Eel aquaculture in Gunditjmara Country

Aboriginal eel aquaculture system in Gunditjmara Country, South West Victoria, Australia.

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Figure 1 Network of shallow races and ponds for eel harvesting.

Context.

Location:	Victoria, Australia
Period:	4000 B.C
Function:	Eel aquaculture
Landscape type:	Volcano stream
Area:	9935 ha.
Water type:	Fresh water
Components:	Canals, weirs, races and traps following the trace of a volcano stream.
Status:	Recreational use UNESCO World Heritage Site for cultural landscape.

The Budj Bim Cultural Landscape is located in the Country of the Gunditjmara aboriginal people in Victoria, Australia. Budj Bim (known today as Mount Eccles) is the volcano that thousands of years ago caused an extensive lava flow that transformed the landscape and provided the base for the aquaculture system developed by the Gunditjmara people. The extensive network of canals, traps and weirs was once a highly productive aquaculture system constructed to trap, store and harvest eels. Today, it is recognized as one of the world's most extensive and oldest aquaculture systems.

Figure 2
Country scale
Australia

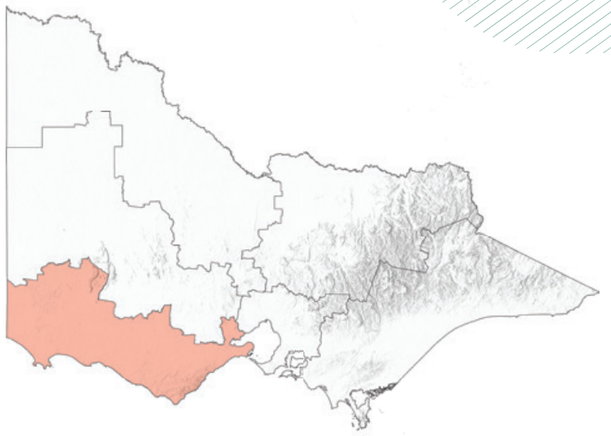


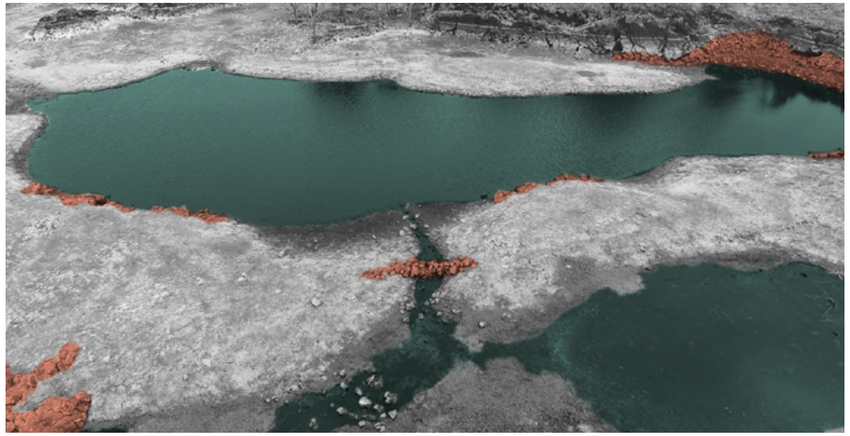
Figure 3
Provincial scale
Victoria

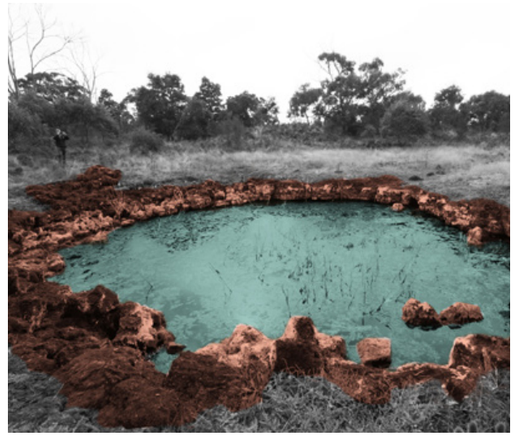
Figure 4
Regional scale
South West Victoria

Remaining traces in the landscape.

Large parts of the system have now disappeared, not only because of environmental changes through time, but also because of the modifications done to the site during British colonization. Nowadays, it is hard to grasp the entirety of what the system once was. However, several areas have been protected and reconstructed, showing a network of components that blend in with the landscape. The traces that can be seen now, hold the cultural practice of many generations which had a deep understanding of their land and lived a dynamic relationship with water, materials, nature, and climate.

The most recognizable features are the constructions made with the placement of basalt rocks. This material was used for constraining the water in canals, shallow races or sinkholes. The rocks were also piled up across waterways to form weirs and dams. Timber fences were placed across waterways and became traps in which woven baskets were placed to catch the eels.





