

Transformative nature-based urban and architectural design values for socio-ecological wellbeing and adaptation in New Caledonia

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ABSTRACT

Working with nature in urban settings as a strategy for improving wellbeing offers significant potential for effective climate change adaptation. It is increasingly being explored and utilized in the region of *Moananui* Oceania. In New Caledonia, ongoing social issues pervade many aspects of life, particularly for Indigenous Kanak peoples, including the appropriateness and effectiveness of housing and the urban built environment in general. This paper examines and suggests eco-relational practices for urban and architectural design in a New Caledonian context. To explore transformative nature-based built environment design agendas that link closely to Indigenous ecological knowledge and understandings of wellbeing, research was carried out through a series of interviews and workshops with local people. We examine the usefulness of starting from understanding worldview, local notions of wellbeing, and relationships to nature in urban climate change adaptation work, and suggest a conceptual framework for transformative built environment design practice. We discuss using the Mauri Ora compass research co-design methodologies to bridge cultural differences, political agendas, and varying worldviews and encourage meaningful engagement with eco-centric local and/or Indigenous communities. Key findings include that the communities engaged with, who are largely Kanak, see that fundamental changes must occur in the design and construction of built environments, and that the nature of the changes is not just technical, but fundamentally requires a cultural shift in how people understand themselves to be in and of the living world. The necessary shift, particularly for non-indigenous, was identified as a collective rather than individual reorientation towards a more care-full, respectful, and ecologically regenerative relationship with living socio-ecological systems.

1. Introduction: climate change adaptation, the urban built environment, and socio-ecological wellbeing

The urgent imperative for transformative change in cultural practices, and in the design of architectural and urban structures and systems has been called for by the Intergovernmental Panel on Climate Change (IPCC) [1,2] and the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) [3]. These calls underscore the critical need to address ongoing earth system crises, including biodiversity loss and climate change, which profoundly impact human wellbeing. The built environment both significantly contributes to the causes of climate change and is the main site of impacts given that most humans now live in cities [4].

The people of the Pacific are joined literally, and through ancestry, by the *moana* (Pacific Ocean). As a physical space, the ocean is shared

among Pacific peoples and seen not as something which separates but as something that connects [5]. The *moana* is known deeply and has been expertly navigated by Oceanic peoples for thousands of years [6]. This intimacy, dependence upon, and cultural connection to the ocean is also a factor in the susceptibility to the impacts of climate change of much of the Pacific. Island nations are particularly vulnerable to sea level rise, ocean acidification, and increased storm surge for example, and many of the world's nations most impacted by climate change are located in the region [7]. This means that climate change disproportionately affects *Moananui* Oceania despite the region's relatively minimal contributions to greenhouse gas (GHG) emissions (excluding Aotearoa New Zealand, Pacific nations have contributed approximately only 0.03 % of global GHG emissions) [8].

Indigenous people and vulnerable groups are more likely to be negatively affected and in greater magnitudes by climate change [9].

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Moananui Oceania is inherently an Indigenous place both in its towns and cities and its more remote communities. Aside from New Caledonia, Aotearoa New Zealand, and Hawai'i, a state of the United States of America, the nations and states of *Moananui* are majority Indigenous populations. These factors emphasize that climate change adaptation has significant social justice implications in *Moananui* Oceania [10], and certainly in New Caledonia. This research focuses on New Caledonia where almost half of the population are Kanak (Indigenous) (see Section 1.1). The New Caledonia archipelago is located in the South West Pacific between Australia and the Vanuatu archipelago. The land covers 19,100km². The main island, Grande Terre, is surrounded by a barrier reef 1100km long which encloses a large lagoon [11] (Fig. 1).

Urban climate change adaptation processes, design and implementation must centre Indigenous wellbeing and the wellbeing of the ecosystems they live in relation with. Understanding cultural values and what constitutes a good life for the region's ecosystems and Indigenous peoples, and comprehending and enabling Indigenous knowledge is paramount for effective climate change adaptation and wider socio-ecological wellbeing [10]. Currently, much foreign aid or national government driven adaptation work tends to be motivated firstly by technical considerations, rather than by technical and socio-cultural factors together. There are many reasons why climate change adaptation work should be driven by, or at least take account of Indigenous knowledges and perspectives including localising solutions, building upon proven resilience and conservation strategies for a given place, and legal and ethical obligations. Importantly however, Indigenous knowledge systems can offer holistic perspectives that encompass interconnected social, cultural, and ecological dimensions and may play a pivotal role in catalyzing transformative mindset change [12–14]. This kind of necessary change in worldview or paradigm is called for among regenerative design practitioners [15,16].

Regenerative design is the practice of designing buildings, neighbourhoods, or whole cities so that the ecological and social outcomes are better after development, and indeed because of it. This is in contrast to sustainability paradigms where the aim is to minimise damage, rather than increase health for all living systems and the life within them including humans [17]. Indigenous perspectives can perhaps provide a comprehensive understanding of climate change impacts and adaptation strategies along with biodiversity change, which may be overlooked by conventional scientific approaches. Essentially, integrating Indigenous knowledge into climate change adaptation efforts including built environment design, may enhance effectiveness, regenerative capacity, and cultural relevance, while generating respect and empowerment for Indigenous peoples through meaningful collaboration [18]. These factors could contribute to more equitable and resilient outcomes for people and other life and living systems including those that are not recognised by Western Science as being 'alive', such as oceans, rivers, and mountains). Hulme [19] points out that 'climate policies need to tap into intrinsic, deeply-held values and motives if cultural innovation and change are to be lasting and effective'. It is paramount then that built environment climate change adaptation work centre Indigenous knowledge and wellbeing in *Moananui* Oceania, certainly New Caledonia, and likely in other regions of the world [20].

1.1. Indigeneity in a New Caledonian context

The word "Kanak" has its origins in the word derived from the Polynesian "Kanaka" meaning "human". American and English whalers likely propagated the term verbally between 1800 and 1820, a period where written texts on the subject are lacking [21]. New Caledonia was annexed by France in 1853. When the first French settlers began to arrive in New Caledonia in the 1850s, they began to use the term

