SALINE BUSH FOODS

INDUSTRY OVERVIEW MANUAL

JANUARY 2022

THIS PROJECT IS SUPPORTED BY KATANNING LANDCARE, THROUGH FUNDING FROM THE AUSTRALIAN GOVERNMENTS NATIONAL LANDCARE PROGRAM.

The Manual is for open public distribution.

A detailed Technical Manual is available under controlled release to people who are seriously considering joining the supply chain in a commercial manner. It can be attained by attending the recognised training course, or by discretion of Moojepin Foods (regards of whether they intended to contract with Moojepin Foods or operate independently). This is to ensure that quality, integrity and volume of the market are well managed in its establishment stages. After 30 June 2024, the Technical Manual will become openly public.

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LEAD WRITER: ELLA MAESEPP

KATANNING LANDCARE

PO BOX 803 KATANNING WA 6317

The Saline Bush Foods program was developed 2018 – 2022 as a collaboration between Katanning Landcare, Moojepin Foods, Wagoga, Chatfields Engineering, Charlotte Creek and Katanning Environmental Inc. Scientific work by Terra Perma.

Funding through the Australian Governments National Landcare Program.

TABLE OF CONTENTS

1.0 INTRODUCTION

1.1 PROJECT DEVELOPMENT AND OVERVIEW

In 2016, Badgebup (Katanning, Western Australia) farmer David Thompson started supplying some saltbush from his property to a chef in Perth who purchased saltbush fed dry-aged mutton from his farm. Seeing a potential new product option from his existing plants, David engaged Wagoga, gourmet food marketers, to investigate market opportunities and saw a viable niche market in native halophytes (salt tolerant plants).

In 2017, Moojeping, Wagoga and Katanning Landcare came together to apply for an Australian Government National Landcare Program Smart Farming Partnerships grant, to develop an agricultural enterprise that would have positive impacts on the environmental condition of natural resources. The hypothesis that improving production from saline land will minimise the impacts of salinity on soil health in particular underpinned the application. Partners Chatfields Engineering, Wide Open Agriculture (later replaced by mutual agreement to Charlotte Creek Horticulture) and Katanning Environmental Inc. were added to the team to provide specialised skills.

Figure 1: The Saline Bush Foods project Team (L-R) Ella Maesepp *Katanning Landcare*, Matt Collis *Katanning Environmental Inc,* David Thompson *Moojepin*, Lance McLeod *WAGOGA,* Dustin McCreery *Chatfields* and Tony Mercieca *Charlotte Creek.*

In 2018, the group were awarded $758,616 from the Australian Government in a four year project to develop the full paddock-to-plate supply chain. Soil scientists Dr Bede Mickan and Dr Jolene Otway joined the project team to add monitoring rigour.

Over the following four years, three growing systems were established (wild harvest, paddock and shadehouse) and two saline groundwater production bores brought on-line. Scientific data collection of natural resources was undertaken at regular intervals. Markets were established, and had to ride out the enormous impacts of the COVID-19 pandemic on the Australian hospitality industry. Students of Horticulture were trained through a collaboration with Great Southern TAFE. Interest in the saline bush foods industry remained strong, with coverage of the project in print, online and radio media and at conferences, expos and other industry meets.

The intent of the project was always to see if a viable saline bush foods industry could be reliably established and then share the outcomes with other growers and communities in southern Australia who are impacted by secondary salinity. To this end, the full outcomes of the project are being captured into two manuals and a training course, to hopefully support and encourage expansion of this industry, and a correlating improvement in saline land management in Australia.

Growing Saline Foods

Working in partnership to develop a paddock to plate supply chain, based in Katanning, using salt affected land and water to grow high value bush foods, and restore degraded land.

Growing

Growing samphire, saltbush, ice-plant and karkalla (pig-face) for the gourmet market.

Pioneering three growing methods – wild harvest, plantation and shadehouse irrigated with saline groundwater.

Harvesting

Developing harvest regimes that ensure fresh, consistent and attractive produce.

Invention of two mechanised saltbush harvesting machines.

Packing

Creation of a Packing Shed enterprise, to process fresh produce from local growers, opening May 2021.

Ensuring quality produce and creating local jobs.

Marketing

Introducing chefs, restauranteurs and consumers to the produce through expos, awards and meals.

Exporting across Australia currently, eventually internationally.

Research

Scientific monitoring of soils, plants and water responses to this farming.

Restoring degraded land through activating ecological processes and creating commercial value.

Training

Horticulture Cert 2 & 3; and Aboriginal Cultural training. Creating a skilled workforce to deliver this industry.

Intensive training for farmers wishing to become saline food growers, March 2022.

Further information: Ella Maesepp, Landcare Officer, 9821 4327 ella@katanninglandcare.org.au

Australian Government | National Landcare Program

This project is supported by Katanning Landcare, through funding from the Australian Government's National Landcare Program.

wagoga WESTERN AUSTRALIAN GOURMET GARDEN | MOOJEPIN | KATANNING ENVIRONMENTAL | CHATFIELDS TASMAN WESTERN AUSTRALIA | Swan Valley Flower Farm | katanning landcare

Figure 2: Project Overview showing activity areas and techniques.

1.2 ROLE OF KATANNING LANDCARE

Katanning Landcare has filled the project management role throughout the course of the Smart Farming Partnerships program. Katanning Landcare is actively interested in supporting innovations that improve the condition of natural resources such as soil and water, and improve opportunities for sustainable agriculture.

Following the completion of the project in May 2022, Katanning Landcare steps away from active involvement in the saline bush foods supply chain. However, Katanning Landcare will continue to house reports, images and learnings obtained throughout the project, to be available to the public into the future.

1.3 TRAINING AND COMMUNICATION ROLL-OUT

The Project has been experimental in many different ways, with trial, error and improvement cycles continually underway in the growing systems, marketing, management and monitoring. It was always the intent of the Project to share widely the lessons and skills learnt, so that as many people suffering the impacts of salinity in southern Australia as possible could consider access to this new option for diversified production.

Release of the technical details of the systems under development were deliberately withheld during this learning period, understanding that the public investment was to allow mistakes to be made and systems refined before exposing private individuals to new industry risks.

It could be detrimental to the future of the saline bush foods industry if someone tried to commence independent production without all the information – either because it hadn't been released yet, or it simply hadn't all been developed. This could lead to inferior products being introduced to market, a failure for the new player and the subsequent negative publicity, or a flooding of the market too soon. The project was designed to be testing and developing these systems, with roll-out of information in a well-supported manner as the final outcome of the project at its conclusion in autumn 2022.

1.3.1 MANUALS

Two levels of manuals have been produced to communicate the information gathered throughout the Project.

This first manual, the Industry Overview Manual, is designed as a general document which gives the interested observer information covering all aspects of the project so they could understand what, when, who and why. For most people, this manual will be of sufficient detail to satisfy their interest, and for those who had considered entering the supply chain as a grower or other role, to consider whether this is something that they would like to seriously pursue further. It is required reading prior to enrolling on any training or submitting an expression of interest to join the supply chain.

The second manual is a full Technical Manual. It contains great detail about the growing systems, shadehouse operation, packing shed process etc, and is designed to be a user-guide for people actually engaging in the supply chain. The level of detail would be simply too much for most readers – it also includes the how, along with the who, why, what and when of the Industry Overview Manual. Release of this manual will initially be controlled to people who have expressed genuine interest and capacity to potentially become part of the supply chain, so that the central project group can manage and support those people.

1.3.2 FARMER TRAINING

A training course will be held in Katanning WA in March 2022 to provide detailed training in all aspects of the established saline bush foods supply chain and to share the learnings of the Smart Farming Partnerships project. Attendees at the training course will be provided with a copy of the Technical Manual. The target

audience for this course are growers / business operators who intend to enter the supply chain at some point in the future.

Only one training course is planned for delivery within the project timeframe, however level of interest may influence this decision.

After the conclusion of the funded project, Moojepin Foods may choose to deliver further iterations of the training course as demand dictates, and Katanning Landcare will continue to hold (and be able to supply) content from the manuals and training program.

2.0 ABORIGINAL CULTURAL VALUES

2.1 ACKNOWLEDGEMENT BY THE PROJECT TEAM

The Saline Bush Foods project team acknowledges the Traditional Custodians of country throughout Australia and their connections to land, sea and community. We pay our respect to their Elders past, present and emerging.

The Saline Bush Foods project team are grateful for the input Anne & Grant Riley from Wuddi Aboriginal Cultural Tours have injected into the project. We are acutely aware that we are working on Noongar land, utilising plants that have been known to Aboriginal people for thousands of years, and have relished the opportunity to learn more about local Aboriginal culture and history.

Figure 3: Wuddi Aboriginal Cultural Tours leading Cultural Training with our Project Team, August 2020.

We encourage all people wishing to cultivate saline bush foods to learn about the cultural values relevant to their location. Anne and Grant have kindly shared some the history of the Moojepin area where our project development work has taken place.

2.2 ANNE & GRANT RILEYS MESSAGE

“My grandmother Elizabeth Riley nee Smith, who’s tribal name is Minyarn, is a custodian of this local area. Minyarn was a very fluent speaker of the Noongar language. She is also a matriarch of the area; her tribe was the Wilman tribe.

It is also known as a Cooroboree area, and as a tool collection area, because of the scar trees. It was also once a dreaming trail that extended to the Stirling Ranges near Albany.

There were many bush foods growing in the area – quandongs, saltbush, pigface and many more.

The lakes were used as sources of food such as the ducks, swans, gilgies and many more.”

3.0 THE SALINE BUSH FOODS MARKET

In Australia, the bush foods market is estimated around $20 million dollars annually, which predominantly supplies the restaurant and catering industry. South Australia currently has the largest concentration of bush foods producers and distributors.

Saline bush foods are a new and niche market within the bush foods industry, which is typically focussed on dryland plants such as bush tomato, quandong, acacia and other species. The Saline Bush Foods project was funded to accelerate the development of the saline bush foods market, with Moojepin Foods acting as the lead producer and WAGOGA responsible for marketing and growing awareness within the consumer base of these products. Saline bush foods can be used as a vegetable within dishes, as a garnish, raw as part of cheese platters, or cooked into relishes and sauces.

Despite the enormous interruptions posed to the hospitality industries, and others, by the COVID-19 pandemic, demand for saline bush foods has continued to grow steadily. Moojepin Foods and the project are currently supplying customers in Western Australia, New South Wales, Queensland and a very small supply into Victoria and South Australia, which are projected to grow further. Our aim is to create an industry initially in the Great Southern that can supply saline foods globally.

3.1 TARGET CUSTOMERS

Domestic Hospitality Market – Currently saline bush foods grown at Moojepin supply WA, NSW, Queensland and some smaller wholesalers in Victoria and SA with fresh saline bush foods product. The majority of the product sold goes to chefs and cooks working in restaurants and the catering sectors. The main target is the high end of the market, with our products notably on the menus of some of Australia's most prestigious restaurants including Quay Restaurant in Sydney and Perth's new top restaurant Fleur. As at December 2021 the products sell for:

- Saltbush sprigs $25 - $30/kg
- Karakalla $24 - $35/kg
- Saltice Iceplant $30 - $40/kg
- Samphire $30 - $40/kg

The goal is to expand and grow the markets in these states, which have all experienced significant interruptions due to COVID-19 but are all showing strong signs of recovery.

Figure 4: A dish prepared by Chef Herb Faust of "Herb Faust Foods" utilising baby pigface (karkalla) from the project farm.

Domestic Retail Market – This is the next and most challenging area for expansion of the saline bush foods products. More investment, product development and marketing is needed, and has commenced, to capture everyday consumers such as home cooks shopping in supermarkets and specialty grocery stores. The range of products will likely include fresh shoots, such as those already sold in the hospitality industry, plus value added products and potentially the health food sector also. In 2022, production will commence using dried saltbush, the first of the species to be value added, into:

- Bush herb spice mixes
- Bread ingredients
- Saltbush pasta
- Savoury crackers, and
- Bulk dried saltbush herb

Many "ordinary" Australians are yet to be exposed to saline bush foods, and will need to be introduced to the products. Clever marketing, in-store promotions and education are three main areas which will be focussed on to develop for the retail market. New labels and QR codes will be used to link back to the website, where consumers will be able to view cooking demonstration videos and print recipes, to assist their uptake of saline bush foods.

Export Market – Expansion into overseas export markets was put on hold at the beginning of the COVID-19 pandemic, with the plan to recommence this angle over 2023 – 2025, with Singapore and Malaysia being the first targeted. The West Australian Government already have export agencies set-up in both countries and initial contact has been made between the Saline Bush Foods project with these departments, who will be of great assistance in opening these new market opportunities.

Figure 5: Lance McLeod and David Thompson presenting the saline bush foods to an export market delegation from the WA Department of Jobs, Tourism, Science and Innovation, 2021.

