South Australian Spatial Data Collection Methodology

Agriculture:

Cropping/Horticulture

This document describes the methodology for processing, analysing and delivering the South Australian component of the Australian Biomass for Bioenergy Assessment (ABBA) for upload onto the Australian Renewable Energy Mapping Infrastructure (AREMI).

The National ABBA Team have consulted widely to ensure a consistent and standardised representation of biomass feedstock data with regard to organisation of content, units of measurement and aggregation methods. This has led to the development of a baseline schema including minimum data requirements for data capture and upload. It is expected that this approach will lead to a robust and repeatable method for data capture and generation of datasets for use across all regions. There will be some variation however, in the way in which each state characterises various feedstocks depending on source data, data analysis techniques, expert advice and other considerations.

Every effort has been made to provide a consistent and consultative approach to data collection and presentation in order to provide the best outcome for users.

What is the Australian Biomass for Bioenergy Assessment?

The purpose of ABBA is to catalyse investment in the renewable energy sector by providing detailed information about biomass resources across Australia. This information will assist project developers make decisions for new bioenergy projects, and provide linkages between potential biomass feedstocks - through the supply chain - to end users. To achieve this, ABBA collects datasets, on a state-by-state basis, about the location, volumes and availability of biomass, and publishes them on the AREMI platform.

https://nationalmap.gov.au/renewables/

ABBA is managed by the Rural Industries Research and Development Corporation (RIRDC), with funding support from the Australian Renewable Energy Agency (ARENA).

Why Agriculture

The generation of bioenergy and production of biofuels from agricultural residues, such as crops (e.g. straw and chaff), horticulture (e.g. fruit & vegetables) and other organic material from excess production or insufficient market (e.g. grass silage) has the potential to provide positive outcomes.

Some of the advantages of using agricultural residues as a biomass feedstock include:

- Improvement of farm waste management practices
- Diversification of revenue streams for farmers
- Improvement of the economic viability of agricultural land
- Offset/reduce GHG emissions from agricultural practices
- Valuable by-product (e.g. biochar)
- Possibility of reduced energy costs
- Diversification of rural economies
- Environmental benefits

What data about Agriculture is uploaded to AREMI?

ABBA has published the following data onto AREMI:

- Residues - from agricultural and horticultural practices
- Landuse - land which is classified as cropping or
- Simulated residual straw (average & reduced rainfall scenarios)

Method

Cropping Biomass residues (including Cereal, Non-cereal, Hay & Silage, Horticulture)

The data for production (in tonnes or kilograms) of crops by ABS SA4 Regions listed in the ABS Agricultural Commodities, 2015-16 data set (ABS, 2016) were converted to biomass generated using a conversion factor, and biomass generated value was then split into residues based on an expected percentage that could be produced from each crop. The assumed conversion factors and residue percentages were those that had been developed previously for the Limestone Coast region in separate study (Zero Waste SA, 2014a) (which were informed by advice from an agricultural scientist and independent research.)

The following provides a basic worked example for Broadacre crops - Cereal crops, Barley for grain, in the Adelaide - Central and Hills region.

1. ABS Crop Production (2014-15) = 153 tonnes (per year)
2. Crop Biomass Conversion Factor (assumed) = 4.0
3. Biomass Generation = 153 × 4.0 = 610 tonnes
4. Potential residue types and % splits and tonnes resulting

- Chaff – 15% = 92 tonnes
- Stem/tiller – 35% = 210 tonnes
- Roots – 25% = 150 tonne

(Roots are not included in the final dataset as these are not considered residual).

Note: This method provides a singular estimate of biomass residues in that year. Crop production, biomass generation, and residue volumes will vary seasonally and in different regions depending on soils, climate and other agricultural conditions. Future agricultural crop biomass data sets could consider providing a range for biomass residue volumes, which may better reflect the uncertainties in annual volumes that may be generated. It is also important to recognise that much of some of the residues may already be resource recovered and reused (e.g. as animal feed, to return carbon and nutrients into the soil). Future data sets could quantify this resource recovery activity. Exploitation of some of these residues could require development of innovative technologies for collection and/or aggregation (e.g. to capture Chaff during wheat harvesting, to recover roots left by crop production).

Further advice was sought from Primary Industries and Regions SA (PIRSA) and Minimum Drought values and Maximum Bumper Year values were also calculated. These values have been calculated by using the total tonnage of a drought/bumper year as a percentage of the total tonnage of an average year and applying these percentages to the total for each region. (41% and 158% of average tonnage respectively).

Minimum calculations have omitted chaff and roots. Maximum calculations have included chaff but roots are not included as a certain percentage will always be left in the field for soil retention and composition purposes and are not considered as residual.

Agriculture – Mapping considerations for the AREMI

As this data is presented at the ABS SA4 level, Landuse information has been overlayed to give users an indication of where the agricultural activity is in the landscape. This landuse information is indicative only.

The landuse spatial data has been sourced from ABARES (http://www.agriculture.gov.au/abares/aclump/land-use/data-download) and contains the combined datasets of the South Australian areas land use mapped to May 2008 (and 2014 South East and SA River Murray corridor). The data presented is a subset of the original data comprising only landuse classified as Cropping.

Simulated Residual Straw – Biomass residues

The simulated Residual Straw modelling links the crop simulation model APSIM (Agricultural Production Systems Simulator) to South Australia's comprehensive soil and land attribute spatial datasets as well as spatial and long-term time series climate datasets.

