMERCIAL, MANUFACTURING & MINING

Valuation Land Use Code	ALUM 7 Lu_code
<<NULL>> (these are polygons from Tasveg 2.0) Need to be classified individually as they may be services, utilities, Food Processing plant, or farm buildings. There maybe 50-100. Code as 5.4.3 if unsure.	5.4.3
C – Commercial	5.5.1
C0 - Business & Residence	5.5.1
C1 - Retail/Business	5.5.1
C10 – Shop	5.5.1
C12 - Mixed-Shops/Offices	5.5.1
C13 - Showroom/Store	5.5.1
C14 - Shopping Centre	5.5.1
C16 - Nursery/Roadside outlet-Retail	5.5.1
C17 - Yard- Motor, Supplies, Domestic	5.5.1

C18 - Service Station	5.5.1
C180 - Service Station-self serve	5.5.1
C181 - Service Station-not self serv	5.5.1
C19 - Converted house/business	5.5.1
C20 – Office	5.5.1
C30 - Funeral Parlour, Crematorium	5.5.1
C31 - Studio/Atelier	5.5.1
C33 – Restaurant	5.5.1
C34 - Car Park	5.5.2
C35 – Stockyard	5.2.8
C4 - Licenced Premises	5.5.3
C40 - Hotel/Motel	5.5.3
C41 – Tavern	5.5.3
C43 - Licenced Club	5.5.3
C5 – Tourism	5.5.3
C50 – Motel	5.5.3
C51 - Private Hotel/Boarding House	5.5.3
C52 - Holiday Apart/Resident. Club	5.5.3
C53 - Caravan, Camping-park	5.5.3
C54 - Tourist complex	5.5.3
C55 - Tourist hostel	5.5.3
C6 - Day Care Centres/Child Minding	5.5.1
C7 – Media	5.5.1
C71 - Broadcasting Media	5.5.1
C8 - Marine Services	5.5.1
C80 - Comm. Slipway/Jetty/Chandlery	5.5.1
C81 – Marina	5.5.1
C9 - Serv Ind(Store, Retail, SemiIndu	5.5.1

Q1	Mine	5.8.1
Q12	Mine-Authority	5.8.1
Q11	Mine-Private	5.8.1
Q3	Quarry/Mine-Natural fuel	5.8.2
Q31	Quarry/Mine-Natural-Private	5.8.2
Q	Quarrying and Mining	5.8.2
Q2	Quarry-Sand,Gravel etc.	5.8.2
Q22	Quarry-Sand,Gravel,etc-Authori	5.8.2
Q21	Quarry-Sand,Gravel,etc-Private	5.8.2
L253	G'house/Nurse/Flower-All irrig	5.1.2
L25	G'house/Nurse/Flower-No retail	5.1.2
L251	G'house/Nurse/Flower-Not irrig	5.1.2
L252	G'house/Nurse/Flower-Pt. irrig	5.1.2
L4	Aquaculture	5.2.6

L42	Aquaculture-Fish Farm	5.2.6
L43	Aquaculture-Licensed Beds	5.2.6
L41	Aquaculture-Research Facility	5.2.6
L17	Farming Speciality Animals	5.2.7
L14	Farming-Mutton Bird Rookeries	5.2.7
L142	Farming-Mutton Bird-Crown	5.2.7
L16	Farming-Pigs	5.2.5
L13	Farming-Poultry	5.2.4
L19	Farming-Speciality	5.2.7
L15	Farming-Grazing/Pastoral	3.2.0
L18	Farming-Horses	2.1.0
L185	Farming-Horses Open,run,bush	2.1.0
L181	Farming-Horses-Not irrigated	2.1.0
L182	Farming-Horses-Part irrigated	2.1.0

SPECIALISED HORTICULTURE

The only available source for information for location of horticulture is the valuation codes from the Office of the Valuer-General. The table below shows the valuation code and the matching ALUM classification. These were validated by field work. Many additional locations for specialised horticulture were added from fieldwork. Some larger establishments were identified from the imagery, and attribute information from Google Earth. Tourists have posted many photos and comments about the Tasmanian vineyards. Many of the vineyards were verified remotely using Streetview. The vines are clearly visible in the Streetview images.