3.2 MARKET PROJECTIONS

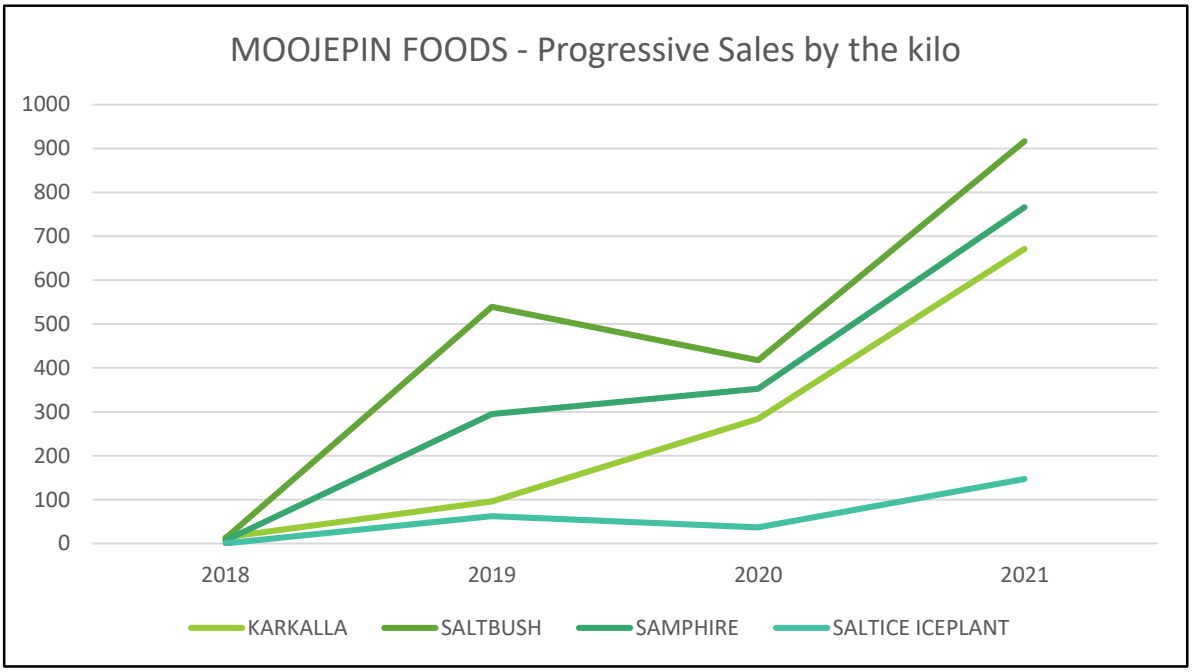
Despite the impact of COVID-19, particularly over 2020, there has been steady growth in demand and sales for saline bush foods since this production site entered the market. From November 2020 through to June 2021 there was an increase on the yearly totals by over 50%. Currently this demand is able to be met by the growing

systems established through the project, but the trajectory indicates that further capacity will need to be brought on line in the future.

The quantities of each of the four focus products sold each year for the past four years is shown in the table and graph below.

MOOJEPIN FOODS - Progressive Sales by the kilo

	2018	2019	2020	2021
KARKALLA	14.16	96	284	671.2
SALTBUSH	12	539.2	417.6	916
SAMPHIRE	7.04	295.2	352.8	766.24
SALTICE ICEPLANT	0	62.4	36.8	147.256



3.2.1 EXPECTED MARKET GROWTH

Domestic:

The expansion of current markets in NSW, Queensland, and WA are predicted to be in the order of 20-25% over the coming five years 2022 – 2027. With the planned expansion of the Victorian market through a new wholesale marketing arrangement, this currently small consumer state is expected to see an expansion in size of around 30% over the same period.

Figure 6: Displaying at various food expos is increasing consumer awareness of saline bush foods.

International:

Of the estimated 6500 different types of Australian bush foods, only a handful have been successfully exported in large commercial numbers: finger limes, macadamias and, increasingly, lemon myrtle. This highlights the high potential and growing popularity of Australian grown produce and native bush foods.

Australia exports around 70% of its agriculture production, with the Asian market being the closest and fastest growing. Australia already has a robust supply chain and Free Trade Agreements in place with most countries in the Asian region. Saline produce is closely matched with seafood and fish dishes, which make up a large percentage of Asian cuisine, and this is one of the main reasons the Asian market is suitable as the next future target market.

There is no bench-mark target yet set for saline bush foods in the international market, to be pursued from 2023, but it will further grow the quantities of demand. The initial overseas target markets will be high end restaurants and catering businesses, same as within Australia.

4.0 THE GROWING SYSTEMS

Three growing systems – Wild Harvest, Plantation and Shadehouse - of differing levels of complexity, were trialled in this Project to see which, if any, could produce commercially suitable saline bush foods. We're delighted to announce that all three systems were proven capable, each with their own strengths and weaknesses. This gives growers considering entering the saline bush foods industry the flexibility to choose which system is most suitable for them, given the time and resources that producer has available, and how immersive they wish to be in the process.

4.0.1 OVERALL SITE SELECTION

Site selection is of critical importance, as it is not a simple thing to change once established.

Particularly with saltbush plantings, the temptation is to put it on the worst country, but this may not bode well long term. Saltbush do not tolerate waterlogging as well as many people think they do, and the amount of salinity in the growing soil can increase the bitterness of the taste of the leaf.

Land that is only semi-productive, or commencing the fall out of standard cropping and pasture systems due to salinity, are indicating to be better sites. Whilst it may feel like "giving up" productive land, it has more opportunity to create a profitable and viable edible enterprise, and can protect both the further degradation of the soil in situ but also halt or slow the spread of salinity upslope further into current cropping or pasture country. Rye grass and other weeds do need to be managed or considered on the better soil.

It is well worth getting an experienced person to conduct a site inspection of your proposed site prior to making any investment.

Access is also a very important issue. Harvesting of saline bush foods occurs all year round, so it is important that it is located in a place with all-weather access. Again, the highly degraded salt flats may seem a good place, but these are often un-trafficable either by vehicle or foot in the wetter months.

Because management and harvest activities happen every few days, it is ideal to locate the sites close to central operations of the farm, making it easy and quick to get to so often.

Being able to get the fresh produce to the supply chain is also an important consideration. The pickings need to be able to get to either the Katanning Packing Shed, or a freight company that can manage the safe transport of the produce, on the same day as harvest. Because harvesting can occur multiple times per week, it is ideal if the farm or identified land is within 100km / one hours drive (or less) of these drop off points. Any further may make transport too large an issue for saline bush foods production to be viable at some locations.

4.1 WILD HARVEST

Wild harvesting requires the smallest amount of set-up, management and infrastructure development, but also has the lowest level of production, highest seasonal variability and highest harvest manual labour needs. It could be a good option for a farmer looking to participate in the saline bush foods industry at a low or casual level.

The annual profit margin being achieved through Wild Harvest production at the project farm is around $10,000. It is hard to quantify this as a per hectare amount, as selection sites are opportunistic and spread out over a large area (greater than 200ha).

4.1.1 CHARACTERISTICS OF A GOOD WILD HARVEST SITE

Wild Harvest sites have proven to be the most challenging of the three growing systems trialled, but they also require the least development.

Wild Harvest sites need to be significantly larger than plantation or horticultural growing sites, as they don't have the plant density nor the consistency of quality that can be achieved in the more managed systems. For this reason, they are also the most time-intensive to harvest, as pickers may have to walk considerable distances to find enough of the right product at the correct stage of growth for harvesting.

Selection of a suitable wild harvest site requires visual assessment of the range of plants that are currently growing there, checking that that target species are present and growing well. Bare salt is unable to support commercial plant growth.

Access to Wild Harvest sites is very important, and must be considered closely. Often these sites can become inaccessible after rainfall, or very unpleasant to work in during hot or windy days as they tend to lack shelter.

Figure 7: Foraging at a Wild Harvest site.

4.1.2 SPECIES THAT CAN BE WILD HARVESTED

A range of native species grow on the salt flats, some of which may prove to be additional saline bush foods for future exploitation.

This project has found the Samphire species *Tecticornia lepidosperma* to be the most suitable for the saline bush foods industry. It produces sprigs that are of commercial quality all year round. Many of the other species, including *Tecticornia quiquenflora,* have been found to only be productive over the summer period (approximately November to March), reducing their viability as a reliable product source.

Karkalla (*Carpobrotus spp)*, also known as pigface, comes in both red and green varieties. It has also been found to only reliably produce saleable product for a portion of the year in the wild, usually October to May. Karakalla is prone to insect attack in the wild, particularly Red Legged Earth Mite, Spider Mite and locusts, which can damage the leaf and make it unsuitable for sale. Chemical control on wild sites is very tricky, and hasn't been done in this project, as these are wild ecosystems and there could be off-target impacts.

Figure 8: Freshly harvested wild karkalla to exact specifications.

Ice-plant (*Mesembryanthemum spp)* also grows in the wild salt-flats, although it is not an Australian native plant. It is not yet fully understood what triggers flowering, with it thought to be linked to heat or salinity, so harvesting the valuable flowers can be hit and miss. They tend to cycle differently depending on whether they grow in shade or out in the open on the salt flats.

Figure 9: Ice-plant growing in the depressions left by tractor tyres at the Wild Harvest site.

4.1.3 PLANT MANAGEMENT

4.1.3.1 SEASONALITY

As they are a natural system, wild harvest sites display high levels of seasonal variability. Some species are only suitable for harvesting at certain times of the year, or only flower at particular periods. Coupled with variations in weather conditions which affect growth and other impacts such as insect attack, it is difficult to supply a highly consistent product year-round.

Wild harvest sites may work best in providing additional supply when possible to boost district production, rather than being a sole provision site. Fortunately, lowest levels of productivity (winter) co-incide with the lowest market demand for saline bush foods currently.

4.1.3.2 SITE MANAGEMENT OPTIONS

Wild harvest sites by nature require less active management than those in the other growth systems.

Plants on the wild salt flats tend to grow slowly, and can be prone to developing woody or brown stems. The saline bush foods industry requires fresh succulent new growth – these will occur in nature but are affected by seasonality, or requires sorting amongst the older woody growth to find it.

Through this project, some mechanical methods were tested to see if fresh growth could be stimulated on the salt flat.

Areas of woody samphire were raked, and then the sites scarified using a tractor drawn implement to 150mm deep. Initially there was a fresh burst of growth, but then this quickly faded.

Figure 10: Visible lines of new green samphire growth post-scarification.

Soil sampling throughout the project provided useful information about the impacts of the scarification process. It indicated that initially there was higher nutrient availability in the scarified area compared to the non-scarified control site, but the variability in these levels was much more significant in the scarified area than the non-scarified. It is postulated that the increase in nutrients in the upper layers of the soil profile fuelled the initial burst in growth, but is then also exhausted more quickly.

The project team feel that raking or rotary hoeing the old stagnant plant material can be beneficial to the stimulation of growth, but that scarification was far too brutal and negatively impacted the production values of the site in the longer term.

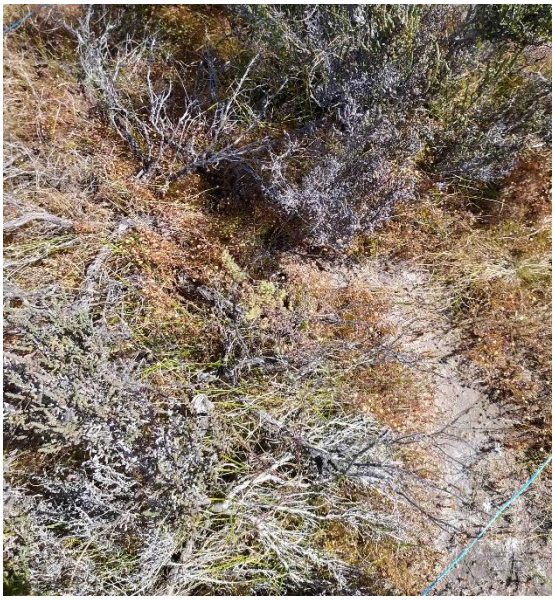


Figure 11: Old, woody samphire on the salt-flats.

Raking the old samphire plants also appeared to allow seed to germinate – there was a lot of seed present naturally at the site and seemed to just need the space and light to grow. The host landholder also noted that there appeared to be fresh stimulation of new shoots following grazing by sheep, who achieve the same outcome of removing / trampling old plants and creating suitable conditions for new germination. However, it must be noted that saline flats are delicate and can be damaged by cloven-hoofed animal grazing, plus there are nutritional concerns for the livestock from a high-salt diet.

As a result of the trials and sampling conducted at the Wild Harvest site, the project team feels that the major limiting factor(s) to higher levels of fresh growth lay beyond what was tried – perhaps a lack of plant available nutrients compounded by the anaerobic conditions of the soil for a significant proportion of the year, or perhaps the tight compaction of the wet-dry soils making it harder for root growth.

Liming is another option that was identified as perhaps a future trial option, which may assist with the plant availability of nutrients at the wild harvest site.

No fertiliser or spray was used on the Wild Harvest site throughout this project.

4.1.3.3 HARVESTING

Harvesting of Wild Harvest sites requires manual pickers, who are skilled in identifying shoots which meet market requirements, and have a good level of physical fitness.

A truck is parked as close to the site as practicable, and then pickers venture onto the wild harvest site with hand secateurs and a bucket. They walk across the site seeking suitable specimens, crouch down to ground level, then they snip and place into the bucket. Periodically, pickers walk back to the truck and transfer the cuttings into foam boxes (ice-plant, samphire, karkalla) or crates (samphire, karkalla) and place them into the truck out of the sun as shoots can start to wilt quite quickly, particularly on a warm day.

It is very hard to estimate the amount of product that can be picked per hour, as it is highly dependent on how far they need to walk and how dense the suitable specimens are on that particular day. Below are some photographs of samphire and karkalla in the Wild Harvest environment that are suitable for harvesting immediately.

Figure 12: Wild samphire (left) and wild karkalla / pigface (right) ready for harvesting in the field.

4.1.3.4 PERMIT FOR HARVESTING NATIVE PLANTS

It is very important for anyone considering commercial harvesting from wild areas, even those privately owned, to understand that a Permit to Harvest Native Plants is required. These permits are issued by the Department of Biodiversity, Conservation and Attractions (DBCA) and incur an annual fee of $125 per year (subject to change – please check with your local DBCA office). After the initial application, provided there are no changes, the permit can be renewed annually.

Holders of a permit are required to report quarterly to the Department on the species harvested and the quantity of each species sold. Information can be submitted electronically. There are penalties for failure to comply.

The permit system is important, as there are currently very little controls over wild foraging in Australia. Over-harvesting can lead to environmental damage, and these reporting systems allow authorities to better understand the scale of operations underway and be able to plan accordingly.

4.2 PLANTATION: SEAKISS SALTBUSH

The project uses “SeaKiss” saltbush, which was selected by the host landholder for its taste features of low bitterness and sweeter leaf.

It is a clonal selection of Old Man Saltbush (*Atriplex nummularia*), identified by CSIRO and partners for having improved nutritional value and palatability to sheep. Moojepin Foods named the clonal selection “SeaKiss” and have an ongoing commercial agreement with CSIRO for its use.

