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The Climate-Conflict-Food Security Nexus:
Pacific Marine Ecosystems

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Summary

Growing scientific evidence indicates the global impacts of climate change are threatening ecosystems and food security. This has a range of flow on impacts, including malnutrition, hunger and the exacerbated risk of conflict over increasingly scarce natural resources. Developing countries, especially coastal communities across the Pacific, are at risk of climate-related food insecurity, due to the climate vulnerability of Small Island Developing States. This is particularly the case in the context of threats posed to the health of marine ecosystems and their capacity to provide protein, income and spiritual connections for Pacific communities. This policy brief advocates for adaptive co-management approaches that integrate traditional and Western knowledge, law, governance, science and technology in a bid to protect nature. It highlights the importance of localised approaches where communities are empowered to be the guardians of the ecosystems in which they live. The ground level up proiritisation is then framed by national and global legal and governance systems, such as the *United Nations Convention on the Law of the Sea*. This approach has been established in nations, such as Samoa, where local by-laws have been established for community-owned protected marine areas. The by-laws support citizens who are trained to monitor and manage local biodiversity. However, this brief warns that the impacts of climate change on marine ecosystems are unprecedented, requiring rapid adaptive responses that will test any management approach.

List of Acronyms

ACM	Adaptive Co-management
GHG	Green House Gases
IPCC	Intergovernmental Panel on Climate Change
ITLOS	International Tribunal for the Law of the Sea
LMMAs	Locally Managed Marine Areas
MPAs	Marine Protected Areas
SDGs	Sustainable Development Goals
SIDS	Small Island Developing States
SLR	Sea Level Rise
SST	Sea Surface Temperature
TEK	Traditional Ecological Knowledge
UNCLOS	United Nations Convention on the Law of the Sea

Introduction

The impacts of climate change continue to threaten the viability of ecosystems across the world. The current risks to dynamic human-nature systems include more frequent and extreme weather events, dramatic temperature fluctuations, sea level rise (SLR) and oceanic acidification. These will be ongoing and will intensify over time.[1] The Intergovernmental Panel on Climate Change (IPCC) has long concluded these risks will disproportionately affect countries that have contributed the least to the impacts of climate change and will be skewed against the interests of already disadvantaged communities.[2]

Climate change related food insecurity is a major concern for the populations of Small Island Developing States (SIDS). Environment and security scholar Homer-Dixon explains how competition for diminishing natural resources is a driver of conflict.[3] This can be described as the Climate-Conflict-Food Security Nexus. At a local level, this may include hunger, reduced job opportunities and income, a sense of failed social responsibility in fulfilling traditional gender roles and ultimately the destruction of relationships between community groups, or individuals, as competition for food increases. Ultimately, an increase in crime and conflict may ensue. On a broader level, this scenario may include the destabilisation of governments that could deteriorate under increasing domestic pressure. "Climate stress may well represent a challenge to international security just as dangerous – and more intractable – than the arms race between the United States and the Soviet Union during the cold war or the proliferation of nuclear weapons among rogue states today." [4] Indeed, the World Food Program notes that food insecurity increases the risk of democratic breakdown, civil conflict, protest, rioting and communal conflict.[5] This is particularly true in countries with already-fragile political institutions, economic development challenges, social welfare and demographic pressures, and explains why climate change is often regarded as an 'exacerbator', 'multiplier' or 'amplifier' of pre-existing tensions.[6]

In Pacific communities, the ocean provides much of their protein requirements through the harvesting of seafood. Badjeck explains at least 20 percent of global protein intake is provided by fish products, and supports the livelihoods of close to 520 million people.[7] The importance of fish to the food security and livelihoods of developing populations is even greater, making up 90 percent of their protein intake.[8] In the Pacific specifically, seafood

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[1] Intergovernmental Panel on Climate Change, '2018: Summary for Policy Makers' in V Masson-Delmotte, O-H P Zhai, D Pörtner, J Roberts, P R Skea, A Shukla, W Pirani, C Moufouma-Okia, R Péan, S Pidcock, J B R Connors, Y Matthews, X Chen, M I Zhou, E Gomis, T Lonnoy, M, and T Tignor (eds), *Global Warning of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty* (United Nations, In Press, 8 October 2018) 1, 1.
[2] Ibid.
[3] Thomas Homer-Dixon, 'Terror in the Weather Forecast', *The New York Times* (online, 14 April 2007) <http://www.nytimes.com/2007/04/24/opinion/24homer-dixon.html>
[4] Ibid.
[5] Henk-Jan Brinkman and Cullen S. Hendrix, *Food Insecurity and Violent Conflict: Causes, Consequences, and Addressing the Challenges* (Occasional Paper No 24, July 2011) 4.
[6] Ibid, 15.
[7] Marie-Caroline Badjeck, Allison Edward, Ashley Halls and Nicholas Dulvy, 'Impacts of climate variability and change on fishery-based livelihoods' (2010) 34 (3) *Marine Policy* 375, 375.
[8] Jim Salinger and Alistair Hobday, 'Safeguarding the future of oceanic fisheries under climate change depends on timely preparation' (2013) 119 *Climatic Change* 3-8.

consumption represents between 50 and 90 percent.[9] Oceanic ecosystems also support economic security. For example, capture fisheries can contribute as much as 10 percent of GDP for some SIDS.[10] As a result, any diminution in marine provisions may result in under-nourishment and malnutrition for coastal communities, coupled with economic stress.