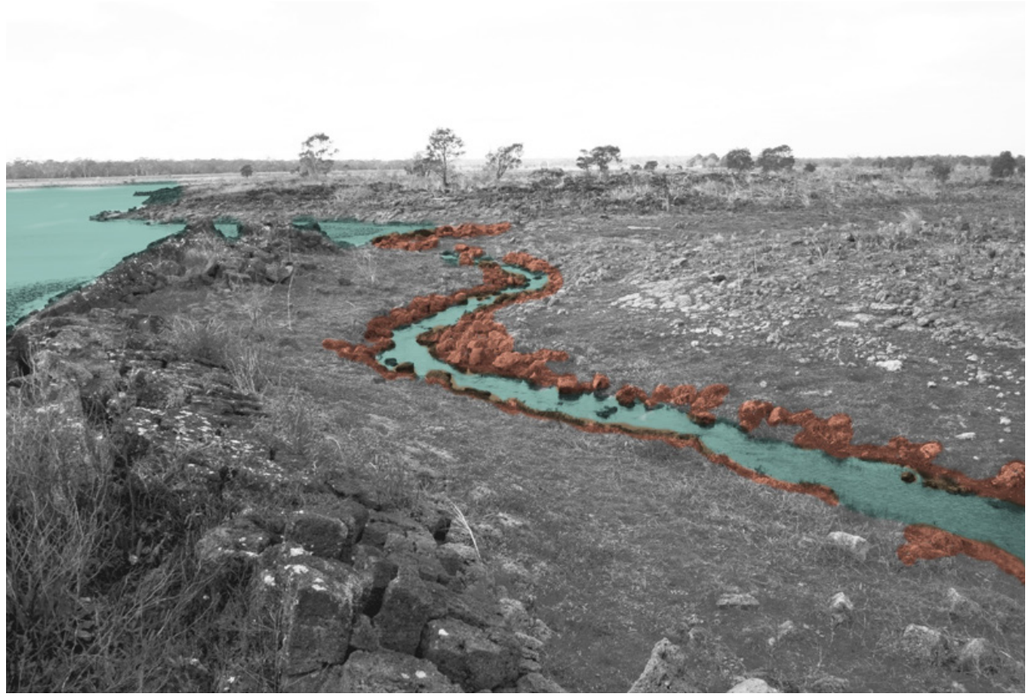


Fig 7 Top Left: 3 different components, a larger pond, a weir and a sinkhole.
Fig 8 Top Centre: Basalt stacked canal.
Fig 9 Top Right: A Sinkhole.
Fig 10 Bottom Left: A woven timber trap.
Fig 11 Bottom Right: A shallow canal / Race.

Climate.

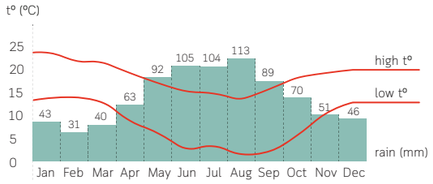
Climate zone: Warm-summer Mediterranean

Climate & Weather Averages

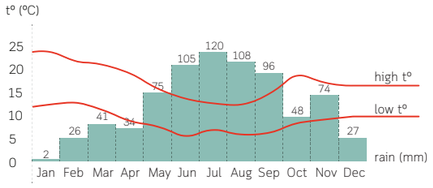
High t°:	25°C
Low t°:	5°C
Mean t°:	15°C
Precipitation:	63.0 mm
Humidity:	77%
Dew point:	9°C
Wind:	15 km/h
Pressure:	1017 mbar
Visibility:	10 km
Hottest Month:	Jan (22°C avg)
Coldest Month:	June (5°C avg)
Wettest Month:	July (120.0 mm avg)
Windiest Month:	Aug (17 km/h avg)
Annual Rainfall:	756 mm per year

In this region of Victoria the average precipitation levels have very drastic changes depending on the season. The time frame between the months of May and September is considered the wet season.
The graphics below show the differences in climate from the end of the 1800's and most recent numbers. Back when this water system was most productive, the seasonal differences were not as drastic as they are now. There is also a clear raise in the average temperature.

