SUSTAINABLE GRAZING SYSTEMS

ASESSMENT

EXECUTIVE SUMMARY

The purpose of the investigation was to find out whether shrubs and perennial pastures can be used to improve the productivity in a sustainable grazing system in south-west WA. The analysis was done using qualitative and quantitative techniques. Data is derived from various secondary and reliable sources. The findings of the study show that perennial pastures and shrubs are sustainable, profitable and can help in increasing the overall productivity of the farm. A number of benefits of using these pastures combined with annual pastures are discussed which further strengthens the hypothesis of the study. Various graphs and tables have depicted that help in the analysis of the problem in depth. It is recommended that these types of shrubs and perennial pastures must be preferred to fill the gap between the autumn and summer and increase profitability of the marginal land.

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INTRODUCTION

In the recent times, adoption of shrubs and perennial pastures has become essential for overcoming the autumn summer feed gap and to improve the profitability of the marginal lands. Perennial pastures are basically those that live for more than two years (Murphy et al., 2017). The interest in perennial pastures and shrubs is increasing as farming systems are building solely on annual crops (Revell, 2017). Therefore, pastures are not sustainable in various parts of Australia. A variety of issues of environment and management are faced in agriculture that demands having perennial pastures as an alternative. The main aim of this report is to critically analyze 'can shrub and perennial pastures improve productivity in a sustainable grazing system in south-west WA'. The report is limited to discussing a farm in southwest SA that is 'Central Wheatbelt' and generalizes the findings for the other regions. The subsequent sections of this report discuss the methodology used for the investigation of the research aim, findings depicting the scope of the practice in south-west WA and discussion of the findings obtained after the investigation. The report then discusses the recommendations followed by a conclusion. The report of utmost significance from the scientific, social and technical view as it helps in the identification of whether perennials pastures assist in uplifting the productivity in the grazing system. This will help people socially to improve their profits and work more efficiently. It will help other researchers to discover the use of the techniques that can help in increasing the fertility of the soil. Further, research on Australian shrub species can act as an addition to the feed base where there are low and medium rainfalls.

HYPOTHESIS

'Adoption of shrubs and perennial pastures is essential to overcome the autumn summer feed gap, improving the profitability of marginal lands.'

METHODOLOGY

Research methodology of any study is the set of basic procedures of techniques that are used in the research to identify, study and analyze some information about the topic. This research is based on both qualitative and quantitative techniques. The data is extracted from secondary sources such as journals, environmental reports, agricultural data, newspapers, media and organizational websites, etc. There are different techniques that will be used

for analysis of both techniques. For qualitative analysis, the Grass Gro model is used. This will help in evaluating whether the adoption of perennial pastures improve the profitability of the system or not. For quantitative analysis, sensitivity analysis tool will be applied (Thomas et al., 2017). This will help in evaluating the effect of supplementation cost on implementation of the perennials system. This will help in analyzing complex data and represent it in simple formats. This will further assist in supporting the discussions and results based on the literature identified.

FARMING SYSTEMS IN SOUTH WEST SA

The agriculture in south-west SA continues to be powerful due to increased production rates over the past decade. The SA accounts for 11% of the value of state production in terms of fruits, vegetables, wine grapes, milk and avocados (Murphy et al., 2017). The seasonal rainfall in the region ranges from 445 mm between the months of June to September (Revell et al., 2013). The soils found in the region are sandy and saline in nature. The pH of the soil is slightly acidic ranging from 5.2-6.4 (Orgill et al., 2017). Studies show that absence of pests, pollution and diseases in the regions of SA makes it an ideal location for development of agricultural activities and investments (Bell et al., 2014). However, the fertility of the soil is low along with low water holding capacity. The map shows the area that is located in the south west of SA.