“SeaKiss” isn’t freely available, for more information contact Moojepin Foods or CSIRO.

Figure 13: SeaKiss saltbush.

4.2.1 CHARACTERISTICS OF A GOOD SALTBUSH PLANTATION SITE

A site assessment by a suitably experienced person is highly recommended to ensure that the saltbush plantation site has the greatest chance of success.

Ideally the site will be located mid-slope on free-draining semi-saline land. This is land that is starting to exhibit signs of salinization with species such as capeweed, ryegrass and barley grass present, and may even be in the final stages of being able to support grain production.

Heavy clays and valley floors, or highly salinized sites, that are prone to waterlogging should be avoided as Old Man Saltbush has only mild tolerance for waterlogging. The project had a frustrating loss of around 2000 individual 3 year old SeaKiss saltbushes at our main production site following the high rainfall experienced in 2021, due to waterlogging. The site is not on the valley floor, and was just downslope from a productive canola crop, demonstrating the serious nature of waterlogging risk to the saltbush and the importance of getting site selection right.

4.2.2 PLANT MANAGEMENT

As SeaKiss is a controlled clonal selection, planting with seedlings is the only establishment option.

The site was subjected to a weed knockdown site spray prior to planting to control weeds, with additional weed management in the first year. A Chatfields Tree Planter machine with a blade at the front to scrape away weed burden and forming an M-shaped mound was used. Seedlings were planted in July, with no fertiliser added. There was a 1.2m spacing between each seedling in the row. Rows were paired, with two rows 1.5m apart, then separated from the next paid of rows by a gap of 3.5m which allows a ute or other vehicle to access along the rows.

Figure 14: Seakiss saltbush site at June 2020.

Picking in earnest for the saline bush foods industry can commence approximately 12 months after the seedlings are established. Plants may be ready for a light pick from as early as 7 months depending on conditions. The saltbush grows fastest in the warmer summer months, and slows down in the cooler winter months.

In the wet year of 2021, the saltbush also experienced some impact from fungus, which made the leaves un-harvestable for the period of infection. The Project Team have not yet determined a management strategy to deal with this risk in the future, discussions are on-going.

Once the SeaKiss saltbush has reached the stage of being harvested from, there is a harvest interval of about 20 weeks between picks for an individual bush.

4.2.3 HARVESTING

There are two methods of harvesting saltbush for the bush foods industry – mechanical and manual.

4.2.3.1 MECHANICAL HARVESTING

Two machines have been developed through the Saline Bush Foods project, by Chatfields Engineering, specifically to see if mechanisation of the harvesting process is possible, and can possibly assist with upscaling the industry.

The **Former** is an implement attached to the front of a tractor via an offset three-point linkage (TPL), custom built by Chatfields. It is driven over the saltbush, with the tractor straddling the row, and cuts the bush to a low triangular shape. This removes old woody growth from the plant, allowing fresh shoots to grow and importantly, these are all then growing at a consistent location on the plant. The implement cannot be towed behind, as the tractor would crush the plants first, making the Former inefficient. Consequently, a bi-directional tractor is required.

The Former can operate at approximately 2km per hour, and it is recommended that each bush is treated by the Former once per year.

Figure 15: Saltbush former front-mounted on a bi-directional tractor.

As you want to stagger the forming of your bushes throughout the year, so that there are always bushes ready at the harvesting stage, use of the Former is probably only about an hour and a half at a time, depending on the size of your plantation. At approximately $31,000 to purchase the bespoke attachment, it is more likely that this job is suited to a contractor or share arrangement than each production property owning their own.

The second machine developed is the **Harvester**. This has been modified from a tea-plantation harvester, mounted onto a ride-on lawnmower, which allows the machine to travel at a constant slow speed.

As the plants have been trimmed with the Former to a consistent size and shape, the Harvester can then move over the bushes trimming the new leaf which has grown up from the woody stems, and using air, blows the delicate stem into the catcher bag on the Harvester machine.

Figure 16: An earlier prototype of the harvesting machine, with the tea-harvester mounted on a quad bike.

The machine is not yet able to get as perfectly clean cut on the stems as manual harvesting can, but its value may be proven with the expedited harvest of product for second-grade lines such as dried and value added products.

4.2.3.2 HAND HARVESTING

Harvesting by hand is still producing the highest quality cuts for the gourmet and hospitality fresh market. The current top picker at Moojepin Foods can pick around 1kg of saleable product every 15 minutes. Stems for sale are at two lengths – 12cm and 30cm.

The truck with foam boxes and crates is parked as close as possible to the site, with pickers moving along the rows on foot, carrying a bucket and secateurs. The cuts are placed into the bucket and periodically walked back to the truck to be loaded into crates and boxes out of the sun. The current system uses 52 litre crates and 25 litre foam boxes. Pickers are instructed as to how many crates or boxes are required to be pick that day, usually running 2 orders ahead for the warehouse in Perth.

Figure 17: A perfect sprig of saltbush, freshly harvested by hand to specifications.

It is important that the pickers work methodically down the rows, and mark which bush they finish at one day, so they can start from that same location the next day. As there is rolling harvest with a pick every 20 weeks and forming occurring annually, it is critical that a progressive system is used as each bush holds its place in the management cycle.

Pickers are paid under the Horticultural Workers Award, at a current adult rate of $25.71 per hour.

The annual profit margin at the project farm is currently around $8000, or approximately $1400 per hectare per year. The impact of COVID-19 reducing demand is unable to be accurately quantified on the potential profit margin, as the site is capable of producing more saleable product than is currently being harvested.

Figure 18: Harvesting saltbush by hand into crates.

4.3 PLANTATION: SAMPHIRE

4.3.1 SPECIES AND SITE CHARACTERISTICS

A small plantation of samphire was established in 2020 during this project, to see if this typically wild-harvested species could be brought into a plantation setting.

The samphire variety *Salicornia quinquofolia* was planted as seedlings into a site down on the natural salt flats at Moojepin. These seedlings were propagated at Chatfields Nursery from seed collected from the wild salt flats, and cost $1 per seedling, plus a cost of around $1 per seedling to plant.

The site was prepared using the Chatfields Tree Planter, but there is concern as to whether the mound that is created by this machine is not necessary, as the plants are used to growing in waterlogged conditions in nature and therefore don't require to be lifted up on a mound.

The *S. quinquofolia* plantation hasn't proven to be as successful as hoped. They are slow growing and turn woody quite quickly, and are really only suitable for harvesting from over the warmer months. Whether they are suffering from a nutrient deficiency causing the slow growth requires further investigation.

The Moojepin Foods team are planning to establish a second samphire plantation of the variety *T. lepidosperma.* This species has growth suitable for harvesting all year round, making it a more commercially desirable species. Plantation establishment was unable to be done in 2020 due to poor seed set over that year, but 2021 was a more successful year and seeds were gathered for planting over the 2021-22 summer. This plantation is going to be located adjacent to a dried up lake within the same pine plantation as the shadehouses – the site is less waterlogged and believed to be more fertile. It also has easier access and can be watered with the saline ground water pumped from the production bores to the shadehouses, if need be, or to experiment with growth stimulation. No data is yet available from this site.

4.3.2 PLANT MANAGEMENT

There is variation in the quality and quantity of harvests achieved / able to be achieved in the future from the plantation samphire, with seasons and species seeming to be the major determinants.

Samphire seeds require fresh water to germinate, and relatively fresh ground to go through their early growth stages. There may be some opportunities for site manipulation to encourage this in the future.

No further management of the plantations, such as fertiliser, spraying or weed control has been done.

4.3.3 HARVESTING

Harvesting from the samphire plantation uses the same method as harvesting from the wild harvest sites (hand picking, bending down or squatting to cut with secateurs), with the advantage of plants being co-located together. It is still a slow and labour intensive method.

Samphire plants are ready for their first harvest at about 15 months of age. Individual plants seem to be able to be harvested approximately once every 3 months (12-13 weeks), with it important not to over-harvest any one particular plant.

No profit margin information is yet available for plantation samphire.

4.4 SHADEHOUSE

Shadehouse growing has shown to be the "Rolls Royce" of the three systems. It is by far the most expensive and complicated to set up, requires the most amount of management, but produces the most consistent, highest quality and highest volumes of product. This system would be most suited to a farmer who is seeking to add saline bush foods as a significant part of their enterprise and to have a high participation rate in the industry.

4.4.1 ROLE OF CHARLOTTE CREEK HORTICULTURAL

Charlotte Creek has provided both advisory and technical help in all aspects of commercial halophyte (saline plants) production, starting with experimental plantings of suitable halophytes through to the design and build of commercial growing systems for these salt plants through this project.

Charlotte Creek has worked in close cooperation with the host landholder, David Thompson, on the commercial production of the saleable halophytes. The process has been a learning one all the way through, and systems and processes have had to change and adapt with the new discoveries every day.

Post-project, Charlotte Creek's role will hopefully continue as it has during the project, advising and adapting the growing process to suit the new discoveries found with these plants. Charlotte Creek will be commercially available to newcomers to the industry.

4.4.2 SPECIES GROWN

Three suitable species were earmarked initially for growing in the shadehouse system: Samphire (*Tecticornia spp)*, Slender Ice Plant (*Mesembryanthemum spp)* and Karkalla (*Carpobrotus spp*). As growing trials progressed, Slender Ice Plant and Karkalla became the main varieties grown in the shadehouses, and a plethora of other halophytes were trialled including sea purslane, heart leafed ice plant, warrigal greens, sea celery and sea parsley. All grew successfully, with plantings of these (outside the project) now included in the shadehouse production and market supply.

Figure 19: Slender Ice-plant (left) and karkalla (right).

4.4.3 SITE LOCATION

A suitable shadehouse site should be accessible and large enough to contain production areas, and all amenities required to carry out normal horticultural activities. A steady slope with free draining soils would be considered advantageous. Protection from wind, frost, and bushfires is high on the list of priorities. Proximity to water

supply, both fresh and salty is a must. Proximity to electricity supply and mobile phone coverage would be helpful.

The site needs an all-weather access road, that should be able to cope with small trucks and mildly heavy machinery. Access to the site should be limited so any visitors may be vetted or restricted from access. As the industry grows and markets developed overseas there may be biosecurity issues that arise especially over unwanted access, and these restrictions should be kept in mind at the planning stage of the project.

The site at Moojepin meets these criteria – it is located within a clearing in a pine plantation, providing good shelter and well hidden from the main road. A reliable farm access track ensures year-round ingress and egress, and is centrally located, making it easy for farm staff to visit regularly. Stand-alone power solved the grid-access distance issue.

Figure 20: General layout of shadehouse site. Open clearing within plantation, production shadehouses center and left, power and water supply to the right.

4.4.4 SHADEHOUSE DESIGN, FIT OUT AND CONSTRUCTION

The design of the structure and the coverings used will depend on which halophytic plants are grown, the site, and, to a large extent, on the budget allocated. Different halophytes have different requirements to shade and heat.

There are two igloo-style shadehouses on site at the Moojepin property established through the project, approximately 10m wide and 26m long. The hoops for the frame were sourced second hand from an old flower farm, and were trucked into the site.

The assembly of the frames took four staff from the farm about a month (on and off) to assemble. Working at heights of up to 5m in the air, and assembling the sheer scale of the frames was a challenge for the on-site team who had never built a shadehouse before. Footings were installed by the farm staff with concrete made on-site to stabilise them, then filled up and completed by a commercial concrete truck. Covering of the shadehouse was done by staff brought in from Chatfields Nursery, as it was a more complex task and not really a job for a beginner!

Figure 21: Shadehouse 1 under construction.

The first shadehouse is covered in 50% transparency shadecloth, and the second shadehouse was covered mainly with plastic film with shade cloth sides to allow extra air ventilation after issues with incoming rain diluting the saline growing conditions were identified, and more was learnt about the temperature preferences of some of the species. The plastic certainly makes it warmer, but also makes the working conditions less pleasant in the higher heat and humidity.

Establishment and fit out of the two shadehouses cost $55,000.

There is a third shadehouse on the agenda post-project, which is to be trailed as a propagation house. This is likely to be much smaller in size and completely covered in plastic.

Fit-Out

Benches

Each of the shadehouses contains four benches that run the entire length of the structure. They can be made from whatever material can be sourced cheaply or on hand, right through to custom made systems such as rolling benches. This will depend on the size and scope of operation. It is important that the benches are installed at a good working height for the staff who will be using them. The benches used in the project were sourced second hand from a nursery, and were placed on top of old IBC (chemical shuttle) frames, which were able to be obtained for free. They created a good working height, but unfortunately are too wide to be able to reach comfortably into the middle, creating some “wasted space”.

Figure 22: Grow bags laid out in the shadehouse. Note the "dead space" in the centre of the benches.

Growing Medium

Hydroponic bags were selected to be used in the shadehouses during the project, as they are free draining, long lasting and easily transported. These 25 x 20 x 17cm blocks are filled with compressed coir (coconut husk) peat which come from India and is distributed in Australia via Melbourne. They are purchased for $1600 per pallet of 1000 bags, and as at November 2021 there were 4200 blocks in the greenhouse with projected capacity of 6100 with some reconfiguration and addition of some second tier benches.

One seedling is planted in each grow bag, except for slender ice-plant which has two seedlings per block. The project team has been happy with the bags, they have lasted 3 years so far and the coconut husk can be reused again and again. There is a need to maximise the number of plants in the shadehouse, as this maximises production per unit area.

Figure 23: Working on initial set-up of grow bags with coir, seedlings and irrigation in the shadehouse.

Irrigation System

A drip system has proven to be the most efficient, with the exact water requirements for the different species now calculated and being used so that no water is wasted. Delivery to the drip will depend on the water supply, and the design will depend on the size of operation and the plants chosen to grow.

Figure 24: Flowering slender Iceplant and Red Karkalla, demonstrating irrigation set up.

The project's irrigation system is via a pressure pump supplying nine valves at present, one valve per bench. A Tefen Fertiliser Injector® for fertigation (combined liquid fertiliser and water application) is currently being set up and the control system upgraded to a Hunter Advanced Commercial Controller®. The shift from granular to liquid fertiliser will help to increase accuracy and also cut down human labour requirements.

