Point. Advisory

Reforestation and afforestation opportunities

within 100 km of the ACT

Prepared for:

ACT Government

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EXECUTIVE SUMMARY

Point Advisory conducted a study to assess, at a coarse scale, the potential for carbon sequestration from afforestation and reforestation activities in the area 100km outside the ACT's boundary.

The study involved analysis using geographic information systems to determine the land available for reforestation and afforestation activities in the relevant area. A sample of points within this area were then modelled in the federal government's FullCAM program to determine the approximate carbon sequestration potential within the available land.

The key findings of the analysis are presented in Table 1.

Table 1: Summary findings of analysis

Total area of land available for reforestation and afforestation within 100 km of ACT	2,291,900 hectares
Average sequestration potential of available land over period 2020 to 2050	166.3 tCO_2-e per hectare
Total sequestration potential of available land over period 2020 to 2050	380,871 $ktCO_2$-e

INTRODUCTION

Background

Point Advisory was engaged by the Environment, Planning and Sustainable Development Directorate of the ACT Government to assess, at a coarse scale, the potential for carbon sequestration from afforestation and reforestation activities in the area 100km outside the ACT's boundary as part of the engagement for modelling pathways towards net zero carbon emissions in the ACT by 2050.

This report presents an overview summarising the key findings of our analysis.

Methodology

GIS assessment

Data analysis was conducted in QGIS using datasets from the above sources collated into a coherent picture of the land available for reforestation and afforestation activities within an area 100km outside of the ACT's boundary.

The 'available land' was identified based on the following criteria:

- Within 100km of ACT boundary
- Not already forested
- Not in National Parks or other state protected lands
- Not on steep slopes or ridgelines
- Not settlements (towns and cities)
- Not waterbodies (lakes, streams and rivers)
- Not roadways (not including dirt tracks and private roads on farms).

This map was analysed to identify a set of ten points broadly representative of the carbon sequestration potential across the available land. The representativeness of these model points was based on the land elevation, slope and topography of the surrounding available area. The representative points selected for modelling are provided in Appendix 1.

FullCAM modelling

The ten representative points selected across the identified areas of available land were then modelled in FullCAM to provide information about their carbon sequestration characteristics. The Federal Government's *Guidance for using the Full Carbon Accounting Model in Human Induced Regeneration Projects* was followed to simulate forest growth at each selected point.

Mixed environmental plantings

The ten representative points were modelled in FullCAM as 'Mixed species environmental plantings' with a project commencement year of 2020, with the yearly carbon sequestration calculated based on total in-situ carbon (in soil, trees and debris). This approach is consistent with the *Carbon Credits (Carbon Farming Initiative) (Human-Induced Regeneration of a Permanent Even-Aged Native Forest—1.1) Methodology Determination 2013* as amended in 2016.

Sensitivity testing was undertaken for four of the representative points by modelling the carbon sequestration at three nearby points (at a distance of between 5 km and 20 km) to assess the extent to which the carbon sequestration characteristics of the available land changed over that distance. In all cases except one, the sensitivity tests were within +/- 6% of the initial values, indicating that the modelled points were broadly representative of the surrounding land.

Plantations

Point Advisory also modelled the potential to regenerate the available land with plantation species. The resulting FullCAM runs suggested that none of the 10 representative sites are productive enough for commercial radiata pine plantations. While anecdotally there is some commercial suitability around four of the points (5, 6, 8 and 10) it was decided not to include this modelling because of the modelled marginality of this type of forest, and because plantation projects are likely to be significantly more complex than environmental plantings from an administrative and operational perspective.

If a way could be found to develop plantations on the available land, the modelling suggests the likely sequestration would be around 30% greater than for environmental plantings because of the higher growth rates and carbon storage in wood products harvested from plantation forests.

Data sources

The following datasets were used to obtain the necessary information to complete the high-level study:

From the NSW Office of Environment & Heritage – Maps and data website:

- NSW National Parks and Wildlife Service (NPWS) Estate
- Vulnerable land – Protected Riparian
- Vulnerable land – Steep or Highly Erodible.

From the Australian Government:

- 2015 data for forest cover from the carbon farming mapping tool for the following areas:
  - SI55
  - SI56
  - SJ55.
- Surface hydrology polygons national.

From other sources:

- Terrain data from the USGS (Earth Explorer) website – dataset GMTED20100S50E120 (US Department of the Interior US Geological Survey).

