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The carbon credits and economic return of environmental plantings on a prime lamb property in south eastern Australia

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ABSTRACT

In Australia, an approved farm action under the Emissions Reduction Fund is for farmers to establish permanent tree plantations. For a livestock farmer who is considering establishing environmental plantings of trees for carbon sequestration, the question is 'what are the benefits and costs of growing trees instead of using that land to grow pasture to feed livestock?' In this research, the case study approach and the methods of farm management economics were applied to assess whether growing trees for carbon on part of a prime lamb case study farm in south-west Victoria could be a better use of resources than using that land to graze livestock. The question was investigated for a range of economic and environmental conditions over 25 and 100 years. A condition was that the trees provided no other benefit on farm and the required rate of return on marginal capital was 6% real (10% nominal). The results indicated that the price of carbon would need to be $AUD132/t CO_2e for growing trees solely for carbon sequestration to be a good investment. Alternatively, if the trees provided benefits in addition to carbon credits, such as shelter for vulnerable young lambs, the investment could be worthwhile to the business at a lower carbon price. Previous research has shown that shelter (in the form of trees, grasshedge rows and other man-made structures) can reduce lamb mortality by reducing wind chill at lambing, through reduced wind speed. The benefits to a farm system from growing trees for carbon depends on the reduction in wind speed the trees create, the weather conditions, the price of lambs, the establishment cost of the trees, the price of carbon, and transaction costs. The results of this research has shown that for the representative livestock farmer, growing trees for carbon is unlikely to be as profitable as alternative uses of their resources.

1. Introduction

The Australian Government has committed to reducing greenhouse gases (GHG) by 5% below the year 2000 amounts by 2020 (Hunt, 2013). One scheme designed to help meet this GHG target is the Emissions Reduction Fund (ERF), which provides incentives to land owners, businesses, community organisations and local and state governments to earn Australian Carbon Credit Units by storing or reducing GHG emissions. The ERF began on 1 July 2015 and builds on the previous Carbon Farming Initiative (CFI). All existing CFI projects approved prior to July 2015 were transferred to the new ERF and previous CFI methodologies continue to be available under the new scheme until they are varied. Participants of the ERF submit a price per tonne for projects that are accepted methods to reduce GHG emissions. The projects are assessed according to the offer price per tonne in a reverse auction process. The auction is held by the Clean Energy Regulator who purchases projects with the lowest cost. One way farmers can participate in the ERF, and previously the CFI, is through environmental plantings; whereby farmers grow trees for carbon. Farmers who grow trees for carbon can potentially earn Australian Carbon Credit Units to sell to the Australian Government, or to other parties.

Past research has considered the area of land that could be available for reforestation projects within the arrangements of the Kyoto Protocol (for example, Mitchell et al., 2012). Polgalse et al. (2013) investigated the area of Australia that could be available for planting new forests based on an estimate of currently cleared land. They concluded that there is insufficient economic incentive to motivate large scale environmental plantings, but their study was not at the farm level and did not consider the other benefits that trees can provide within a farming system.

The key question from the perspective of a farmer grazing livestock is: 'Am I better off using that land to grow trees rather than using the same land for my usual grazing activity?' Research has

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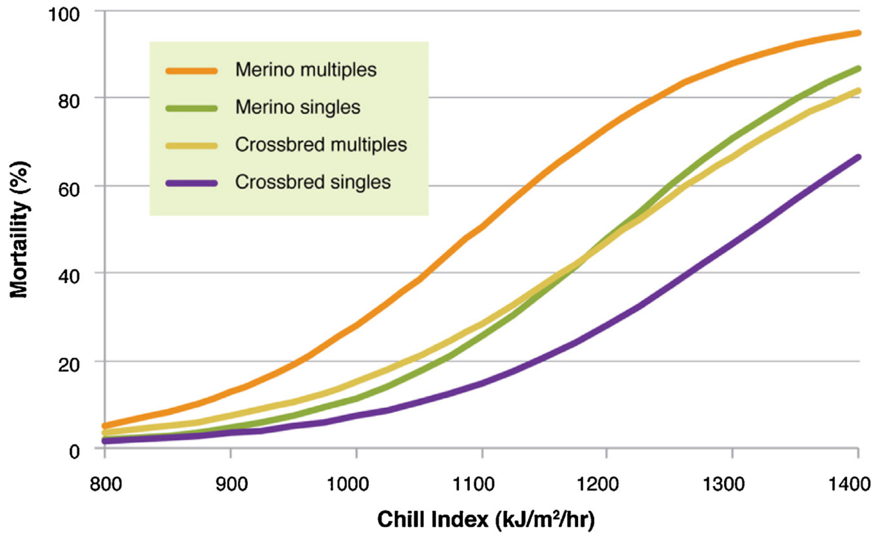