As with the irrigation scheduling, the fertiliser regime varies with the type of plant grown, the stage at which the plant is and the season. It is a moving feast, generally an all-purpose evenly balanced macro fertilizer (NPK) with trace elements is preferred as a base and this is topped up with a granular quick release when required. As the move to the new system is completed, the requirements will be better able to be quantified.

Figure 25: One of the fertiliser trials undertaken through the Smart Farms project.

Watering is undertaken automatically at the site three times per day, to a total amount of 15 minutes / day.

Pest Control

Being an ideal environment for plants can unfortunately render shadehouses ideal environments for pests also. Mice were an early problem, burrowing into the coconut husk within the growbags, but it was discovered this only occurred when the plants were big and had dried off – the mice were eating the seed. A change in management technique to no longer allow the plants to mature has removed the favourable conditions for the mice and the problem has all but disappeared.

Figure 26: Damage caused by mice burrowing in the grow bags.

Aphids were a major issue for the karkalla in the shadehouse. A garlic and chilli spray has been used to control them effectively. Although there are no withholding periods for this natural product, we choose not to spray prior to harvesting, so undertake any required spraying on Fridays, giving the weekend before picking commences again in the new week.

4.4.5 WATER SUPPLY FOR SHADEHOUSE

Two sources of water are required, a salty source and a fresh water source.

The salt water is required for plant irrigation and depending on the concentration of this supply may need to be shandied with the fresh water to obtain the optimum concentration. Fortunately, at the project site, no dilution is required, but other sites may need to do so.

Fresh water is required for general horticultural practices, such a washdowns, and staff amenities. Fresh water can be obtained from scheme water, or rainwater tanks and association collection infrastructure.

To supply the saline water for irrigation, and to assist the drawdown of saline water tables, two groundwater production bores were successfully put down at the Moojepin farm.

Siting the bores required finding a location that was within practicable distance to the proposed shadehouse site, with a soil profile that would allow high enough extraction of the target groundwater – and for the water to be saline! A diviner was used to identify the sites, very accurately. The bores were sunk using a professional drilling service, which was a significant financial outlay in the order of $30,000. The bores are each 5 inch diameter, with one being 50m meters deep and the other 60m deep. Water salinities achieved were lower than expected with 800mS/m yielded in the valley floor bore and 100mS/m in the second bore located slightly further south.

Figure 27: Production bore drilling underway. Note young saltbush Plantation in background.

Both production bores were fitted with solar pumps, to extract the water and pump it to a 9000L holding tank at the shadehouse site. In the second year of operation, there was an issue with one of the pumps, so it was extremely fortunate that water supply could be very quickly switched to the secondary bore allowing continuity of irrigation. Ideally the holding tank at the site would also be larger, to provide buffer against supply interruptions like this in the future.

Figure 28: Yellow solar pump on the northern production bore.

Water usage at the shadehouse was originally estimated at around 16 kilolitres per day, but so far, the water requirement has not even come close. As the irrigation system has been refined and become highly accurate in delivering exactly what the plants need, water demand has settled out to around 2000 litres per day, dropping to around 1200 litres per day when it is raining, and rising slightly in the hot weather.

Trails at greenhouse facilities in Perth showed that the tastiest products were achieved with water approximately half the salinity of seawater. For this reason, as the projects production bores are less salty than expected, the plants are irrigated with straight groundwater – no dilution with freshwater to create a shandy is needed at this location. Extended periods of rain were found to dilute the taste of the product, so consideration was given to rain exclusion in the shadehouses with plastic sheeting added to the Number 2 shadehouse.

Figure 29: Trialling different concentrations of irrigation water salinity on Slender Ice-Plant.

It is important to consider however, that with spillages of water around the shadehouse site, the saltier water has potential for more negative impact on the local ground. Very good overflow capture systems are important to mitigate this risk, especially when dealing with highly saline water.

4.4.6 ELECTRICITY

Electricity is required to run a number of shadehouse functions including irrigation systems, pumps and staff amenities. Depending on the size of operation power supply will vary in size and whether single phase or three phase is required.

Due to distance from the mains grid and a desire to use renewable electricity for environmental reasons, the projects shadehouse system is powered by a stand-alone solar power system. The 5kVa system consists of a 1.5KW solar/battery system, using four 370 Watt panels, four 200 Amp batteries and a 3024 inverter. It was purchased in kit form in Perth and then installed and wired by a local electrician. The system size is more than adequate for current needs. There is a small back-up generator onsite, but hasn't been needed yet. The system established at the Moojepin site cost just over $9000.

In event of a power system failure, the shadehouse system could go up to 4 days (weather dependent) without power because the growing medium bags can hold enough moisture to sustain this period.

Figure 30: The complete on-site solar power system unit.

4.4.7 SHADEHOUSE OPERATION AND HARVESTING

Management of the shadehouse operation is very time intensive. It takes more time than all the other sites (Plantation and Wild Harvest) at Moojepin combined, at around 20 hours onsite per week (excluding harvesting). Tasks include keeping an eye on the overall system, mowing the grass, checking growth rates, inspecting for insects, recording, pump & water system checks, planting (currently 500 new seedlings planted every fortnight), fertiliser application, setting up more expansion infrastructure and general troubleshooting.

The intensity of management required is leading towards the potential employment of a dedicated shadehouse manager at the Moojepin site in the future. David Thompson, who has been doing this role currently alongside running his sheep and grain enterprise (fortunately with a number of other farm staff), says that the task of managing the shadehouse has been very rewarding, but can be stressful when things go wrong. Any issues need to be identified and addressed quickly as consequences can be significant.

Harvesting of the product is done by the same people who pick from the plantation and wild harvest sites also, to the order requirements of that week. As of late 2021, two people are employed two days per week (0.8 FTE) specifically to pick for market, and it is anticipated that this will need to increase in 2022 to meet projected demand.

Harvesting in the shadehouse system is the easiest and quickest of the three growing systems. Most harvesting is done at a comfortable waist height, eliminating the need for all the bending and squatting in the field, and shoots aren't contaminated with dirt. Plants at the same growth stage are co-located together, meaning that pickers don't have to go "hunting" for the right plants to pick from. The truck with crates and foam boxes can be parked right next to the shadehouses, eliminating the large distances walked in the field. The site is sheltered from wind, the shadecloth provides shade and staff amenities are close-by, making it a much more pleasant work environment for staff.

Figure 31: Shadehouse in full production.

4.4.8 ON-GOING OPERATING COSTS

Time and labour are the major on-going operating costs for the shadehouse system. Purchase of new seedlings periodically is another cost. Currently ice-plant is propagated for the shadehouse by Katanning Environmental Nursery, from seed supplied by Moojepin. This is a commercial arrangement that incurs a fee, and has been done partly to outsource some of the labour requirements at the shadehouse, and partly to support the local nursery.

With the off-grid renewable power set-up and by supplying on-site own groundwater, power and water costs are effectively zero.

There will be longer term system upgrade and replacement costs, periods of which have not yet been reached by the system in the project timeframe. It's anticipated that the shadecloth & plastic coverings for the shadehouses may need to be replaced at 6- 8 year intervals, 10 years for the solar pump etc. The pressure pump and solenoids will also need to be maintained.

PVC pipe degradation from the sun may be another issue, and perhaps may have been better managed by using poly-pipe initially.

The profit margin at the shadehouse site has unfortunately come in at a loss of $240 for the past year. However, the impact of COVID-19 has meant that demand has been highly fluctuating and unpredictable, and much good quality product has had to be thrown away simply due to lack of market – meanwhile it still incurred costs for growing, unlike the outdoor sites. At the time of writing (January 2022), the Sydney market was back down to only 30% of usual demand due to the COVID-19 Omicron outbreak, and once again, good product has nowhere to go. The project team feels that the calculated profit (loss) is not reflective of where the shadehouse system would be in a non-pandemic world, and are looking forward to markets stabilising and the real potential of the shadehouses being utilised in the near future.

4.5 ACCESS TO SKILLED WORKERS

As part of the Smart Farming Partnerships program, Great Southern TAFE to delivered Horticulture training specialising in Bush Foods. In 2020, 6 local adult students completed a Certificate II (Horticulture), with 3 students successfully completing the Certificate III level in 2021. These students undertook the standard TAFE Horticulture curriculum, but also spent time at the Saline Bush Foods site, met with Project Team members and undertook Aboriginal cultural training with Wuddi Aboriginal Tours.

These people may be a valuable option to farmers wishing to become a grower, particularly for those taking on higher-intensity growing systems ie shadehouse or at a larger scale, and needing to employ additional local labour.

Figure 32: The 2020 TAFE Horticulture Cert II specialising in bush foods class.

5.0 THE SUPPLY CHAIN

5.1 ROLE OF MOOJEPIN FOODS

Within the Smart Farming Partnerships program, Moojepin Foods at "Moojepin", Badgebup, had principal responsibility for establishing the growing systems behind the supply chain, with a smaller role in the marketing and building of product awareness within the consumer sector.

Since it's establishment in 2017, Moojepin Foods have developed a recognisable brand, reputation for quality and valuable experience within the bush foods market, and this will be capitalised on for the commercial roll out of the industry, beyond this project.

Moojepin Foods will be the central operator, continuing to grow produce but also contracting other growers to grow and deliver into the supply chain. Moojepin Foods will manage marketing and packing contracts, and may also supply services such as harvesting and technical support back to contracted growers.

Moojepin Foods will also manage the release of the Technical Manual until the control period ends in 2024. This is not to exclude other enterprises from entering the market – Moojepin Foods does not hold exclusivity rights and new operators are welcome – but rather to ensure that the build-up of the market is managed appropriately for everyone's benefit in the long run.

5.2 OPTIONS FOR ENTERING THE SUPPLY CHAIN

5.2.1 BECOMING A GROWER

The most obvious opportunity to participate in the supply chain is as a grower. This can be at a range of scales and focussing on any number of the target species, and undertaken through the established supply chain or independently.

There is of course, also opportunity for participation at other stages, such as establishing your own packing enterprise, establishing a unique brand of your own or offering a harvest contract service. At the time of writing, market projections are that it is too early for expansion to this scale, but hopefully these will be viable options in the future.

5.2.1.1 SUPPLYING TO MOOJEPIN FOODS

As the demand for saline bush foods grow, the amount of product required will no longer be able to be met by that grown at the current sites held by Moojepin Foods. At this point, which is expected to be within the next 12 – 18 months (market conditions pending) additional contract growers will be required.

Contract growers will be sought, to enter into an agreement with Moojepin Foods to supply for sale under the Moojepin Foods brand. Options will be available as to the species, growing system and volumes. For some farmers, wild harvest a few times a year from existing salt flats may be the preferred options, while others may wish to go for more deliberate plantation or shadehouse systems.

Growers will be trained in all manner of their supply obligations, through the formal training course provided through the Smart Farming Partnerships program, and/or provision of the full Technical Manual and individual training by Moojepin Foods. Growers will be required to meet strict quality and timeliness guidelines. On-going

support will be provided by Moojepin Foods to assist growers with any troubleshooting along the way, identify any issues early and ensure end customers needs are met.

Contracts will be awarded to growers who are able to supply (or are gearing up to supply) the required species and quantities as per market predictions, and are approved following a site visit inspection and mutual discussions. Terms will be negotiated, including price, the use of harvesting services and transport arrangements, if required. Lead times for getting crops to harvest stage will also be considered as part of future market projections, and the engagement of new farmers to the network.

Payments will be made based on weight of saleable product received at the Packing Shed.

5.2.1.2 INDEPENDENT

Growers may choose to create their own brand, and supply saline bush foods outside of the Moojepin Foods supply chain. The research and development of the supply chain system was publicly funded under the Australian Governments National Landcare Program Smart Farming Partnerships, and therefore the outcomes are publicly accessible. They are provided through this General Manual, the training program funded through the project, and also the detailed Technical Manual.

Independent growers may choose to engage the Katanning Environmental Inc. Packing Shed to package their produce through their own contract, just as they may choose to enter into contracts with bodies involved in the established supply chain. This may include marketing through Wagoga, accessing harvest services through Moojepin Foods or engaging horticultural services through Charlotte Creek. Through mutual independent discussions these may be contracted with, if agreeable to both parties, or independent growers may make their own arrangements with other service providers.

Any commercial or technical information generated outside of the publicly funded project, or after the conclusion of the project, will not be in the public domain and would only be accessible to independent growers through mutual negotiation with the knowledge holder(s).