The ALUM 7 codes were assigned to the valuation land uses as per table below.

VALUATION LANDUSE CODE	LANDUSE	ALUM 7 Lu_code
L213	Hops-All irrigated	4.3.0
L211	Hops-Not irrigated	3.3.0
L212	Hops-Part irrigated	4.3.0
L2	Horticulture/Market Gardening	3.3.0
L24	Market Garden	3.3.0
L243	Market Garden-All irrigate	4.3.0
L244	Market Garden-Irrigat. scheme	4.3.0
L241	Market Garden-Not irrigated	3.3.0
L242	Market Garden-Part irrigated	3.3.0
L20	Orchard	3.4.0
L203	Orchard-All irrigated	4.4.0
L204	Orchard-Irrigation scheme	4.4.0
L201	Orchard-Not irrigated	3.4.0
L202	Orchard-Part irrigated	3.4.0
L23	Soft Fruit & Nut	4.4.5
L233	Soft Fruit & Nut-All irrigated	4.4.5
L231	Soft Fruit & Nut-Not irrigated	3.4.5
L232	Soft Fruit & Nut-Part irrigate	4.4.5
L22	Vineyard	3.4.9
L223	Vineyard-All irrigated	4.4.9
L224	Vineyard-Irrigation scheme	4.4.9
L221	Vineyard-Not irrigated	3.4.9
L222	Vineyard-Part irrigated	4.4.9

TASVEG 2.0

The land use classification for the vegetation land uses were obtained from TASVEG 2.0.

Some vegetation has a dual land use. For example Residual Native Cover (1.3.3) and Grazing Native Vegetation (2.1.0) for some Dry eucalypt forest and woodland.

Clip out the reserves from the tasveg layer.

Convert Tasveg 2.0 to single part polygons, not multi-part. Water bodies are multi-part but have more than one type of land use in the various parts.

Many Tasveg codes equate to non-agricultural ALUM codes.

Selection expression files have been created to easily attribute relevant vegetation in Tasveg 2.0 with ALUM codes.

```
133_Residual_Native_cover.exp  
("VEGCODE" >= 'DAA' AND "VEGCODE" <= 'DZZ') OR  
("VEGCODE" >= 'SAC' AND "VEGCODE" < 'SRC') OR  
("VEGCODE" > 'SRC' AND "VEGCODE" <= 'SWW') OR  
("VEGCODE" >= 'NAD' AND "VEGCODE" <= 'NNP') OR  
("VEGCODE" >= 'WBR' AND "VEGCODE" <= 'WVI') OR  
("VEGCODE" >= 'RCO' AND "VEGCODE" <= 'RPW')
```

VEGCODE	ALUM 7 Lu_code
AHF	6.5.0
AHL	6.5.0
AHS	6.5.4
ARS	6.5.4
ASF	6.5.0
ASS	6.5.4
AUS	6.5.4
AWU	6.5.0
DAC	1.3.3
DAD	1.3.3
DAI	1.3.3
DAM	1.3.3
DAS	1.3.3
DAZ	1.3.3
DBA	1.3.3
DCO	1.3.3
DCR	1.3.3
DDE	1.3.3
DDP	1.3.3
DGL	1.3.3
DGW	1.3.3
DKW	1.3.3
DMO	1.3.3
DMW	1.3.3
DNF	1.3.3
DNI	1.3.3
DOB	1.3.3
DOV	1.3.3
DOW	1.3.3
DPD	1.3.3