Climate change related displacement, or migration can be a further symptom of food insecurity. When food resources become scarce, many communities are left with little choice but to move to where resources are more available. In 2016, over 24.2 million environmentally displaced people were forced to migrate, world-wide.[11] Scheffran et al. explain that countries with low human development are particularly vulnerable, and argues in favour of effective institutional and governance mechanisms to prevent climate-induced conflict.[12] Otherwise, there is a risk that migration and forced displacement will compromise states' capacity to maintain domestic security, and the associated legal, governance and management challenges that accompany the issue.[13]

Global architecture is in place that attempts to respond to climate change-related food insecurity, including across the Pacific region. For instance, the 2015 Sustainable Development Goals (SDGs), strive to "take urgent action to combat climate change and its impacts" (SDG 13 – Climate Change) and "conserve and sustainably use the oceans, seas and marine resources for sustainable development" (SDG 14 – Life Below Water).[14] This policy brief responds to these SDGs and other global legal and governance frameworks in a bid to streamline effective adaptive co-management strategies in the context of food security of Pacific SIDS.[15] It also advocates for a focus on the interplay between scientific, legal and management perspectives. This includes a synthesis of both Western and traditional customary law and knowledge, which has much to offer contemporary climate adaptation strategies designed to secure the sustainable provision of food. Communities across the Pacific, particularly those in rural villages, can offer innovative approaches to climate adaptation. Historically, subsistence or part-subsistence livelihoods have meant that communities have conserved local ecosystems which provide food and shelter. Adaptation to changing environmental, including climatic, conditions is an accepted norm. Locally based management practices have a high rate of community acceptance and produce

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[9] Johann D Bell, Neil L Andrew, Michael J Batty, Lindsay B Chapman, Jeffrey M Dambacher, Brian Dawson, Alexandre S Ganachaud, Peter C Gehrke, John Hampton, Alistair J Hobday, Ove Hoegh-Guldberg, Johanna E Johnson, Jeff P Kinch, Robert Le Borgne, Patrick Lehodey, Janice M Lough, Timothy D Pickering, Morgan S Pratchett, Aliti Vunisea and Michelle Waycott, Adapting tropical Pacific fisheries and aquaculture to climate change: management measures, policies and investments' (2011) *Vulnerability of Tropical Pacific Fisheries and Aquaculture to Climate Change. Secretariat of the Pacific Community, Noumea, New Caledonia* 803, 846.

[10] 'Global Blue Growth Initiative and Small Island Developing States (SIDS)' (Report, Food and Agriculture Organisation of the United Nations, 2014) 4.

[11] Joanna Apap, 'The concept of climate refugee: towards a possible definition' (Briefing, European Parliamentary Research Service, February 2019) 3.

[12] Jürgen Scheffran, Michael Brzoska, Jasmin Kominek, P Michael Link, and Janpeter Schilling, 'Disentangling the Climate-Conflict Nexus: Empirical and Theoretical Assessment of Vulnerabilities and Pathways' (2012) (2012) 4(5) *Review of European Studies* 1, 8.

[13] *Climate Change and Its Possible Security Implications,* UN GAOR, 64th sess, Agenda Item 114, UN Doc A/64/350 (September 11 2009) 15.

[14] *Progress towards the Sustainable Development Goals,* UN GAOR, 75th sess, Agenda Items 5, 6 and 18(a), 75th sess, UN Doc E/2016/75 (27 July 2016) 17-18.

[15] Patrice Guillotreau, Liam Campling and Jan Robinson 'Vulnerability of small island fishery economies to climate and institutional changes' (2012) 4 *Current Opinion in Environmental Sustainability* 287, 288.

responses with the highest conservation values. It is therefore important that food security is addressed, with the inclusion of localised solutions, in a bid to prevent conflict risks.

Climate Change and Marine Ecosystems

Ocean warming is reaching unprecedented levels due to increases in Green House Gas (GHG) emissions. Marine life in tropical (and polar) regions is particularly susceptible to this change due to the narrow temperature bands in which marine life can survive.[16] The impacts of climate change on marine systems broadly include: increased ocean temperatures, sea level rise, and changes in ocean salinity and acidification. These impacts are predicted to result in: growing areas of the ocean that are nutrient-poor and cannot sustain diverse marine ecosystems, warming of the upper ocean, changing animal migratory patterns, and difficulties for organisms in adapting to changes in temperature, pH, and salt content, which affects their development and life cycles.[17] Projected increases in the size of low oxygen (hypoxic) zones and climatic events also affect the ability of marine ecosystems to recover,[18] and their capacity to provide reliable food sources to sustain communities.

Fisheries and Food Security

Fish populations directly respond to climate change impacts. Changes in Sea Surface Temperature (SST) have resulted in shifts in the spatio-temporal distribution of fish stocks, also referred to as "climate forced distribution shifts."[19] Subsequent changes in SST are predicted to result in fish species shifting poleward, including in the Pacific, which has ramifications for commercial fisheries and subsistence fishing. Further, increasing evidence shows that the changing distribution of species results in shorter life spans and smaller sizes of mature stock.[20] This has implications for indigenous species, as the expansion of non-indigenous species introduces ecological competition, resulting in environmental and economic impacts on the supply of local fish stocks.[21]

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[16] Hans Pörtner and David Karl, 'Ocean Systems' in Kenneth Drinkwater and Alexander Polonsky (eds) *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects* (Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change, Cambridge University Press, 2014) 414-415.