1861 - 1890



2019



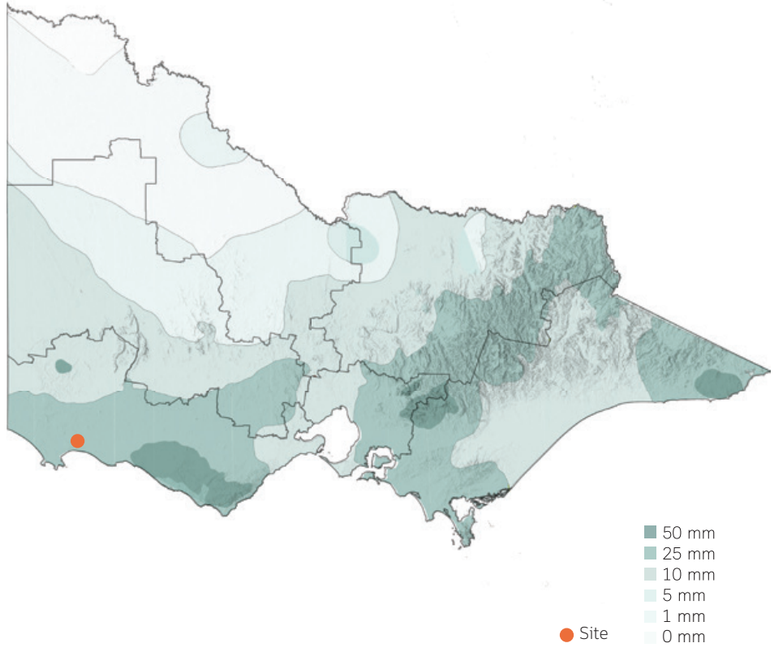


Figure 5
Precipitation
October - April

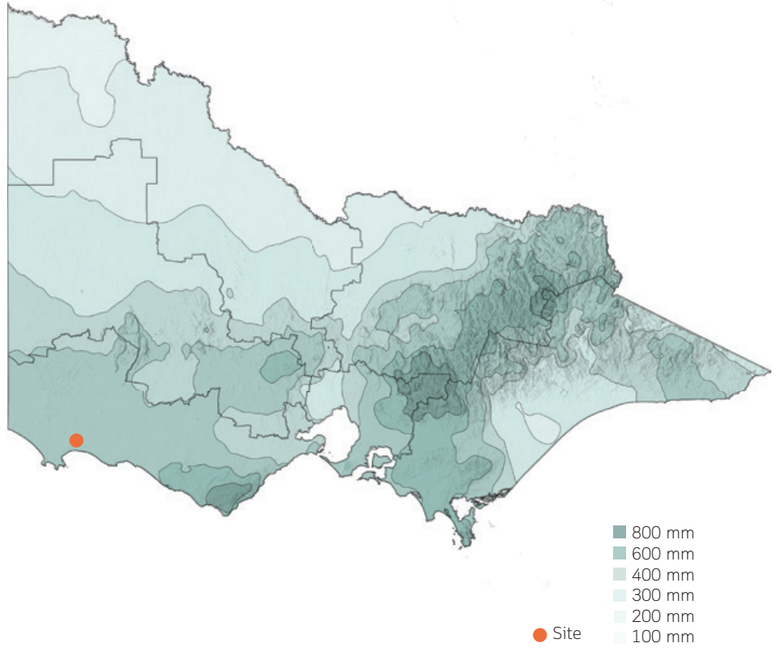


Figure 6
Precipitation
May - September

Catchment area.

The transformation on this landscape began nearly 6000 years ago with the eruption of the Budj Bim mount and the expansion of the lava flow for nearly 50km. Following the lava stream and using the resulting material of the basalt rocks, the Gunditjmara people shaped and manipulated the land to deliberately direct and manage the waterways and wetlands.

The system is spread in clusters of networks that start in the upstream creeks and lakes and continue all the way down to the ocean at Portland Bay. The sources of the fresh-water that feed into these wetlands are the two rivers that join as they reach the coast. The volcanic stony soil sup-ports woodland and open forest dominated by Eucalyptus and Blackwood trees. The highest terrains in the northern areas are only 60 m.a.s.l.