Given that rainfall is the most uncertain parameter within future climate projections, climate change scenarios were selected which focus on different levels of rainfall decline (-5%, -10% and -20% compared to historic 1900-2009 climate records), while keeping constant levels of warming and constant CO2 increase. These scenarios are consistent with the projected envelope of likely change by 2030.

Source: Department of Environment, Water and Natural Resources (2012). 'Climate change, wheat production and erosion risk in South Australia's cropping zone: Linking crop simulation modelling to soil landscape mapping'.

Data based on Land and Soil Spatial Data supplied by DEWNR Soil and Land Program (July 2009).
Wheat crop simulations performed by SARDI using the APSIM model.
Funded by State NRM Program, DEWNR and DAFF Australia's Farming Future.
Rainfall data supplied by Bureau of Meteorology (APSIM modelling based on daily climate files for period 1900 - 2009).
Land assessment: DEWNR Soil and Land Program
Metadata for this dataset can be found at:
http://location.sa.gov.au/LMS/Reports/ReportMetadata.aspx?p_no=1995

Level of Current Use

An attempt was made to estimate the proportions of each of the various categories that is currently disposed of (and hence could be considered most available for redirection into bio-industrial use). As mentioned previously, some of these residues may be resource recovered and reused and others may have a logistic or economic barrier to recovery.

This is an area where more information will become available as the project progresses.

Outputs

The final data outputs are:

- Agriculture: Cereal Straw, Non Cereal Straw, Hay & Silage
- Horticulture: Fruit & Nuts, Vegetables
- Landuse: Agricultural and Horticultural landuse footprints
- Simulated Residual Straw – 4 data layers

  Average Annual Rainfall, 5%, 10% & 20% Reduced Rainfall scenarios

Note: This method provides a singular estimate of biomass residues in that year. Crop production, biomass generation, and residue volumes will vary seasonally and in different regions depending on soils, climate and other agricultural conditions. Future agricultural crop biomass data sets could consider providing a range for biomass residue volumes, which may better reflect the uncertainties in annual volumes that may be generated. It is also important to recognise that much of some of the residues may already be resource recovered and reused (e.g. as animal feed, to return carbon and nutrients into the soil). Future data sets could quantify this resource recovery activity. Exploitation of some of these residues could require development of innovative technologies for collection and/or

aggregation (e.g. to capture Chaff during wheat harvesting, to recover roots left by crop production).

Assumptions

For this initial version, readily available public data and reports were used, which others can access to reproduce this data set if necessary. In some areas, original methods have been developed and assumptions made on how to convert source data into biomass resource estimates. These methods and assumptions were informed by the knowledge and expertise of experts engaging with biomass generating activities in South Australia. These experts have also been involved with reviewing and preparing similar data sets for other State Government agencies.

The scope and quality of this initial data set is necessarily limited by the scope and quality of the information in the data sources used, types of methods, and assumptions used when converting source data into biomass resource estimates. These assumptions should be kept in mind when interpreting the SA Biomass data set.

Note

The data that has been analysed and uploaded to AREMI is based upon sources, experimentation and methodology which, at the time of preparing this document, were believed to be reasonably reliable and the accuracy of this information subsequent to this date may not necessarily be valid.

It is important to recognise that this is the first version of this type of State-wide biomass data set that has been prepared for South Australia. The data set relies on readily available public data and reports so that others are then able to access this information to reproduce this data set if necessary. However, this publicly available data is relatively limited. There are potentially other more detailed data sets that could be used to improve the scope and resolution of the SA Biomass data set.

Over time it is expected that the feedback gained from the initial baseline data that is currently being uploaded to AREMI will help to inform subsequent versions of the information contained in the various data sets.

Methods and assumptions were also developed on how to convert source data into biomass resource estimates. These were based on a similar previous (biomass mapping) study undertaken for the Limestone Coast region of South Australia. These methods and assumptions, too, could be expanded, refined, and improved in future versions of the SA Biomass data set.

Consequently, this inaugural State biomass data set should be considered an important starting point for future development of improved knowledge about biomass resources potentially available in South Australia for bioenergy opportunities. It can reasonably be

expected that over time this initial SA Biomass data set will continue to evolve and expand in scope and detail, which should improve its utility for potential bioenergy investors.

Data Sets and Data Sources

For the Agricultural Biomass Residues the following data sets have been produced using the listed data sources and the limitations of this data have been described.

Data Set:

Agricultural Biomass Residues:

Cereal Straw, Non Cereal Straw, Hay & Silage, Fruit & Nuts, Vegetables

Source Data:

ABS Agricultural Commodities data SA4 Region, SA, 2014-15

Waste Biomass Opportunities Map for the South-East report (prepared by Zero Waste SA)

Limitations/Clarifications:

Geographical areas are ABS SA4 Regions.

Percentages used to calculate crop biomass residues were from a previous study for South Australia's Limestone Coast, which were extrapolated to all other areas of the State.

Data Set:

Simulated Residual Straw

Source Data:

Simulated average excess residual straw on arable land - with climate change scenarios

Limitations/Clarifications:

See the following metadata link:

http://location.sa.gov.au/LMS/Reports/ReportMetadata.aspx?p_no=1995

References

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