[17] Ove Hoegh-Guldberg and John F Bruno 'The Impact of Climate Change on the Worlds Marine Ecosystems' (2010) 328(5985) *Science* 1523.

[18] Robert Diaz and Rutger Rosenberg 'Spreading Dead Zones and Consequences for Marine Ecosystems' (2008) 321(5891) *Science* 926.

[19] Jason S Link, Janet A Nye and Jonathan A Hare, 'Guidelines for Incorporating Fish Distribution Shifts into a Fisheries Management Context' (2011) 12 *Fish and Fisheries* 461, 461; Walther Gian-Reto et al., 'Ecological responses to recent climate change' (2002) 416 *Nature* 389-395; Allison L Perry, Paula J Low, Jim R Ellis, and John D Reynolds, 'Climate Change and Distribution Shifts in Marine Fishes' (2005) 308(5730) *Science* 1912; Keith Brander, 'Global Fish Production and Climate Change' (2007) 104(50) Proceedings of the National Academy of Sciences of the United States of America 19709.

[20] Perry (n 19) 1914; Martin Genner et al., 'Body-size dependent responses of marine fish assemblage to climate change and fishing over a century-long scale' (2010) 16 *Global Change Biology* 517.

[21] Sapna Sharma et al., 'Comparing Climate Change and Species Invasions as Drivers of Coldwater Fish Population Extirpations' (2011) 6(8) *PLoS ONE* 1, 1.

However, the projected diminution of fish stocks is not consistent across the world. One projection suggests an overall increase in fish production of 3.4 percent by 2050, with regional changes including increases of up to 30 percent, while other estimates show reductions of up to 15 percent in other locations, particularly in tropical regions. [22] Additionally, the Food and Agriculture Organisation notes that the impact of climate change on some fish species may mean previous rates of commercial and subsistence fishing will no longer be sustainable.[23]

Fish populations in SIDS are particularly vulnerable to climatic variability due to their geography, exposure to natural disasters, and the rise of global competitors in the market.[24] The impacts of climate change on tropical coral reefs is projected to lead to a 20 percent drop in coral fisheries in the Pacific Islands by 2050,[25] making it difficult for countries such as Fiji, Samoa, and Vanuatu to maintain their standard fish consumption rates.[26] SIDS communities also have a high dependence on coral reef fisheries, and are therefore highly sensitive to any changes in local fishing industries, and have a limited financial capacity to adapt to change.[27] Coastal fisheries in the Pacific are predicted to be "less productive due to the degradation of coral reefs caused by the projected synergistic effects of more frequent bleaching, lower levels of carbonate, increased cyclone intensity and greater turbidity of coastal waters."[28] Additionally, it is likely that aquaculture will encounter problems predicated by higher temperatures, floods and rising acidification. In Vanuatu subsistence fisheries, extending over 3,100 square km in waters from 0 to100m in depth, engage approximately 50 percent of the rural population, and play a central role in supplying the nation's protein.[29]

Legal Approaches

The role of law in breaking the link between climate change and food insecurity needs to be employed alongside scientific, management and customary perspectives. This intersection is crucial in ensuring that 'top down' and 'bottom up' approaches are both supported and therefore have the capacity to make the greatest impact. In the Pacific context, legal approaches are not limited to merely Western international and domestic law, but also

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[22] Manuel Barange, G. Merino, J L Blanchard, J Scholtens, J Harle, E H Allison, J I Allen, J Holt and S Jennings, 'Impacts of climate change on marine ecosystem production in societies dependent on fisheries' (2014) 4 *Nature Climate Change* 211.
[23] 'Review of the state of world marine fishery resources FAO Fisheries and aquaculture' (Technical Paper No 569, Marine and Inland Fisheries Service, Marine and Aquaculture Resources Use and Conservation Division, FAO Fisheries and Aquaculture Department, 2011, Rome) 1, 384.
[24] Robert Gillet and Ian Cartwright 'The Future of Pacific Island Fisheries' (Secretariat of the Pacific Community Nouméa, New Caledonia, Pacific Island Forum Fisheries Agency, Honiara, Solomon Islands, 2010) 22.
[25] Poh Poh Wong et al. 'Coastal systems and low-lying areas' in C B Field, V R, D J Barros, K J Dokken, M D Mach, T E Mastrandrea, M Bilir, K L Chatterjee, Y O Ebi, R C Estrada, B Genova, E S Girma, A N Kissel, S Levy, P R MacCracken, Mastrandrea, and LL White (eds.) *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* (Cambridge University Press, 2014) 361.
[26] Ibid; Leonard Nurse and Rodger McLean 'Small Islands' in *Climate Change 2014 Impacts, Adaptation and Vulnerability* (Working Group II Contribution to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change, Cambridge University Press, 2014) 1619.
[27] Guillotreau et al (n 15) 287.
[28] Gillet and Cartwright (n 24) 8.
[29] Marc Léopold et al., 'Community-based management of near-shore fisheries in Vanuatu: What works?' (2013) 42 *Marine Policy* 167, 168.

encompass traditional and customary law and knowledge passed down through communities across generations.