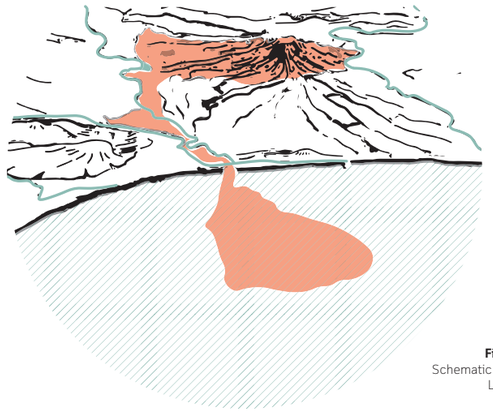


Figure 12
Schematic diagram
Lava flow

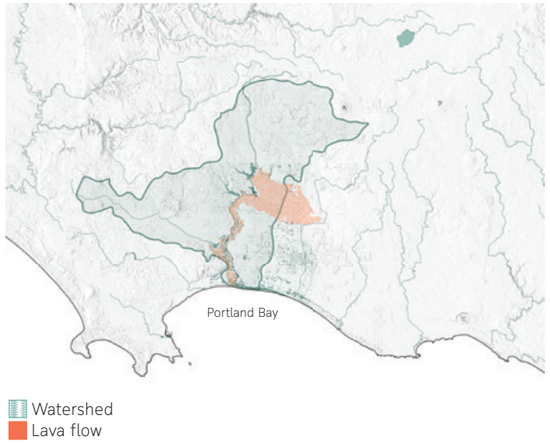


Figure 13
Watershed area

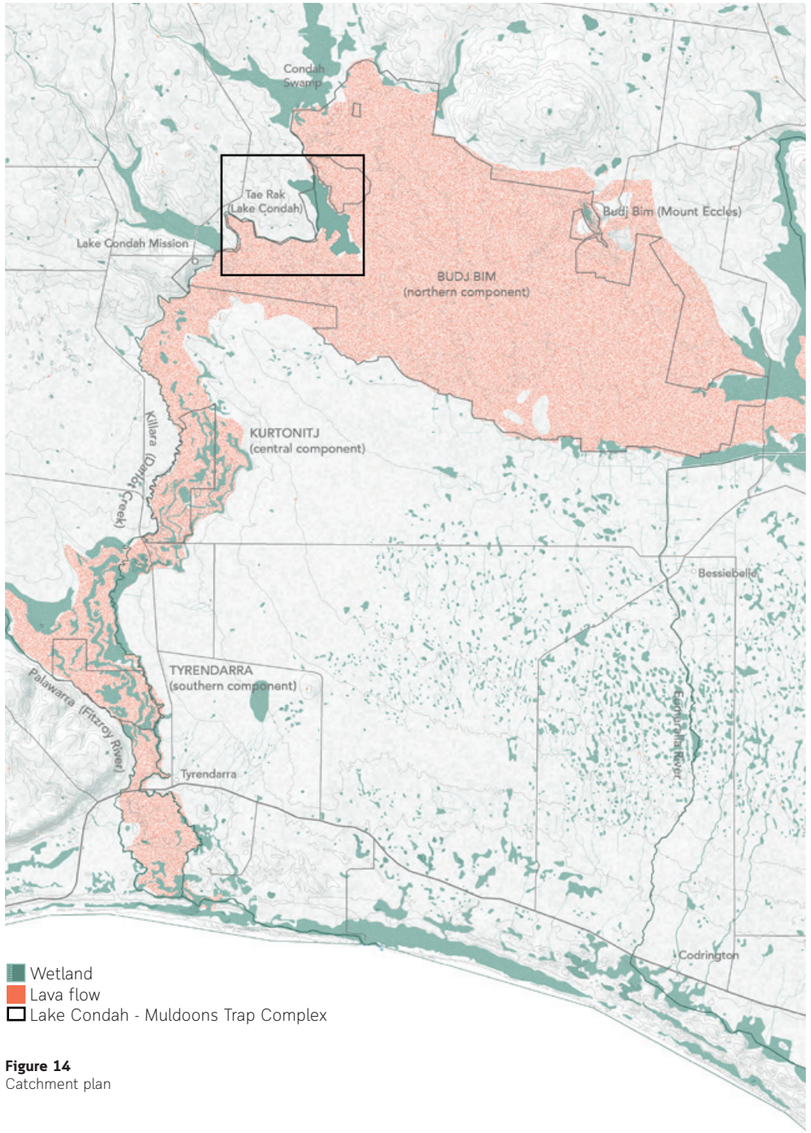


Figure 14
Catchment plan

Water System Plan.

The following representation of the system is a reconstruction of the Muldoons Trap Complex, located west of Lake Condah, which is on the edge of the Mount Eccles lava flow. This trap complex is positioned within a basalt lava flow, surrounded by eucalyptus woodland and grasses. In this section of the system, there are at least 350m of canals, they are located 2-3m above normal levels of the lake, which suggests they operated during strong flooding periods. This complex allowed the eels and other fish to swim seasonally between the lake and the following water bodies.

The canals were dug about 60cm into sediments and lava flow, taking advantage of natural cracks in the terrain (see fig.15). Basalt rocks were displaced and used to build block walls of about 0,4m high. Water flowed from the eastern end of the complex, passing through the canal features and several weirs and dams. Some of these canals would only be used when water levels were too high. The excess water would be emptied into the sinkhole.