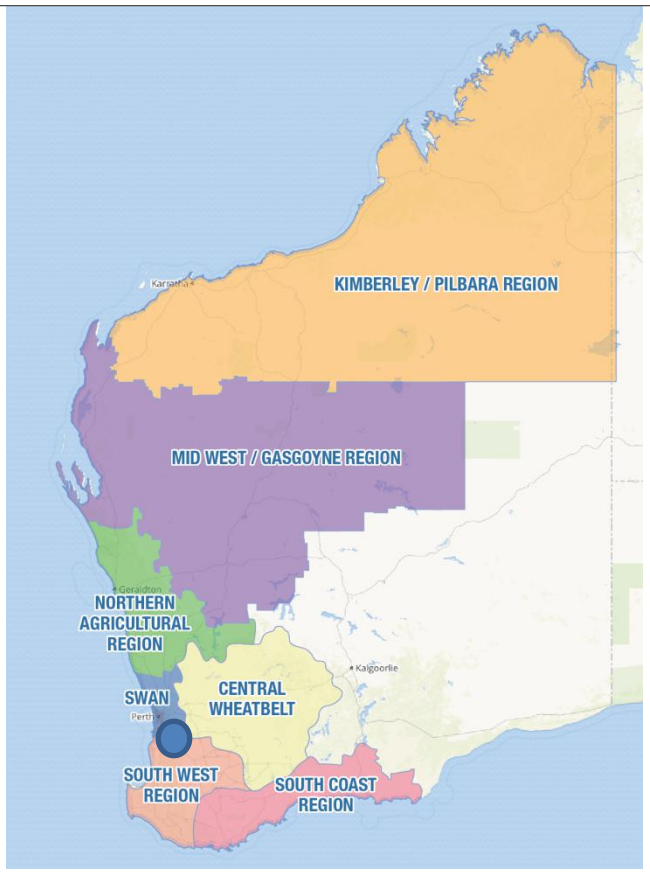


Figure 1-
Source- [http://gga.org.au/grower-groups/]

The flock characteristics in this region generally vary from 1500-1600 heads (Orgill et al., 2017). The breed acts for dual purposes and is called Merino breed. The breed is shown in the figure below.

Figure 2-
Source- [https://www.evergraze.com.au/library-content/lower-southwest-victoria-livestock-systems-and-industry-benchmarks/]

The stocking rate is 7 DSE per hectare (Bell et al., 2014). The species involved in pastures play an important role in increasing the productivity and profitability for the farms. Research shows that legume species are highly valued feed and have the ability to fertilize the soil with the help of nitrogen fixation (Agric, 2018a). Pastures in this area are identified to be dominated by annual species (Bell et al., 2014). These include ryegrass (Figure 4), subterranean clover (Figure 3) and, the range of other legume species such as serradella, biserrula, etc. However, in many situations, perennial pastures such as warm-season grasses, lucerne and fodder shrubs can help in improving the production (Thomas et al., 2017).

Figure 3- Subterranean clover
Source-
[https://www.smithseed.com/seed/legumes/clovers/subterranean-clover]

Figure 4- Rye Grass
Source-[http://www.johnnyseeds.com/farm-seed/grasses-millets-and-sorghums/ryegrass/ryegrass-cover-crop-seed-988.html]

In addition, these can also help in the protection of natural resources and enhance the capacity of the production systems for meeting future needs and environmental encounters. The forage value of feed is shown below. The production, digestibility, energy and crude protein in rye grass and subterranean clover are shown in the table below.

	Rye Grass	Subterranean clover
Digestibility (%)	65	70
Metabolisable energy (Mj/Kg)	10	10
Crude protein (%)	16	20
Dry Matter production (tn/ha/year)	9	8.5

The annual pasture growth rate in Australia is shown with respect to feed. It is seen that the in growing season there is a high rate of pasture growth while there is no growth from December to May. Thus, summer autumn gap

is visible. This is as productivity decreases during these seasons due to low rainfall, lamb morbidity and increased expenses for supplements.