5.2.2 SUPPLY CHAIN MODEL

The relationship between each of the elements in the supply chain, including the role of contract growers is depicted in the following diagram

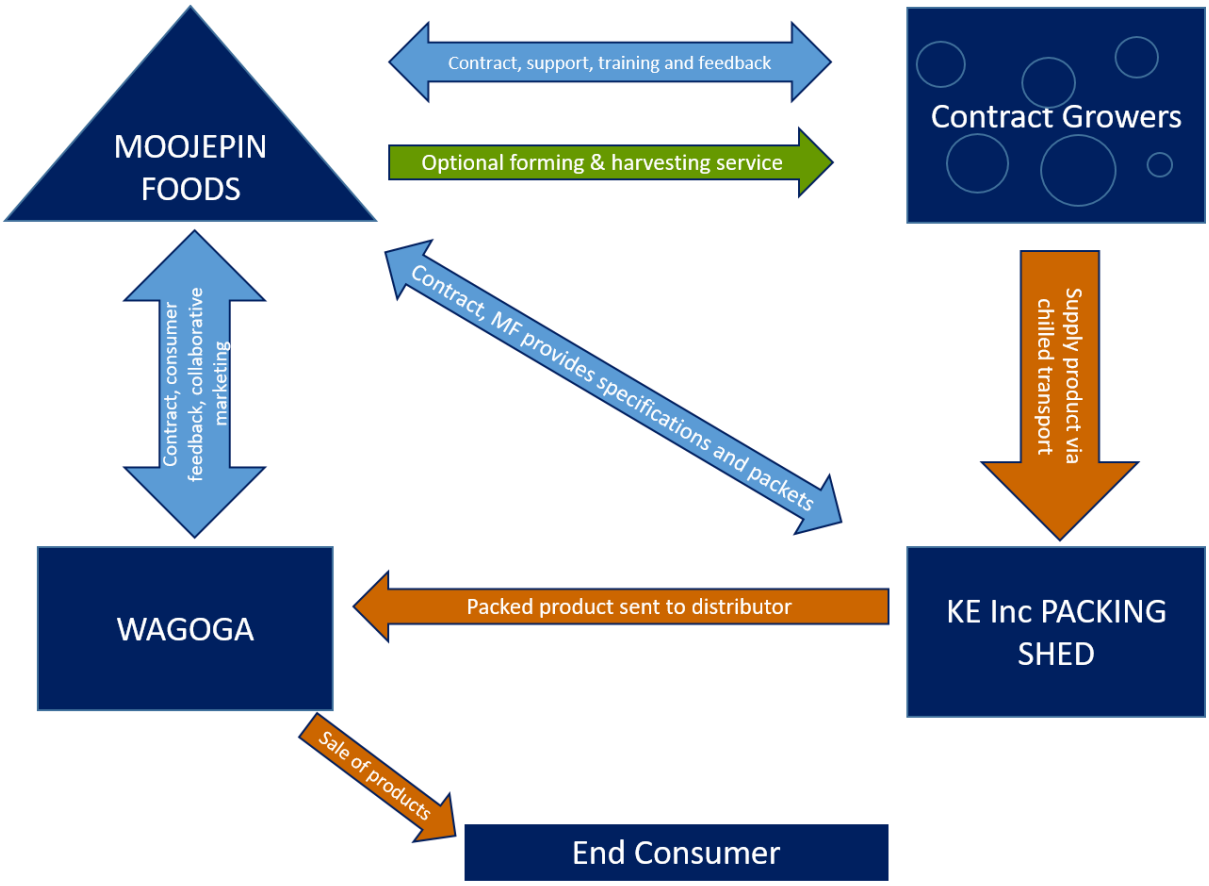


Figure 33: Saline Bush Foods supply chain. Orange arrows indicate flow of product. Blue arrows indicate contractual and feedback relationships. Green arrows indicate optional additional services.

Moojepin Foods will be the peak co-ordinating body of the supply chain. As well as growing produce themselves, they will manage contract growers, and hold contracts for packing and marketing of the product.

Contract growers will hold individually negotiated contracts, and have a working relationship with Moojepin Foods. Contract growers will deliver fresh product to the Packing Shed via chilled transport (Moojepin Foods can assist with transport arrangements, if required). Growers will be paid by Moojepin Foods for the amount of usable product received at the Packing Shed, as sorted to the specifications.

Katanning Environmental Inc. operate an independent packing shed facility and service. A contract to sort and pack saline bush foods is held with Moojepin Foods, as one of their customers. The Packing Shed will receive produce fresh from the growers, will sort and pack to the specifications agreed under their contract with Moojepin Foods, and then will transport the packed product (in ready for sale condition) to the distributor, Wagoga. Packaging materials and labels will be specified and supplied by Moojepin Foods. Katanning Environmental Inc. will report product amounts to Moojepin Foods, so that payment of contract growers can be made.

Wagoga are the marketer / distributor of the saline bush foods in this established supply chain. They are in contract with Moojepin Foods to undertake branding and marketing work of the Moojepin Foods products, and provide regular feedback to Moojepin Foods on market needs and projections. Wagoga receive packaged produce direct from the Packing Shed via chilled transport to their distribution centre, and from there send it on to the final consumers in WA and interstate.

5.2.2.1 RATIONALE FOR SUPPLY CHAIN STRUCTURE

In the fledgling years of the saline bush foods industry, it will be of critical importance to ensure that the end consumer is well catered for. Ensuring consistent product, high quality, freshness, and volumes being able to be met in a timely manner will set the industry in good stead for the future. If end consumers have a negative experience with a relatively "new" product, they are unlikely to return to it. For example, getting a bad tomato doesn't put people off tomatoes for life, as they are familiar with the qualities of a tomato, use them regularly in their diet and their experience suggests that poor ones are fairly rare. However, with a new product, first impressions count.

By placing Moojepin Foods at the centre of the supply chain, Moojepin Foods are able to manage all aspects of the chain – through their contracts with growers which can specify type, quality and volumes, their engagement of a single Packing Shed which can ensure consistent sorting and handling of product, and one distributor marketer to ensure consistent messaging out and a single-point for feedback in. This can ensure tight management of the entire supply chain while the industry is becoming well established.

Once there is a sizable repeat industry, it may then be suitable for other players to enter the market independently or to open up this supply chain, as poor performance by another new brand (which may be possible), shouldn't be able to catastrophically damage the built reputation of the existing system. It is hoped that public provision of the Technical Manual from June 2024, will assist any additional brands or players to avoid poor performance and help protect the industry as a whole.

5.2.2.2 POTENTIAL FUTURE FARMER CO-OPERATIVE MODEL

At the moment, the scale of the saline bush foods supply chain suits a single peak operator. However, if the market and industry grows significantly and a large number of growers become vested in the Moojepin Foods scheme, the option of transferring to a farmer co-operative model is on the table.

This could see all Moojepin Foods growers taking a more active role in the management of the saline bush foods supply chain, and reaping shared benefits. It is unlikely the scale and market conditions required to consider transition to this model would be met within the first 5 years.

6.0 TRANSPORT AND PACKING

6.1 TRANSPORT

There are a number of stages in the supply chain that require transportation of the product – from the farm to the Packing Shed in Katanning, from the Packing Shed to the wholesaler in Perth and then from the wholesaler to the Perth restaurants and/or the distributors in Melbourne / Sydney / Adelaide and Brisbane (via air). Other than the initial transport from the farm to the Packing Shed, all stages of transport are managed on behalf of the grower.

Figure 34: Foam boxes of produce collected from the Perth truck depot after arriving from Katanning.

The current production system at Moojepin has a 3 tonne chiller truck for transporting the produce the approximately 35km into Katanning town. Distance from delivery point is a key consideration for those looking to enter the supply chain as a grower, as they are responsible for the time and transport costs on this leg of the journey.

The saline bush foods, particularly the saltbush and ice-plant, need to be handled with care particularly on hot days. Throughout most of the year, the chiller doesn't need to be turned on in the truck as the crates and foam boxes provide sufficient protection. However, on those hot days, the product needs to be picked early in the morning and the chiller used.

6.2 PACKING

The Katanning Packing Shed is a purpose-built facility located on Dore St Katanning, opened in January 2022. It is owned and operated by Katanning Environmental Inc and will provide a range of food packing services to the local agricultural industries.

Established through the Saline Bush Foods project, the packaging of saline bush foods for Moojepin Foods is its first contracted customer. Staff from Katanning Environmental Inc will sort and pack produce to the specifications required for each individual customer, and deliver it to the trucking company for on-movement to Perth.

Previously, raw product from the paddock has been processed and packed in Perth. This increased the amount of time it took for fresh product to get into the stay-fresh packaging, and also meant that non-viable product cuts were being freighted long distances, only to then be discarded in Perth. It also missed a valuable employment and enterprise opportunity for the regional town of Katanning.

6.2.1 PACKING SHED ESTABLISHMENT

The Katanning Packing Shed is a 9m x 18m structure consisting of a concrete floor and commercially constructed steel shed walls and roof. It has a large roller door for access, as well as personnel access doors, windows for cross-ventilation and roof insulation. Construction of the facility cost around $74,000 including GST.

Figure 35: Some of the Project Team at the Katanning Packing Shed, November 2021.

The shed was constructed on a lot in the Katanning Light Industrial Area, and also required the installation of fencing, a toilet facility, signage and connection to utilities (power, water, sewerage).

The shed is equipped with all the necessary requirements for handling the packing tasks. These include:

- Hand-washing station with hot water supply
- Stainless Steel Benches
- Anti-Fatigue Matting
- Double wash tub sink for product
- Scales for product weighing
- Materials handling equipment (pallet jack/forklift, hand trolley etc)
- Storage shelves for unused packaging
- Secateurs, hand snips etc for trimming product to requirements
- Cool Room storage
- Bins for waste

The Packing Shed required initial approval from the Shire of Katanning to operate as a Food Handling Premises, and is currently undergoing accreditation with the FRESHCARE system. It is anticipated it will commence packing operations early in 2022.

Insurance required for the operation of the Packing Shed include building and contents insurance, workers compensation insurance and public liability.

6.2.2 PACKING SHED OPERATION

Staff from Katanning Environmental Inc are trained to process and pack raw product to the specifications required. For products currently being produced through the project, it is expected that between 140 and 215 punnets can be packed per hour (dependant on quality of product).

Sorting and packing of the product will occur in the mornings of Tuesdays and Thursdays currently, ready for transport to Perth by truck at 2:00pm that afternoon. The product then arrives at the Perth warehouse approximately 7:30am the following morning ready for distribution to customers.

Packing Shed staff are remunerated under the Storage Services and Wholesale Award. Katanning Environmental Inc manages administration and HR matters.

Growers producing through contract with Moojepin Foods do not have to book directly with the Packing Shed, but may need to get in touch to arrange drop off times for the fresh produce. Other customers, such as those growing saline bush foods through an independent option, or growers of other produce requiring packing (eg. cherries, nuts etc.) can contact the Katanning Packing Shed directly through the details provided at the end of this manual. A contract will be tailored to each client specific to their needs. Invoicing for services rendered will occur after the work has been completed, at agreed intervals.

6.2.1 SALINE BUSH FOODS PACKAGING

In the field, saltbush, samphire and karakalla product is hand cut to the approximately correct length, but with saltice iceplant the entire plant is harvested.

Once the product reaches the Packing Shed, staff then complete final trimming, if required; a skilled harvester in the field can significantly reduce the processing needed at the shed stage.

Saltbush is cut into 12cm lengths for punnets and 30cm lengths for one kilogram packs. Samphire and karkalla are processed to 5 – 10cm long tips, depending on the needs of the customer. Saltice iceplant have the good tips of the plants trimmed at the shed, and the remainder of the plant is discarded.

Figure 36: Red karkalla, samphire and saltbush (below) cut to the correct length ready for packaging.

The saline bush foods are currently packed into two sorts of punnets – an 80g clear plastic punnet, and a 120g clear plastic punnet, with hinged lids. Anywhere between 140 and 220 of the 80g punnets can be packed by a skilled worker per hour.

1kg plastic bags are also being added to the product line. These are more space efficient for larger orders travelling by air freight interstate.

These have been a progression from rectangular takeaway containers, with the newer 80g packets now made from 80% recycled plastic. The packages aim to strike the right balance between price, preventing the product from drying out, ability to stand and stack neatly on display, and for customers to be able to see the product inside the box.

Figure 37: Red karkalla, saltbush and samphire packed in punnets and ready for the customer.

The clear packets are then labelled with a sticker, describing the product, brand and other information.

Investigations are on-going into plastic-free packaging options, but none that are both suitable and cost-competitive have been found yet. The labelling is also under review as Moojepin Foods moves into the retail sector, and to include *Packed in Katanning* information.

7.0 ENVIRONMENTAL BENEFITS

The Project Team has long held the view that using saline soil and water to grow commercially viable saline bush food crops will have a positive environmental impact. It was felt that the use of saline groundwater will help to lower groundwater tables, the removal of salt from the soil by plant uptake and subsequent harvesting will aid in salinity management. Salt-affected soils typically have depressed soil health characteristics such as organic matter and biological activity; it is anticipated that stimulating the growth of plants on these sites will also help to stimulate corresponding soil activity, improving soil health.

To test these assumptions, Dr Jolene Otway and Dr Bede Mickan, two soil scientists, were engaged to monitor the biophysical parameters around the production sites over the project period. Although the timeframe of just a few years is too short to draw long term conclusions, early data can be indicative of potential trends.

Figure 38: David Thompson and Dr Bede Mickan working to gather initial site information.

7.1 RESEARCH OVERVIEW

The environmental assessment focused most particularly on the observable impacts on soil health (through microbial activity, biomass, salinity, nutrient availability, plant cover), groundwater (through salinity variation, potential plant salinity extraction and seasonal ground water depth) and plant behaviour (through soil cover provided by plants, the vertical plant profile and hence potential habitat creation).

The environmental benefits were tested within a mass planting “Plantation” site and a Wild Harvest area (with comparative analysis of Scarified versus Non-Scarified terrain within this site). Additional examination of some data from the greenhouse experiment and the production bore characteristics were incorporated to provide a more holistic view. The Plantation site comprised part of the upper portion of a saline drainage between two broadacre cropping fields on the farming property. The crop was a pseudo-monoculture of saltbush planted in rows in 2019 with a variety of other species planted less systematically or allowed to self-propagate opportunistically. The Wild Harvest area was a lower lying saline drainage area with existing native halophytes that have been previously used for wild harvests (ice-plant, samphire, pigface). The area was scarified using a tractor mounted wide spaced scarifying rake to promote new growth in mid-2020 and effectively removed the majority of the above ground and shallow plant based carbon from the location. Areas were left unscarified to serve as control locations to enable season specific comparable samples to be taken.

The shadehouse constructed as part of the project was irrigated with saline groundwater from a production bore located adjacent to the Plantation site. Whilst the shadehouse is not within the scope of the environmental monitoring, insights were recorded as somewhat indicative of field based plant characteristics.

Soil samples were extracted from the sites in August 2019 (Plantation site only), August 2020 (Plantation and Wild Harvest sites), August 2021 (plantation site only) and October 2021 (Wild Harvest site sampled late because of inaccessibility due to rainfall). Plant health was assessed in 2021 through the assessment of plant height (with consideration of harvest and scarification implications), and soil coverage for habitat creation both above and below ground.