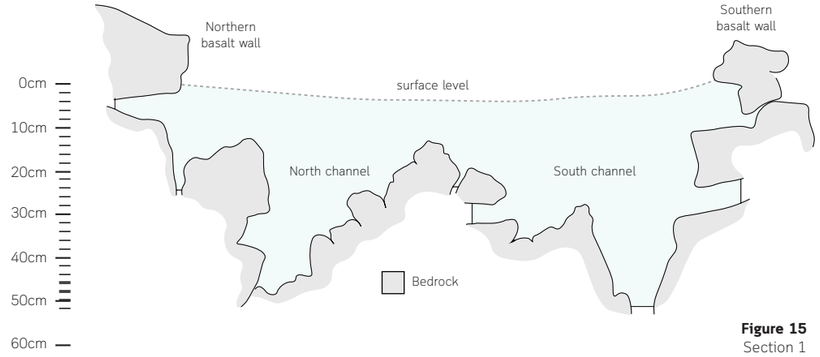


Figure 15
Section 1
Canal excavation

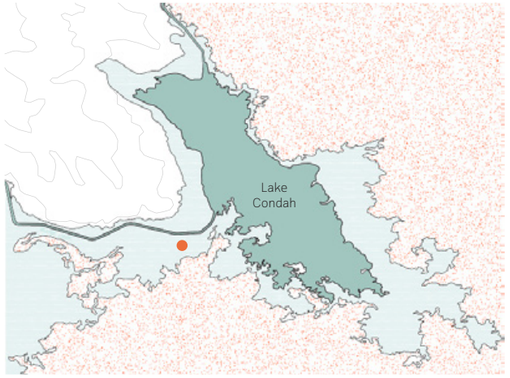


Figure 16
Lake Condah

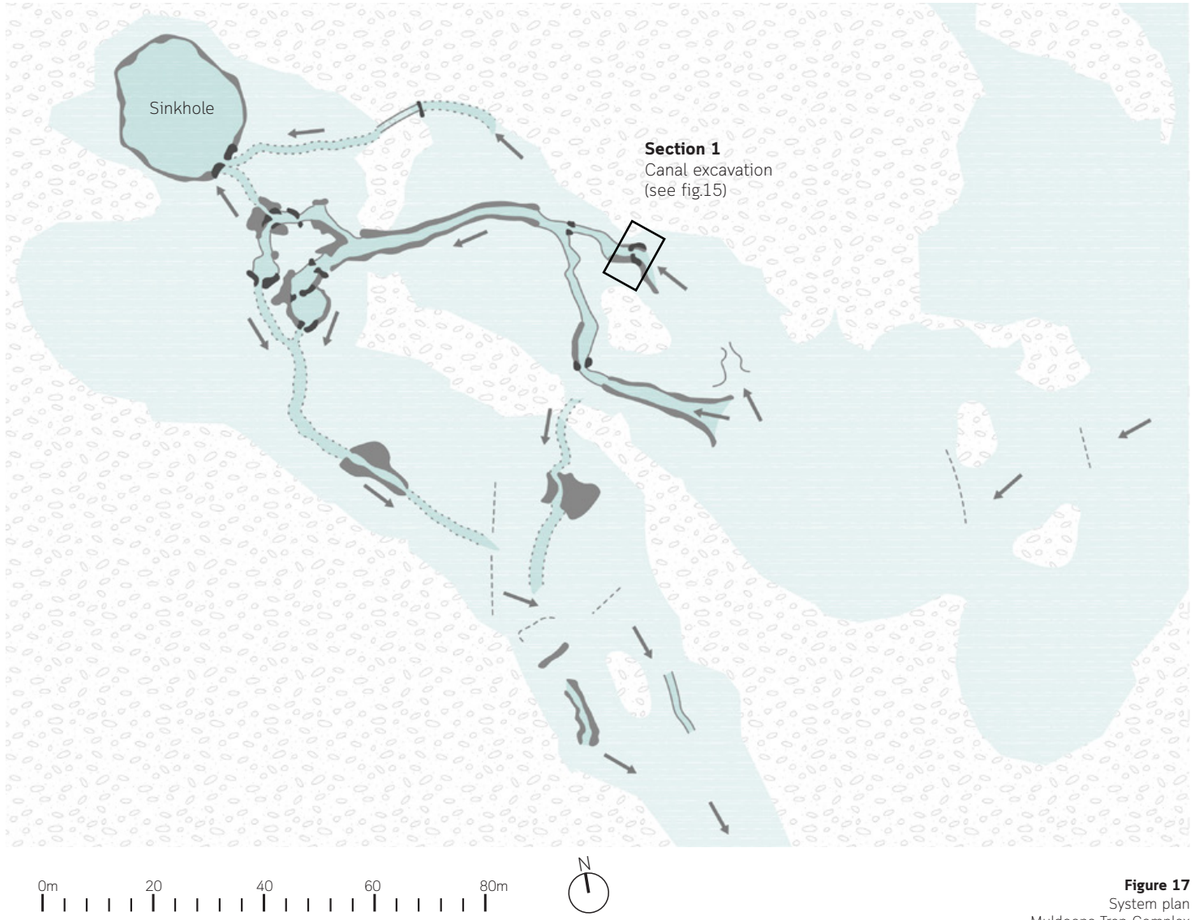


Figure 17
System plan
Muldoons Trap Complex

Circularity.