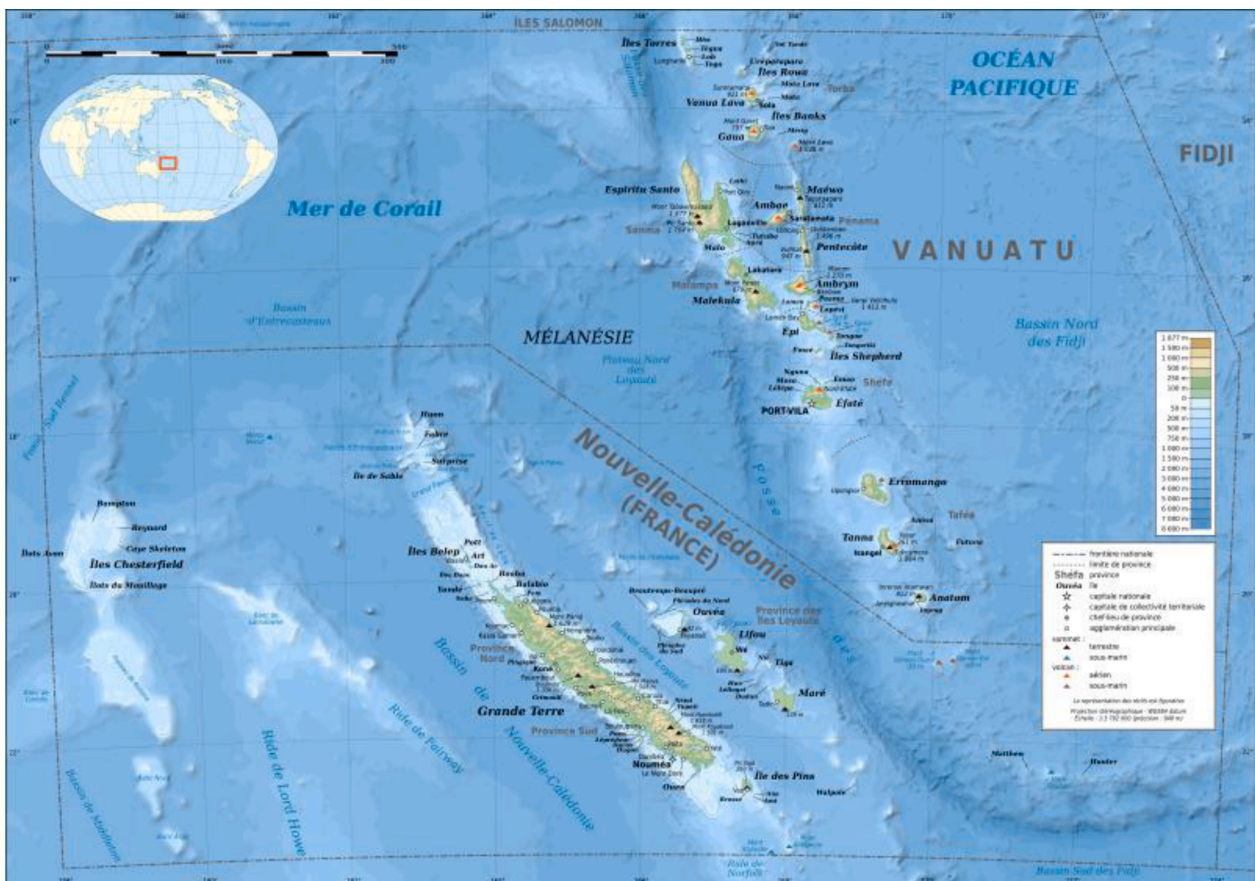


Fig. 1. Map of New Caledonia. Image by E. Gaba, 2009.

"Canaque" to refer to the local inhabitants. This word was laden with pejorative connotations during the early colonial period. Over time, pro-independence activists rehabilitated the term by reverting to its original spelling of "Kanak". This new spelling was made official in 1998 by the Nouméa Accord to specifically designate the Indigenous peoples of New Caledonia [21]. The word "Kanak" is a political and identity-based appropriation of the term "kanaka" by the Kanak independence movement. It symbolises the struggle for self-determination and recognition of the Kanak people and their land [22].

New Caledonia became a significant part of France's empire in the late 19th century. Beyond its strategic importance in the predominantly British-colonised Southwest Pacific region, New Caledonia served as a French penal colony from 1864, receiving 21,600 convicts before the practice ceased in 1897 [23]. By that time, the colony's abundant mineral resources, notably its nickel reserves, had become apparent. Presently, New Caledonia ranks as the world's third-largest nickel producer [24].

The impacts of colonisation are complex and ongoing in New Caledonia and have left a lasting legacy of systemic inequity for Kanak peoples [23,25]. With the introduction of the Code de l'Indigénat in 1887, communities were dispossessed of their names and their land, and wide-spread displacements ensued [23]. This led to a loss of livelihoods and sacred sites for Kanak clans, ultimately causing identity crises and disruption of Kanak social structures. Population movements fractured traditional hierarchies, often disregarding legitimate authorities and imposing unfamiliar powers, further exacerbating negative outcomes. Additionally, Kanak cultural heritage was either denied or plundered, compounding a denial of identity [26]. In addition to these injustices, Kanak people faced restrictions on civil liberties and political exclusion, despite their significant troop contributions during World War I for example [27]. They were pushed to the margins geographically, economically, and politically, fueling uprisings that were often brutally suppressed, intensifying resentments and misunderstandings. Colonialism severely undermines the dignity and identity of Kanak peoples, resulting in tragic loss of life and intergenerational suffering [26].

In 2019, the number of people identifying as Kanak rose to 111,860, compared with 104,960 in 2014 [28]. This was the first time since the Matignon Accords were signed, that the Kanak share of the New Caledonia population rose, reaching 41.2 % compared with 39.1 % in 2014. Some sources indicate the Kanak proportion of the population reached 45 % in 2023 [23]. This increase can be explained in part by the significant emigration of non-Indigenous people. Kanaks now account for 95 % of the Loyaltian population, 72 % of the North Province and 29 % of the South Province. They are in the majority in all the communes on the east coast of Grande Terre and the west coast of the North Province, with the exception of Koumac and Pouembout. Over the past five years, the Kanak community has grown mainly in the South Province, where 52 % were living in 2019, compared with 49 % in 2014 and 39 % in 1989. At the same time, the proportion of Kanak living in tribal areas has fallen steadily, from 51 % in 2014 to 48 % in 2019, compared with 65 % in 1989. The tribal population has thus fallen from 61,000 to 57,000 in five years [28]. This is due to a rural exodus among Kanak peoples seeking work and better education opportunities for their children. Secondary schools are concentrated in Grand-Nouméa, and certain academic courses are only available in Grand-Nouméa. This means that appropriate urban housing for the urbanising Kanak population living outside their own tribal areas is increasingly important.

The Kanak people belong to the Melanesian group, characterised by a social structure based on clans and customary ties established over thousands of years across Grande Terre (the main island), the Loyalty Islands and other islands of New Caledonia. The Kanak language group comprises 28 distinct languages, eleven dialects, and one Creole (a mixture of two languages) language, with French as the common language of communication. Vernacular languages play a vital role in the process of passing on Kanak knowledge from one generation to the next. These rich, complex languages are key to understanding the Kanak

people's visions of and relationship with nature. Concepts of human and nature are sometimes specific to each clan, tribe or customary area. The social structure of Kanak society is based on customary organisation, with the clan as the fundamental unit. These clans are grouped into tribes, which in turn form part of customary districts, which are grouped into customary areas (Fig. 2). Kanak territory is therefore organised differently from French administrative boundaries. Kanak spatial boundaries are divided based on cultural areas, i.e. customary areas. These are: Hoot Ma Whaap; Ajië-Arhö; Drubea-Kapumè; Xaracùti; Paicì-Cèmuhi; Iaai; Drehu; and Nengone.

Among members of the Kanak community aged 14 or over, 80.3 % are fluent in one or more Kanak languages, while 12.6 % claim not to speak but to understand at least one language, and 7.1 % neither speak nor understand any Kanak language [28]. 30,800 people claim to be of mixed race. The number of people of mixed race, which was stable between 2009 and 2014, rose from 9 % to 11 % between 2014 and 2019. Two-thirds of mixed-race people indicated belonging to two communities and 15 % three communities. Of the *Métis* (mixed race) people who indicated two communities, nearly 5,000 said they were European and Kanak, 2,200 were Kanak and Wallisian-Futunian, and 1,600 were Kanak and Tahitian. As a result, in 2019, Kanak and mixed-race Kanak represented 47.2 % of the population, compared with 43.0 % in 2014 [28,29].

1.2. New Caledonia, urbanisation, and the built environment

Urbanization, particularly around the nation's main urban centre, Nouméa is a significant spatial trend. Almost two thirds of people in New Caledonia live in Greater Nouméa [30]. Urbanization presents both opportunities and challenges for the Kanak people, influencing demographic trends, cultural dynamics, socioeconomic conditions, land tenure rights, cultural self-determination efforts, and environmental sustainability. There is increasing Kanak urbanisation centred largely on Nouméa, and driven by the seeking employment and education opportunities [31]. Recognizing and addressing the specific needs and aspirations of Kanak urban populations is therefore essential for promoting inclusive and sustainable urban development in the territory.

The influx of people into urban centers can also lead to demographic shifts within non-urban Kanak communities. Like any group, urbanization has brought about cultural changes for the Kanak people, as traditional practices and values evolve or adapt in urban settings. This may involve challenges in maintaining cultural identity and connections to ancestral lands, as well as preserving or creating opportunities for cultural exchange and revitalization within urban Kanak communities. One issue highlighted (discussed in Section 2 further) is the absence of easily accessible gathering spaces for Kanak people in Nouméa to engage in cultural practices. Urbanisation can bring economic opportunities, however urban Kanak communities often experience socioeconomic disparities compared to non-Kanak peoples, including higher rates of unemployment, poverty, and less access to essential services such as education, healthcare, and housing [23]. Effective housing for urban Kanak has to address these important social-justice elements. Furthermore, urbanization in New Caledonia has raised questions about land tenure and ownership rights for Kanak communities, particularly as urban expansion encroaches upon traditional Kanak lands and ecosystems, and the legacy of forced removals still requires redress [23]. Ensuring the recognition and protection of Kanak land rights in urban planning processes is essential therefore for preserving cultural heritage and addressing land-related grievances and decolonisation in general. Although there is the often cited and excellent example of the Jean-Marie Tjibaou Centre to the north of Nouméa, designed by Renzo Piano in 1998 (Fig. 3), efforts to promote cultural revival or increased social wellbeing within urban Kanak communities (who are themselves diverse), may need to expand further, and certainly beyond housing itself, to include social initiatives such as establishing (more) cultural centers, gathering spaces, language revitalization programs, and other



Fig. 2. Map of customary areas and Kanak languages (source: Académie des Langues Kanak, 2015).