Data provided within this project is done so with just 24 months of plant development following significant disturbance and is provided as an indication of a potential direction of future change. I.e. final sampling was competed ~ 24 months post tilling, planting and inspection/harvest traffic alteration on the site for the Plantation location and ~ 18 months post scarification. It was not anticipated that significant change would be noted within the 2019/2020 results within the plantation area, however these data with the additional data from the 2021 within the plantation and wild harvest sampling regime provides validity for some conclusions presented here – indicating the system impact from disturbance and a potential future trajectory once this disturbance impact has been overcome. It is also noted that there was the transition from El Niño to La Niña within the Pacific Region between 2020 and 2021 bringing greater rainfall for Australia in the second year of the trial. Such a transition is inferred to have significantly influenced the results of the project. Hence the criticality of the retention of control plots within the Wild Harvest Area and the limitations imposed by the absence of a control plot within the Plantation Area.

Differences identified when assessing under versus between, 2019 versus 2020 versus 2021, between the individual plantation plots, between the scarified and non-scarified areas, and coarsely between the plantation and wild harvest sites under a similar but abnormal seasonal rainfall trend, delivered interesting graphical trends for the duration of the project. This allowed comparative understandings of the impact of the saline bush food plants and the more general site treatment impacts (i.e. tilling, traffic and scarification) as variations in these trends.

7.2 PLANTATION OUTCOMES

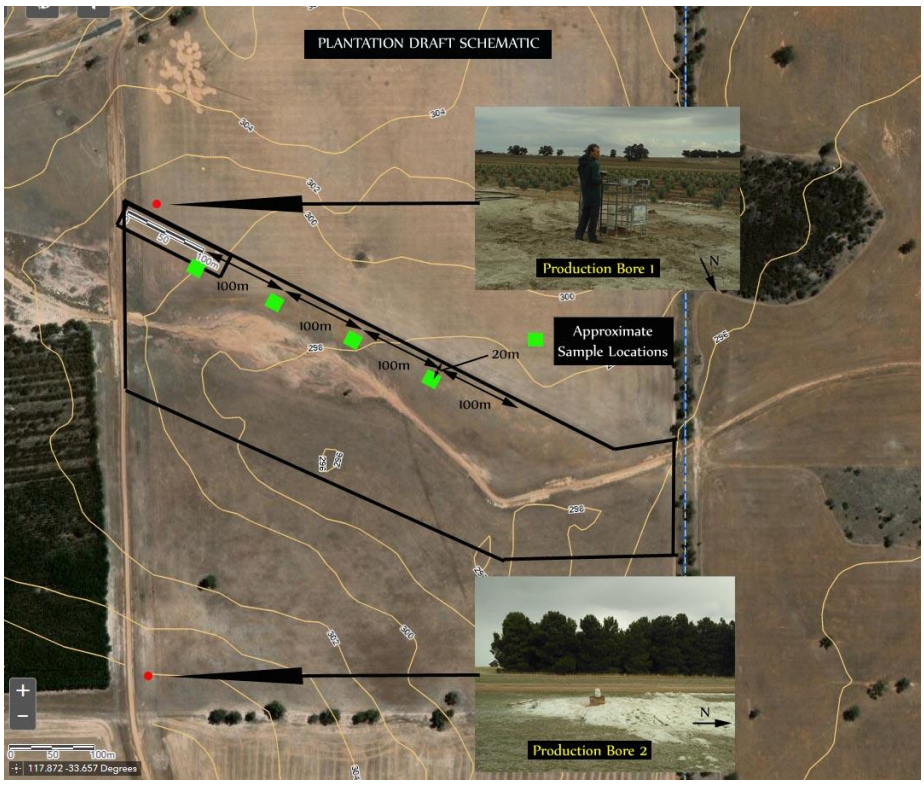


Figure 39: Layout of sampling sites in the Plantation Area.

7.2.1 2019 PLANTATION RESULTS

The key findings of the analysis of the 2019 Plantation Area sampling regimen are:

- Significant differences between the individual plots across the plantation area were noted, which is not uncommon even across much smaller areas. These differences were identified in a number of soil parameters - pH; total carbon; carbon/nitrogen ratio; effective cation exchange capacity; exchangeable and base saturation calcium, magnesium and potassium; base saturation aluminium, plant available phosphorus, and the calcium / magnesium ratio. Plot 2 (¬200m from northwest boundary) was the most extreme variant for many of the soil properties.
- A baseline for both the plantation site as a whole, and plot specifically, was established within that year's work scope.
- The overall analysis identified high salinity soil and poor nutrient availability compared to a standard agricultural expectation. This highlights the appropriateness of the location for alternate production options from which value can be obtained within, tailored to these conditions without exorbitant expense for that production to be sustainable.

Figure 40: David Thompson and Dr Jolene Otway discussing plot layout in the Plantation area.

7.2.2 2020/2021 PLANTATION RESULTS

Within the 2021 Plantation data, the electrical conductivity, the exchangeable sodium and the exchangeable sodium as a percentage (ESP) of the effective cation exchange capacity (ECEC), being indicators of salinity, are all higher under the plants rather than between. The dominant cause was considered most likely to be the tilling of the soil bringing up the more saline subsoils combined with the plant coverage partially protecting the area of the plants from rainfall and hence reducing the soil washing effect. It was not anticipated that for the short duration of the trial the impact of salt removal from the soil by the plants would be detectable. Whilst the under plant samples are higher than the between plant samples, these values from the 2020 sampling were well in excess of the 2019 levels. The 2021 data set determined these salinity indicators to have dropped back to the 2019 level, suggesting the system is recovering from the initial impact of soil inversion and is establishing a new

trajectory. If it assumed that the 2020 to 2021 trajectory best represents the recovery of the plantation system, then this snapshot indicates:

- Increasing 2020 to 2021, total data set – total nitrogen %, exchangeable calcium, exchangeable aluminium, calcium %, aluminium %, hydrogen %, Manganese and Copper
- Decreasing 2020 to 2021, total data set – Electrical Conductivity, sulfur, exchangeable sodium, and sodium %.
- The Total Nitrogen, aluminium (exchangeable and total %), and calcium % results were replicated both under and between plants.

Absent from this list was the total carbon behaviour within the plantation area. By the conclusion of the project, the total carbon within the plantation area had been generally re-established following the degradation incurred in the preparation for planting process. Future carbon behaviour is anticipated to continue this increasing trajectory should the impact of the water logging within 2021 not be too severe. Saltbush harvesting, excluding the incident of compaction as a risk of increased traffic within the area, should serve to promote soil carbon through regular shedding of root systems as the plant foliage is reduced and the promotion of new root systems during regrowth. Soil coverage within the plantation area bodes well for the preservation and growth of the soil flora and fauna community, further increasing both the carbon and the system's resilience to extreme events impacting plant and soil health. The 2021 total nitrogen within the plantation area demonstrated a similar trend to the carbon, with the 2021 data sets all higher than those from 2020 and approaching the 2019 original levels. Such information highlights the importance of minimum tillage and keeping soil coverage in place to minimize the impact of the topsoil's (and its ecosystems) exposure to diurnal and seasonal weather extremes and the potential for erosion.

7.2.3 PLANTATION DNA

At the time of printing the analysis of soil-based DNA was not yet complete. These results will be included in the full scientific report.

7.2.3 PLANTATION VEGETATIVE COVER

The mean vegetative coverage for the Plantation area increased from 70% in 2020 to 87% in 2021. It was noted that the coverage was estimated at 0% at the completion of the Plantation site preparation and 10-20% at the completion of the initial planting. No analysis was performed prior to the preparation and so the overall impact on the ecosystem cannot be determined.

The mean tree height for the Plantation area increased from 76cm in 2020 to 124cm in 2021. Whilst this was not surprising over that period, it indicated that even with harvesting occurring at various times in between the two sampling regimes, a generally larger vertical habitat was evident in 2021 than in previous years. With both a greater soil coverage and tree height, the increase in habitat available which was visually evident has been reinforced through an objective analysis.

Figure 41: Measuring plant height in the Plantation site in 2020.

7.3 WILD HARVEST OUTCOMES

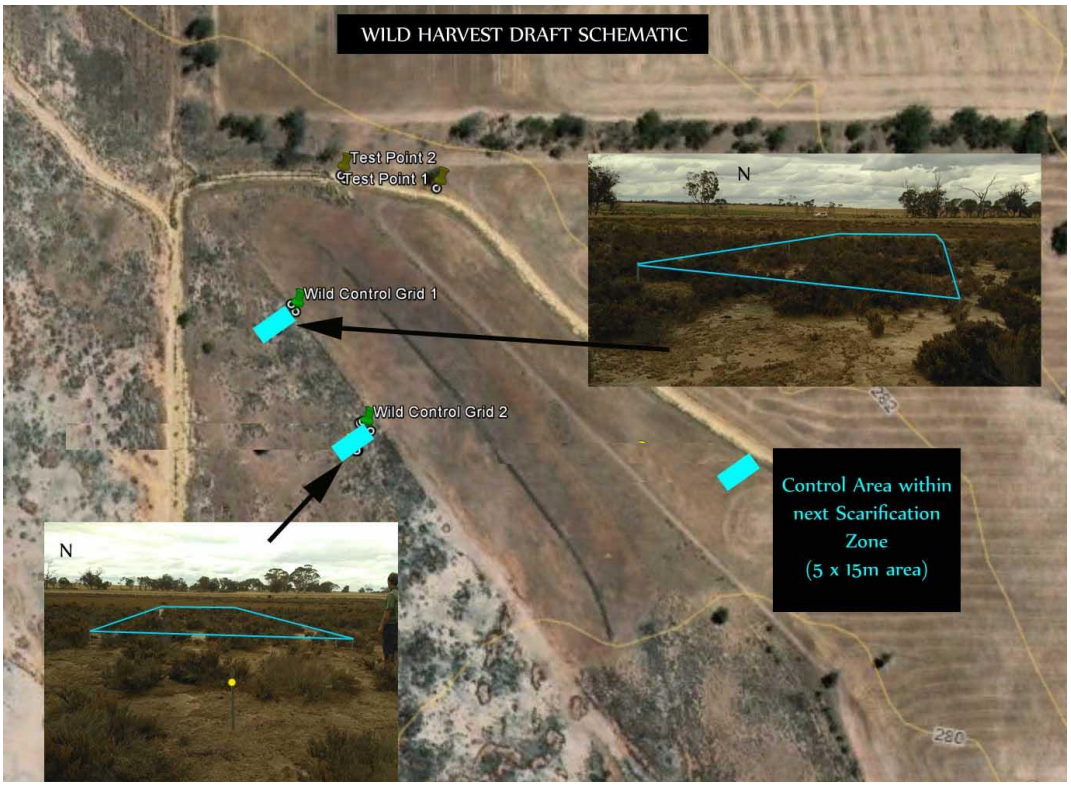


Figure 42: Layout of Unscarified control sites within the Wild Harvest area.

The Wild Harvest Area had typically a lower available and total soil nutrient content than the Plantation Area. Throughout the analysis of the Wild Harvest data there was the consistent presentation of higher exchangeable sodium and effective cation exchange capacity within the scarified compared to non-scarified areas. Within the 0-10cm sample depth total data set, the exchangeable sodium and sodium - ESP %, key salinity indicators, were higher between the plants in the 2021 results. For the under plant subset, the 0-10cm depth the electrical conductivity, exchangeable magnesium, exchangeable sodium, and the effective cation exchange capacity were all higher within the scarified area. The higher exchangeable sodium and the effective cation exchange capacity in the scarified compared to non-scarified area was replicated in the 10-30cm depth. Within the 2021 sampling regime there was also a statistically significant difference identified (a) between the electrical conductivity of the scarified and non-scarified soil samples taken from the shallow depth soil under plants; and (b) both in the 0-10cm depth and the 10-30cm depth, there was a significantly higher conductivity identified between the plants as opposed to under them.

The rise in electrical conductivity, effective cation exchange capacity and exchangeable sodium of the soil sampled occurring between 2020 and 2021 was steeper within the scarified area as compared to the non-scarified. Whilst the electrical conductivity, exchangeable sodium and cation exchange capacity was higher in soil sampled from between the plants to under them, the change in these values from 2020 to 2021 was a consistent significant rise for both locations. All results, irrespective of depth, plant proximity or scarification indicated elevated salinity compared to the laboratory recommended guideline.

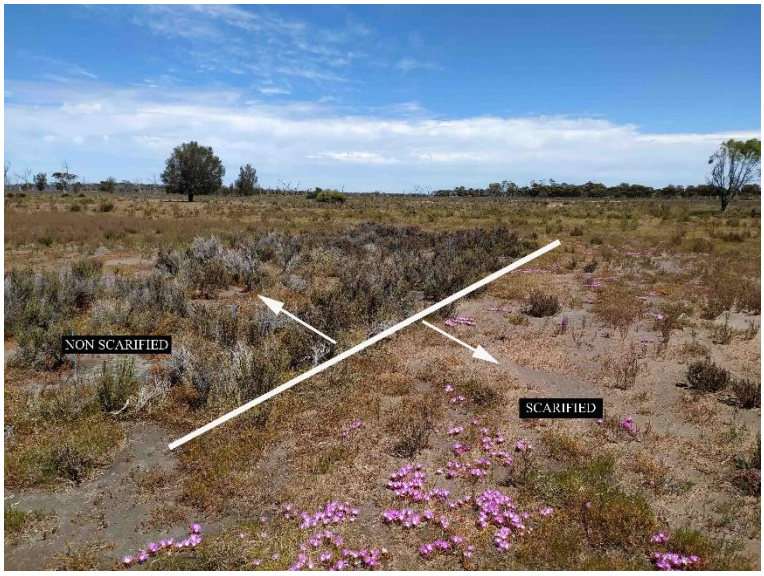


Figure 43: Visual differences in scarified and non-scarified parts of the Wild Harvest area

Within the Wild Harvest area, the under plant total carbon was higher than the between plant for the shallow soil depth in the non-scarified area in 2020, highlighting the benefit of root systems in promoting and protecting soil flora and fauna (represented by carbon measurement). This indicates that the plant coverage was developing and protecting carbon stores pre-scarification. For the 2021 samples, where no significant statistical difference was determined between the scarified and non-scarified samples, it suggests that with coverage the system is recovering. However, it is noted that for the non-scarified area a higher carbon content was identified under the plants compared to between in 2021 suggesting that the more plants that are available in the long term, the higher the system's total carbon. The scarified area had minimal trees/ bushes compared to the non-scarified area due to the scarification process. The bush layer as opposed to the current, fine leaved ground cover / individual tiny plants is anticipated to take many years to return to pre-scarification levels.