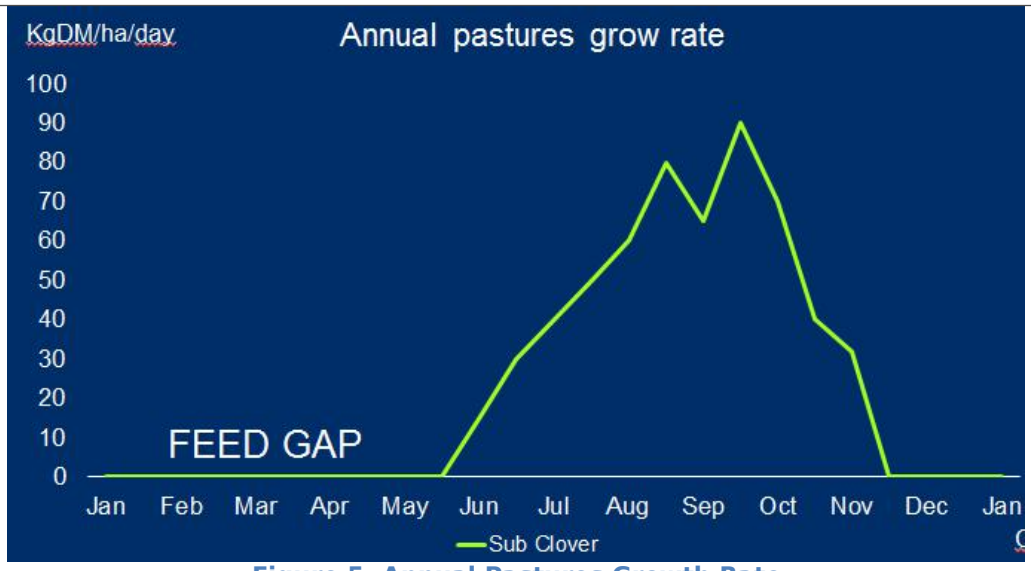


Figure 5- Annual Pastures Growth Rate
Source- [Revell, 2017]

Therefore, use of perennial pastures and shrubs can be profitable as it can help in filling the summer and autumn gap, increase the life expectancy of lambs, make marginal land more productive and can maximize productivity per hectares (Thomas et al., 2017). In addition, it will also increase profits due to fewer supplementation costs resulting in more pastures. As a result, the percentage of lambing will also increase at a significant rate.

ADOPTION OF PERENNIALS IN THE SYSTEM

PRODUCTIVE BENEFITS

The production benefits of the perennial pasture in south-west SA is that they provide a supply of feed during the gap months of summer and autumn. In the research, it is identified that the sub-tropical grass and serradella combined in southern west SA are highly productive (Biswas, 2015). However, there are a number of prerequisites essential for success.

Figure 6- Perennial grass pasture (left) and Serradella (right)
Source- [https://www.agric.wa.gov.au/pasture-species/highly-productive-sub-tropical-grass%E2%80%93serradella-pastures-southern-western-australia]

The outcome that will be obtained after combining both of these will lead to productive pasture by having sub-tropical grasses growing evidently in the summer and autumn followed by out-of-season rainfall while serradella will be the dominant species over the winter growing season. Combining perennial species with the annual pasture species is one way to increase productivity and fill gaps (Revell et al., 2013). However, their characteristics must be seen before using them as they require different climatic conditions and soil types to grow. Evidence suggests that the combination of these species is sustainable (Smith, 2015). Further, perennial pastures are found to reduce the extra requirements of the feed. Another benefit of perennial pasture is that it defers the grazing of annual pastures during the early winter.

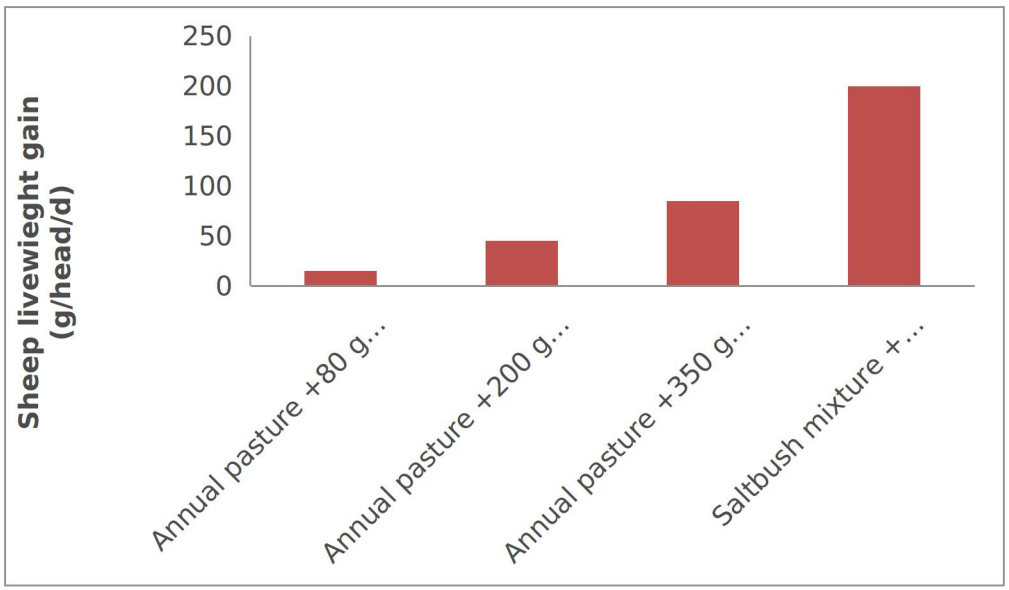
ENVIRONMENTAL BENEFITS

The environmental benefits of perennial pasture are that it is drought tolerant and responds effectively to rain (Revell et al., 2013). When conditions are favourable the production levels become extremely high. Perennial pastures are palatable, well taken by the cattle and sheep and preferentially grazed. Perennial pastures stay at the surface of the soil for years which decreases risk for soil erosion keeping the soil covered all time (Smith, 2015). Soil conservation helps in building and maintaining the