Limitations and assumptions

The assessment conducted is subject to the following limitations:

- The carbon sequestration potential is based on a relatively small number of points (10) across the available land. While some sensitivity testing was conducted to assess the potential for variations in the sequestration profile of nearby points, the findings of this analysis should nevertheless be regarded as indicative only, and not suitable for use in making investment or policy decisions.
- Work did not include an assessment of the practicality of potential reforestation and afforestation activities according to individual (property-level) commercial or land tenure considerations.
- Work did not include an assessment of the social or environmental impacts to inform what scale of afforestation may be acceptable and appropriate.
- The FullCAM modelling is based on a 'Mixed species environmental planting' type of project. Plantation type projects were also considered but subsequently excluded for the reasons outlined above.
- Reforestation and afforestation activities were modelled with a 2020 start date.

RESULTS

Land available for reforestation and afforestation

The results of the initial GIS analysis to identify the land available for reforestation and afforestation (as outlined in the 'Methodology' section above) are shown in Table 2 below.

Table 2: Summary of land use characteristics in 100km outside of ACT

	Total area (ha)
Area of ACT	235,800
Total land area within 100 km of ACT (excluding ACT)	5,361,900
Total area available for reforestation and afforestation within 100 km of ACT[1]	2,291,900 (43% of total area)

The total amount of land available for afforestation and reforestation within a 100km radius of the ACT was calculated to be 2,291,900 hectares.

Carbon sequestration potential of available land

The area of study is shown in Figure 1 on the following page, along with the location of the modelled representative points and their total carbon sequestration (per hectare) from 2020 (the modelled project start date) to 2050.

FullCAM results showed geographic variance in the carbon sequestration potential of the representative points across three distinct regions – to the south, north, and west of the ACT. Table 3 shows the average potential sequestration per hectare of these broad areas.

Table 3: Modelled carbon sequestration potential of regions surrounding ACT

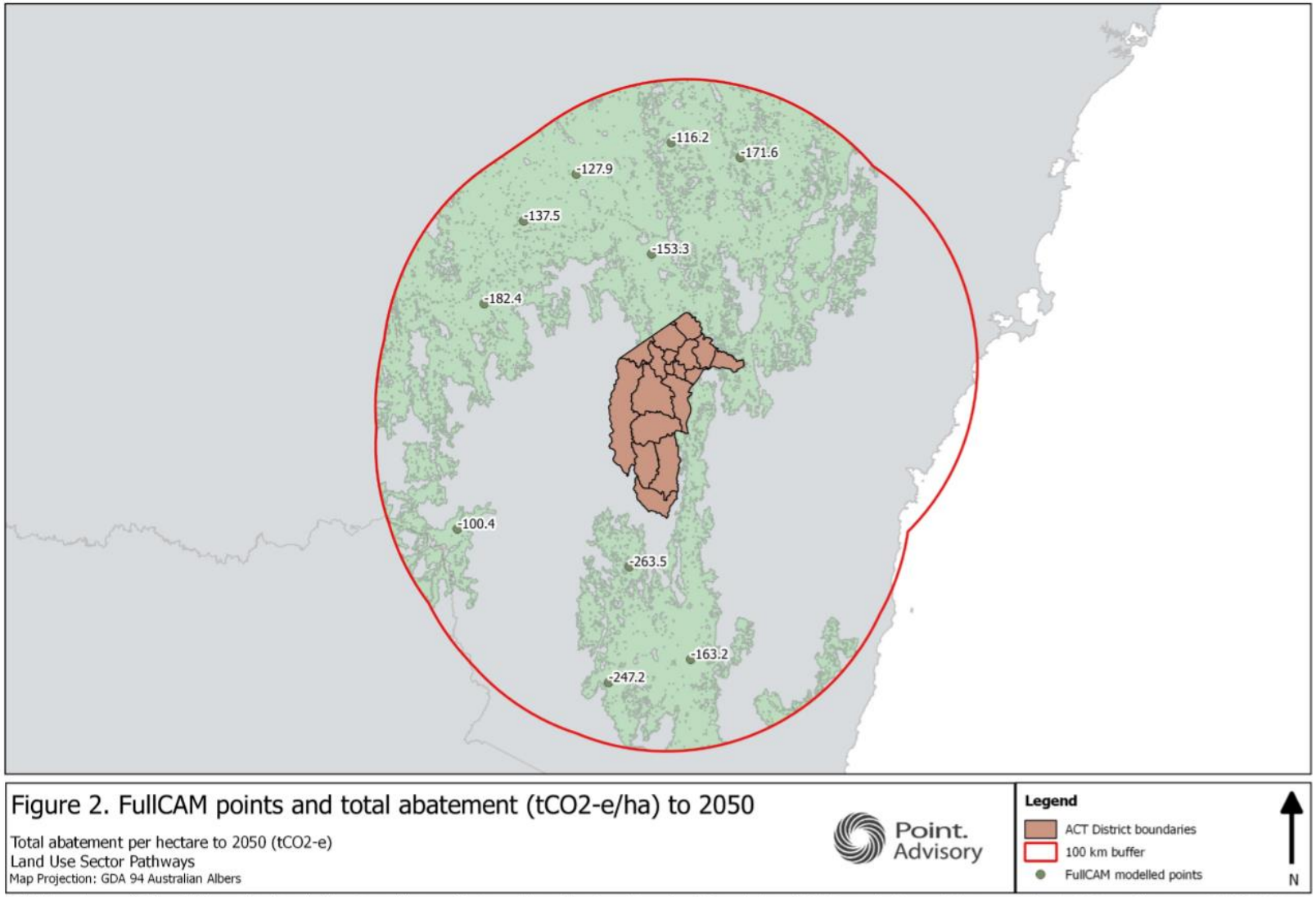
Region	Points	Average potential sequestration (tCO_2-e per ha) to 2050
South	1-3	224.6
North	4-8	148.1
West	10	100.4
Average across area of study		166.3