DPE	1.3.3
DPO	1.3.3
DPU	1.3.3
DRI	1.3.3
DRO	1.3.3
DSC	1.3.3
DSG	1.3.3
DSO	1.3.3
DTD	1.3.3
DTG	1.3.3
DTO	1.3.3
DVC	1.3.3
DVF	1.3.3
DVG	1.3.3
DVS	1.3.3
FAG	0.0.0
FMG	1.3.3
FPE	1.3.0
FPF	3.6.0
FPL	3.1.0
FPU	3.1.0
FRG	3.2.0
FSM	1.3.3
FUM	1.3.3
FUR	5.4.1
FWU	3.6.1
GCL	1.3.3
GHC	2.1.0
GPH	1.3.3
GPL	2.1.0
GRP	1.3.3
GSL	1.3.3
GTL	1.3.3
HCH	1.3.3
HCM	1.3.3
HHE	1.3.3
HHW	1.3.3
HSE	1.3.3
HSW	1.3.3
HUE	1.3.3
MAP	1.3.3
MBE	1.3.3
MBP	1.3.3
MBR	1.3.3
MBS	1.3.3
MBU	1.3.3
MBW	1.3.3
MDS	1.3.3
MGH	1.3.3
MRR	1.3.3
MSP	1.3.3
MSW	1.3.3
NAD	1.3.3
NAF	1.3.3
NAL	1.3.3
NAR	1.3.3

NAV	1.3.3
NBA	1.3.3
NBS	1.3.3
NCR	1.3.3
NLA	1.3.3
NLE	1.3.3
NLM	1.3.3
NLN	1.3.3
NME	1.3.3
NNP	1.3.3
OAQ	6.2.0
ORO	1.3.3
OSM	1.3.3
RCO	1.3.3
RFE	1.3.3
RFS	1.3.3
RHP	1.3.3
RKF	1.3.3
RKP	1.3.3
RKS	1.3.3
RKX	1.3.3
RLS	1.3.3
RML	1.3.3
RMU	1.3.3
RPF	1.3.3
RPP	1.3.3
RPW	1.3.3
RSH	1.3.3
SAC	1.3.3
SBM	1.3.3
SBR	1.3.3
SCA	1.3.3
SCH	1.3.3
SCK	1.3.3
SCW	1.3.3
SDU	1.3.3
SHC	1.3.3
SHF	1.3.3
SHG	1.3.3
SHL	1.3.3
SHS	1.3.3
SHU	1.3.3
SHW	1.3.3
SLW	1.3.3
SMM	1.3.3
SMP	1.3.3
SMR	1.3.3
SQR	1.3.3
SRC	1.3.3
SRI	1.3.3
SSC	1.3.3
SSK	1.3.3
SSW	1.3.3
SWW	1.3.3
WBR	1.3.3
WDA	1.3.3

WDB	1.3.3
WDL	1.3.3
WDR	1.3.3
WDU	1.3.3
WGK	1.3.3
WGL	1.3.3
WNL	1.3.3
WNR	1.3.3
WNU	1.3.3
WOB	1.3.3
WOL	1.3.3
WOR	1.3.3
WOU	1.3.3
WRE	1.3.3
WSU	1.3.3
WVI	1.3.3

Be aware that the FUM polygons must be individually verified. Many of the FUM are mining, recreation, easements, with about 10% being rural residential.

ROADS

Roads are stored spatially in three theList datasets:

- thelist_transportsegments_gda94_polyline
- thelist_easements_gda94_polygon
- thelist_parcelsgda94

The transport segments are not suitable as they are a line, and need to be converted into a polygon. This proved to be complex.

The easements omit a large number of rural roads (area 48019567.807144 compared with Area 368225350).

Thelist_parcelsgda94 cad_type1 = "Casement" has a large number of road segments, and appears to be the most complete contiguous road polygon layer. It has the advantage that it will align seamlessly with Rural Residential land use.

1. Select from Thelist_parcelsgda94 where cad_type1 = "Casement", then
2. Dissolve on cad_type1
3. Select "Shape_Area" > 1000
4. Run a Spatial Join with the thelist_parcelsgda94 (this will add the attributes back to the dissolved records. This is done to specifically to add the create date back into the layer.)