International Law: The United Nations Convention on the Law of the Sea (UNCLOS)

The dominant international legal instrument focused on governing the ocean is the *United Nations Convention on the Law of the Sea* (UNCLOS),[30] which includes a global framework designed to protect and manage marine ecosystems and resources. It affords the 164 state parties territorial sea limits that require coastal states to enforce "any [domestic] law, regulate any use and exploit any resource."[31] Under UNCLOS, it is necessary for States to adopt all measures "to ensure that activities under their jurisdiction are conducted in a manner that does not cause pollution damage to other States and their environment."[32] Further, Article 235 states, "[s]tates are responsible for the fulfilment of their international obligations concerning the protection and preservation of the marine environment. They shall be liable in accordance with international law."[33]

These provisions emphasise a balance in the interests of state sovereignty and international responsibility, and indicate that any limit to a state's activities comes only in the event of harm to another state. The concept of transboundary harm in this instance can be so far-reaching as to include the foreseeable (and increasingly evidenced) impact of GHG emissions produced by states on the marine environment. This is emphasised in UNCLOS (through Article 194) which states the prohibition of releasing "toxic, harmful or noxious substances, especially those that are persistent,[34] [whether] "from land-based sources [or] through the atmosphere."[35]

Matters of ocean governance surrounding UNCLOS fall under the jurisdiction of the International Tribunal for the Law of the Sea (ITLOS)[36] which involves "all disputes concerning the interpretation or application of the Convention."[37] UNCLOS, through the ITLOS, presents an opportunity for SIDS to pursue cases against high GHG emitting States, pertaining to resultant damage to marine ecosystems and food security.

While this strategy was once seen as a radical approach to seeking climate justice, it has become more common for states to use international courts as an avenue for attributing blame, and with it, financial and legal responsibility to compensate. This wave of litigation

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[30] Richard Saunier and Richard Meganck, *Dictionary and Introduction to Global Environmental Governance* (Earthscan, 2nd ed, 2009).
[31] *United Nations Convention on the Law of the Sea*, opened for signature 10 December 1982, 1833 UNTS 3 (entered into force 16 November 1994) Part XV.
[32] William Burns, *Potential Causes of Action for Climate Change Damages in International Fora: The Law of the Sea Convention*, (2006) 2(1) *McGill International Journal of Sustainable Development Law and Policy* 1.
[33] UNCLOS (n 31) art. 235.
[34] Ibid art. 194(3).
[35] Ibid art. 194(3).
[36] UNCLOS (n 31).
[37] Ibid. The Tribunal's jurisdiction is subject to "the provisions of article 297 and to the declarations made in accordance with article 298 of the Convention." Nonetheless, "Article 297 and declarations made under article 298 of the Convention do not prevent parties from agreeing to submit to the Tribunal a dispute otherwise excluded from the Tribunal's jurisdiction under these provisions (Convention, article 299). The Tribunal also has jurisdiction over all disputes and all applications submitted to it pursuant to the provisions of any other agreement conferring jurisdiction on the Tribunal."

has largely come on the back of the Urgenda case in the Netherlands, which developed a landmark requirement in 2015 for the Netherlands government to adopt stricter emissions reduction targets to uphold their duty of care to citizens.[38] A Pakistani case, *Leghari v Federation of Pakistan,* also established the right to challenge a lack of action on climate change, on the basis that it violated basic human rights to security of water, food, and energy.[39]

Traditional Customary Law

Across the Pacific, 'legal pluralism' is practiced, meaning that more than one legal order can operate simultaneously.[40] This is a common phenomenon where 'documented normative law', as well as often 'unwritten customary law' operates like statute.[41] Customary law is established, and built upon, by usage, whereby customary statutes are binding only once they have been judged and accepted by the public. As a result, anything that is publicly approved, with or without a written rule, is equally binding for all.[42] It is important to note that for many indigenous communities in the Pacific, traditional customary law will differ from island to island, or even from village to village, as in Melanesia. Papua New Guinea has even gone as far as to denote in its Constitution the recognition of local or regional rules.[43]

Traditional customary law and international law are not mutually exclusive. In fact, traditional customary law is recognised under international law. For example, UNCLOS (Article 51) includes customary law, noting the traditional fishing rights of archipelagic States should be recognised. Other international frameworks support this, including the *Convention on Biological Diversity*, [44] the International Labour Organization *Convention 169*[45]*,* the *United Nations International Declaration on the Rights of Indigenous People,* [46] and *The Nagoya Protocol.* [47]

The intersection of traditional customary law and domestic state law requires more qualification. There are two ways wherein customary law may be recognised under state law. The first is by way of a formal recognition by the state, which may be done through the constitution, statutes or judicial decisions.[48] The second is the functional recognition of customary law, where the latter is not only formally recognised but subsumed within