Kanak community-led initiatives. Such initiatives need physical infrastructure, including buildings, which must be woven into the wider urban fabric within the context of climate change. This highlights that it is not just housing, or indeed buildings, but urban design that must evolve in Nouméa in particular, but also in other New Caledonia towns, to reflect the priorities and identities of Kanak peoples.

1.3. Working with nature for urban climate adaptation in New Caledonia

Designing nature into urban environments brings with it multiple co-benefits. Such an approach can tie together urgent urban climate change adaptation, transformative regenerative built environment design initiatives, and Indigenous knowledge and priorities. Nature-based Solutions (NbS), are defined by IUCN as ‘actions to protect, sustainably manage, and restore natural or modified ecosystems, that address societal challenges effectively and adaptively, simultaneously providing human well-being and biodiversity benefits’ [32]. Calls have been made to contextualise this definition more carefully to the region of Moananui Oceania [10], however experts agree that NbS offer significant potential for effective climate change adaptation and are increasingly being explored and utilized in Moananui Oceania [33]. Given the unique relationships Indigenous peoples tend to have to nature, which form part of underlying worldview and values, NbS may also act as a kind of bridging between cultures and may have a place in social justice agendas. Whether this is true or not is still being tested in Moananui Oceania, and is yet to be seen in New Caledonia, but it is certain that working with nature in the region does have deep meaning for Indigenous people and potentially political implications also [10]. An example is that if a group of people consider the ocean to be alive and possessing a certain spirit or life force, and if creatures within it also have deep cultural significance, both of which are true in New Caledonia [31], then actions to change or rehabilitate the ocean, such as through coral reseedling, or the use of artificial breakwaters, both known NbS, will have additional cultural implications and meaning. This is in

comparison to if these strategies were used in a place where people do not have these same relationships to the ocean. If we then consider the cultural harm degradation of ecosystems has on some Indigenous peoples that feel a connection or even literal kinship to these ecological elements, including rivers, mountains, and oceans, actions to restore these to health can be healing of relationships between groups that have been damaged through colonisation or other means [10]. This relationship repair can even be enhanced by careful species selection for NbS interventions [34].

It is crucial then that local relationships to nature are carefully understood when working with Indigenous people for climate change adaptation. This was the basis for the beginnings of our work to consider transformative urban and architectural design in New Caledonia. That is, starting future adaptation design work by seeking to understand relationships to nature and local notions of wellbeing. The aim of this research therefore was to explore interconnected social, cultural, and ecological wellbeing for Kanak peoples in New Caledonia to deepen the understanding of relationships to nature and cultural values as a foundation for transformative built environment design. Recognizing the complexity of ecological, climatic, and cultural challenges faced by Indigenous communities, policymakers, urban governance leaders, and building industry professionals, this study sought to address the fundamental question: Is climate adaptation fostering a future where cultural uniqueness and social justice are pillars of wellbeing, or could it inadvertently perpetuate neo-colonial agendas? Through an examination of community perspectives on the relationship between people, place, and the living world, this research sought to elucidate pathways for maintaining or revitalizing ecological and socio-cultural wellbeing through built environment design in New Caledonia.

Taking a departure from conventional approaches to urban climate change adaptation, this research emphasizes that working with nature is widely regarded as pivotal to successful climate adaptation strategies, particularly when informed by Indigenous knowledge [10,18]. It acknowledges the inherent wisdom found in Indigenous Oceanic



Fig. 3. Jean-Marie Tjibaou Centre, Nouméa, New Caledonia. Photo by Pedersen Zari, 2023.

communities' harmonious relationship with the environment, underscoring the necessity for a contextualized and culturally specific approach to urban development and climate adaptation [20,35].

1.4. Positionality

An aspect of decolonizing research practices is to make the positionality of researchers apparent [36,37]. Yates is Ngāti Rangiwewehi, Ngāti Whakaue, Te Aitanga a Māhaki and Rongowhakaata from Aotearoa, New Zealand. Pedersen Zari is Pākehā (a person of European descent) from Aotearoa New Zealand. Juni is a Kanak person from the island of Drehu, from the Inagoj tribe in the Lössi District. The research was conducted in collaboration with the New Caledonian Government's Construction Department and a larger 'Oceanian Habitat' project [38], resourced by the Pacific Fund of the French Ministry of Foreign Affairs, which promotes social, economic, scientific and cultural development and integration in the Pacific. The part of that larger research, which is reported on here is in turn based within two larger research programmes, NUWAO and the BBHTC Urban Wellbeing programme, both run from Aotearoa New Zealand. The Nature-based Urban design for Wellbeing and Adaptation in Oceania (NUWAO) research programme was a Marsden project funded by the New Zealand government through the Royal Society of New Zealand and led by Pedersen Zari. NUWAO's aim is to develop nature-based urban design solutions, driven by Indigenous knowledges that support climate change adaptation and individual and community wellbeing in diverse urban settings in *Moananui* Oceania [10]. The Building Better Homes, Towns and Cities (BBHTC) Urban Wellbeing programme was a National Science Challenge programme also funded by the New Zealand Government and led by

Yates. The programme researched how cities and communities can broadly transition to more resilient and regenerative systems, particularly within the context of complex ecological emergencies. Indigenous knowledge of ecological, social and cultural wellbeing is central to the programme [13,39].

We have used Kanak words throughout the paper. There are 28 Kanak languages across New Caledonia though French tends to be the lingua franca between peoples and occupies the hegemonic position [40]. Non-English words are in italics in this article followed by a translation in brackets to English where they first appear. We use the term *Moananui* alongside Oceania rather than terms such as Micronesia, Polynesia, and Melanesia in an effort to follow Hau'ofa's [5] concept that *Moananui* (the Pacific Ocean) is what connects Oceanic peoples rather than separates them and to follow calls to decolonise language used to describe peoples of *Moananui* Oceania.

2. Methods

Workshops and interviews were held in Kanak communities in both urban and semi-urban settings in New Caledonia from the 8th to the 19th of July 2023 in order to understand:

- Indigenous perspectives on relationships between people, land, ocean and the living world and how these concepts do or could feed into transformative change. We also talked to social housing workers and youth workers in Nouméa.
- Place-based and culturally specific perceptions of social, cultural and ecological wellbeing, and what underpins Kanak wellbeing in relation to the built environment.

- How ecological, social, and cultural wellbeing could be enhanced from Kanak perspectives and how such wellbeing concepts could lead to changes in normative practices of built environment design. Key contexts for this research are complex current challenges including widespread ecological degradation, bio-simplification, climate change, and human wellbeing deficits at housing, neighbourhood and city levels.

A total of five workshops and one presentation to key government representatives were conducted:

1. Workshop 1: 12th July at Koné with representatives of the local Kanak community.
2. Workshop 2: 13th July at Magenta Towers in Nouméa with provincial housing services and social workers, and the Kanak President of the Towers community.
3. Workshop 3: 17th on Drehu (Lifou) Island with representatives of the local Kanak community.
4. Workshop 4: 18th July at Direction de la Protection Judiciaire de l'Enfance et de la Jeunesse (Directorate of Judicial Protection of Children and Youth) (DPJEJ) in Nouméa with social workers and Kanak youth.
5. Presentation: 18th July in Nouméa to national and regional government representatives.

