Heritage Food Security in a Changing Climate

By Susan McCleary and Cora Moran

ABSTRACT

In addition to providing support for cultural heritage, permaculture guild food forests also provide potential to improve the food security of indigenous peoples in a changing climate. Far from simply being supplemental to people's diets, in many instances food forests have the potential to provide a substantial proportion of the caloric requirements for a community, reducing their reliance on remotely produced grain crops. This paper advocates further research in this area, using work by McCleary (2016) as a template to assist indigenous communities in maintaining their food security and cultural traditions in a rapidly changing climate.

Key Words: marginalized communities, high density food, forest gardens, food security, food sovereignty

Permaculture is an agroecological practice that can integrate traditional ecological knowledge into sustainable agriculture such as forest gardening. The term is derived from the words 'permanent agriculture' and 'culture', as created by David Holmgren and Bill Mollison, who developed the permaculture design system during the mid 1970s (Mollison & Holmgren, 1978). One goal of permaculture design is to create a regenerative closed loop ecosystem. Currently, there are many uses for it. Permaculture has been described as a development strategy (Veteto & Lockyer, 2008), a conscious landscape design (Holmgren, 2002), an agriculture philosophy (Mollison, 1998), and a design system for the application of agroecology. Furthermore, one of the widely held definitions is that permaculture is a design system that is based on agroecology, indigenous farming systems and traditional ecological systems.

Permaculture is also broadly classified as a holistic section of the ecological design of sustainable development (Rhodes, 2012) that is a practice of agroecology. Permaculture practitioners claim that their techniques have a wide range of positive effects on the social and ecological environment (Mollison & Holmgren, 1978; Ferguson & Lovell, 2014). In comparison to industrial agriculture, these benefits include reduction of water pollution, increased biodiversity, enhanced soil quality, and increased food yields (Rhodes, 2012), with practices that are organic and biodiverse. These practices incorporate techniques such as companion planting, water harvesting and sustainable resources use such as composting manure use (Conrad, 2013). Mollison & Holmgren define permaculture as a:

> design system [that] allows individuals to use their knowledge of large abstract issues and then implement small changes within their own lives to make a difference. This is one of the fundamental benefits that the design system provides. The framework is also loose enough that it can be applied per the needs of the user in extremely varied situations. The users of the permaculture design in these cases have all focused on improving local food security by growing food for local and subsistence purposes and wish to increase their communities' capacity to become self-sufficient (Mollison & Holmgren, 1978: p.151).

Practitioners and professionals have embraced permaculture across fields ranging from governments [e.g., Cuba] to smaller social justice organisations [e.g., Movement Generation] as a way to create sustainable development on a local level (Starr & Adams, 2003). The nature of permaculture practice can be, in principle, a form of community participation that promotes social justice by creating a space that is separate and resistant to the capitalist form of agriculture that plays a prominent role in widespread food insecurity (Starr & Adams, 2003). As such, permaculture can be used as a strategy to help enable economically marginalised communities to reduce their food insecurity and levels of economic inequality, and as such merits further investigation. Permaculture is an eclectic and adaptive approach that emphasises local and bioregional perspective and practice. At the same time, it is informed by a global view, maintains a strong tradition of technology and knowledge transfer across diverse areas and cultural traditions, and is fundamentally based on empirical observation and experimentation (Veteto & Lockyear, 2008).

Permaculture, Forest Gardens and Tree Guilds

There is a growing amount of evidence that permaculture methods offer a way to address soil degradation, and food insecurity and Food Sovereignty through regenerative or restorative agroecology (Rhodes, 2012). Permaculture also helps to increase overall soil health (Rhodes, 2015), along with natural and social capital in marginalized communities (Altieri, 2009), which helps in addressing food sovereignty. In creating a permaculture design, patterns of landscape and function are emphasised to incorporate the principles of permaculture to minimise waste and energy inputs, by creating systems that are holistic and resilient (Rhodes, 2012). Figure 2 captures the complex interactions that occur in the soil food web system. ***(Figure 2).***

Permaculture designs are created to mimic natural interactions such as the soil food web as illustrated. These designs are created to evolve into complex systems that are capable of producing a high density of food with minimal energy input (Rhodes, 2012). These principles are an important consideration in the experimental design of this research project since permaculture can regenerate and maintain soil health of the project. It can help also grow perennial culturally appropriate food with little input or maintenance requirement. One method of the permaculture design is the forest garden.