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[38] Urgenda Foundation (on behalf of 886 individuals) v The State of the Netherlands (Ministry of Infrastructure and the Environment), First instance decision, HA ZA 13-1396, C/09/456689, ECLI:NL:RBDHA:2015:7145, ILDC 2456 (NL 2015), 24th June 2015, Netherlands; The Hague; District Court.
[39] *Leghari v Federation of Pakistan* (2015) W.P. No 25501/201, Lahore High Court.
[40] Sally Merry, 'Legal Pluralism' (1988) 22(5) *Law and Society Review,* 869, 870.
[41] Justinian, *Institutiones Justiniani* (J.B. Moyle trans, Oxford, 1911).
[42] Justinian, *Justiniani Digesta* (Charles Monro trans, Cambridge University Press, 1904).
[43] Jennifer Corrin Care, 'Wisdom and Worthy Customs: Customary Law in the South Pacific' (2002) 80 *Australian Law Reform Commission Reform Journal* 31, 31.
[44] *Convention on Biological Diversity* (Rio de Janeiro) 5 June 1992 (entered into force 29 December 1993) 31 ILM 822 (1992).
[45] International Labor Organization, *Indigenous and Tribal Peoples Convention,* C169 7 June 1989, (entered into force 5 September 1991) 1650 UNTS 383 (1989).
[46] Ian Brownlie, *Principles of International Law* (Oxford, 8th ed, 2012) 15.
[47] *Protocol on the Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from Their Utilization to the Convention on Biological Diversity* (Nagoya) 29 October 2010 (entered into force 12 October 2014).
[48] Miranda Forsyth, 'A Typology of Relationships between State and Non-State Justice Systems,' (2007) 56 *Journal of Legal Pluralism and Unofficial Law* 67.

national law for "particular purposes in defined areas of law."[49] The former creates a regime of legal pluralism, while the latter results in the incorporation of customary law into state law.[50] An advantage of the formal legal pluralist approach is that it keeps customary law distinct and separate from mainstream state law. Incorporating legal pluralism can therefore be advantageous when developing a localised 'bottom up' approach, such as in the case of protecting food security, threatened by climate change.

Customary Law and Traditional Ecological Knowledge in Fisheries Management

Customary law may be most appropriately applied to environmental management at a local level. Embedded in local culture, it is malleable to traditional island community structures, and thus is likely to be regarded favourably. Community engagement is also likely to be higher due to fear of customary penalties. Enforcement of customary law is usually the responsibility of the landowner or village chief,[51] who levels "fines and threats of supernatural retribution" at those breaching the rules.[52] In addition, social alienation, violence, gossiping and other forms of social pressure within the community are all viewed as penalties for the violation of certain customary management practices.[53] Whether out of positive motivation, or fear of retribution, the alignment of customary law with traditional island practices is likely to improve conservation outcomes in the long term.

The regulation of marine resources plays a significant role in traditional customary law for coastal communities across the Pacific. Customs, including fishing management practices, are informed by traditional ecological knowledge (TEK). They consist of spatial, temporal, effort, catch, species and gear restrictions,[54] made effective through local customary governance structures, determined by customary law and enforced by community chiefs.[55] A number of studies provide evidence that such restrictions lead to ecological benefits.[56] However, others have suggested that short-term closures provide minimal benefits.[57]

For example, in Vanuatu, fishing-related customary laws are enforced with the intention of allowing the chance for marine resources to recover from fishing activities. In particular, there are *tabu* areas or "no-take" zones involving harvesting prohibitions. These zones are often put in place by a chiefly authority, marked with tabu sticks or leaves, and are ritualised. Breaching the rules of these areas leads to fines and supernatural retribution, described by traditional Vanuatu communities as "black magic." In addition to "no take" zones there are

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[49] Law Reform Commission of Western Australia, *Aboriginal Customary Laws*, Final Report (2006) 71.
[50] Forsyth, (n 48), 70.
[51] Joshua Cinner and Shanker Aswani, 'Integrating Customary Management into Marine Conservation' (2007) 140(3) *Biological Conservation* 201, 205.
[52] Erika Techera, 'Enhancing legal frameworks for biodiversity conservation in the Pacific' (2015) *Pacific Conservation Biology*, 1, 2.
[53] Cinner and Aswani, (n 75) 205.
[54] Ibid.
[55] Joe McCarter, Michael Gavin 'In Situ Maintenance of Traditional Ecological Knowledge on Malekula Island, Vanuatu' (2014) 27 *Society and Natural Resources*, 1115, Techera, (n 53), 2.
[56] Timothy R. McClanahan, Michael J. Marnane, Joshua E. Cinner, and William E. Kiene, 'A Comparison of Marine Protected Areas and Alternative Approaches to Coral-Reef Management' (2006) 16 *Current Biology* 1406; Sophal Chhun, Viktoria Kahui, Henrik Moller, and Paul Thorsnes, 'Advancing Marine Policy Toward Ecosystem-Based Management by Eliciting Public Preferences' (2015) 30(3) *Marine Resource Economics* 261, 264.
[57] Gaya Gnanalingam and Chris Hepburn, 'Flexibility in temporary fisheries closure legislation is required to maximize success' (2015) 61 *Marine Policy* 39, 40.

customary legal mechanisms that control who is permitted to fish, and the location, timing, quantity, and species of fish they can harvest.[58] Alternatively, in an area of partial depletion, the chief may ban all net fishing and only permit rod fishing as a management method of limiting the number of fish extracted.