Attendance at the workshops resulted from a combination of an open invitation to the community and targeted invitations to key community members. Attendance varied in relation to the nature of community engaged with. Smaller groups had smaller workshops (8 – 10 people). Workshops at Koné and Drehu, held in community communal spaces, had relatively large attendance (25-30 people). Some workshops, such as those in Koné and Drehu, were solely attended by the Indigenous communities, while other groups such as those of Magenta Towers and the DPJEJ represented the mixed communities associated with those spaces. Kanak voices were heard, and acknowledged in those mixed group meetings, and the discussion between cultural groups specifically addressed cultural differences bringing attention to the Indigenous as a model for ecological connection. Most of the community spoke English as well as French and/or Kanak. However, Kanak and French comments were transcribed, and language translation was provided both during the session and thereafter when reviewing the interview material. Where particular concepts to do with cultural knowledge and socio-ecological concepts were being discussed in Kanak, particular time and attention was taken to discuss, translate and communicate in Kanak, French and English. The intention was to work collectively to discuss place-based knowledge in a way that enabled basic understanding of thinking without breaking the protection of sacrosanct cultural knowledge. Large format posters, in French, outlined the key questions of each workshop, and provided a storyboard on which to post community responses garnered during the sessions.

The research methodology involved discussion-based co-creation sessions with local communities in which simple urban wellbeing 'Mauri Ora compasses' were developed. The Ngā Tohu Mauri Ora urban wellbeing compasses are part of Aotearoa National Science Challenge urban regeneration research led by Yates. The compasses are designed as community discourse and collaboration tools. Compasses are developed in collaborative workshops with diverse communities including with Indigenous kinship groups, neighbourhood groups, school communities, businesses or Councils. Discussion focuses initially on how participants understand their relationship to local ecosystems, what matters to them, and what brings resilience, resource, or joy in their lives. Ideas of *mauri*, as life-field, and *mauri ora*, the wellbeing of that life-field, are discussed. An understanding of the inseparable connectivity of the living system of the planet is inherent to these ideas; earth, sea, sky, mountains, rivers, birds, fish, insects and humans, all together, in exchange. Subsequently, focus shifts to what principles and actions can enable positive wellbeing-

centered change in their communities or domains of endeavour. The compasses are intended as transition tools that help reorient from current human-centric to more Indigenous or regenerative eco-centric cultural models [13,39].

The compasses are rendered as a complex visualisation focusing on *mauri ora* (social and ecological wellbeing) and depicting a range of principles and actions to enable just and wellbeing-centered urban system changes. Five key domains of transition are depicted as concentric circles or a helix. Ecological regeneration is the outermost circle. Example actions for change identified here include the need for enhanced local biodiversity and blue-green infrastructures. Zero-carbon energy is the next transition state. Wellbeing-centered actions here emphasise system shifts to renewable zero-carbon energy for both buildings and transport. A regenerative circular economy is the next transition state, focusing on actions for non-toxic materials and systems. More connected urban communities is the next helix, signposting the transitional value of active transport, walkable and bikeable communities, and more third-space or public infrastructures. Finally, the innermost circle addresses regenerative buildings that bring together all the transitions noted above as they work with ecological systems, generate energy, harvest water, utilise non-toxic materials, and where possible include intergenerational or co-housing models [13,39]. The visualisation summarises all five transitional domains; in ecology, energy, economy, urban community and built environments, as well as strategic actions for change in order to resource communities with their own self-made wellbeing-centered transition plan (Fig. 4).

The compasses are important as a system change methodology because they:

1. Are cultural not socio-technical change tools. Compasses presuppose that we will not heal current ecological rifts with the same human-centric cultural framework that created current socio-ecological crises.
2. Acknowledge the fundamental strategic and ethical importance of eco-relational cultural systems that afford care and respect to the living world, to earth, sea, sky, ocean, and other living entities.
3. Blend an 'ontological' order of eco-relational care with a systems-level analysis of what urban domains need to change and note pragmatic strategies or 'actions' to effect that change on the ground.
4. Enable and support local place-based knowledge and community capacity to lead sensitive and effective change.

Face-to-face participatory workshops are part of the compass co-creation process. The intention here is that the workshop process supports the voices of communities and their existing knowledge and intentions for wellbeing-led change. In the context of New Caledonia, this engagement process sits well with the Kanak emphasis on collective discussion and oral knowledge transfer. The spoken word is of profound importance in Kanak life and is central to 'a whole way of being, a philosophy of living, a way to navigate one's relationship with the universe' (Poedi, in [42]). An emphasis on discussion and storytelling, and relational practices is common (though in varied forms) among Indigenous people of *Moananui* Oceania. This is encapsulated by the Samoan term *vā* [43]. Simplistically, in this context, *vā* means the relational space of exchange between peoples and between people and the living world [44]. Other similar, but diverse examples of important relational principles in *Moananui* Oceania include *sautu* in Fiji, *fakaaloalo* in Tuvalu, *fakaapaapa* in Tonga, and *piri'anga* in Niue [45]. Essentially, the process of engaging and building relationships, and of building trust and rapport is of great importance in *Moananui* [46]. To honour this aspect of relationship building, and create special spaces to discuss important questions, the primary researchers, both from Aotearoa New Zealand, drew upon the Indigenous cultural traditions and language of Aotearoa New Zealand as a way to connect with Kanak peoples, essentially considered distant cousins over the *moana* (ocean) to *tangata whenua* (Indigenous peoples of Aotearoa). We began workshops with *karakia* (Māori chants).

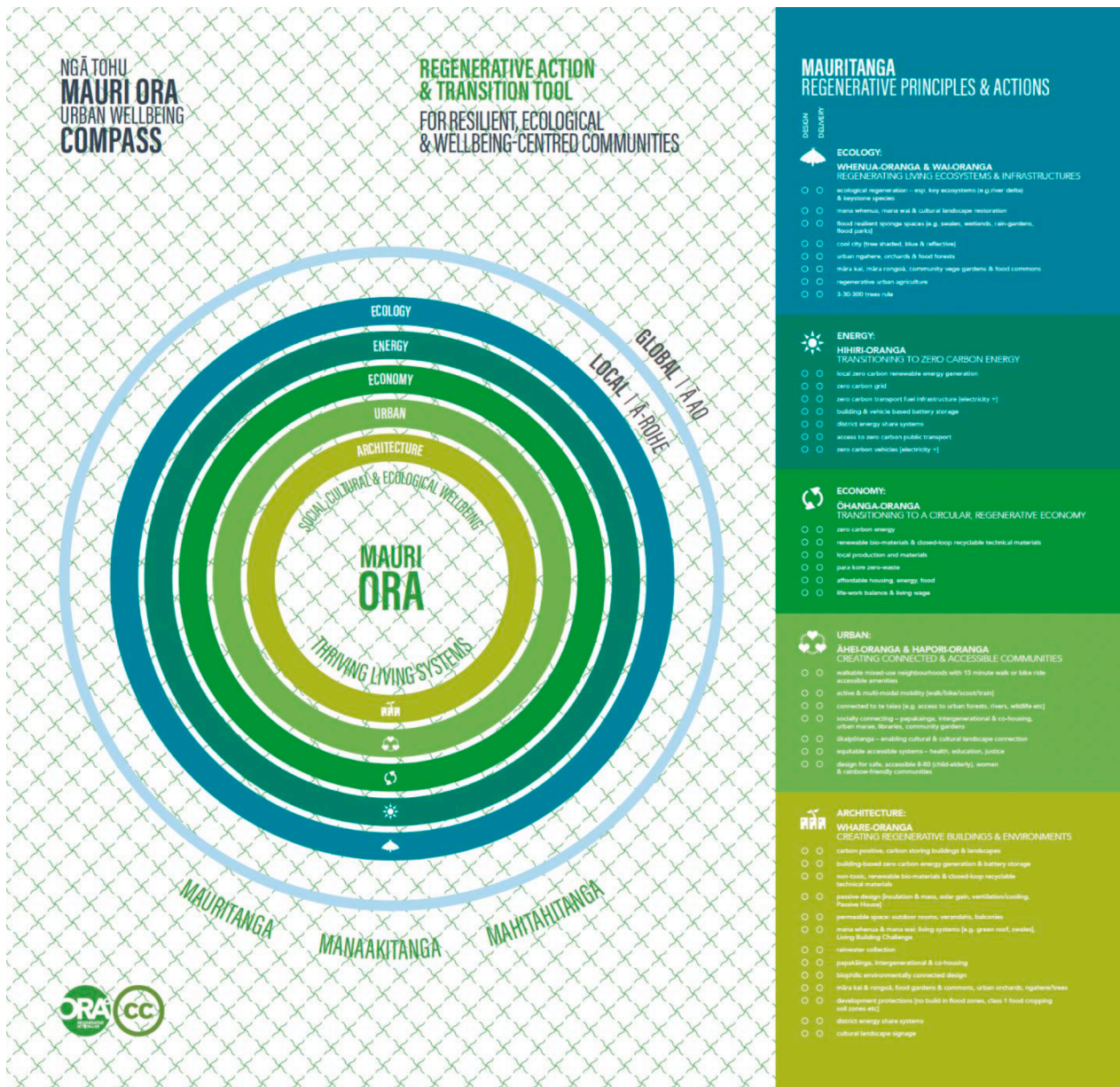


Fig. 4. Ngā Tohu Mauri Ora urban wellbeing compass. Yates, A., Powley, C. (Clarke, K., Grieve, F.), 2024.