Fig. 1. Relationship between the chill index and the mortality of single and twin lambs born to merino ewes and crossbred ewes (Young et al., 2014, adapted from Donnelly, 1984).

shown that farmers who grow trees in an appropriate location and plantation design also derive other benefits for their farming business, through protection of their livestock from either extreme heat or cold. Marai et al. (2007) found that extreme heat affects production and reproduction traits. Trees that are grown to protect livestock from extreme heat events may reduce these affects. Trees that are grown to protect livestock from cold can reduce lamb mortality (Hume et al., 2011; Bird, 1998). However, trees grown in an orientation and density for protection from cold may not be as efficient for the protection from heat stress (DEPI, 2013) and vice versa. To protect against cold, shelter should aim to minimize wind speed (DEPI, 2013), whereas to protect against heat, the shelter should allow for the cooling effect of the wind. In practice, farmers will plant trees in a location and select species as part of a process that will take into account the environment and climate they farm in and the long term aims for their business. This will include consideration of the needs of current and future farming enterprises, topographical features on the farm, existing infrastructure (e.g. fencing/paddocks) and aesthetic aims. As the establishment of tree plantations is costly and to a large degree permanent, usually the aim will be to achieve multiple outcomes. Therefore, given the significant investment required in establishment and the longer term considerations for the farm, various other forms of shelter may have advantages. For example, grass hedgerows can provide similar wind speed protection with lower establishment costs (EverGraze, 2014). Land and Water Australia (2006) found that providing shelter using trees established through natural regeneration,[1] could be profitable (adequate return on capital), but it may take years for cumulative net cash flow to be positive (payback period). In contrast, grass hedgerows have been found to be profitable with a shorter financial break-even period in regions where lamb mortality is significantly reduced (Young et al., 2014). So, for a farmer to grow trees instead of grass hedgerows, the price of carbon must compensate for the higher establishment costs of the trees.

The proposition tested in this study was that a prime lamb farmer growing trees for carbon would benefit more than if the resources involved were used in some other way. This proposition was tested using the case study approach (Crosthwaite et al., 1997).

[1] Natural regeneration, does not include planting, it is the process of reintroducing vegetation to a site by naturally allowing seed, suckers or lignotubers to grow.

2. Method

2.1. Case study analysis

Use of case studies in farm economics is well established (Crosthwaite et al., 1997). Case study research aims to generalise to theory, or validate theory, unlike approaches that aim to generalise to the populations from which the sample is drawn. In the work reported here, the results from the case study analyses will either add support to explanations of current theory about farmer behaviour, or will not be consistent with theory and challenge accepted wisdom. The case study method is appropriate for this analysis, as survey data of large samples can only represent reality in a shallow way, whereas case studies can capture the full breadth and depth of all the important features of an actual farm (Malcolm et al., 2012).

2.2. The farm

A prime lamb enterprise located near Hamilton in south-west Victoria, Australia was selected as the case study farm. The business comprised 560 ha (400 ha on the home block and a 160 ha outblock), with an average stocking rate across the whole farm of 16.3 dry sheep equivalents (DSE)/ha. The flock comprised 3000 cross bred ewes (Coopworth Composite ewes: with 1000 of the ewes mated to a maternal sire and the remainder to a terminal sire). Lambing was in mid-July and weaning was in early December. The average annual rainfall was 730 mm and the farm was located in an area of very high wind chill during the month of lambing. The average July wind chill in unsheltered conditions in Hamilton is classed as very high (980–1000 kJ/m^2/h) (EverGraze, 2014).

Shelter that is located appropriately can reduce the speed of wind. Together, wind, rain and temperature make up chill index. Donnelly (1984) used the chill index of Nixon-Smith (1972) in a series of equations to describe the mortality of single and twin lambs born to pure Merino and cross-bred ewes (see Fig. 1). At a chill index greater than 900 kJ/m^2/h, the risk of lamb mortality increases significantly (Fig. 1), therefore shelter, which reduces wind speed, should reduce chill index and subsequently lamb mortality (Donnelly, 1984; Bird et al., 1984). Lambs that benefit the most from shelter are those with low birth-weights; usually twin/triplet born lambs (Bird et al., 1984; Pollard, 2006). Shelter can be in the form of grass hedgerows, artificial constructs, and trees and