One of the most remarkable aspects of the Gunditjmara people is their extensive knowledge and understanding of their land. This knowledge was passed through generations through oral transmission for thousands of years, and allowed them to obtain an active and profound relationship with nature and the living beings that surround them.

The productivity of the system as well as the settlement of the communities was largely determined by the different seasons. Another factor that was key for the productivity of the system is the understanding of the eel's life cycle and their migratory behavior. The kooyang (short-finned eels), spend the majority of their life cycle in fresh waters but return to their spawning grounds along the Coral Sea. The eels have five stages in their life cycle, as adults they migrate to the sea during summer and autumn for spawning, and return to the fresh water during winter and spring.

Because the eels returned to fresh waters during the winter, this meant the population was more sedentary around this time. They remained close to the water, creeks and ponds, where they had more food resources. One of the main objectives of this system was to extend the time in which eels are available. The construction of canals, races and weirs allowed them to control water and eel flows, an example of this is the adaptation of the sinkholes, where they could keep eels for capturing when needed. During the summer, when eels migrate to the ocean and water levels decrease in the wetland, the communities would be more mobile, having temporary camps along the coast and diversifying their food sources.

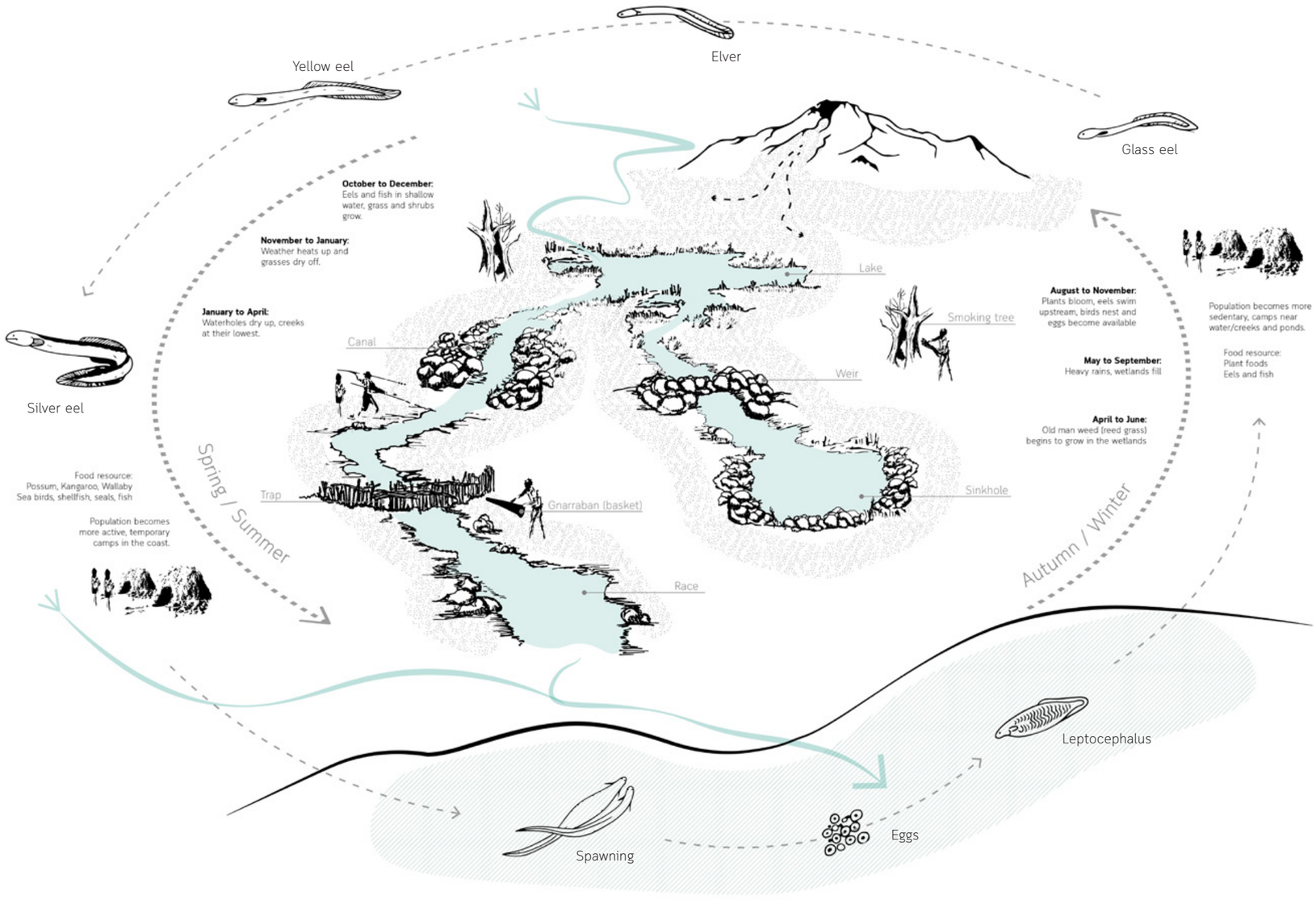


Figure 18
Water cycle and eel growth cycle in Gunditjmara Country.