Introductions or greetings to local lands and waters as venerated entities, and to local people were important to establish rapport and transparency. Workshops ended in most cases with *waiata* (song) as a way to pay respect to participants and their knowledge and contributions and to close the event in a culturally appropriate way.

The New Caledonian workshops explored cultural and local wellbeing knowledge and principles, and revealed pragmatic actions for built environments designed with social and ecological care and wellbeing in mind. Sessions revealed local place-based and traditional cultural understandings, or *kustom* (traditional) [41] thinking about the relationship between people and the ecosystems they are part of, live within, have kin-ship with, and rely upon for air, water, food, shade, material resources etc.

The first question asked in the workshops was “what is the relationship between people and the living world”. With this we aimed to map *Moananui* (Oceanic) connections as we discussed the idea of *mauri* (life-field or social-ecological connectivity), and other similar concepts found across *Moananui* Oceania, and also Asia. We asked participants how they understood themselves in relation to the living world they

inhabit; the sea, sky, earth, forest etc. In asking these questions we sought to determine whether participants saw the world around them as an inanimate resource available for extraction, or as a living entity that required a care-full relationship. Two further questions explored how their oceans, land, and sky could be healed, and what it meant to live well in their communities and environments.

In the action focused section of the workshop the three initial questions set the cultural and pragmatic ground for specific actions that could be taken to enhance wellbeing and shift current unsustainable systems. Ancient customs and highly contemporary actions for social and ecological wellbeing were proposed by attendees as important ways to change business-as-usual urban and built environment design and initiate system transitions. Workshop findings and co-created actions were documented during the workshops using compass posters as visualisations that brought together complex approaches to change (Fig. 5). Workshops focused to three key transition areas - ecological regeneration, energy transition and mobility, and regenerative buildings - to enable sufficient depth of discussion within the available time.



Fig. 5. Mauri Ora compass posters. Designed by Yates and Powley, photos by Pedersen Zari, 2023.

3. Results

The following is a detailed summary of some of the co-creation workshop discussions. The discussion was transferred to notes, which were added to posters, pictured below, for each workshop. We also include here the transformative action findings from the workshops. Workshops were done in Koné and Nouméa (Magenta Towers & DPJJE) on Grande Terre and on the Island of Drehu.

3.1. Koné Kanak community

The town of Koné is situated in the North of Grande Terre. Koné is a small urban centre servicing a wider rural area with a significant Kanak community. Kanak in Koné are mostly forest people from the mountains. The customary area is Païci-Cèmuhi. A collaborative compass workshop process was held in Koné by the team focusing on Indigenous thinking for wellbeing and living systems vitality in a built environment context. Approximately 30 people attended the Koné workshop, sited in the local community event centre on the periphery of the town. The Mauri Ora compass process began by identifying how participants understood their relationship to place, whether as resource or as venerated ancestral kin. Posters posed questions, and workshop responses were recorded and also captured via notes placed onto the posters. The summarised discussion as well some notable terms are summarised below for each question.

Question 1: What is the nature of the relationship between people and the living world?

People discussed several aspects of human-nature relationships and used specific words to try to explain relationships between people, nature, and buildings:

- A clan’s element/totem is their foundational spirit. Clans are linked to their totem ‘like a mirror’. This link is established ‘through birth and death’. This knowledge is not shared. It is an important responsibility of the clan to protect their totem (e.g., sun, moon, whale, thunder).
- Clear water is important to indicate good / pure energy. This can be termed *pwéla jawé*.

- *Wādé* is possibly similar to a term like *mauri* (a Māori word), meaning the life force between things.
- *Wāo* means hutt as well as clan / nature / ancestors. Lashing, used to connect building elements, signifies links between people and the natural world.
- The endemic cordyline can protect homes ‘from bad energies’. Coconut trees symbolise women. New Caledonia pine (*araucaria columnaris*) symbolises men and is used to form pathways to buildings. Trees are used to ‘make a bridge to ancestors’.

Question 2: How can your ocean, beaches, forests, earth and sky be made well, vital, and healthy?

Negative changes to the ocean and rivers have been seen by people and this was of great concern. People noted that fish are disappearing. Cows, mining, bush fires, clearing of forest, and dams, are all seen as major ecological issues that impact people spiritually and practically. For example, rocks put into rivers from mining are believed to lead to floods, while the dams prevent normal movement of fish. The biodiversity crisis was seen in the presence of more weeds in the forests. In direct answer to the question posed, people mostly discussed practical ecological regeneration measures such as:

- Regeneration of mangroves.
- Regeneration / replanting of the forest, and addressing invasive species.
- Removal of marine pollution sources.
- Addressing river pollution and flooding issues that stem from mining, damming, and forest clearing.

Question 3: What brings wellbeing or makes a good life for your community?

The conversation then focused specifically on people and community wellbeing.

- Living together in the tribe. One person noted that ‘there is space, so there is freedom’, and that ‘There is no loneliness’ (unless there is temporary family conflict).

- Having and following the rules of the clan. These demonstrate respect for people and the environment. This enables freedom.
- Having a healthy forest. People noted that the soil feeds them and that It feels good to be in the forest and ‘kiss the trees’.
- Having fresh water. This was clearly linked to the health of the forest and the health of people. Clean water is a key indicator of a healthy environment, and healthy clan.

Question 4: Focusing on where you live, what actions can bring wellbeing for humans and nonhumans?

In the action focused section of the Mauri Ora compass workshop, participants determined priority key actions for regenerative change. Comments were recorded and transcribed onto posters live during the discussion. We have summarised these actions for wellbeing-led system change into three themes:

Ecological Regeneration & Community Connection:

- Begin a process of ecological regeneration, particularly of key ecosystems and keystone species. The health of local rivers is of vital importance.
- Develop flood resilient strategies for areas of settlement.
- Create walkable neighbourhoods with appropriate shared local amenities such as green-grocers, food hubs, and community spaces.

Zero Carbon Energy & Enhanced Access/Mobility

- Produce zero-carbon energy such as from solar and/or wind sources locally.
- Introduce free or subsidised zero-carbon public transport (buses & car-share for example).
- Though currently thought to be too expensive, investigate use of zero-carbon fuelled cars. Increase use of bikes and horses (currently well used) where appropriate.

Regenerative Housing & Neighbourhoods

- Construct intergenerational and co-housing for extended families with shared amenities such as community spaces, laundries etc.
- Design and construct carbon storing buildings made from timber and renewable materials for example.
- Investigate greater use of green roofs, rainwater-gardens, and strategies to increase freshwater storage.

- Develop community vegetable gardens, food commons, and/or urban orchards.

3.2. Nouméa, Magenta Towers, specialised housing professionals, and president of the Towers community

Magenta Towers is a high-rise social housing development, located in the north-east of Nouméa. The Towers community is diverse, but has a significant number of Kanak peoples who have come from rural areas of Grande Terre or outer islands. Approximately eleven residential towers are distributed around a central green space which also holds a community centre and vegetable gardens (Fig. 6).

A team from the larger ‘Oceanian Habitat’ project had interviewed Magenta residents earlier in 2023 [38]. In this follow up workshop, we engaged in an interactive discussion framed by the Mauri Ora Compass posters and questions. Approximately fifteen people attended the workshop, sited in the community centre on the Magenta site. Attendees were of mixed cultural origins including Kanak, French born on the island, and continental French people. We asked three key questions and summarise answers below. These questions, particularly the first one, revealed differences that tended to stratify across those cultural settings.

Question 1: What is the nature of the relationship between people and the living world?