Permaculture growing methods such as forest gardening offer the potential to further the preservation of such species including those that are even

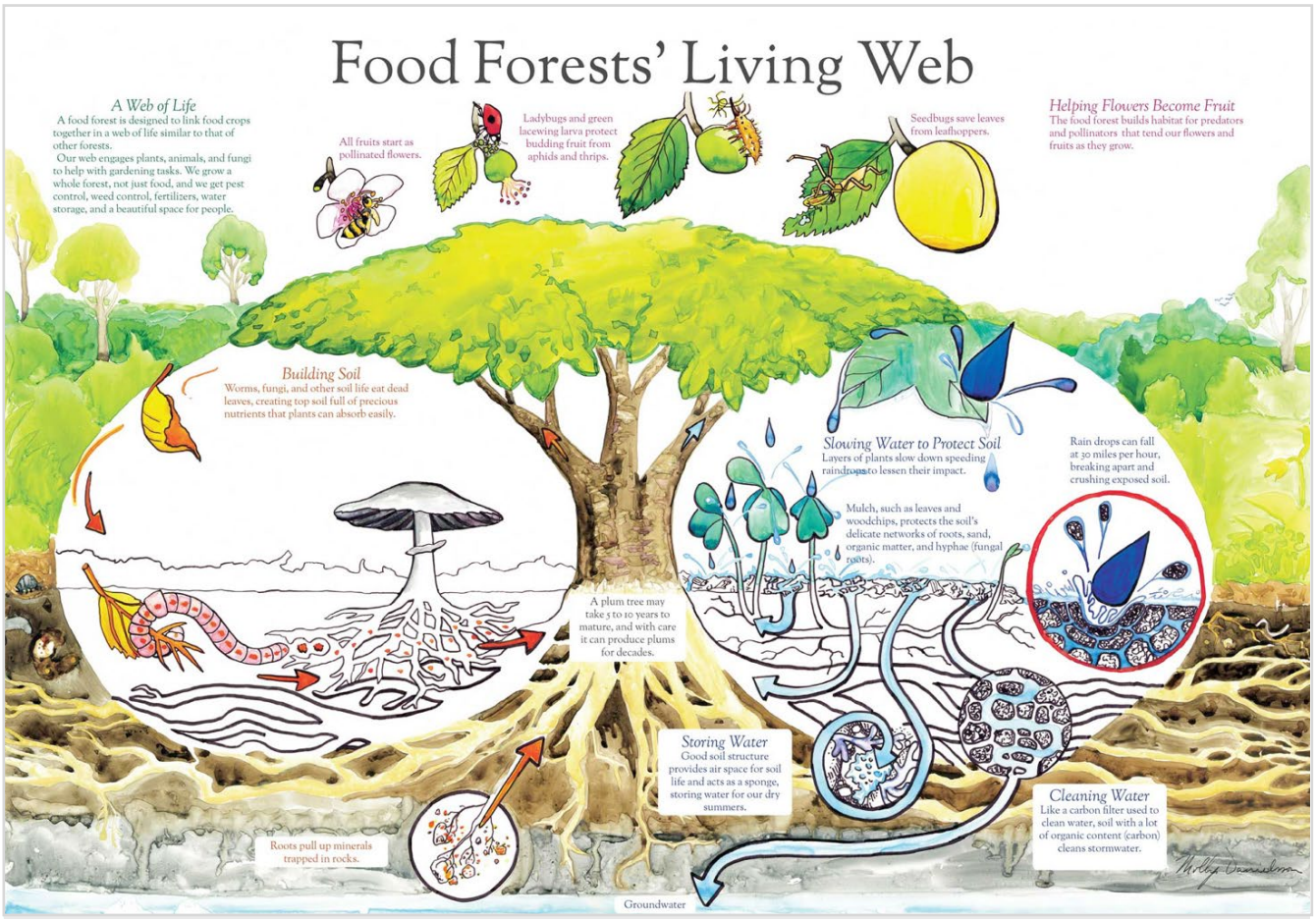

Figure 2: Depiction of the interaction between the food forests and the soil food web (Langstraat 2016).

more obscure than those mentioned above. Preservation is achievable for species such as an only regionally found sister species to Hopniss, Apios Priceana from Kentucky (Robins, 2012). Forest gardening offers a range of benefits over annual monocropping, as the plants grown are predominantly perennials there is a reduced need for fertiliser inputs and have reduced cost outlays beyond initial start up, such that new seed is not needed to be purchased every year (Eliade, 2011). Most modern cultivars of annual crop have been bred for yield and are very vulnerable to climate change, yields often being drastically cut by erratic weather. Perennial plants have often undergone less intensive selection and have greater capacity to cope with erratic weather. Forest gardens are also polycultures and as functioning ecosystems have greater subsidiarity of functions, many different species within the overall system can stand in for one another and maintain system stability in the face of adverse conditions (Eliade, 2011). Another method of the permaculture design is the permaculture guild or the tree guild.

A permaculture guild is defined as "a grouping a plants, trees, animals, insects, and other components that work together to help ensure their health and productivity" (Never Ending Food, 2019).

The permaculture tree guild as depicted in Table 1 below is a component of the "food forest" design.

The food forest was the framework for the design of the permaculture community agriculture project. A permaculture tree guild has seven levels:

Table 1:

Seven Levels of a Forest Garden:	
1	Fruit tree or nut tree level
2	Lower tree level
3	Bush or shrub level
4	Herbaceous level
5	Rhizosphere level
6	Grown cover level
7	Vertical/ climbers level

A permaculture tree guild utilises the concept of companion planting, which is the close planting of plants that benefit from each other's growth and/or they protect each other from pests (Food Forest and Gardens, 2010). This is one of the fundamentals of permaculture gardening ***(see Figure 3)***. As a self-sustaining system with multifunctional plants that maximizes plot space (Food Forest and Gardens, 2010) it reduces the need for physical energy and chemical amendments.

Food Security in the Face of Climate Change

There have been many international declarations throughout the years, for example, The Universal Declaration of Human Rights (1948); The Interna-