Appendix 2 shows the sequestration profile of each representative point (categorised by region) in five yearly intervals.

Extrapolated across the whole of the available land, the modelling suggests a maximum potential sequestration of 380,871 $ktCO_2$-e from reforestation and afforestation activities within a 100km radius of the ACT over the period 2020 to 2050. It is important to note that experience with afforestation on regional scales elsewhere in Australia suggests that potential environmental and social impacts and community resistance will limit the available land resource to significantly less than this total, and may be in the order of up to 10% of the total available land.

[1] Excluding urban land, watercourses, forested land and protected land, as described in the Methodology section of this report

Figure 1: Available land for afforestation / reforestation



DISCUSSION

Key trends

The following trends were evident from the modelling (refer to Table 2 for data):

- A significant difference was observed in both the yearly and total (to 2050) carbon sequestration achieved depending on location. This indicates that site selection is an important consideration for carbon farming projects.
- The highest sequestration potential on a per-hectare basis is in the Monaro and sub-alpine regions to the south of the ACT. This is likely due to more favourable soil types in this area. However, in these locations, less land is available for reforestation and afforestation.
- Abatement levels are lower in the north and northwest, which are characterised by grassland plains, however this is where the greatest amount of land is available for reforestation and afforestation.
- The annual carbon sequestration for the modelled points peaks around 10 years after plantings (refer to Appendix 2). Thus, annual sequestration for a project commencing in 2020 would quickly grow for the first 10 years and then growth rates would slowly but steadily decline beyond 2030.

Level of reforestation required to contribute to ACT zero net emissions target

Table 4 below provides general guidance for the amount of reforestation activity the ACT government would need to initiate to achieve certain levels of carbon sequestration to offset the residual emissions from other aspects of its greenhouse gas inventory. Note that this assumes an average abatement per hectare of 164 t CO_2-e by 2050 (a weighted average using maximum area available of each representative point).

Table 4: Summary of estimated reforestation activity to contribute to ACT zero net emissions target[2]

Sequestration required by ACT Government	Area required to be reforested (ha)	Proportion of available land
500 ktCO_2-e	3,006	0.13%
1,000 ktCO_2-e	6,013	0.26%
2,000 ktCO_2-e	12,025	0.52%
4,000 ktCO_2-e	24,051	1.05%

It is important to note that the sequestration amounts indicated in Table 4 above represent the total potential sequestration of the indicated area of forest for the whole of the period from 2020 to 2050. For example, to achieve a total cumulative sequestration of 500,000 tCO_2-e in 2050, approximately 3,006 hectares of forest would need to be planted in 2020.

Use of modelled sequestration to offset against ACT inventory

The land within a 100km radius of the ACT's boundary is entirely within NSW. According to Australia's carbon accounting rules, any reforestation that occurs on this land would automatically be attributed to NSW. For the ACT to legitimately claim this sequestration as an offset against its residual emissions, some sort of carbon crediting and

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[2] Based on an average sequestration potential of 166.3 tCO_2-e per hectare for the period 2020 to 2050.

surrender would need to take place. While the Federal Government's Emissions Reduction Fund (ERF) offers this possibility, work would need to be done (and potentially a new ERF method developed) to identify a pathway for the ACT Government to act as a 'project proponent' (who is therefore entitled to create carbon credits) under this scheme, particularly as the reforestation activities would occur largely on private land.

Appendices

APPENDIX 1: MODEL POINTS

The coordinates selected through the GIS analysis as 'representative points' for reforestation or afforestation and modelled in FullCAM are shown in Table 2.