- Ancestry is the link to the earth and the living world. Healing people can occur through housing / thinking about space.
- People need to connect to nature and to walk barefoot more ‘because this relieves stress and connects us to soil’. People are dependent on the connection to the clean sea, blue sky, earth, and gardens to feel well. Natural light is very important to feeling good.
- There is a well recognised ‘obvious’ connection of human wellbeing to ecological health (non-Kanak island-born French).
- The stronger connection to nature in Nouméa is seen by newcomers from Europe as special and they ‘feel lucky’ to live here. ‘Nature is a gift’. ‘It is better for my family’. ‘Birth is the first connection to nature here’. Nature is more powerful and physically immediate in the Pacific. ‘Rain is the last connection to nature in big European cities’ (comments from France-born people).



Fig. 6. Magenta Towers. Image by AFD, 2015.

- ‘My thinking feels very French. There was limited mixing with Kanak at school’. ‘I feel a strong link to nature through the animal world rather than the earth’ (island-born non-Kanak).

Question 2: How can your ocean, beaches, forests, earth and sky be made well, vital, and healthy?

Participants engaged in a general discussion about what was necessary for ecological wellbeing now. A more specific conversation around pragmatic actions for change was then had, in a slight workshop format change due to time constraints. A summary of actions for wellbeing-led system change follows:

Ecological regeneration:

- Regeneration of the ocean.
- Regeneration of common gathering spaces in the city.
- Urban agriculture (‘we have a chance here because this kind of subsistence food growing is still prevalent in Kanak culture’). This needs some governance or organisation.
- Bringing more vegetation into the city. ‘Keep trees in the ground’. A ‘greener’ city is wanted. More shared urban green space in residential areas.
- Think more carefully about collective wastewater treatment and the recycling of water. Water sensitive urban design. More rain water collection.
- Organise activities that enable people to participate in or connect to nature (visits to botanical gardens for example).

Circular Bio-Economy:

- Address the kinds of materials that are used in the built environment (think low carbon). Encourage use of bio-materials.

Accessible & connected communities:

- Have a long term vision that takes into account local and global wellbeing.
- ‘Trust Kanak people to manage the land well’. This may help with tensions that can arise and could lead to more equitable relationships.
- Manage relationships and find balance.
- Reassess urban sprawl and the damage being done to soil. Consider denser neighbourhoods.
- Reconsider the use of cars and large car parks. Many people don’t have cars already. Think about better mobility options. Address the cost and waste of old cars. Create more walking and biking opportunities.
- Rearrange allotment sizes of homes for less impact as part of devising a better programme for social housing.

Question 3: What brings wellbeing or makes a good life for your community?

- The kind, gentle climate here and favourable environment leads to the ability to be outside a lot.
- Spending time in nature and making connections with nature. Understanding the environment. Seeing it and understanding what it tells you about your quality of life (a clean environment means a healthier life for example). An environment that is immediately perceptible to all senses.
- The ability to transfer traditional knowledge. This leads to respect.
- Gathering the wider family together. This makes transmission of intergenerational knowledge easier. Larger homes and communal gathering areas in the city would support this.
- Having a lot of space and being able to move around freely.
- ‘Love, family, and strong relationships to others’.
- Autonomy or self-determination, equality, and support.

- Peaceful relationships (with close family and the rest of society).

Concluding comments:

- The boarding school system may cause a disconnect to traditional knowledge and respect. The means of traditional transfer of knowledge is interrupted.
- ‘I feel different after listening to this talk’. ‘I am happy to see a correlation between the professors’ approach and Indigenous thinking’ (Kanak social worker).

3.3. Drehu (Lifou) island, Kanak community

Drehu island is a half hour flight from Nouméa. Participants included Kanak with local traditional knowledge expertise, and those with expertise in fields such as governance and resource management. The people we engaged with in Drehu described themselves as mostly ocean people. Approximately thirty-five people attended the Drehu workshop, which was sited in the community centre. The summarised discussion will show some notable terms are recorded below for each question.

Question 1: What is the nature of the relationship between people and the living world?

The Lifou community identified strongly with the ocean, as small island dwellers. Conversation focused around the ocean, as a revered entity, and how to relate appropriately to it.

- The sea, the earth, the forests, the mountains, the aquifers are all alive (there are no rivers on Drehu).
- People are aware that the western world sees nature very differently and not as alive.
- Humans are like children to nature, but act too as guardians or like parents in order to offer respect and care to nature and think about the next generation coming.
- Reciprocity and respect is important.
- The link to the sea for some clans is as strong as the link to the earth for others. People interact with the ocean as if it were another person. They feel it as though it is a living organism. People can communicate with the spirit of the sea: ‘when there are shipwrecks or lost seafarers we can feel it’. Plants are put onto the body sometimes for protection, or like a prayer before going out fishing. There are taboo paths where other clans ask the sea clans to communicate with the spirit of the seas for safe passage, or for permission to pass. Signs can be read in the ocean and creatures of the ocean (‘like when the sharks come it means time to stop fishing’).
- The clan totem is not alive. It is a conduit for ancestors who are alive and around and demand respect. ‘Qatr’ is ancestor.
- A spirit is a consciousness. ‘Consciousness is the same as the relationship to the sea; it is spiritual’.
- People connect to the earth / totems / nature through dreams. There is some disconnect now due to Christianity.
- Taboo land is respected, even though there is some loss of that through colonisation. Taboo areas are communicated through word of mouth not symbols. This system has potential to more widely protect ecologically depleted land or seas.

Question 2: How can your ocean, beaches, forests, earth and sky be made well, vital, and healthy?

As with the earlier question, participants emphasised the need firstly for non-Indigenous peoples to engage in a profound culture change process and become more connected and respectful of the living world. Participants then suggested a range of longer-term strategic actions, such as changing laws and improving management approaches, combined with immediate pragmatic and local responses to effect change. A summary of the discussion follows:

- ‘What needs to change in New Caledonia for environmental healing is the way of thinking of non-Kanak’.
- There is a need to rebuild the relationship between people and the living world.
- More environmental education is needed for non-Indigenous people locally (and more widely).
- ‘Province level rules for ecological respect and wellbeing would be very effective; more than national level rules’.
- ‘We should change environmental laws to require more careful harvesting of ‘resources’.’
- Although not a new relationship (this is already in place due to *kustom* (traditional) thinking), moves are being made to make written rules that outline animals having the same rights as people (like turtles).
- There are no written rules regarding building. ‘We should write environmental laws that include consciousness of environmental impacts especially at the provincial level’.

Question 3: What brings wellbeing or makes a good life for your community?

Participants agreed on the importance of social, cultural and ecological respect and connection. Culture change in relation to the environment again figured strongly and was at the base of potentially transformative suggestions such as legislating for animal (turtle) rights in a process similar to those countries that have legislated for rivers or land to have legal personhood status such as Aotearoa New Zealand, and India [47].

- Strong communities.
- Respect for others and the environment.
- Education and the ability to transfer traditional ecological knowledge and cultural connections to the next generation.
- ‘The *kustom* (traditionally managed) lands and how these are managed protects people from some of the more difficult aspects of capitalism, where living nature is hurt or damaged’.
- Freedoms: ‘ours stops where others’ begins’.

Question 3a: And what actions could you take to enhance this?

Attendees then discussed approaches for enhancing community wellbeing. The summary of this discussion follows.

Culture & Community Actions:

- A different way of thinking is needed. For example, ‘sharks are not a problem; the behavior of people around them is’. ‘People need to see more ecologically and avoid pollution’. ‘The key thing is to return to respecting the living world like Kanak do’.
- Observe signs in the natural world closely and act accordingly. Strengthen / reconnect the relationship to nature.
- Make links between people in their own communities stronger. Find ways to reconcile between cultures in regards to understanding how to care for the living world.
- Give Kanak the ability to protect and control human interactions with the living world.
- Establish a common trajectory for wellbeing for all.
- Build bridges around world views. ‘Some people don’t want to change’.
- ‘Educate politicians about the need to care for and respect the environment’.
- ‘More environmental / worldview education is needed in Nouméa for non-Kanak people’.
- ‘The tribal areas are always in nature, which helps to build connection. It is more difficult to feel this in Nouméa’.
- Reconnect to cultural knowledge through *kustom* (though people are aware of certain limits). There is a *kustom* path and there is an effort to revive some lost knowledge.

Ecological regeneration:

- Make gardening the town more communal (through schools perhaps).

Question 4: What are key Mauri Ora Compass actions for change?