7.3.1 WILD HARVEST DNA

Soil bacteria diversity profiling via DNA sequencing, with subsequent analysis of functional genes relating to carbon and nitrogen cycling processes, indicates little or minor differences to these soil biological processes when examined under and between the plants in the 2020 sampling regime. The Plantation trial site showed no diversity changes from sampling between or under plants, though there was alpha and beta diversity changes to soil as a function of soil depth; this can be explained by soil type and characteristics rather than farm management practice(s). Wild Harvest also displayed only minor changes caused by farm management practices (e.g. scarification) or sampling location (under, between plants), with even lesser of changes soil carbon and nitrogen cycling processes. This is the first sampling of DNA and it is likely there hasn't been enough time for some of these biological processes to be realised. 2021 sampling anaylsis is yet to be completed and will be included in the full scientific report.

7.3.2 WILD HARVEST VEGETATIVE COVER

In 2020, the non-scarified plots in the Wild Harvest had greater vegetative coverage than the Scarified (76% and 64% for non-scarified Plot 1 and 2 respectively compared to 24% for the scarified). After a further year's growth, the soil coverage within the scarified versus individual non-scarified plots were no longer significantly different, however the combined non-scarified areas did demonstrate a higher coverage (78% versus 64%). In the comparison of the 2021 data, the Plantation Area had a higher plant coverage than that identified in the Wild Harvest Area (87% compared to 74% respectively). It was noted that the examination of coverage does not take into account the quality/longevity/height of coverage which must also be considered in the defining of environmental benefit and habitat/micro-climate creation.

Figure 44: Measuring bush height in the non-scarified Wild Harvest zone.

Not surprisingly, in the 2020 analysis (4 months post scarification), the tree/bush heights recorded for the non-scarified areas were approximately double that identified within the limited number of trees/bushes in the scarified area (51cm and 25cm height respectively). A similar relative presentation was recorded for 2021 (63cm non-scarified and 28cm for the scarified areas). Plant height considered in conjunction with soil coverage demonstrates the significance of the increase in habitat compared to immediately post plantation preparation or wild harvest scarification.

7.4 GROUNDWATER OBSERVATIONS

Seven observation well water property timestamps were recorded between February and November 2021. Both the plantation based and wild harvest well results were examined however due to access to the Wild Harvest area being impossible in late winter only 5 data points are available for that location. As only one year's data was available and the recording year had abnormal climate conditions, this data is a record for future years and has been considered an interesting means of capturing what was a very unusual season as described previously.

Both the Plantation observation wells identified a general trend of reducing EC throughout the majority of 2021 with an increase commencing towards the end of the year reflecting the reducing water level / dilution. The observation well within the Plantation Area had a significantly higher salinity / electrical conductivity (EC) than that of the well adjacent to this area. The Wild Harvest observation well water had a greater EC recorded than for the Plantation Area well and did not reveal a consistent trend over the duration of sampling.

Figure 45: Observation bore monitoring in the Wild Harvest site

The significant elevation in water level from July to October 2021 was accompanied by significant drop in pH. This may be a result of the unusual season where the influx of water has brought more acidity from adjacent structures or anaerobic biological activities may have led to acidification in surface soils. This would need to be confirmed in a subsequent year of testing as the degree of change was surprising. Over the course of the records, the Planation area has a greater degree of variation in pH than that observed within the Wild Harvest area.

7.5 FULL SCIENTIFIC REPORT

The full Research Report prepared by Dr Otway and Dr Mickan is a separate document, and is available from Katanning Landcare from February 2022. It contains extensive information on the monitoring of the Plantation and Wild Harvest sites for environmental response.

The outcome of this study has highlighted the conflicting interest within the short term of a saltbush regenerative program coupled with a saltbush harvesting program on ecological systems. It was apparent that the detrimental impact on the soil itself as a result of the preparation of the Plantation area (broad area tilling and full landscape exposure rather than rehabilitation typical individual plant holes) had not been fully recovered by the conclusion of the trial, where soil health is measured in terms of soil carbon.

When considering the salinity indicators, the electrical conductivity and sodium content of the 2021 analysed soils both under and between the plants was approximately equivalent to the 2019. In the longer term however it is anticipated that salinity indicators will reduce and, should light harvesting is continued, the soil carbon and available mineral content as well as the above ground coverage and vertical habitat creation will increase. In turn this increase will provide ecological and environmental benefits potentially in excess of what was present prior to the project (note: pre-project measurements were not taken within the Plantation area). However, it is noted that in the Plantation area where water logging, due to unusually consistent winter rains, hampered the growth of the bushes in 2021 and where heavy pruning was subsequently implemented, this benefit was likely significantly set back.

Within the Wild Harvest area, the trial of scarification to enhance bush food plant growth demonstrated that, again in the short term and under the weather conditions of the project period, the ecological cost was significant with exposed soil subject to weathering and micro climate / habitat removal. This impact was marked by an overall increase in the 2020 to the 2021 samples for electrical conductivity (1:5 water) for the total data set which was dominated by the change in the scarified data set (0.79 dS/m to 1.03 dS/m, and 0.78 dS/m to 1.4 dS/m respectively). The effective cation exchange capacity (reflected in the exchangeable sodium content) as a salinity indicator also demonstrated a rise from 2020 to 2021 within both the under and between locations of the scarified area, whilst the non-scarified remained relatively consistent. The sodium content as a percentage (ESP) of the effective cation exchange capacity (ECEC) was lowest under plants, in the non-scarified soils and within the 0-10cm depth. With the larger area scarified and with the majority of plants within this area removed, the average salinity within the Wild Harvest area has been significantly increased and the habitat markedly depleted within the short to medium term.

8.0 NEXT STEPS

Land Managers are invited to participate in the Saline Bush Foods supply chain. As covered in this manual, it is important that new supply sources are secured and their production staged to meet the growing demands, without flooding the market. There is also a lag time between on-farm set up and first harvest.

To support the highest chances of success, a pathway has been developed for interested people.

- **Step 1:** Read and consider the information contained within this General Manual. Consider the time and resources required, the location and suitability of your site and how passionate you are about joining the industry.
- **Step 2:** Enrol to attend a Saline Bush Foods training course. The first will be held in Katanning on Thursday 24th March 2022. This training course will give potential growers a more detailed insight into what is involved, including contact with all of the current Saline Bush Foods Project Team. More training courses may be delivered in the future when market projects show need for more growers to be brought online.
- **Step 3:** Receive the Saline Bush Foods Technical Manual, which goes into high levels of detail, designed to support you to actually implement and operate a saline bush foods growing system. Again, consider if participating in the Saline Bush Foods industry is right for you.
- **Step 4:**
    - **Independent Pathway**. Go for it! From here, you will continue to have access to all information and data that was produced as a result of the Smart Farming Partnerships project, as housed at Katanning Landcare. However, you will not have access to any additional information or support as produced under commercial arrangement post-project (public funding ceases autumn 2022).
- **Step 4**:
    - **Moojepin Foods Pathway**. Contact Moojepin Foods to place an Expression of Interest. Moojeping Foods will then arrange with you:
        - A site visit to your proposed site to determine suitability and identify any issues or strengths.
        - One-on-one time at the established Moojepin Foods facility to experience hands-on training.
        - Contract negotiation, including volumes, species, price, timelines etc.
        - On-going support over the period of the contract.
        - Please note: all on-farm infrastructure and set-up costs are the responsibility of the landholder(s).

There are other roles that may become available in the growing industry, such as marketing, research or packing, which individuals or organisations may be interested in pursuing also.

9.0 GENERAL

9.1 PROJECT TEAM CONTACTS

Organisation	Contact Person	Phone	Email
Katanning Landcare	Ella Maesepp	(08) 9821 4327	ella@katanninglandcare.org.au
Moojepin Foods	David Thompson	0418 932 507	moojepin@westnet.com.au
WAGOGA	Lance McLeod	0413 289 705	sales@wagoga.com
Katanning Packing Shed (KE Inc)	Matt Collis	0459 620 445	generalmanager@katanninglandcare.org.au
Chatfields Engineering & Nursery	Dustin McCreery	0427 371 075	info@chatfields.com.au
Charlotte Creek Horticultural	Tony Mercieca	0407 293 964	tony.mercieca@outlook.com

9.2 SUPPLY CHAIN WEBSITES

Organisation	Website
Katanning Environmental Inc	www.katanninglandcare.org.au
Moojepin Foods	www.moojepinfoods.com
WAGOGA	www.wagoga.com
Chatfields	www.chatfields.com.au

9.3 MEDIA COVERAGE

The Saline Bush Foods project has received a range of media attention. Included are some of the print media generated during the project period.

Countryman: 14th October 2021

Living with the salty scourge

When life gives you lemons, make lemonade. Or as in this case, when life gives you salt – grow saline bush foods.

ELLA MAESEPP

I remember as a young student when salinity was known as "The White Death", a creeping menace of immense threat to our environment, waterways, agriculture and towns.

The language around it was of fear and overwhelm.

But over the past few decades, in my work with Landcare and as part of a broadacre farming family, I've seen that attitude change somewhat, for the better.

Through numerous public programs, research by institutions and farmer groups, and, of course, good old-fashioned farmer ingenuity, we've developed quite a toolkit for living with the "salty scourge".

Saline pastures and saltbush for livestock feed have revolutionised the way farmers use salt flats.

Deep drainage, pumping, raised beds, revegetation with salt-tolerant species, crops with higher salt tolerance are all innovations that are now in use.

Salinity is still a massive issue.

It still needs resourcing and research and action. It's still taking out productive agricultural land and valuable ecosystems.

But it also brings with it new opportunities.

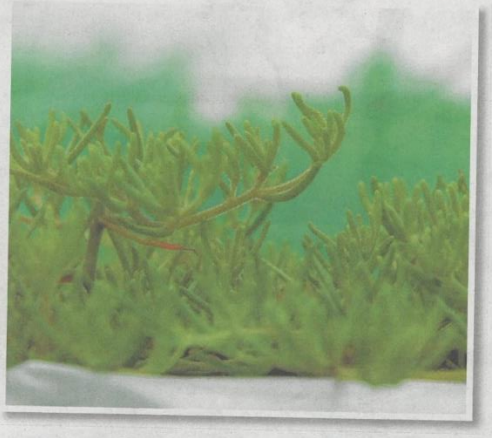
I've been fortunate to spend the past four years working on a project in Katanning, funded through the National Landcare Program Smart Farming Partnerships program, epitomising the saying when life gives you lemons, make lemonade.

Or or in this case, when life gives you salt — grow saline bush foods.

Taking a walk on the salt flats with Moojepin Foods grain and sheep farmer David Thompson will invariably have you eating plants that you ordinarily would have overlooked or stepped on.

It will also change the way you think about what's growing down on these waterlogged, sometimes smelly and generally unattractive flats.

Out of this curiosity and a chance conversation in 2017, Mr Thompson started exploring what plants on his own salt country were edible and, with a bit of creativity, could be enticed on to the plates of the most discerning diners.



And with it came a partnership, cemented through Federal Government funding in 2018, bringing together Katanning Landcare, Moojepin, gourmet food marketer Wagoga, Chatfields Engineering, Charlotte Creek horticulturalist and social enterprise Katanning Environmental to create a full paddock to plate supply chain of saline bush foods.

This project has made the next leap — as an agricultural sector we'd already succeeded in saline plants for livestock to eat but this was now about bringing it to direct human consumption. It's exciting stuff.

Focusing on four species — saltbush, karakalla (aka pigface), ice plant and samphire — the project has developed, growing systems at three different levels of complexity — wild harvest from the salt flats, plantation growing in salt-affected paddocks and a Rolls-Royce shadehouse system irrigated with pumped saline groundwater.

It's done a lot of work with chefs, restaurants and the gourmet food scene to promote these "new" foods and the ways they can be enjoyed.

Work on harvesting, packing, transporting and marketing have closed the gap between the paddock and the restaurant.

Soil scientists have been monitoring the trial systems to see if the invigorated growth and active management of saline areas through saline foods production has a positive environmental benefit.

And the results so far have been fantastic.

Even with the rollercoaster ride that COVID-19 unleashed on the hospitality and restaurant sector, demand for the products has grown. Back in January 2019, our saltbush product sales were just 9kg of samphire and 12kg of red karakalla for the month.

Fast-forward to June 2021 and those monthly figures were 127kg of saltbush, 132kg of samphire and 98kg of red karakalla.

And this is just at a very controlled small scale, while the system is still being properly developed, tweaked and refined.

When you consider that the products market for between $30 and $75 a kilo wholesale, the potential economic benefit to Australian farmers and communities is visible.

It gives options for farmers who have "lost" land to salinity, employment opportunities in regional communities, and "new" Australian flavours for the end consumer.

Next year, the project closes and left behind will be a fully commercial supply chain — one we hope will continue to grow.

The project is developing a manual and training course to upskill others to enter the supply chain — which will be tightly managed and grown incrementally in line with growth in demand and chain capacity.

It's of no benefit to anyone to flood the market, supply inferior product or promise a volume that can't be met.

Careful and intelligent management will create opportunities for more players over the long term, giving environmental benefits to oft-neglected saline land, diversification options to farmers and rural communities, and changing the way we think about saltland agricultural production.

And it shows what can happen when people with vision can pair with skilled team members, and get support to "give it a crack".

That is, after all, the way we do things in rural Australia.

> And it shows what can happen when people with vision can pair with skilled team members.

