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## **Australia: Drought Resistant Solutions In The Midst Of The Australian Climate Change Crisis**

### **1.0 Introduction**

For years, the impact of climate change on Australia has been steadily growing. Since 1910, Australia has warmed by an average of 1.51°C on land, and by 1.08°C in the oceans. The ever developing crisis of climate change within Australia is impossible to ignore.

### **2.0 Country Facts**

Australia, both one of the world's seven continents and an island, is about 2.9 million square miles or about 7.7 million square kilometers in size. Australia's topography is characterized largely by the infamous Australian outback, which makes up roughly 81% of the continent's total land. The outback is extremely arid, dusty, dry, and hot. It is important to note that the outback is known for its weather extremes, with extreme heat in the summer, on average 36C - 39C in the "arid zone," and extreme cold in the winter with the average temperature being around 18C-24C.

Australia has a population of roughly 26.8 million people, the current population density of Australia in 2025 is 3.48 people per square kilometer. It is because of these extreme conditions that the outback is largely unpopulated, with only 13.5% of people living in rural areas. The remaining 86.5% of the population live along Australia's shores, in cities like Sydney and Melbourne. Australia is comprised of only 2 territories and six states, an uncharacteristically small number considering Australia's immense size.

Australia has a federal parliamentary system. As of 2025 the current Prime Minister is Anthony Albanese. Australia is currently a member of the Commonwealth of Nations, and as such, its head of state is the British monarch—which is currently King Charles III. Despite this, Australia is an independent country. The role of the monarchy is largely ceremonial, and holds no power within the government, similar to its role within the United Kingdom, Canada, and Sweden.

Australia's major export crops include wheat, canola, cotton, and grapes (for wine production). As well as this, Australia exports large amounts of animal products; specifically beef, dairy, mutton, and wool. 369 million hectares of land in Australia, or roughly 49.13% of Australia, is used for agriculture. In 2021 a reported 239,093 Australian's, or roughly 0.89% of the population, work in the agriculture industry. In the same year, the average size of a large Australian farm was 4,305 thousand hectares.

### **3.0 Family Life and Nutrition**

There are, on average, 2.5 people per household in Australia. The average Australian adult makes \$98,000 annually, with the most common jobs in Australia being: Registered Nurse, Software Developer, Electrical Engineer, Construction Manager, Civil Engineer, Plumber, Human Resource Manager Supply

and Distribution Manager, Project Manager, and Accountant. School in Australia is mandatory from ages 6-17, with 88% of students graduating high school and 50% of those who graduate going into higher education. Tuition for universities is partially subsidized by the government, making higher education relatively accessible. The same is true for Australian healthcare, as most healthcare is entirely subsidized by the government, excluding “extras” such as dental, physiotherapy and optical services.

Generally, Australians get the majority of their food from local supermarkets and stores, roughly 52% of Australians grow a portion of their food themselves. Most Australian families have access to in-home kitchens and make their food using appliances such as ovens, stovetops, or microwaves. Nutrition is a major issue for Australians of all ages; In 2022, the proportion that did not meet the recommended daily serving of vegetables was: 94% in adults aged 18 and over and 96% for children and adolescents. As well as this, In 2022, the proportion that did not meet the recommended daily serves of fruit was: 56% in adults aged 18 and over and 36% for children and adolescents.

Climate change has created drought conditions affecting land all across Australia. 16.4 percent of the state was declared drought affected, 46.6 percent declared in drought onset and 36.3 percent in drought watch, exacerbating food insecurity issues all throughout the nation as food supply chains are disrupted by these extreme weather events. In an already high cost of living country, families don't need the rising cost of nutritious food as another barrier to healthy eating practices.

The drought conditions affecting much of the outback has resulted in large amounts of agricultural water usage, greatly contributing to the growing problem of water scarcity in Australia. This excessive use of water is only exacerbating the drought conditions affecting Australia, resulting in environmental damage and increased risk and frequency of the bushfires that are already plaguing Australia. As well as this, the increased water usage by farms to grow their crops results in higher cost of manufacturing, eventually resulting in higher overall cost for consumers.