In the final section of the workshop, working with the Compass poster, participants identified pragmatic actions that could be taken locally for system transitions for improved wellbeing in communities or neighbourhoods. A summary of key actions determined by the community follows:

Ecological Regeneration & Community Connection

- Ecological regeneration, particularly of key ecosystems and keystone species. For example, regeneration of local rivers.
- Walkable neighbourhoods with local amenities.
- Community vegetable gardens, food commons, and urban orchards.

Zero Carbon Energy & Access/Mobility

- Increase energy efficiency and passive approaches in building design.
- Local production of zero-carbon energy such as solar and wind.
- Free zero-carbon public transport (buses and car-share for example).
- Increase zero-carbon cars (currently thought to be too expensive) and bikes.

Regenerative Housing & Communities

- Carbon storing buildings made from timber and renewable materials.
- Green roofs, rain-gardens, water storage.
- Intergenerational & co-housing for extended families with shared amenities.
- Community vegetable gardens.

Concluding comments:

- ‘*Mel*’ was a tem used to mean life; ‘*Hlapa*’ is the ground or clan or house; ‘*Qahlapa*’ is the sea or clan; ‘*Hagé*’ is spirits.
- Working in Nouméa is difficult because it is a different land (from Drehu island). There is social housing there but people want to be where they were born. People need to be near the ocean. Working in Nouméa can lead to a loss of identity.
- Religion and colonisation have greatly reduced connection to traditional knowledge (termed here ‘colonised hearts’). There is an attempt to rebuild this through reconnecting to nature.
- Everything comes to Drehu from across the ocean.
- Oral transmission of ideas is very important. ‘We ask if the ancestors agree that we should write things down’.

3.4. Nouméa - DPJJE, social workers and Kanak

Our final Mauri Ora compass workshop occurred in Nouméa with the Direction de la Protection Judiciaire de l’Enfance et de la Jeunesse (Directorate of Judicial Protection of Children and Youth, DPJJE), a government youth protection government service. Participants were Kanak, New Caledonian born non-Kanak, and French.

Question 1: What is the nature of the relationship between people and the living world?

Kanak and Island-born French participants shared a perception that the world is ‘alive’ and that humans must engage respectfully and carefully with the environment. The sole continental French attendee had quite a different perspective and approach. A summary of the discussion follows:

- The world is alive.
- The Kanak relationship to nature occurs through clans and emphasises different aspects of nature (forest, ocean, sharks, lightning etc.). The environment is important to all Kanak; there is a base thinking of respect through familial relationships.
- ‘The Earth is like a mother and should be respected (terre mère)’.
- ‘Nature feeds us (nurtures us) and organises society’.
- There is a relationship of exchange between people and nature and an awareness of the indivisible relationship between people and nature and that there is something abstract or ‘mystical’ about that relationship (island-born French).
- ‘The Earth is like a child that should be looked after and primarily is a source of resources’ (Continental France-born Frenchman).

Question 2: How can your ocean, beaches, forests, earth and sky be made well, vital, and healthy?

Participants were all Nouméa city dwellers. The discussion focused on how the wider system needed to be changed to work within ecosystems, and there was again an emphasis on a need for people to become more ecologically aware and attuned. Participants spoke of the need, after urbanisation, for the regeneration of local forests and the biodiversity rich mangroves that work synergistically with other marine ecosystems like coral reefs and seagrass beds. The nearby Nickel mine was also identified as a source of ongoing pollution that is also an integral part of the nation’s current economy.

Ecological regeneration:

- Addressing air pollution from the nickel mines / factories especially in Nouméa. ‘The Canadians have done some replanting’. ‘Kanak from the mountains won’t work in the mines because there is pain there about the state of the mountains’.
- Regeneration, particularly of mangroves, trees and other biomass.

Circular economy:

- Stopping waste and pollution.
- Transition to better building materials. ‘There is the start of reuse thinking in Noumea, especially regarding plastics’.

Zero-Carbon Energy Transition:

- Transition away from fossil fuel driven cars. Reduce cars.

Culture & Community:

- Investigating, understanding, and connecting the health of social relationships to ecological health is needed.

Question 3: What brings wellbeing or makes a good life for your community?

Participants agreed on the importance of community to build strong social ties. They spoke of the need for structural changes to better support social connection, particularly avoiding the need for overwork due to cost-of-living difficulties and providing more local urban green space. Some notes from the conversation about what makes a good life are as follows:

- Community and extended family. ‘Being with friends’.
- Meaningful employment, but too much time spent working is an issue too. ‘Too much time working means weaker family and nature connections and that you can’t take care of children or family fields’.
- Being able to choose where to live. ‘People (Kanak) coming in can’t choose. It would be better to be able to choose to live near to work, or to nature, or the ocean, or trees etc.’

- Spending and sharing time together doing dance, sports, music, and shared cultural activities for example. ‘There is a need to create events that bring communities together and to have physical spaces that are close, free, and accessible for such events’.
- ‘Finding balance between time for oneself and time for others’.

Question 3a: And what actions could you take to enhance this?

Attendees then discussed approaches for enhancing community wellbeing. A summary follows:

- People cultivating a more careful (‘precise’) sensitivity to the natural world. A change in perception is needed.
- ‘Keep the best practices of the ancestors for the future’.

Question 4: What are key Mauri Ora Compass actions for change?

The discussion then focused on pragmatic actions that could be taken locally for improved wellbeing in their neighbourhood and urban community. These were noted onto the Mauri Ora Compass diagram. A summary of the actions determined by participants follows:

Ecological Regeneration & Community Connection

- Ecological regeneration, particularly of key ecosystems and keystone species [for example regeneration of health of local rivers].
- Flood resilient sponge spaces.
- Walkable neighbourhoods with local amenities.
- Community vegetable gardens, food commons, urban orchards.
- Shared public amenities such as local green-grocers, food hubs, community spaces, and space for customary meetings and events.

Zero Carbon Energy & Access/Mobility

- Increase energy efficiency and passive approaches in built environment design.
- Local production of zero-carbon energy such as through solar and wind.
- Free zero-carbon public transport.
- Increase of zero-carbon cars and bikes

Regenerative Housing & Communities

- Carbon storing buildings made from timber and renewable materials.
- Green roofs, rain-gardens, and water storage like rainwater tanks.
- Intergenerational and co-housing for extended families with shared amenities.
- Community vegetable gardens.

Concluding comments:

- ‘Something in these talks has touched me’ (Kanak).
- The large (polluting) Nickel factory in the city is seen as an issue, though it does provide employment.
- French being the connecting common language between Kanak is seen as difficult but can act as a bridge.
- The Kanak youth (in Nouméa) seem to care less / know less about the natural world. ‘A love of nature feels higher in the islands’. There is pain because of that disconnect. There are youth programmes, like how to make fire for example where an instinct or memory for this kind of connection to the living world was noticed among Kanak youth.
- A love of nature can be a good bridge between cultures.
- A lack of space for *kustom* activities is an issue in the city. More shared outdoor space is needed.

4. Discussion

A key finding from interviews, workshops, and presentations is that

there are highly consistent views, aspirations, and visions for improved social, cultural and ecological wellbeing among the Kanak attendees. There was a shared understanding of the urgent need to improve the wellbeing of the living world; the earth, sea, sky, mountains and forests, and animals, including humans. There was also a sophisticated understanding across communities of how contemporary building practices, urban form, and urban systems have degraded ecosystem wellbeing and lessened social and cultural ties and community cohesion. Workshop attendees developed a range of action strategies for wellbeing-centered buildings, neighbourhoods and cities that met their cultural values and imperatives as they supported social, cultural and ecological wellbeing and resilience.

Our workshops and interviews showed a high level of interest and engagement in local resilience and wellbeing (social, cultural, ecological). Across the Kanak communities, there was agreement that the sea, earth, sky, and wider world are 'alive' and should be afforded a deep respect and care. This differs from normal westernised conceptions of what is alive and what is not, but is quite consistent with other Indigenous people across *Moanau* Oceania [10,39]. Concepts such as *hnalapa* (Drehu / Lifou) and *wādē* (Koné) were used in the context of describing holistic wellbeing or vitality of the living world.