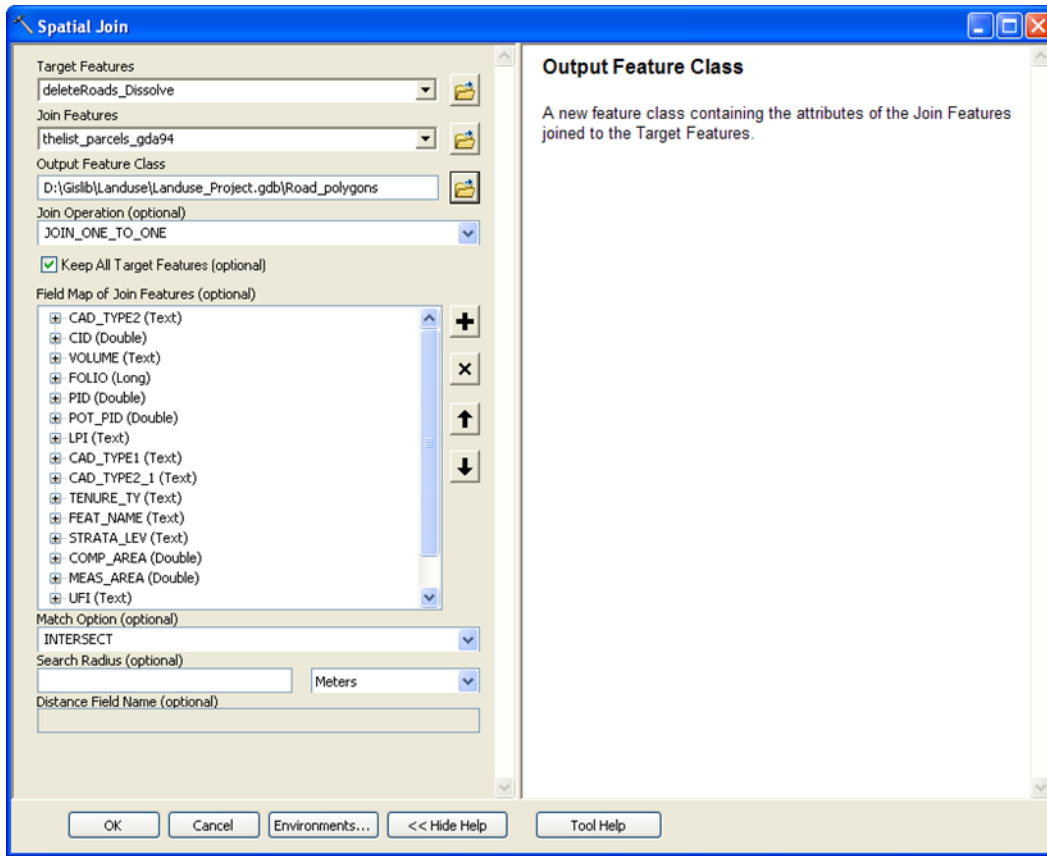


Figure 3 Spatial Join Dialogue for Road Land Use Polygons

5. Create a Lu_code field text 8 8
6. And attribute landuse to the table below:

CAD_TYPE2	Lu_Code
Acquired Road	5.7.2
Casement Unknown	1.3.0
Footpath	5.7.0
Footway	5.7.0
Forestry Road	5.7.2
Horseway	5.7.0
LGA Subdivision Road	5.7.2
Other Railway Reserve	5.7.3
Pathway	5.7.0
Reserved Road	5.7.2
Road (type unknown)	5.7.2
State Rail Network	5.7.3
Stratum Road	5.7.2
Subdivision Road	5.7.2
Tramway	5.7.3
User Road	5.7.2
Walkway	5.7.0
Water Race	5.7.0

7. Join to Landuse_Data_structure
8. Save the joined layer as Road_polygons_lu
9. Copy the created_on date field to the Source_date field
10. Update the Luc_date to today's date, set source_scale to 25000, and set the reliability to 2(ancillary dataset)
11. Delete the following fields:
Cad_type2, OBJECTID_1, CREATED_ON, and Lu_code_1

This process has created a spatial layer containing the land use for roads called *Road_polygons_lu*.

Road_polygons_lu should be updated to the current version layer of land use.