### **5.0 Genetically Transformed Crops**

A way to both fight climate change and help remedy this nutrition crisis within Australia is by embracing University of Adelaide's “Growing plants for space” initiative. The research for this project is being conducted by utilizing both traditional breeding techniques and genetic transformation in order to create plants that are able to adapt to the cold and dry conditions of space while still being nutrient dense. By embracing the research The University of Adelaide produces in this initiative we can create “zero-waste plants” of our own. Specifically, we can model these plants after the Opuntia, a flowering species of cacti that produces delicious, edible, and highly nutritious prickly pear fruit. Through genetic transformation we can take the drought resistant qualities of the Opuntia and transplant them into spinach, one of the most nutritionally dense vegetables, as well as apples, which are both popular and nourishing.

We can see a similar idea to ours being applied by John Cushman and his departmental colleague Assistant Professor Won Yim, and international collaborator Assistant Professor Sung Lim at Sangji University, South Korea. They are using cacti as a model of CAM photosynthesis, an alternative form of photosynthesis that “avoids water loss by absorbing carbon dioxide through open pores, or stomata, in their leaves and storing it as malic acid at night while during the day, the stomata stay closed while the plant uses the stored malic acid and sunlight to convert carbon dioxide into sugars and starch.” Cushman

is integrating these genetic traits found in cacti into other plants, altering them so they can use CAM photosynthesis.

By combining these two methodologies, of traditional breeding techniques and genetic transformation of CAM photosynthesis and Opuntia's protective, fire resistant skin we can make "space crops" of our own! We can partner with the University of Adelaide and the University of Nevada, specifically the college's University's College of Agriculture, Biotechnology & Natural Resources to work on this project. These two Universities would be the perfect fit for our product due to the research both are conducting on the genetic transformation of crops in order to make more fortified and drought resistant produce.

These new genetically transformed crops will be both nutritious and easy to grow in the harsh, drought stricken Australian outback. With the widespread use of our transformed crops we can both offer affordable produce to Australians and significantly decrease the amount of water used in Australian agriculture (9,981 gigalitres of water from 2021-2022, roughly 74% of the nations total water use. ) To help fund this research we can partner with major Australian agricultural companies such as the Costa Group who would have a vested interest in water efficient produce, and the Australian Agricultural Company (AACo) which would benefit from the cheaper feed for livestock that would result from water efficient crops.

Before these crops are released to the public for consumption several field trials will be conducted in order to ensure safety. These trials will include, but not be limited to Short- and Long-term Feeding Trials on livestock, Allergenicity Testing, detailed Expression Analysis on how the inserted genes are expressed in the plant, including any potential unintended effects or interactions with other genes, and Post-Market Monitoring after we are able to sell our products. These extensive trials will help to obtain and keep the proper authorization needed to grow, transport, and sell our GM crops.

## **6.0 Eating Invasive Effort**

A way to both help fight climate change and to help Australians meet their nutritional needs is through the consumption of the Opuntia Cactus. This initiative, highly inspired by the "Eat The Invaders" campaign sweeping the globe, can help the ecosystem of the Australian outback while providing affordable fruits and vegetables to the Australian public. The "Eat The Invaders" movement is a campaign and movement that encourages people to eat invasive species as a way to reduce their populations and to mitigate the damage they cause to ecosystems, agriculture, and local wildlife. This cause stretches all around the world, from seaside invaders, to land, to even in the field.

The Opuntia cactus, also known as the "Pest Pear," is highly invasive in Australia, occupying over 22 million acres of Australian land. Thankfully for our initiative, both the pads and fruit of the cacti are edible and delicious. With the fruit from the Opuntia Cactus being used in beverages, deserts, and jams in countries such as Mexico, Guatemala, Brazil, Italy, Lebanon, and Morocco.

Despite the plentiful nature of the Opuntia cactus, many Australians would not be able or willing to go foraging in the hot and arid Australian Outback to harvest them for themselves. This is why I believe in order to be successful in this movement we should partner with Wakonda. Wakonda is an agricultural company based in Lecce, Italy, specializing in cultivating prickly pear (Opuntia cactus) to produce

sustainable products like juice, flour, and biofuel. They focus on revitalizing arid regions through innovative cultivation methods and a circular economy model.