Conclusion.

Ethnographic and Identity values - This system remains an important part of the cultural identity for the Gunditjmara people. It reaffirms their presence in the land from thousands of years ago, and the extensive knowledge of their environment continues to be carried through generations.

Landscape Value - The system is born because of the changes and special characteristics within the landscape. The major input for the system is found within the land, the materials, the soil and the water. The human activities and movement are determined by the functioning of the larger system.

Functional Value - The system provided the main economic and social base for the Gundtijmara people for thousands of years. The system also allowed them to manage the water during heavy rain winters.

Sustainability Value - The system entirely uses materials which are found locally within the same natural resources. The knowledge of the Gunditjmata people in regards to the natural cycles allowed for the understanding of scarcity and abundance of resources, and working with nature instead of against it.

Strategic Value - The location of the system is in favour of the natural course of the water, taking advantage of the topography and soil conditions resulting from the volcanic eruption and lava flow. This condition also allows for the use of Basalt rock for most of the structures within the system. Other materials grow naturally on the site.

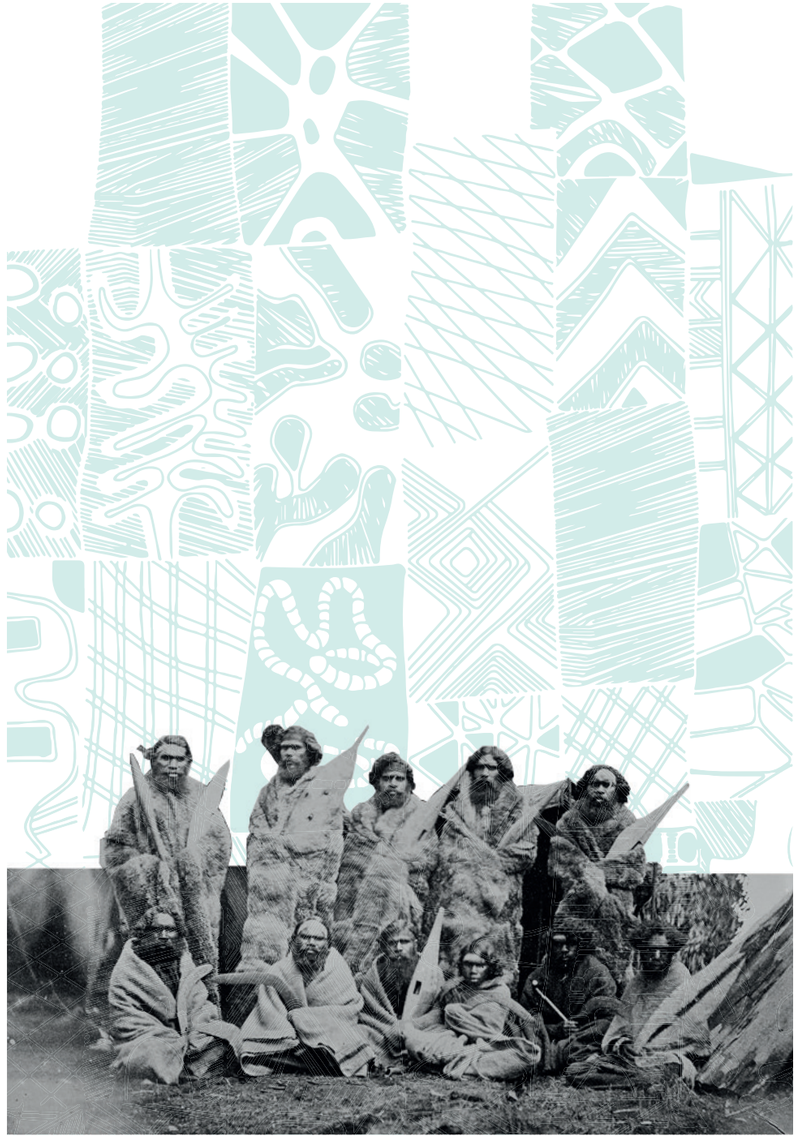
Architectural Value - It presents a remarkable knowledge and experience within hydrology and the natural processes surrounding the site, being present and functioning for 6000 years. The construction and materials adapt to the natural landscape and the use.