Within Kanak communities there was widespread agreement about the urgent need to change contemporary housing and neighbourhood systems to regenerate ecological, social and cultural wellbeing. Another key theme that arose was the need for a different kind of housing; one that enables larger families to live together and share expenses. The need for places to gather in order to share concepts and teach younger generations within oral traditions was also noted, particularly in Nouméa.

Workshop participants co-created a list of built environment actions to effect change. There were consistent notions regarding repairing or regenerating damaged ecologies. Workshops with New Caledonia-born people with French ancestry further revealed a cohesive attitude towards the environment and wider ecological systems. Island-born French particularly, like Kanak, tended to perceive the earth, sky, sea and wider ecosystem as being alive in a sense and spoke of the need to act respectfully towards the living world including when considering how housing and neighbourhoods are developed.

Commentary from the workshops reveals further detail about specific hopes and aspirations as summarised here:

- Kanak people want more meaningful engagement about worldview and cultural practice in discussions about housing and built environment design, construction, and use. The process of engagement, rather than just a focus on outcomes is important.
- Being able to participate in and live near or with extended family and community is a key source of wellbeing for Kanak and was a clear recurring theme. People living in Nouméa find it difficult to find space for extended family living and gathering. Transmission of traditional knowledge, often orally and face-to-face is key to wellbeing. This is hampered by spatial conditions in the city to some extent.
- 'Nature' is seen as connected and alive to Kanak. People *are* land, waters, forests and embody those relationships. This is particularly illustrated by clan totems. The totem can be an animal or a plant or other aspect of the living world. Depending on which totem is attached to the clan, it may provide information about the clan's role within the tribe and/or the chiefdom. There are sometimes clans whose totem is a tortoise or parrot fish for example, and these clans are often the guardians of these animals. Depending on the customary area, district, tribe or clan, the totems and relationships are different and depend upon the history and stories of each clan.
- Connection to the living world is another key theme that underpins Kanak wellbeing. This connection is diminished when people cannot participate in traditional knowledge transfer activities and/or when they are removed from natural elements, particularly in Nouméa.

- Care and respect for, therefore ceasing damage to, land, oceans, mountains, forests, rivers, and air is key to transformative change and is tied closely to cultural identity and world-view through clan totems and elements. Almost all (including non-Kanak) tended to see a clear and 'obvious' relationship between healthy ecosystems (especially air and water) and healthy people. This can be enabled through strategic regenerative architectural and urban design.

Workshop attendees also discussed barriers to improving the efficacy and wellbeing of built environments. Restrictions or limits included the high cost currently to transition to new systems; for example the high cost of solar panels or e-vehicles. Participants agreed that they would preferentially seek these wellbeing-centered technologies or actions as costs came down. Importantly, the changes in building and urban systems noted in the workshop *Mauri Ora* compasses and action points included an intention to support more simple, passive, and efficient approaches, such as passive design strategies for ventilation or solar heating, or continuing to walk or use horses as is currently the norm for many Kanak communities living adjacent to Koné for example.

Another important finding from the research was that it is highly effective to begin by discussing the specific cultural norms of Kanak people, and to reveal and value this cultural and contextual knowledge before moving into practicalities such as sizes of rooms, or numbers of bathrooms in a building. The questions asked in the first part of the compass workshops were 'ontological' in that they established at a meaningful philosophical, spiritual, and ethical level the nature of 'life' for participants, and what they saw to be 'living'. Beginning in this way set Indigenous knowledge and world-views as normative. Indigenous knowledge-led urban systems change is inherently decolonising as it disrupts business-as-usual extractive approaches to social and ecological systems [48]. This first part of the workshop established a deep cultural ground as the normative place from which to make pragmatic and strategic decisions and consider actions for change. The practical actions defined in this way were tightly attuned to Kanak traditional values for social and ecological wellbeing. Many participants noted that they had not been asked such questions before and that a sense of pride in cultural values and Indigenous knowledge elevated through the workshops made them 'feel happy and changed' and perhaps more likely to engage. As researchers, we also registered that their ideas were in line with the transformative mindset called for among non-Indigenous regenerative urban and built environment practitioners [15,16]. Indigenous and local knowledge and practices are increasingly acknowledged as important models for more ecologically sensitive relationships to place, whether urban or rural, and for climate change adaptation or biosphere regeneration [1,49].

Limitations to the study include the short research period, which restricted the number of communities that could be engaged with. There were at times three languages in play which extended the time and complexity of discussion. However, attendees were used to speaking across languages, and collectively within the workshop groups translations would be exchanged and communication achieved. The combination of a government agency with Kanak communities offered opportunities to provoke productive exchange, but may also have placed limits on what could be said.

5. Conclusion

This research revealed productive areas for further enquiry and engagement for urban resilience and wellbeing-focused building strategies. Through collaborative exchange, better design and planning practices were highlighted that would support healthier built environment design, urban climate change adaptation, and wider socio-ecological wellbeing. The importance of engaging in a meaningful way with Kanak is clear. The interfacing of community and customary knowledge with government level strategies and policy is important and likely to be a more effective means by which to develop effective

housing and urban forms that meet local needs and realities.

Workshop results were highly relevant to current discourse around the need for swift change in our urban and built environments for climate adaptation and wider socio-ecological wellbeing. Key findings from engagement with place-based communities include the important confirmation that research participants, largely Kanak, with island-born and continental French also, arrived with sophisticated understandings of the current deficits in their environments. Furthermore, attendees largely agreed on required changes, and understood that these evidenced a need for a fundamental shift in current cultural practices. The necessary shift, for non-Indigenous, was identified as a full reorientation towards a more care-full and ecologically regenerative relationship with living systems. Communities therefore perceived the necessary changes to be cultural and systemic in nature, i.e. not individually led or related just to technologies. Specifically, in relation to the design of wellbeing-centered built environments, many were able to offer ideas for high-level political/strategic actions and/or highly pragmatic local community-based regenerative changes. The findings supported the value of the place-based, community-led wellbeing compass approach to system transition. The workshop process created a space for communities to connect, coordinate, and communicate necessary change as a means of empowering and activating their own communities and partner groups such as local councils, agencies, or developers.

Participants agreed on the value of testing out building design and urban change strategies in real case studies, or pilot projects, working with local communities and with local authorities and the government. They understood that such practical examples would help to seed wider change. To communicate the results of this research, we produced a report for the New Caledonian Government, a public report (housed on the online NUWAO repository of research (www.nuwao.org.nz)), presented findings to local political and business leaders in New Caledonia, and produced this journal article. We anticipate producing short summaries for the community in the future and understand the value of short videos and podcasts to reach a different audience, which will be investigated.

Further discussion, workshops, and community-generated decision tools such as the place-based compasses would be useful to expand and test the results of the research. Certainly, exemplar buildings or pilot projects that test out nature-based strategies and actions from community-created urban wellbeing compasses would powerfully model change. Such frameworks and models for engagement and design outcomes can meaningfully forefront Kanak worldviews and create more just and more regenerative built environments. These kinds of approaches meet growing calls to ensure that climate change adaptation in Oceania does not unintentionally become a vehicle of neo-colonisation, but rather is achieved in a culturally just and ecologically appropriate manner. The cultural frameworks and intentions with which we conceive, build and live in built environments determine the nature of our built environments but also, in the context of current ecological collapses, the very viability of human civilisation. Regenerative, nature-based design developed in participatory ways with Indigenous communities in place can become a vehicle for re-Indigenisation, decolonisation, and relationship building with each other and with place.

NBS impacts and implications

- Fundamental changes must occur in the design and construction of built environments, requiring a cultural shift in how people understand themselves to be in and of the living world with a reorientation towards a more care-full, respectful, and ecologically regenerative relationship with living socio-ecological systems.
- The process of engaging with local and Indigenous populations is vital in working with nature for transformative change and overall effectiveness

- Understanding and incorporating Indigenous priorities and knowledge for NBS implementation processes and outcomes is key for just and effective transformation of built environments in New Caledonia.

CRedit authorship contribution statement

Amanda Yates: Writing – review & editing, Writing – original draft, Visualization, Resources, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization. **Maibritt Pedersen Zari:** Writing – review & editing, Writing – original draft, Visualization, Project administration, Methodology, Investigation, Funding acquisition, Formal analysis, Data curation, Conceptualization. **Qatrené Juni:** Writing – review & editing, Writing – original draft, Visualization, Investigation.

Declaration of competing interest

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Data availability

The authors do not have permission to share data.

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