

Case Studies

Case Study 1: A Horticulturist's Approach to Drought Resilience

Background:

Operating on a 1000-hectare mixed production model, including horticulture, protected cropping, and livestock, the farm has faced varying climatic conditions, particularly drought, over several decades. The experience of drought has been a significant factor shaping the farm's water management, preparedness, and resilience strategies.

Experience of Drought:

The farm has experienced "dry years" rather than complete droughts, with notable fluctuations in rainfall patterns. In years like 2007, when rainfall was scarce until October, the farm managed to salvage the season thanks to timely rains, leading to an average crop. The farm has learned that rainfall patterns have shifted, with drier winters followed by brief periods of rain. Despite this unpredictability, the farm has not had to destock completely due to their preparedness and robust water management systems.

Key to their success is recognizing the variability of rainfall over the decades, with significant variations in water availability affecting crop and livestock production. Preparedness has been vital, as the farm has consistently held feedstock in reserve to ensure that livestock can be sustained even during dry periods.

Challenges and Concerns:

Looking forward, the farm is particularly concerned with how climate change will affect water availability and crop viability. While they have not faced severe, prolonged drought like in some eastern states, they have seen intermittent dry spells that stress both crops and water reserves. A core concern is the changing pattern of rainfall, which has shifted significantly from what it was 50 years ago. This has introduced unpredictability in crop planning and livestock management, requiring adaptive strategies to ensure consistent productivity.

Another challenge has been ensuring that water storage systems can meet future demands. Despite implementing large water-holding capacities, the farm recognizes that if a drought were to extend beyond two years, they would likely face the need to destock due to lack of water in paddocks.

Key Drought Resilience Strategies:

The farm has implemented several key strategies to mitigate the impacts of drought and changing climate patterns:

1. Water Infrastructure Investment:

The farm has built larger dams and reservoirs, with holding capacities ranging from 2000 to 3000 cubic yards. These have proven essential in ensuring water availability for livestock and irrigation during dry periods. Additionally, they have developed a 35-hectare roaded catchment system to capture surface water effectively.

2. Surface Water Management:

In the mid-nineties, the farm invested heavily in expanding water storage and drainage systems. More recently, with the introduction of covered cropping, the farm installed a gutter system to capture water from 4 hectares of hard surface cover. This system captures approximately 80,000 m³ of water annually, which accounts for about half of the farm's needs for production.

3. Partnerships and Resource Sharing:

The farm has explored unconventional solutions, such as negotiating with neighboring landowners for access to disused dams. These arrangements provide additional water resources, which are piped and maintained by the farm, ensuring flexibility in times of drought.

4. Feed and Stock Management:

The farm always prepares for dry starts by holding extra feedstocks. If the feed is not needed, they sell it later, ensuring that they are not caught off guard by dry conditions. This has allowed them to maintain livestock through dry periods, unlike in the past when they might have had to reduce herd sizes.

Adaptation to Climate Change:

The farm recognises that climate variability is now a part of normal farming operations. As a result, they have adjusted their practices, such as reassessing water storage needs every few years and budgeting for repairs and maintenance to keep their infrastructure in good condition. This strategic approach to long-term planning has allowed the farm to remain resilient even as climate patterns shift.

Additionally, the farm has explored desalination and reverse osmosis systems to ensure that mildly saline water can still be used for irrigation, particularly in protected crop production where water quality is critical.

Lessons Learned and Future Planning:

1. Strategic Water Planning: Having reliable water sources, both on-farm and within the broader community, is crucial for drought resilience. The farm suggests using aerial imaging to identify potential emergency water supplies for firefighting and drought preparedness.

2. Forward Planning and Preparedness: The farm emphasises the importance of preparing for dry years every year. Their approach involves maintaining higher than necessary feed and water stocks to mitigate the impacts of unpredictable weather patterns. They are planning for what could happen in February.

3. Innovation and Resourcefulness: Thinking outside the box has allowed the farm to thrive in challenging conditions. This includes unconventional resource sharing agreements and investment in water-efficient technologies that reduce strain on existing systems.

Conclusion:

This approach to drought resilience showcases the importance of long-term planning, water management, and adaptability in farming operations. By investing in water infrastructure, adopting flexible strategies, and anticipating dry conditions, the farm has been able to mitigate the impacts of drought and ensure continued productivity. As climate variability increases, their experience offers valuable lessons for other horticultural farms facing similar challenges.