Ella Maesepp is the landcare officer at Katanning Landcare

Farm Weekly: 24th June 2021

Food from the bush finds its market

By **MOLLIE TRACEY**

ONCE undesirable plants on farms, wild salt-tolerant plants have become the latest new product to hit the restaurant sector, with demand from chefs continuing to grow.

Based at Katanning, the Saline Bush Foods project has spent the past three years trialling and developing commercially viable production systems for edible plants that naturally grow in the Australian bush.

Funded by the National Landcare Program's Smart Farming Partnerships program 2018-2022, the project has been developing a supply chain and industry for vegetation that many farmers have always deemed a nuisance.

The project is led by Katanning Landcare and with just nine months until it is due to be presented, landcare officer Ella Maesepp said it has come together well.

"Over the past three years we have been trialling and setting up three different growing systems – wild harvest, which is down on the salt flats; in-paddock plantation on areas of paddocks which are falling out of traditional cereal grain production because the salinity has increased; and the horticultural shade house system, which is more controlled and irrigated using saline groundwater pumped from on the site," Ms Maesepp said.

"These three systems have been going really well.

"While these plants grow in the wild, we didn't know if we could control the growth of them into a crop system.

"We didn't know which way was going to work best, because we needed to find a way to not only get the plants to grow, but because of the market we are supplying we need to be able to grow them to a consistent quality and also throughout the year.

"So the point of the three growing systems was to see which one would allow us to have consistent supply."

As the wild system is the most prone to seasonal variations it will only produce for certain times of the year.

Whereas Ms Maesepp said the in-paddock system was a little more controlled and then the shade house was fully controlled.

"Initially those three systems were about learning, but we have found they have given us opportunities around seasonality that we can't get just in harvesting off the wild salt flats," she said.

"So going forward, when a new farmer participates they are going to be able to make a choice about what scale they want their operation to be.

Some farmers may want to do seasonal harvesting on their salt flats and only engage in the supply chain for a few months of the year, but other people who want to make it a bigger part of their operation might see the shade house and horticultural system with year-round supply and tighter control would fit them better.

"It has given us opportunities now for the rollout."

Establishing the market has been one of the latest developments in the project, with the hospitality industry, both local and interstate, embracing the bush foods.

Although the pandemic slowed demand for a period as the hospitality industry was severely affected, Ms Maesepp said demand has picked up.

Moojepin Foods co-owner and WA Gourmet Garden (WAGOGA) owner Lance McLeod has been steering the project's marketing into the restaurant sector.

He said the produce has proved popular with casinos, catering companies, restaurants and hotels.

The four plants which are offered – samphire, saltbush, karkalla (ice-plant) and red karkalla (pig-face) – give the market a variety of uses.

"The quality of the produce offers the market something that is a cut above the rest," Mr McLeod said.

"The local market has grown quite a lot in the past four months.

"I think the push for people to travel locally has prompted more chefs to source local produce."

Chefs have been using the foods with seafood, meat and vegetarian dishes, with grazing boards, for seasoning and in marinades, as garnish and even in chutney and preserves.

Ms Maesepp said also helping to raise the profile of the foods was being recognised as a State winner in the Earth category of the Delicious Harvey Norman Produce awards last month.

"This has made a huge difference not just from a marketing point of view, but also in people understanding what they are, how they can be used and how they fit into the food space," she said.

The general consumer has not yet been a focus of the project but Ms Maesepp said it was part of the plan.

When COVID's impact on the hospitality industry was felt, the project team sped up its plan to market to consumers, particularly domestic cooks, which has led to the bush foods being sold in some gourmet supermarkets.

But the hospitality industry has remained the focus.

"We are also working on the development of some dried products for home cooks to use as seasoning," she said.

The project has also involved developing new machinery to harvest the saline bush crops, with one machine already undergoing trials and another set to be available by spring.

The first machine is used to form the saltbush plant into a consistent shape for it to be harvested and the second machine will be the actual harvester.

"In the future when other farmers are producing, they can use these machines as labour saving devices, so that will help with the rollout of the industry," Ms Maesepp said.

With the project to be completed next year, Ms Maesepp said the next stage will be around training other farmers to become saline food growers, "which was always our long-term goal".

She said there has already been a lot of interest from farmers.

"We have so many farmers who have land that has gone out of production because of salinity and there's so many farmers who would benefit from being able to diversify their product range," she said.

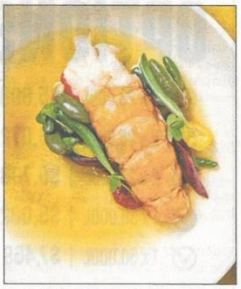
❒ The team behind the Saline Bush Foods project, Katanning Landcare officer Ella Maesepp (left), Katanning Environmental Inc chairman Matt Collis, host farmer and Moojepin Foods co-owner David Thompson, WA Gourmet Garden owner and Moojepin Foods co-owner Lance McLeod, Chatfields Engineering owner Dustin McCreery and Swan Valley Flower Farm owner Tony Mercieca.

❒ Field day participants checking out the shade house production system with host farmer David Thompson (left in blue shirt).

"In March 2022, we are going to hold an intensive two to three-day training workshop.

"Growers who are interested in becoming saline food growers can come to the training, which will be full technical level training, which will equip them to be able to join the supply chain.

"Now we are starting to put together the technical and training manual, because with the market demand growing we see there is going to be space in the market very soon for more than what we can produce, so we would like to see other growers come on board in the next few years."



❒ Karkalla pairs well with seafood.

Countryman 17th June 2021:

'Spike' in bush tucker

Lance McLeod and David Thompson, of Moojepin Foods, with a patch of pigface growing on Mr Thompson's property.

SHANNON VERHAGEN

Demand for WA-grown native saline bush foods is booming, with a Great Southern farmer ramping up plantings to meet an even bigger "spike" anticipated come spring.

It could mean by this time next year, more WA farmers will be entering the supply chain of the blossoming industry.

Sales for the produce — which plummeted last year as restaurants across the country were forced to shut during coronavirus lockdowns — are up more than 400 per cent this quarter compared to the first quarter of 2019 nationally.

In Perth alone, there has been a mammoth 250 per cent surge in sales since September.

It comes as "terrific news" to Badgebup farmer David Thompson and gourmet food supplier Lance McLeod, who founded their native food enterprise Moojepin Foods in 2017.

"COVID-19 gave us a chance to reset and rethink," Mr McLeod said. "Because we stopped harvesting we put a lot of effort into bringing new varieties in and it's starting to pay off now.

"Instead of four products we went to nine and I think that has helped with our brand as we have more to offer.

"It's very encouraging and tells us we're on the right track."

The pair — who supply saltbush, samphire, karkalla (pigface), sea purslane, ice-plant and a number of native herbs to wholesalers and chefs across the country — are hoping to double, if not triple their production to meet the fierce interest, which is expected to "spike" in a couple of months.

Ice-plant growing in a shadehouse on the property.
BELOW: Packaged saltice.

"We should see a spike in spring-summer when people make their menus," Mr McLeod said.

"I'd like to double what we're doing, at least. I don't think we've reached anywhere close to what we could. We'll just keep the same distribution channels but expand our brand awareness.

"We're really focusing on trying to educate people on how our saltbush is different."

He said major orders were also rolling in ahead of NAIDOC Week, which starts on July 4. However, he said they were "taking their foot off the accelerator" through winter to ensure they did not overcommit themselves and end up with too much demand for them to supply.

Moojepin's Sandy McLeod and Sue Thompson. Pictures: Shannon Verhagen

But once the season turns, they will be firing the engines back up with gusto.

Fierce interest in the blossoming industry has seen their enterprise grow exponentially, with two pickers and two packers now on the books, as well as a new set of wheels — a refrigerated truck — on the road to keep the orders fresh.

And there should be plenty to harvest, with Mr Thompson bumping up plantings in February.

He is now growing some 3300 ice-plants, 850 karkalla, 500 sea purslane and recently, 50 sea blight in the two purpose-built greenhouses on his property east of Katanning.

He also grows about 25,000 seakiss saltbush plants and hoped to establish a 2000-plant strong plantation of sea blight outside of the greenhouse.

"If we can triple the saltbush, that's where the biggest opportunity lies," Mr Thompson said.

"Because we have so much of it, we could triple or supply 10 times as much and we'd still have enough plants."

Both men said their focus and challenge was ensuring their saltbush was marketed as a different, less bitter variety to others on the market.

"All of the other varieties I'm aware of are old man's saltbush, which has a bitter — some call it peppery — after-taste," Mr Thompson said.

"Our variety (seakiss) is the only one we know of that doesn't have that."

Expansion plans to build a third greenhouse are on ice, with wait times for the hydroponic bags needed to plant the extra plants sitting at more than eight weeks due to COVID-19-induced shipping delays. However, construction of a Katanning-based packing shed is set to wrap up by the end of the year.

The venture is part of a four-year research project with Katanning Landcare to investigate ways for farmers to increase agricultural production on degraded salt-affected land on their properties.

Mr McLeod previously dubbed it "the dream" for more farmers to get on board to enable them to form a co-op which could produce higher and consistent volumes for the national — and potentially international — markets.

It is a vision they are already working towards, Katanning Landcare officer Ella Maesepp said, with forward projections being worked on to determine just how many growers the market needs.

"With the demand growing, there is going to be space — need — for more growers," she said.

Having now determined how to grow the saline foods on degraded land, they are putting together a training program and guide for other farmers interested in growing saline foods early next year.

Farm Weekly: 8th October 2020

Saline bush foods make industry firsts

❒ Survey host farmer David Thompson and soil scientist Jolene Otway in one of the saltbush plantations being monitored.

❒ Shadehouse program horticulturalist Tony Merceica (right) and host farmer David Thompson checking over the newly established seedlings in the shadehouse facility, irrigated with saline groundwater.

AN innovative industry development project at Badgebup, east of Katanning, will open its gates to the public for the first time this month, for the Saline Bush Foods Spring Field Day, to be held next Thursday, October 14 from 10am to 3pm.

Starting almost by accident five years ago, project host farmer David Thompson began supplying shoots from plants growing naturally in the salt-affected areas of his farm to a handful of gourmet chefs.

"I found out a Perth restaurant which I was supplying mutton to was importing saltbush from South Australia," Mr Thompson said.

"I basically said that I have some at my farm and will just pop some in for him with the next delivery of meat.

"It grew very quickly from there."

It became apparent that there was potential for a real industry to develop, utilising plants that grow naturally on degraded salt land.

"It was a way to bring value back to degraded land, to turn an economic benefit for the farmer, contribute to food security and hopefully help see an improvement in the health of land that has been damaged by salinity," he said.

However, it also became apparent that in order to make a viable industry and a real on-farm impact, there were numerous hurdles that needed to be overcome.

Lance McLeod, WA Gourmet Garden (WAGOGA) became involved in the project early on through his gourmet food marketing company.

"Consistency of product is a big one," Mr McLeod said.

"Foraging with secateurs on wild salt land that wasn't able to produce a consistent product all year – size, volume, growth stage or palatability – is what the hospitality industry needs."

In 2017 Mr Thompson's enterprise Moojepin Foods, WAGOGA and some other complementary organisations, teamed up with Katanning Landcare and successfully received funding through the Federal government's National Landcare Program (NLP) Smart Farming Partnerships program, to develop a full paddock-to-plate supply chain of saline bush foods – and then to teach others how to enter the chain as growers too.

Katanning Landcare officer Ella Maesepp said the Spring Field Day will mark the halfway point of the four-year project.

"The project is about learning how to grow, market and supply these foods, whilst better understanding the impact on salinity – which we expect to be positive," Ms Maesepp.

The Spring Field Day will show attendees the three different growing systems that are being refined for saltbush, samphire, pigface and ice-plant – the original wild harvest sites, plus also planted stands of the edible species and a full shade house horticultural system, being irrigated with saline groundwater pumped from the rising water table right there on the farm.

A research team has been investigating the impact of groundwater use and the changes in soil health from the increased production of biomass from the saline soils in the project.

Results to-date will be shared on the day.

"Working out how to grow these saline species consistently to a high quality is only part of the equation though," Ms Maesepp said.

"The project is also addressing how to harvest, pack and market these products, as well as to introduce the consumer to these different foods."

Produce from the project has won three Delicious Produce Awards to date, including the National Gold Medal in 2018, raising awareness among restaurateurs, chefs and individual consumers.

Pre-COVID-19, sales of the saline bush foods had experienced continued growth, particularly in WA and in New South Wales and South Australia, with demand threatening to outstrip current supply.

Attendees will get a chance to sample the foods themselves, with lunch being prepared by Gypsy Kitchen Co.

Working with Chatfields Engineering on how to efficiently and delicately harvest the plants is also being addressed.

Lead developer of the machine, Dustin McCreery, Chatfields Engineering, said they would showcase a new piece of machinery in action, developed specifically for this new food industry.

"We're nearing the end of the trial stage for the prototype machines and the field day will be the first time it will be publicly shown working," Mr McCreery said.

"The first machine shapes saltbush to a regular form, so that the second machine – which has been adapted from a carrot harvester – can follow through about every six weeks to delicately harvest the soft new shoots desired for human consumption."

A packing shed facility is the next major part of the project, to be constructed later this year.

It will create a local independent enterprise that can quickly process and pack fresh produce coming off numerous properties, so that it can reach the market in top condition.

"The packing shed will become a key part of the supply chain and also provide local employment opportunities within Katanning," said packing shed development manager Matt Collis, Katanning Environmental Inc.

Ms Maesepp said a key objective of the project was to train other farmers who have degraded saline soils on their properties, to be able to grow and supply into this promising market.

"As we approach 2022, we will be packaging everything we have learnt into a training program, so that we can support many other landholders to participate, with the benefit of all learning from our mistakes and successes," she said.

"If we can bring saline land back into production, improve its health, provide more employment and income for rural communities and help feed the world, then we'll have succeeded."

❒ Two groundwater bores have been sunk to supply saline irrigation water to the bush foods horticultural growing system and simultaneously draw down problem groundwater levels affecting farmland.

❒ **More information: tickets are $15 and can be booked through Katanning Landcare via ella@katanninglandcare.org.au or 9821 4327.**