RIVERS AND WATER BODIES

CREATE WATER LAND USE LAYER

Careful as the thelist_hydarea_gda94_polygon layer has overlapping polygons (see Great Lake for an example).

Select out only the elements that are required for the Land Use classification.

The Query is :

```
("HYDARTY1" = 'Wetland' OR "HYDARTY1" = 'Artificial Watercourse' OR
"HYDARTY1" = 'Water Body' OR "HYDARTY1" = 'Watercourse')
AND "PERENNIAL" = 'Perennial' AND "Shape_Area" > 1000
```

Assign:

Description	Land Use Classification
Artificial Watercourse	6.4.0
Watercourse	6.3.0
Wetland	6.5.0
Water Body and area > 5ha	6.1.0
Water Body and area < 5ha	6.2.0

Note that HYDARTY1 = Dam refers to the dam wall only, not the water body.

Result is a multipart polygon because ArcGIS creates all spatial results as multipart not singlepart.

This layer is called water_uses.

This layer could be updated to TasVeg Layer or leave it as its own layer. It is recommended to leave it as a separate layer, and merge it into the land use layer when all the other layers are merged.

REMOVE WATERBODIES FROM TASVEG 2.0

The rivers and waterbodies in TasVeg do not match the boundaries in the thelist_hydarea_gda94_polygon layer. This can be corrected by removing the water bodies from Tasveg, then inserting the water bodies from the hydrology layer.

Procedure to remove water bodies from TasVeg

- Make the Tasveg layer single part.
- Dissolve on lu_code

- (make the result single part)
- Run a select by attribute query to select water features
- Run Eliminate (by border)

Now have a Tasveg Layer without water (except saline marshlands)

APPENDIX 2 – PDA INSTRUCTIONS

PDA INSTRUCTIONS

The field work was primarily undertaken using a GeTac PDA running ArcPAD.

The data layers needed to be setup using ArcGIS prior to being transferred to the PDA. These PDAs do not have much memory, and they run slow if more than a couple of layers are displayed at the same time. Only the area of the field work for the day is transferred to the PDA. Any shapefiles made using the PDA should be saved from the PDA as soon as possible after the field work.

SYNCHRONIZING THE PDA TO THE PC (INSTALLATION)

1. Insert Getac CD
2. Install the windows mobile device handbook (if you feel it's needed).
3. Before installing ActiveSync go to Start → Run and type in 'fixmapi'. Click ok
4. Proceed to install ActiveSync by clicking on the installation icon. The installation process should complete successfully.
5. Connect the PDA to the PC (via the USB cable).
6. The Microsoft Outlook Wizard should initiate. Do not install this, so click cancel to reject installation and reject the forthcoming warning windows.
7. Next the Synchronization Setup Wizard should appear. Click next to access the following screen.
8. The Sync Options screen will appear. Nominate favourites, files (click ok to file sync) and media (click ok to media sync). Click next to access the following screen.
9. The Allow Wireless Connection screen will appear. Do not nominate this. Click next.
10. To complete the setup click finish.

The PDA and your PC should now be in Sync. From here, I recommend creating an ArcPad folder where datasets from the PC to the PDA can be placed.

1. On your desktop there should be a new short cut called '____ My Documents' identified with two blue arrow logos on the front. Click on this and this will take you to where the PDA shares its folders with your PC.
2. In this area create a new folder called ArcPad. This is where you will add data to the PDA to be displayed in ArcPad

ADDING DATA TO ARCPAD FROM A GEODATABASE

1. Open ArcMap. Click on View → Toolbars and add the ArcPad toolbar.
2. Add the Weed feature classes (WeedPoint, WeedLine and WeedPoly) to ArcMap.
3. To add data to ArcPad click on 'Get Data For ArcPad' which is the first icon on the ArcPad toolbar. Select the layers you want to get from ArcMap to add to ArcPad and click next.
4. To check out the datasets select the relevant layers again and click next.
5. In the next window, make sure the full extent of the selected layer(s) is selected (if you want to add the entire dataset). Specify a name for the folder where your data will be kept in the PDA and click on the folder icon below to navigate to the ArcPad folder created previously (within my documents folder). This is where the layer(s) will be stored. Leave everything else as is and click finish.
6. The layers should now be available for editing in ArcPad.