Lessons to learn - This system is a clear example of the overlapping relations between culture and landscape. The land became the primary source of knowledge, the understanding of the land became their most important message to pass down. This knowledge not only meant the economic survival of a community but also the tangible representation of their identity and their life.

From this system we can learn the importance in the knowledge of spatial and seasonal distributions that allow for a sustainable and coherent use of resources and can be matched with active and diverse human conditions. The understanding of biological cycles, in this case the behaviour and migratory patterns of animals, is key to adapt water systems into responding to these behaviours, adjusting in order to allow for increased or decreased productivity, depending on the needs.

Essentially, this system exemplifies a dimension of an eco-cultural landscape, where local ecology is not significantly altered, yet it is strategically enhanced, resulting in a more sustainable and resilient management of the land. It shows that a highly functional system does not need large and strongly invasive alterations in nature and can be built and sustained with only local resources.

Finally, it also exemplifies the value in maintaining and spreading traditional ecological knowledge, where both tangible and intangible factors create a distinctive cultural landscape that should always be present in the future developments of the land.



Eel aquaculture Gunditjmara Country

References.

Project 10 - Eel Aquaculture, Gunditjmara Country.

Australian Climate Averages - Rainfall (Climatology 1961-1990). (n.d.). Commonwealth of Australia 2020, Bureau of Meteorology. Retrieved December 3, 2019, from http://www.bom.gov.au/jsp/ncc/climate_averages/rainfall/index.jsp?period=jan&area=vc#maps

Bell, D and Johnston, C (2010). Budj Bim - Caring for the spirit
and the people: Finding the spirit of place. In: Spirit of Place: Between Tangible and Intangible Heritage, Turgeon, L (ed.), Les Presses de l'Universite Laval, Quebec.

Builth, H (2004). Mt Eccles lava flow and the Gunditjmara connection: a landform for all seasons. Proceedings of the Royal Society of Victoria, 116(1), 165-184.

Builth, H (2006). Gunditjmara environmental management: The development of a fisher-gatherer-hunter society in temperate Australia. In: Beyond Affluent Foragers, Kim, J, Grier, C and Uchiyama, J (eds), pp. 4-23. Oxbow Books, Oxford.

Builth, H., Kershaw, A. P., White, C., Roach, A., Hartney, L., McKenzie, M., Lewis, T., & Jacobsen, G. (2008). Environmental and cultural change on the Mt Eccles lava-flow landscapes of southwest Victoria, Australia. The Holocene, 18(3), 413-424.

Dept. of the Environment and Energy (2017). Budj Bim Cultural Landscape: World Heritage Nomination. Department of the Environment and Energy. Canberra, Australia.

Gunditj Mirring Fact Sheets. (n.d.). Gunditj Mirring Traditional Owners Aboriginal Corporation RNTBC. Retrieved November 5, 2019, from https://www.gunditjmirring.com/gunditj-mirring-fact-sheets

McNiven, I., Crouch, J., Richards, T., Sniderman, K., Dolby, N., & Mirring, G. (2015). Phased redevelopment of an ancient Gunditjmara fish trap over the past 800 years: Muldoons Trap Complex, Lake Condah, southwestern Victoria. Australian Archaeology, 81(1), 44-58.

McNiven, I. J., Crouch, J., Richards, T., Dolby, N., & Jacobsen, G. (2012). Dating Aboriginal stone-walled fishtraps at Lake Condah, southeast Australia. Journal of Archaeological Science, 39(2), 268-286.

UNESCO World Heritage Centre. (n.d.). Budj Bim Cultural Landscape. Retrieved September 15, 2019, from https://whc.unesco.org/en/list/1577/

Veth, P. M., Weir, J. K., & Australian Institute of Aboriginal and Torres Strait Islander Studies. Native Title Research Unit. (2003). "Abandonment" Or Maintenance of Country? Native Title Research Unit, Australian Institute of Aboriginal and Torres Strait Islander Studies.

Weir, J. K (2009). The Gunditjmara Land Justice Story. Australian Institute of Aboriginal and Torres Strait Islander Studies (Native Title Research Unit), Canberra.

Illustration credits

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