Case Study 2: Drought Resilience in Viticulture

Grape vines are tolerant to dry conditions and drought, however even though grapevines can survive a dry spell with minimal watering, they will start to shed their leaves when their ability to circulate water and nutrients is reduced by 50 per cent. This is due to lower water pressure in their stems and roots. Under stress, the vines push hard to draw water and can form air bubbles in tissues that circulate water from the roots. These air bubbles stop the sap from flowing into the vines so they start losing leaves and can eventually kill the vine. There is also a direct correlation between the amount of water a vine receives and the fruit it will yield. Eighty per cent less water means eighty per cent less fruit, so impacting on productivity and cost of producing wine.⁶²

A dry year means a dry subsoil and a reduced canopy which is the engine room for ripening. This results in reduced yields and increased sugar levels in the fruit which accelerate quickly making picking time difficult because it needs to be determined on sugar levels instead of taste. The high sugar levels impact on fermentation and wine quality.

According to a viticulturist in the Coastal Great Southern region, a lower-than-average rainfall year is 450 mm of rainfall. Evaporation rates on dams increase from 22-30% in a normal year to 40-45% in a dry year. In a below-average rainfall season, there is an increased risk of frost in spring which can be even more damaging if it occurs at bud bursting time.

Background

Vineyard owners interviewed in the Coastal Great Southern region report facing increased challenges due to climate change and drought, particularly in relation to erratic weather patterns and drought, water availability, vine health, and overall production. Adopting various innovative water management strategies have been fundamental to mitigating the effects of drought, ensuring the vineyards' long-term sustainability in an increasingly unpredictable climate.

Key Drought-Resilience Strategies:

Catchment and Water Diversion: One vineyard relies on a large-scale catchment system covering 70 hectares to capture runoff during the winter and spring rains. This water is stored in a series of seven satellite dams, providing a buffer during the dry months. However, recent consecutive years of reduced rainfall (dropping from 600 mm to 450 mm) have severely impacted the vineyard's ability to capture and store adequate water.

Another common key strategy is to consider diversifying water sources to mitigate the risks posed by increasingly unreliable rainfall.

Polymer Spray on Catchment Areas: To improve water retention, one vineyard applies a polymer spray on catchment areas, reducing water absorption into the soil and maximizing the amount of water that can be captured. However, it is also commonly acknowledged that maintaining catchment areas come at a high cost, involving roller and grader services to ensure the catchment remains functional.

Irrigation Management: Developing a sophisticated irrigation system is key. However, the prolonged dry years and a dry spell from February to April 2024, have left young vines in one vineyard without water, leading to weakened growth. Shiraz yields, which typically average 8-10 tons per hectare, dropped to just 3.5 tons per hectare due to the heat.

In the 2019-2020 vintage year, one viticulturist experienced a 40% reduction in yield due to a dry growing season and low water availability. In some areas, particularly where young vines were planted, the lack of water during critical periods has led to long-term damage, weakening the vines' ability to survive future dry seasons.

Adaptation to Market Demands: Climate change is compelling some vineyards in the Coast Great Southern region to reconsider which varieties to plant. A common strategy is to remove a percentage of its lowest-yielding vines to preserve resources for the higher-producing areas of the vineyard. Some viticulturists notice that red grapes, like Shiraz and Grenache, fare better under dry conditions than white varieties, but market shifts often complicate long-term planning.

Challenges and Outcomes:

For one viticulturist the ongoing challenge is the diminishing ability to catch water. A shortage of rainfall in the catchment area has led to critically low dam levels which is illustrated from the photograph in Figure 80. In 2020, the main irrigation dam was overflowing, but recent seasons have seen it at dangerously low levels, threatening the viability of the vineyard.

In response to these challenges, the vineyard has had to remove 20% of its lowest-yielding vines to preserve resources for the higher-producing areas of the vineyard. Additionally, there is growing concern about the impact of consecutive dry seasons, which increases the risk of frost, further affecting yields.

Community and Economic Resilience:

To ensure long-term resilience, there are advocates for increased collaboration within the viticulture industry and support for innovative water management solutions. Additionally, financial assistance and mental health support for growers will be crucial as they navigate the financial and emotional tolls of climate change.

Beyond just vineyard management, viticulture plays a significant role in local economies. For example, in Frankland River, vineyards support approximately 85 permanent staff, many of whom live locally and contribute to the town's economic vitality. A continued decline in viticulture would have cascading negative effects on the broader community.

Addressing these climate impacts is crucial not only for vineyard owners but also for maintaining the economic stability of the surrounding regions.

Conclusion:

Vineyards in the Coastal Great Southern region exemplify the complexities of managing viticulture in the face of climate change and drought. While some vineyards have implemented strong drought-resilience strategies, ongoing dry seasons are testing the limits of these approaches. The future success of these vineyards will depend on their ability to continue adapting, particularly in securing water resources and adjusting to market demands.