RETRIEVING DATA FROM ARCPAD AND UPDATING THE GEODATABASE

1. Open ArcMap. Click on View → Toolbars and add the ArcPad toolbar.
2. Add the Weed feature classes (WeedPoint, WeedLine and WeedPoly) to ArcMap that were previously used to store data in the PDA.
3. Start an editing session for the selected layers.
4. On the ArcPad tool bar click 'Check in Edits From ArcPad' which is the second icon on the ArcPad toolbar.

5. Nominate the layers you want to check back in and then click 'check in'.

All edits that were made in the PDA should now be added to the feature classes in ArcMap.

TRANSFER SPATIAL DATA TO PDA

Copy everything to a directory/s on the laptop using the Get data for PDA button from the ArcPad toolbar, and then copy the files to the PDA using file explorer. Copy the files to a SD card on the PDA. Except the shapefiles that need to be modified on the PDA, these need to be on the main memory to avoid errors.

IMAGES

The RaipdEye image works well on the PDA, however the PDA will only view **ecw** images smaller than a 20x20km section (or 10x30). Use the Raster Clip in Toolbox for one off sections, or the Python script following to clip a larger region into 20x20 images.

VECTOR LAYERS

Set the symbology prior to transferring the layer to the PDA, also set the labels and label the layer. The symbology can be changed on the PDA, although occasionally it will cause the layer to not display at all.

The ArcPad toolbar only transfers layers in a geodatabase, so copy all required shapefiles into a geodatabase.

Tick the "Create an ArcPad map referencing the data" box when transferring vector layers to the PDA as some shapefiles do not load without it.