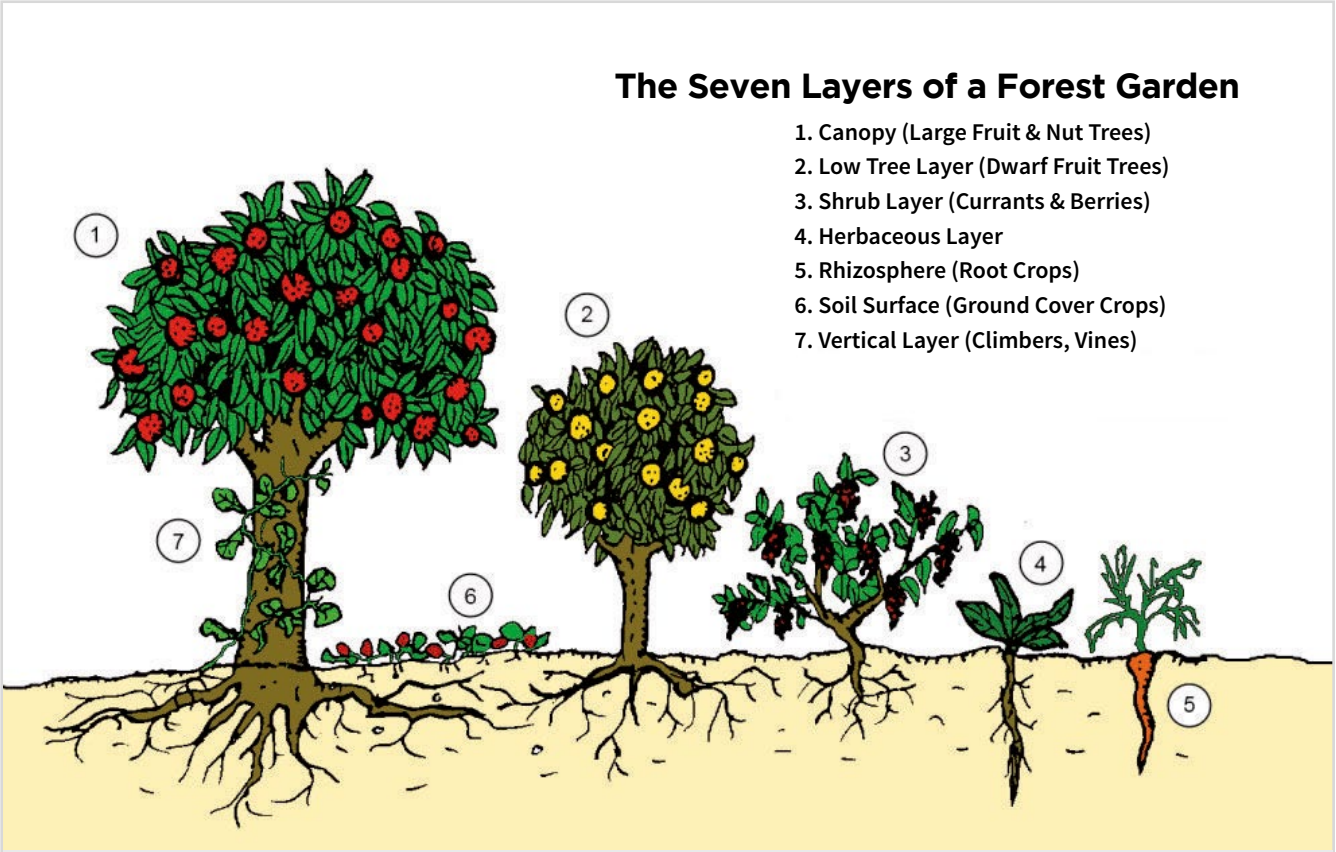

Figure 3: The components of a Food Forest Tree Guild (Eliade, 2011)

tional Covenant of Economic, Social and Cultural Rights (1964); and the UN Millennium Declaration (2000) and the UN 2015 Sustainable Development Goals (2015) that have declared freedom from hunger as a basic human right (Gregory, 2009). However, this right is being contravened in many of the countries that signed those declarations including the U.S. despite identifying specific goals relating to hunger. Rates of hunger globally have been increasing since 2014, with 821 million people undernourished as of 2017 (FAO, 2018). This can in part be attributed to an increasing number of adverse climate events in addition to economic and geopolitical issues in different regions of the world (FAO, 2018).

Current farming systems have continued to improve yields from the mid-20th century to the present. However, the majority of global calories are provided by a small number of crops, partly due to their ability to be produced on a very large scale with minimal labour and stored for long periods, making them a highly profitable commodity. Wheat, rice and maize currently provide more than half of the calories for humanity globally (Awika et al 2011, p.1).