structure of the soil and the organic matter. Further, it is found to enhance the replacement of the nutrients preventing soil erosion on slopes.

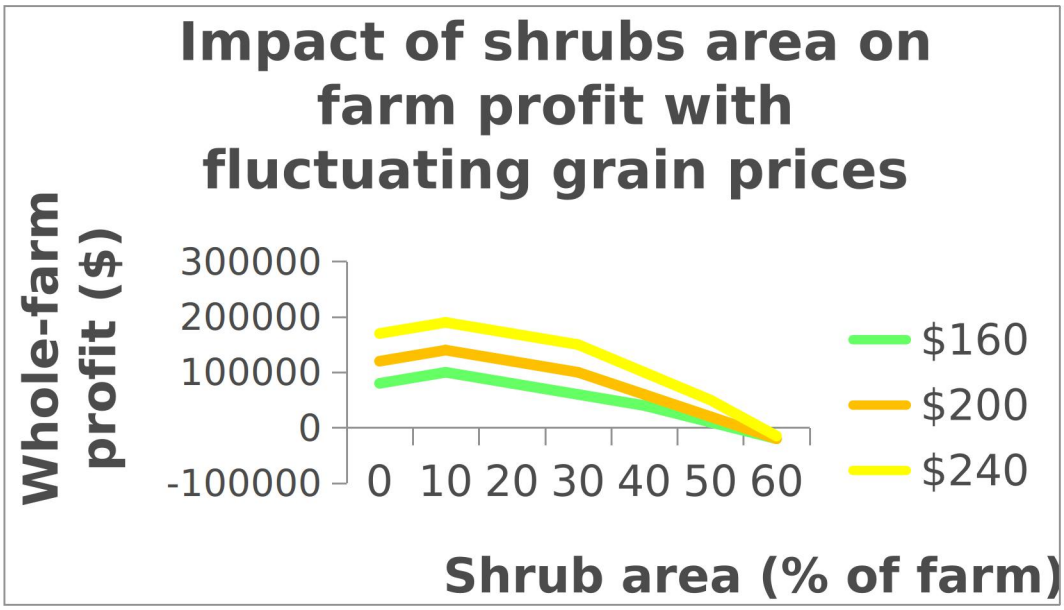
SHRUB AND INTER-ROW SPECIES

The interest in the shrub and inter-row species is increasing in broad agriculture due to their protective roles. This is more particularly important for the areas where agriculture has disrupted the processes and landscape becomes unstable. The use of shrub and inter-row species have nutritional, economic and environmental benefits. Research shows that it is possible that these plants may be capable for improving the health of animals but the cost of establishment and management may not justify its use from the large perspective (Thomas et al., 2017). Further, these species provide with out of the season feed by deferred grazing. This makes the feed available in the shortage season and reduces the grazing pressure. It also contributes to the cycling of protein and mineral nutrition. Another complimentary benefit is that it leads to increased growth of the herbaceous species that grow along with the shrubs due to the effects of shade and shelter (Agric, 2018b). It also helps in giving shade and shelter to the livestock. Research shows that it helps in the identification of gut parasites and improves the survival rate from 15 to 20% (Carbon Farming, 2014). In addition, these species helps in making a valuable contribution in ensuring the stability of the landscape by reducing the risk of wind and water erosion. However, the use of marginal lands is appropriate for this type of species and is not suitable for crops (Agric, 2018b). The environmental benefits consist of improvement in biodiversity and storage of carbon.



Source- (Revell, 2017)

The graph shown below performs a sensitivity analysis between the types of pastures and its effect on the weight gain of the sheep. It is evident that when sheep are fed on annual pastures their weight is low, the weight increases with the increase of supplements as seen from the graph. However, when sheep are fed on saltbush mixture (annual pasture) along with interrow shrubs the weight of the sheep increases substantially by a considerable amount.