Case Study 3: Drought and Cultural Resilience in the Wagyl Kaip Southern Noongar region

Background

The Wagyl Kaip Southern Noongar region includes the Menang, Goreng, Keneang, Wilman and Wudjari language groups from the Great Southern area of Western Australia. The region is approximately 52,246 sq km and includes all local government areas that fall within the coastal subregion (Albany, Cranbrook, Denmark and Mount Barker). The region faces growing challenges due to prolonged drought and climate change, which threaten both cultural heritage and the environmental integrity of traditional lands. The Wagyl Kaip Southern Noongar Corporation plays a vital role in coordinating efforts to preserve cultural heritage while adapting to the impacts of increasingly severe droughts and changing weather patterns.

Impact of Drought and Climate Change

Cultural Heritage at Risk

The region has observed both physical and non-physical losses of cultural heritage due to extended dry seasons and more intense bush fire cycles. The non-physical loss involves the challenges in passing on Traditional Ecological Knowledge (TEK) from elders to younger generations. This knowledge is essential for managing the land and responding to environmental changes.

The physical loss includes the bush fire destruction of and/or disrupted access to cultural sites, both documented and undocumented. The loss of flora, fauna, and archaeological opportunities have impaired the study and conservation of significant sites. The loss of bush foods is a threat to diet and food-security, and a negative impact for indigenous enterprises.

Economic Impacts on Indigenous Enterprises

Indigenous-run enterprises are focused on re-vegetation projects and seed cultivation through community nurseries. Water scarcity and the lack of consistent rainfall are disrupting seed cultivation, re-vegetation projects, and threatening the economic sustainability of the enterprises.

Tourism Disruptions

Indigenous tourism, which involves sharing the natural and cultural significance of the land with visitors, has also been affected. The increasing frequency and intensity of bush fires, as well as drought-induced water scarcity, have made it harder for tourists to access key cultural and natural sites. This has had a negative impact on tourism-related income for the community.

Community Concerns and Challenges

Mental Health and Community Well-Being: One of the key concerns is the impact of climate change on mental health. The cumulative effects of drought, bush fires, and the potential loss of cultural heritage have placed immense strain on the community. This has led to calls for more mental health support services for those managing and working on the land.

Capacity Building for Fire and Land Management: There is a need for greater investment in fire mitigation strategies that integrate TEK. Traditional burning practices, which have long been part of the region's land management, are seen as critical to managing bush fires in a way that protects cultural sites and restores ecological balance. However, the lack of resources and support backing TEK into current fire management plans is a significant gap in preparedness for drought and climate change.

Prescribed Burns and Fire Mitigation: The community believes that more resources are needed to increase the frequency of prescribed burns, particularly cool burns that help manage fuel loads without causing widespread damage to the land. This approach requires training more rangers and volunteers, which would allow the community to better manage the land and prepare for longer fire seasons.

Adaptive Strategies and Tools

Integration of TEK in Fire Mitigation: One of the key strategies for adapting to drought and climate change is the integration of TEK into fire management practices, including TEK-based fire mitigation to be incorporated into training programs for rangers and volunteers. Additionally, schools are starting to incorporate cultural land management into their curriculum, ensuring that younger generations are equipped with the knowledge to continue these practices.

Resource Allocation and Training: There is a need for more resources to fund ranger programs and build fire management capacity. The development of a register of trained individuals who can be mobilised for fire mitigation efforts would allow for a more effective response to the increasing number of bush fires while also helping preserve cultural heritage.

Collaborations and Partnerships: Collaboration with government agencies such as the Department of Biodiversity, Conservation, and Attractions (DBCA) to improve fire mitigation efforts is important. By working together with wider organisations, the Wagyl Kaip Southern Noongar Corporation aims to develop more effective land management strategies that integrate both scientific approaches and traditional knowledge.

Future Directions and Recommendations

Support for TEK and R&D: It is recommended that investment in research and development focuses on substantiating the use of TEK in modern farming and land management practices. This would not only validate the effectiveness of TEK but also increase its acceptance among the broader agricultural and scientific communities.

Economic Opportunities through TEK: There is potential for turning drought preparedness into economic opportunities. For example, there is value in promoting agri-tourism, bush foods, and native plant cultivation as part of a broader strategy to connect the public with sustainable farming practices that incorporate TEK. This could also bridge the gap between urban and rural areas, creating a greater understanding of the importance of traditional land management.

Conclusion

The Wagyl Kaip Southern Noongar region faces numerous challenges as they adapt to the impacts of drought and climate change. These challenges threaten both cultural heritage and economic sustainability. However, through TEK-led fire mitigation efforts and the development of partnerships with government and scientific communities, the community is working towards a more resilient future. Continued investment in capacity building, mental health support, and research will be key to ensuring that cultural heritage is protected, and that the region remains resilient in the face of ongoing environmental changes.