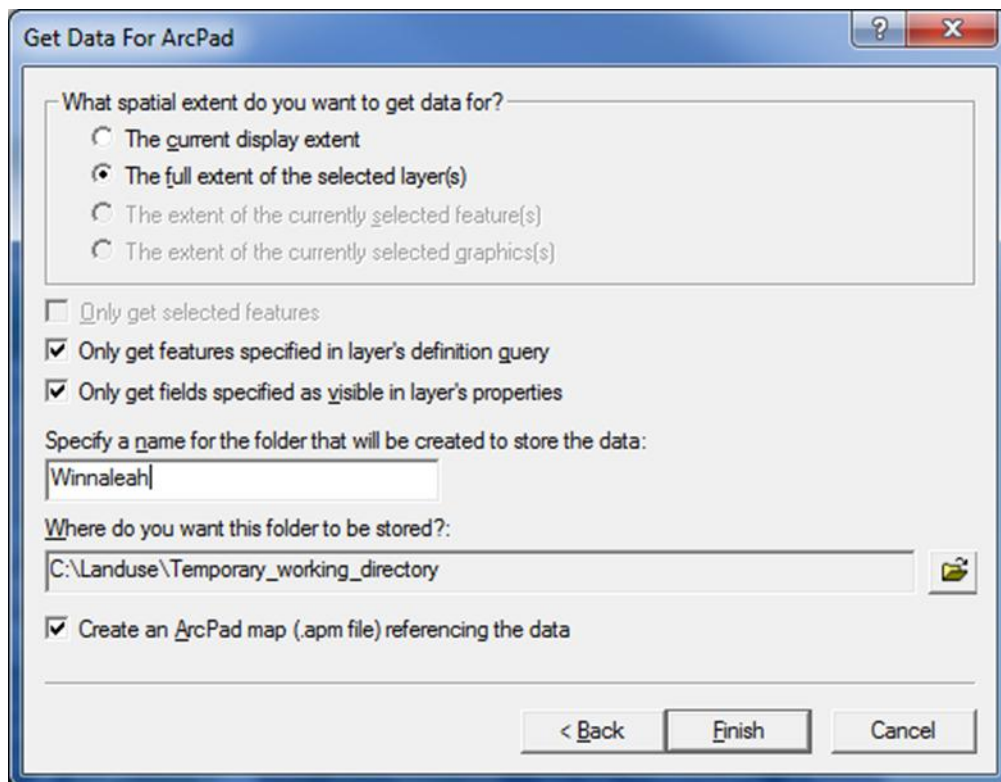


Figure 4 Dialogue box for Get Data

PYTHON SCRIPT TO BREAK RAPIDEYE INTO 20X20KM TILES

```
# -----  
# clip_image.py  
# Created on: Tue Oct 12 2010 11:53:20 AM  
# (generated by ArcGIS/ModelBuilder)  
# -----  
  
# Import system modules  
import sys, string, os, arcgisscripting  
  
# Create the Geoprocessor object  
gp = arcgisscripting.create()  
  
# Load required toolboxes...  
gp.AddToolbox("C:/Program Files/ArcGIS/ArcToolbox/Toolboxes/Data Management Tools.tbx")  
  
# Local variables...  
RE2_20 = "C:\\Landuse\\RapidEye_Tasmania_Mosaic_Rev3\\ECW Compression_20-  
Rev2\\887a001_Tasmania_WGS84SUTM55.ecw"  
ymax = 5400000  
ymin = ymax  
print "Start"  
while (ymin >= 5340000):  
    # set the x values  
    xmin = 500000  
    xmax = xmin  
    #mve the clip rectangle to the next block ymax = ymin  
    ymin = ymax - 20000  
    while (xmax <= 600000):  
        # move the rectangle to the next 20k block  
        xmin = xmax  
        xmax = xmin + 20000  
        namechange = str(xmax)[0:2] + str(ymax)[0:3]  
        # note the .img extension is not required in geodatabases  
        Output_Raster_Dataset = "C:\\Landuse\\Landuse_project.gdb\\RE20" + namechange # + ".img"  
  
        Rectangle = str(xmin) + " " + str(ymin) + " " + str(xmax) + " " + str(ymax)  
        print Rectangle  
        # Process: Clip...  
        gp.Clip_management(RE2_20, Rectangle, Output_Raster_Dataset, "", "", "NONE")  
        print "Created" , Output_Raster_Dataset  
  
print "End of pr0gram"
```

APPENDIX 3 – NOTES FROM WORKSHOPS

NOTES FROM NRM SOUTH WORKSHOP

- Norske plantation missing
- Some plantation overlaps in south
- Change 1.3.3-3.2.0 to 1.3.3 – 2.1.1

Comments for future versions of the project;

Neville – his preference would be to undertake the project at Sept\Oct\Nov instead of Nov\Dec\Jan

RECOMMENDATION:

- Cereal and seed crops have been harvested by Nov.
- All field maps should contain the irrigation boundaries.
- Add about 20-30% of the grazing would be seed and cereal crops.
- High probability of these crops being there at 20-30% of them.

Irrigation is strategic in agriculture. It is used to establish crops and also to finish them off.

Supplementary irrigation: supplements seasonal rainfall deficiency

Irrigated in Autumn (Feb, Mar, Apr), and Spring(Aug, Sept, Oct)

Let it dry off in summer irrigation is used for beef cattle, meat sheep to fatten stock.

NOTES FROM NRM NORTH WORKSHOP (14/2/2011)

Next time recommend Rural Residential intersect house location (possibly available from ILS DPIPWEE) with Rural Residential as this would make sure that each rural residential actually is lived upon.

Deloraine

– a lot of rural residential residence is unlikely change to grazing.

- Check forestry in residual native vegetation

Water rights maybe indicative of the level of irrigation, may have been over-estimated.

HORTICULTURE NOTES FROM THE TAS FRUIT GROWERS

Horticulture is grouped in regions around the state.

- Spreyton
- Dilston
- Legana
- Woodbridge
- Coal River Valley(full of cherries)
- Derwent Valley(Between Hamilton and OUSE)
- Huon
- Franklyn
- Cygnet
- Geeveston
- Dover

- One Cherry Farm on Bruny Island (Barnes Bay)

91 Fruit growers requested export licences in 2009.