The graph above depicts the impact of shrub areas on the farm profits. It is evident that when shrub areas are smaller profits of the farms are increasing. However, when the shrub areas keep on increasing the profits of the farm start declining with the fluctuating grain prices.

PERENNIAL PASTURES

The two of the perennial pastures such as panic grass and Rhodes grass are found to be profitable due to their features and potential (Smith, 2015). These are shown in the table below.

	Panic grass	**Rhodes Grass**
Rainfall (mm)	425	425
Drought tolerance	Moderate to high	Moderate to high

Persistence (%)	85-100	85-100
Soil type	Sandy soils	Medium texture
Soil pH_{Ca}	>4.3	>4.3
Waterlogging tolerance	Low	Moderate
Salt tolerance	Nil	Moderate to high
Dry matter digestibility (%)	57-72	61-65
Crude protein (%)	11	12

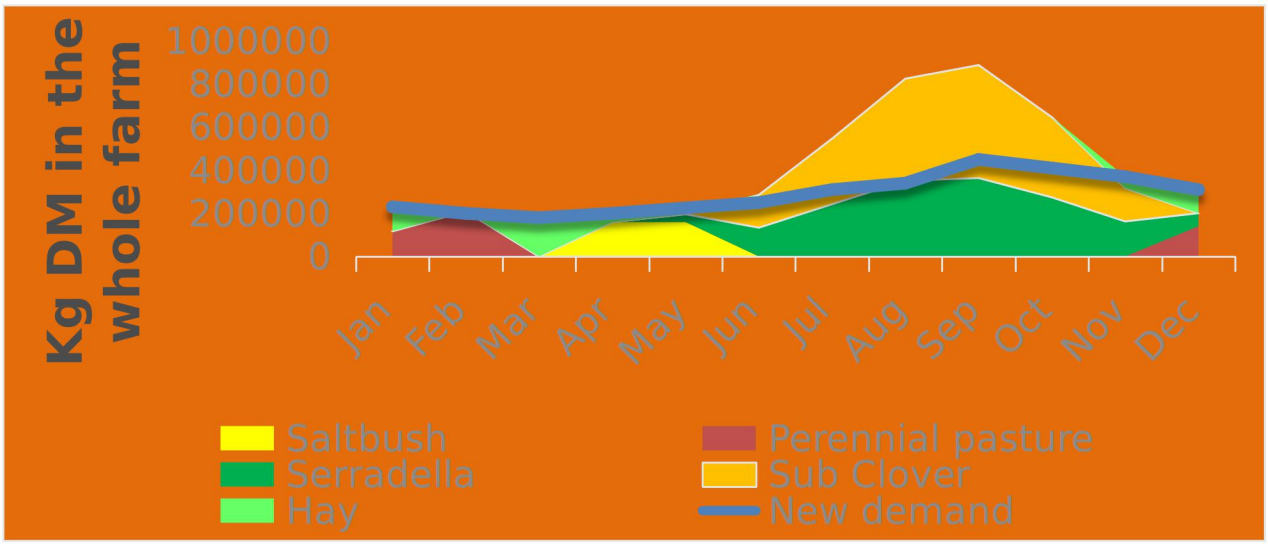
It is evident that these pastures are highly efficient and high in forage which makes them suitable and profitable to be applied in the sustainable farming system in south-west SA.

RECOMMENDED SYSTEM

The recommended system consists of a rotation of crops that is shown below. This system is designed in a way to promote maximum productivity (Biswas, 2015).

Figure 7- Sequence of Rotation

The first crop to be planted is Wheat followed by Serradella, Canola, Lupin, Wheat, Subterranean clover.



From the graph above it is evident that demand for the pastures considerably increases in the season from June to September which is the main season (Agric, 2018b). Therefore there is a need that other perennial pastures are used to compensate the increasing demand. The demand for perennial pastures is relatively higher than shrubs.

RECOMMENDATIONS

From the above analysis, it is recommended that south-west SA must incorporate 10% of shrubs and 20% of the perennial pastures. Hay must be incorporated in months of maximum production. Further, the stocking rate must be from 7 to 9 DSE per hectare.

CONCLUSION

It can be concluded that the adoption of shrubs and perennial pastures is essential to overcome the autumn summer feed gap and improve the profitability of marginal lands. Perennial pastures have the capacity to transform huge areas of agriculture in south-west WA. They give the best results and are sustainable when used in combination with annual pastures.