9.4. Case Study 4: A Small Landholder's Challenges in Drought and Climate Change

Background

One experienced Coastal Great Southern farmer manages a small landholding of approximately 65-80 hectares and has seen the effects of drought firsthand. His farm has experienced what is referred to as a “green drought” in the Southwest region of Australia, where despite the appearance of greenery, there is insufficient water and feed for livestock. 2024 was a particularly challenging year for him, with multiple factors exacerbating the effects of the drought.

He is part of a community of small-scale farmers with significant combined-supply to the Western Australian fresh meat market. Despite their significant contribution to the food supply, individually, these small farmers face growing challenges due to prolonged droughts and changing climate conditions.

This case study explores this farmer's experiences and concerns regarding drought, highlighting the urgent need for adaptive strategies and targeted support for small landholders

Impacts of Drought and Climate change

Hay and Fodder Shortages: 2024 marked the first time this farmer had to purchase hay due to a lack of on-farm fodder. The experience highlighted the difficulty of sourcing quality hay, especially when reliant on suppliers located far away. There were challenges with managing the different shaped bales.

Destocking Challenges: The decision to destock livestock due to drought has long-term consequences. Rebuilding the herd can take more than two years, affecting not only an individual farmer's financial stability but also the broader supply chain of fresh meat in Western Australia.

Reliance on Off-Farm Income: Like many small landholders, off-farm income is necessary to maintain operations, with most small farmers in the region working part-time jobs outside their farms to cover costs. This reliance on external income creates additional stress and is not sustainable long-term.

Key Concerns for the Future

As the climate continues to change, this farmer and other small farmers in the area are increasingly worried about the future viability of their farms. He raises several concerns regarding the long-term effects of drought.

Generational Farming at Risk: The traditional model of generational farming is under threat. As farming becomes less profitable and more reliant on external income, the younger generation is discouraged from continuing family farming operations. The increasing challenges of drought and climate change make it difficult for the average person to buy into farming.

Economic Viability of Small Farmers: Small farmers, despite their significant contribution to the fresh meat supply, face pricing pressures that undermine their cash flow and financial viability. Practical support is needed to help small farmers remain resilient, assistance with early warning/data/support.

Challenges in Drought Preparedness

In this farmer's view, current drought preparedness and response strategies fall short, particularly for small landholders. Several gaps in preparedness and response need to be addressed:

Pricing and Cashflow Management: Most small farmers are struggling to afford basic operational costs, and the reliance on off-farm income is not a sustainable model. Practical assistance is needed to improve cash flow, such as targeted financial support for small farmers based on their output and size.

Early Identification of Triggers: Farmers need access to early-warning systems and data that can alert them to the risks associated with drought. Providing this information early would help farmers prepare for the potential impacts and make informed decisions about destocking, water management, and financial planning.

Recognition of Small Farmers' Contributions: Small landholders are often dismissed as “hobby farmers,” even though their collective contribution to the fresh meat supply is substantial. More recognition is required of the role that small farmers play in the local food supply chain and for policies that provide practical support, such as better pricing mechanisms and financial assistance.

Key Actions

Some of the key actions that would assist small landholders include:

Tools for Increasing Adaptive Capacity: It is important to provide the right tools and support to help small farmers increase their adaptive capacity in the face of drought.

Grading Systems for Hay Quality: Implementing a grading system for the quality of hay would help small farmers make informed decisions when purchasing fodder during dry seasons. This would reduce the risk of buying poor-quality feed that is less effective for livestock.

Practical Financial Support: Government programs should focus on providing practical financial assistance that directly improves cash flow for small farmers. This support should be proportional to farm size and output, ensuring that small farmers receive the help they need to remain resilient.

Early Warning and Data Support: Developing early-warning systems and providing farmers with real-time data on drought conditions would enable them to make proactive decisions. This could include alerts on water shortages, fodder availability, and potential risks to livestock health.

Reducing Reliance on Off-Farm Income: Policy change is needed to make farming more financially viable, allowing small farmers to reduce their dependence on off-farm jobs. This could involve subsidies, improved pricing mechanisms for agricultural products, and investment in infrastructure that supports small-scale farming.

Conclusion

Experiences of small landholders highlight the urgent need for adaptive strategies and targeted support for small farmers facing the impacts of drought. With increasing reliance on off-farm income, poor cash flow, and the long-term challenges of rebuilding livestock herds, small farmers require practical solutions that address both their financial needs and their role in the local food supply chain. By recognizing the contributions of small landholders and providing early-warning systems, better pricing mechanisms, and practical financial assistance, the agricultural sector can help ensure the resilience and sustainability of small farms in the face of climate change.

Improving productivity on these farms is an opportunity to manage climate variability, manage risk and animal welfare outcomes. Capacity building programs tailored to this market would decrease the vulnerabilities identified for small landholders and farmers.