Table 5: Coordinates of representative points

#	Latitude	Longitude	Point description
1	-36.55609	148.82166	North of Dalgety
2	-36.47452	149.19056	Northeast of Myalla
3	-36.10537	148.90835	South of Dry Plain
4	-34.91093	148.95367	Between Yass and Murrumbateman
5	-34.50021	149.37630	Southeast of Crookwell
6	-34.47531	149.03441	Between Boorowa and Crookwell
7	-34.59041	148.57508	Between Harden, Binalong and Boorowa
8	-34.71045	148.30925	East of Cootamundra
9	-35.10998	148.17514	Southeast of Gundagai
10	-35.99117	148.04953	West of Tooma

These points are shown on the map in Figure 1.

APPENDIX 2: EMISSION PROFILES OF REPRESENTATIVE POINTS

The charts below show the carbon emission curves of each of the 10 representative points modelled in FullCAM in five yearly intervals over the period 2020 (planting) to 2050.

Note that the charted carbon emissions are negative, which indicates carbon sequestration through the growth in carbon stock of the forested areas.

Figure 2: South region representative points - emission profile (tCO_2-e per hectare per five years)

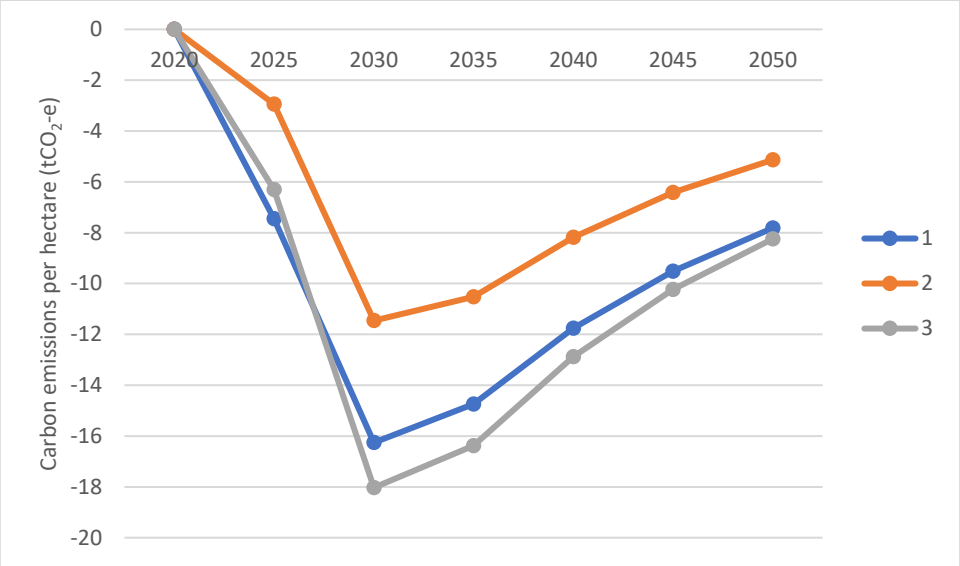

Figure 3: North region representative points - emission profile (tCO_2-e per hectare per five years)

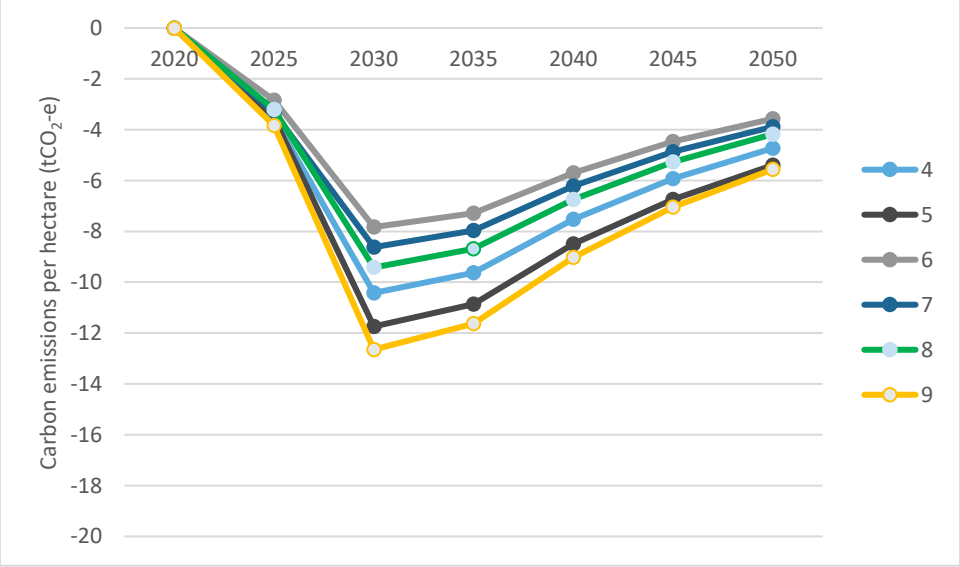

Figure 4: West region representative points - emission profile (tCO_2-e per hectare per five years)