However, there are some scholars who argue that customary practices and traditions are not enough to guarantee ecological conservation and sustainability. In his study of village-based marine management, Johannes argues that the intention of traditional practices to maximise harvest yield, rather than to prioritise conservation, means that management overall can be compromised. He warns that "Management of marine resources by traditional villagers does not guarantee their sound use."[59] He believes a lack of scientific information on the part of local communities in the Pacific, and an insufficient skills-base to formulate management strategies, leads to a weakness in "best management strategies", and could even lead to mismanagement of fisheries and resources. [60]

Others have similar concerns in regards to how customary traditions treat biodiversity. For instance, Techera found "many traditional practices were not specifically aimed at biodiversity conservation, but focused upon improving harvests and achieving broad socioeconomic and cultural benefits".[61] She argues that, "traditional ecological knowledge and customary management mechanisms are directed more at improving the harvesting of marine resources than conserving them."[62] However, while there are some drawbacks to customary management, it is important to note that SIDS in the Pacific are more vulnerable to climate change impacts than their developed counterparts, and have been forced to be more adept at making hard decisions to restrict, reduce and manage their coastal resources for current and future generations. [63] Veitayaki explains that the challenge and focus of adaptive co-management strategies in the Pacific needs to revolve around "effectively conserving their resources for the benefit of the communities … as well as the environment."[64]

Evidence of this is provided by a scientific study that has compiled data from more than 25 thousand reefs in over 46 states to identify coral ecosystem 'outliers'.[65] The outliers are 'bright spots', that are in substantially better condition than expected, and 'dark spots' that are in substantially worse condition than expected, given the environmental conditions and socioeconomic drivers they have been exposed to. Significantly, the data show that bright spots do not always appear in remote areas with low fishing pressure and beneficial environmental conditions. In fact, bright spots are generally found in areas of high use "characterized by strong sociocultural institutions such as customary taboos and marine tenure, high levels of local engagement in management, [and] high dependence on marine

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[58] Techera, (n 52), 88.
[59] Robert Johannes 'Government-supported, village-based management of marine resources in Vanuatu' (1998) 40(2) *Ocean and Coastal Management* 165, 165.
[60] Ibid.
[61] Techera, (n 52), 89.
[62] Ibid, 286.
[63] Joeli Veitayaki, Akosita D.R. Nakoro, Tareguci Sigarua and Nanise Bulai, 'On cultural factors and marine managed areas in Fiji' (International Ocean Institute, School of Islands and Oceans, University of the South Pacific, Fiji) 37.
[64] Ibid.
[65] Joshua E. Cinner et al, 'Bright Spots Among the World's Coral Reefs' (2016) 535 *Nature* 416.

resources."[66] One bright spot highlighted is Karkar Island in Papua New Guinea. In this locality practices include an adaptive rotational harvest system, marine tenure that excludes fishers from other villages, and initiation rites limiting entry into particular fisheries.[67] This data adds to a growing body of research suggesting that the long-term viability of ecosystems depends on local populations willingly cooperating in the collective management of marine resources.[68]

Samoa is an excellent example of where traditional customary law has been embraced. Locally drafted by-laws create community-owned protected marine areas, while simultaneously training community members to monitor and manage biodiversity.[69] As traditional customary law regards coastal waters to be the property of villages, the capacity for them to act as stewards could be further utilised as a mechanism for conservation.[70] This approach has allowed the development of limits on over-harvesting implemented through customary 'tabu' ,or bans, enabling the protection of marine resources where stock was threatened or declining.[71] Similarly, the Kubulau District of Fiji has adopted a co-management approach by integrating traditional knowledge across the marine protected area network.[72] This approach combines customary practices with contemporary fishery management principles by incorporating 'tabu' areas with permanent no-take zones.[73]

Regardless of whether customary marine management is designed for the purposes of conservation, or rather for harvesting quality and quantity, it offers the marine environment a form of *de facto* protection that is supported by local communities who are both culturally and practically invested in its long term viability. It is also clear that customary practices, regardless of their intention to conserve, or to boost, harvesting, provide a platform to learn from and build upon. The task is now to combine these practices, with elements of sustainable development, to improve the adaptive capacity of Pacific Island populations in the face of increasing climate variability.

Adaptive Co-Management

The first *World Ocean Assessment* in 2016 highlighted the importance of adopting a 'co-managed', or 'hybrid' approach integrating local input into wider legal and governance frameworks. It noted that, "although climate change is perceived as a broadly global phenomenon, its impacts will be local, depending on a host of local/regional drivers that will interact with global climate changes."[74] While traditional knowledge may sometimes be

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[66] Ibid.
[67] Ibid 418.
[68] Carl T. Folke et al, 'Adaptive Governance of Social-ecological Systems' (2005) 30 *Annual Review of Environment and Resources* 441; Per Olsson et al, 'Adaptive Comanagement for Building Resilience in Social-ecological Systems' (2004) 34 *Environmental Management* 75; Rebecca Weeks and Stacy D. Jupiter, 'Adaptive Comanagement of a Marine Protected Area Network in Fiji' (2014) 27(6) *Conservation Biology* 1234.
[69] Erika Techera, 'Samoa: Law, Custom and Conservation' (2006) 10 *New Zealand Environmental Law Journal* 361.
[70] Ibid,365.
[71] Ibid.
[72] Weeks and Jupiter (n 68).
[73] Ibid.
[74] Office of Legal Affairs, *The First Global Integrated Marine Assessment: World Ocean Assessment 1,* (21 January

dismissed as "unscientific", Cinner and Aswani listed the various ways traditional approaches have informed and parallel modern fisheries management. They argued that co-management approaches would benefit from a greater decentralised governance so that local customary practices can be effectively integrated.[75] Co-management involves the sharing of rights and responsibilities amongst those who have a claim to a natural resource.[76] In the context of fisheries and the marine environment, co-management can "strengthen the potential of customary management to protect both the local environment and the stakes and rights of resource-users while improving the legitimacy of State involvement."[77] This relies on more inclusive and transparent decision making processes between local stakeholders and state bodies.[78]