In exchange for offering Wakonda full reign of the invasive Opuntia cactus in Australia they would sell the prickly pear juice and harvested Opuntia pads in Australian stores at discounted prices. This solution will help to lower the alarming percentage of Australians who do not meet their recommended fruit or vegetable intake while finding an extremely beneficial use for a highly invasive species.

### **7.0 Promoting Healthy Eating**

To market our crops to the public we must first start a campaign stressing the importance of eating a wide range of fruits and vegetables in order to have and maintain proper nutritional needs. As of 2022, the proportion that did not meet the recommended daily serving of vegetables was: 94% in adults aged 18 and over and 96% for children and adolescents. As well as this the proportion that did not meet the recommended daily serves of fruit was: 56% in adults aged 18 and over and 36% for children and adolescents.

We can fund this campaign through various partnerships. Firstly, the Australian Government Department of Health, as this campaign aligns with the Australian Government Department of Health's mission of ensuring "better health and wellbeing for all Australians, now and for future generations." We can also partner with ALDI, a grocery brand known for its budget friendly products. Our affordable produce will be the perfect fit for their budget friendly shelves. We can even have ALDI put our projects into their weekly ads and discounts.

To begin this campaign we will create several "got milk" style advertisements that highlight the importance of proper consumption of fruits and vegetables in how it affects children's growth, strength, and focus. In these advertisements we will utilize the power of ethos by having recognisable Australian athletes and academics within our advertisements. Showing how eating your fruits and vegetables can help to make the viewer strong, athletic, and intelligent.

Next, we will introduce our products made of the invasive Opuntia cactus to the general public, starting in schools. We will introduce a program modeled after the American "Weekend Bag Program," which is a program that provides essential supplies or resources for individuals or families to use over the weekend, typically focusing on food, hygiene, or other necessities. In our program we will send Australian children home with our Opuntia based products: such as prickly pear juice, and grilled Opuntia pads. This will help to introduce these products to both children and their families.

We will continue to partner with Wakonda with promoting their Opuntia based products. Specifically through offering free samples that come with informational packets about the nutritional and environmental benefits of the products in major supermarkets, conventions, and farmers markets.

### **8.0 Marketing our "Space Crops"**

Initially, some Australians may be hesitant to consume our transformed crops. To remedy this issue I suggest another marketing campaign to familiarize our crops to the public. To start off our campaign we

can create several nationally broadcasted advertisements promoting our crops, in collaboration with famous athletes, musicians, and even astronauts!. In our commercials we can highlight the idea that they are “space crops,” leading the public away associating our crops with the stigma of genetically modified produce and instead pushing them towards the novel of “space plants.”

As well as this, we can create several free and publicly accessible pamphlets, informational videos, and info sessions showing both the process and safety of our transformed products. Specifically bringing to light the extensive field and safety trials the crops passed in order to receive approval from the Australian government, proving our crops' safety to the Australian public. As well as showing the reason why they were created in the first place, the effects of traditional agriculture, specifically the amount of water it depletes.

As well as freely distributing these pamphlets and distributing these videos on public broadcasting we can also focus our efforts on schools. Going from school to school hosting assemblies on the environmental effects of the agricultural industry on the country and climate as a whole. These presentations will not directly push our transformed crops, but simply introduce them as one of many solutions available to help the environment.

Next, we can donate large amounts of our crops to food pantries. Not only will this put nutritious food into the hands of those who need it, but it will also help shift public perception of our crops.

Often, low-income families are unable to afford fresh and nutritious produce. By introducing our crops as safe, nutritious, and affordable more people will feel comfortable with purchasing them, consequently leading to lower amounts of malnutrition and lower consumption of water inefficient produce.

### **Conclusion 9.0**

Ultimately, choosing to pursue water efficient strategies such as these as possible ways to combat climate change would help to create a healthier country and less drought affected environment in Australia. The steps we take to fight climate change in the next few years are vital. These solutions are a positive step towards the global changes that need to be made in order to ensure a livable future for the generations that come after us.

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Amanda

Amanda is an adventurer.

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