Co-management can also be described as adaptive co-management (ACM), a concept which has received considerable attention recently as a means of sustaining socio-ecological systems. It is founded on building community resilience and adaptive capacity in establishing sustainable pathways.[79] Plummer found that ACM can contribute to climate change adaptation by developing characteristics that promote the ability to respond to specific kinds of challenges. Additionally, ACM can provide institutional arrangements that work towards generating effective adaptive responses.[80]

Vanuatu has embraced the ACM approach over the last three decades. Moses Amos, a trochus specialist with the Fisheries Department, offered advice on trochus management to fishing rights owners, on their request. He and his team had local support and commenced the process of conducting trochus surveys on village fishing grounds. They provided the villagers with information and advice on trochus, such as where to situate trochus refuges and why minimum catch limits are desirable. They discussed how long trochus fisheries should be closed so stocks could rebuild. In a deliberately informal approach, "Every evening, after each day's diving, the research officers arranged for further informal discussions with resource owners and fishermen, about the importance of harvesting only legal-size shells. (These discussions are usually held around bowls of kava.)"[81].

While Vanuatu has had some success with the ACM approach, not all SIDS have enjoyed the same cooperation. Barriers have included the conflict between Western and customary approaches in both their conceptual underpinnings, intent, and application. However, as the threats posed by the climate crisis become clearer, the need and willingness to embrace

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2016) Oceans and Law of the Sea: United Nations http://www.un.org/Depts/los/global_reporting/WOA_RPROC/WOACompilation.pdf 4.

[75] Joshua Cinner and Shanker Aswani, 'Integrating Customary Management into Marine Conservation' (2007) 140(3) *Biological Conservation* 201, 205.

[76] Olsson et al, above n 68; R. Plummer and D. Armitage, 'A Resilience-based Framework for Evaluating Adaptive Co-management: Linking Ecology, Economy and Society in a Complex World' (2007) 61 *Ecological Economics* 62; C. Fabricius, C. Folke, G. Cundill and L. Schultz, 'Powerless Spectators, Coping Actors, and Adaptive Co-managers: A Synthesis of the Role of Communities in Ecosystem Management' (2007) 12:1 *Ecology and Society* 29.

[77] Ibid.

[78] Ibid.

[79] Olsson et al (n 68) 1; Plummer and Armitage (n 76); Fabricius (n 76).

[80] Ryan Plummer, 'The Adaptive Co-Management Process: An Initial Synthesis of Representative Models and Influential Variables' (2009) 12(2) *Ecology and Society* 24.

[81] Vicki Vaartjes, Quentin Hanich and Aurelie Delisle, *Empowering Community-Based Ecosystem Approaches to Fisheries Management: Strategies for Effective Training & Learning* (University of Wollongong, 2015).

ACM is changing. The key to achieving an ACM approach is to treat customary law and fisheries management as dynamic and adaptive. The answer also lies in community education that integrates both scientific and TEK.[82] The synthesis of the adaptive processes of customary law with contemporary conservation techniques will ensure optimal natural resource conservation, and result in cost-effective monitoring and enforcement solutions. In a marine context, co-management regimes involve the integration of TEK (custom) with modern fisheries science and management strategies (Western). These regimes typically involve both customary and State governance systems, including sanctions to implement management strategies for marine resources[83] in Marine Protected Areas (MPAs).[84] MPAs can provide a bridge between traditional 'no take' zones and Western concepts of 'sustainable management'. They prevent the exploitation of some marine ecosystems, and provide 're-charge' stations for marine life[85].

A 'participatory', or 'community-based', approach to the governance of marine resources is critical to ACM. This has been acknowledged by Pacific governments that recognise that the centralised management approach is both prohibitively expensive, and unlikely to succeed. Therefore, local people are best positioned to act as environmental stewards.[86] Part of the key to a participatory model is community education and consultation that integrates science and TEK. The evidence of the benefits of such an approach were described by Techera, in her discussion of the traditional collection of trochus by communities:

> The trochus are harvested for their shells, which are used for buttons and ornaments and ground down and used as a component in some lacquers. These traditional marine management practices were boosted by governmental endorsement, and the cooperative approach allowed information to flow both ways and traditional knowledge to be combined with western scientific data. Under the scheme the villagers remained in control of their customary fishing grounds and they decided whether or not to impose fishing bans or restrictions, and the form these would take.[87]

Another example comes from the Aceh province of Indonesia. The coral cover of the province was protected by customary management. When examined, the biodiversity was found to be four times more developed when compared to nearby open-access areas subjected to destructive fishing practices, including dynamite fishing and cyanide use.[88] It was observed that there was greater fish diversity, biomass of fish (particularly grazing species), and herbivory inside managed areas integrating modern marine protected areas with customary management. These ecosystems were significantly healthier when

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[82] Cinner and Aswani, (n 75) 211.
[83] Ibid.
[84] Michelle Lam, 'Consideration of customary marine tenure system in the establishment of marine protected areas in the South Pacific' (1998) 39 *Ocean & Coastal Management* 97-104.
[85] Ibid 102.
[86] Johannes, (n 59).
[87] Erika Techera, *Environmental Governance, From International Law to Local Practice* (Routledge 2012) 219.
[88] Cinner and Aswani, (n 75) 207.

compared with the adjacent areas that were open to local fishing.[89] This example demonstrates the impact the ACM approach can have on the wider ecosystem. It serves to show how practices from the Pacific can be applied to marine environments experiencing similar ecological challenges.

Customary governance systems retain a central role in natural resource management in many Pacific island communities. Recognition of this role has been integral to the widespread implementation of locally managed marine areas (LMMAs) throughout the region.[90] Contemporary LMMAs aim to maintain, or improve, livelihoods and food security, conserve biological diversity, and guard against the impacts of climate change. This involves a synthesis of local custom and scientific knowledge, together with incorporating a diverse range of management strategies.

For instance, in Fiji, approximately 400 villages have established LMMAs with support from the Fiji Locally Managed Marine Areas network. This is a national network of educational institution, government, non-government and regional organisations that work with communities to implement marine resource management.[91] It is significant that such schemes are locally driven and their roles range from advisory to active management. LMMAs demonstrate that they can support an effective approach to conserving fisheries and food security for SIDS. It is clear that ACM schemes place great importance on the need for conservation strategies to be responsive to changing social, economic, and environmental contexts. There is also emphasis placed on responsiveness to new information and scientific breakthroughs regarding biological diversity, costs, threats (such as climate change), and how to include this information in planning to ensure ACMs continued effectiveness. [92]

Conclusion

This policy brief outlined how the impacts of climate change on Pacific marine ecosystems are threatening food security. It described the Climate-Conflict-Food Security Nexus, or the linkages between increasing competition over natural resources and the resultant likelihood of conflict. The urgent need to protect ecosystems was highlighted in the interests of maintaining food security, income, social structures and stability of Pacific communities. Legal and management options, focused on the importance of a locally based adaptive co-management approach that engage and empower local people, were discussed. The role of customary law and traditional ecological knowledge was stressed in the context of contemporary environmental governance. There is, however, an underlying warning that the impacts of climate change are unprecedented, requiring rapid adaptive responses that will test any management approach. This policy brief has responded to the Sustainable Development Goals 13 'Climate Change' and 14 'Life Below Water', describing how Pacific communities can strive to take urgent action and "conserve and sustainably use … marine

[89] Ibid.
[90] Weeks and Jupiter (n 68) 1235.
[91] Ibid.
[92] J E Cinner et al, *Institutional designs of customary fisheries management arrangement in Indonesia, Papua New Guinea, and Mexico* (Science Direct 2012) 284.

resources for sustainable development." [93] As the climate warms, ecosystems will become increasingly stressed, and will fail to provide adequate food, leading to the escalating likelihood of community conflict. The overarching message of this brief lies in the importance of working with local communities, as the 'front line' guardians of nature.

Policy Recommendations

1. Climate- Conflict- Food Security Nexus

Environmental science indicates that climate change will place increasing pressure on the capacity of marine ecosystems to provide food, and the effects will escalate the likelihood of conflict.

Recommendation: There is an urgent need to protect marine ecosystems in the interests of maintaining food security, income, social structures and stability for Pacific communities.

2. International law

Through UNCLOS and ITLOS there is an opportunity for SIDS from across the Pacific to pursue cases against high GHG emitting States, pertaining to the resultant damage to marine ecosystems and the threat to food security.

Recommendation: SIDS have the opportunity to secure compensation for loss and damage pertaining to diminishing food security, as the result of the impacts of climate change on marine ecosystems. Compensation will aid adaptation activities, including the restoration and conservation of marine ecosystems.

3. Customary law and traditional ecological knowledge

Customary law and traditional ecological knowledge have an important role to play in the conservation of Pacific marine ecosystems and in the context of contemporary environmental governance. Their inclusion will be more cost effective and will enhance community engagement and stewardship.

Recommendation: When developing Pacific marine conservation strategies, it is important to incorporate customary law and traditional ecological knowledge to strengthen a localised approach.

4. Adaptive co-management

As introduced in Vanuatu, Fiji, and Samoa, ACM should be employed increasingly within a broader schema of legal and management frameworks, responding adaptively to the detrimental impacts of climate change on food security.

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[93] *Progress towards the Sustainable Development Goals,* UN GAOR, 75th sess, Agenda Items 5, 6 and 18(a), 75th sess, UN Doc E/2016/75 (27 July 2016) 17-18.

Recommendation: The amalgamation of local customary practice, knowledge and community education and engagement with modern conservation, scientific and management initiatives will support the ACM approach.

5. Rapid adaptive responses

The impacts of climate change on marine ecosystems are unprecedented and predicted to deteriorate, requiring rapid adaptive responses that will test any current management approach.

Recommendation: New forms of dynamic and adaptive responses to protect Pacific marine ecosystems, and their capacity to provide food, will be required as the impacts of climate change escalate.

The Author

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