Of these only a few main cultivars are grown and a combination of rising global demand and the increasing prevalence of extreme weather events due to climate change means the risk of shortages is increasing annually. This is a risk that is being further exacerbated as a few main countries only supply products for international markets. There has been an average of one degree of warming so far globally and yields of major crops are predicted to decline with every degree of warming (see Figure 1 below), though global population is set to continue to increase. It also seems most likely that ambitions to meet the Paris Climate Goals are unlikely to be

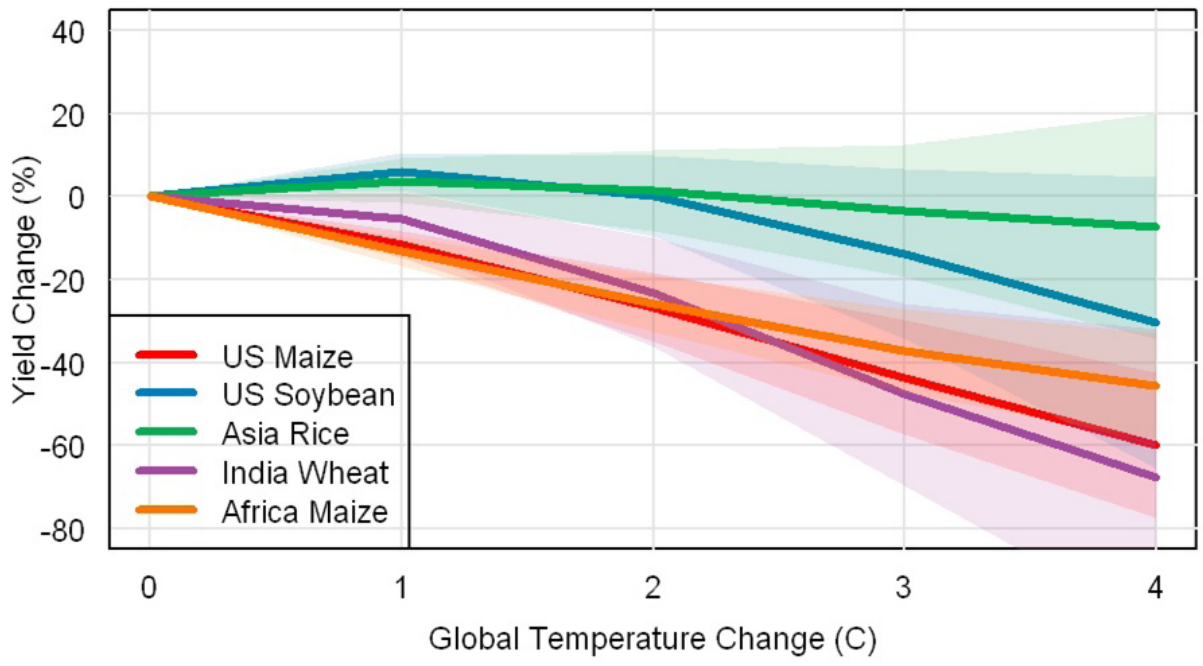

Figure 1: Loss of Crop Yields per Degree of Warming (climatechange-foodsecurity.org, 2019)

met (Raftery et al., 2017) with capacity for much greater warming than currently experienced. There is also a substantial risk that positive feedback loops within natural systems will be triggered which will irreversibly change the climate and substantially increase the total amount of warming (Alfthan et al 2019, p.48), exacerbating the effects on agriculture.

The use of a wider range of crops than the few main grain crops that provide the majority of global calories has great potential to improve levels of food security, particularly for marginalised groups. Some plants that were the staples of indigenous peoples around the world have become popular global commodities such as maize from what is now Mexico and potatoes from the Andes. Many of these plants are still used as staples amongst indigenous peoples, alongside other crops that though not known well globally are still grown at scale within specific regions. For example, in Andean South America root vegetables such as Ulluco, Mashua and Oca are grown as subsistence crops alongside the more widely known potato (International Potato Center, 2018). There are other unusual plants like Yakon that are also locally cultivated (International Potato Center, 2018). Promoting wider scale planting of such crops will provide a greater level of resilience to climate disruption in agriculture.

A variety of other crops that are less well known have also recently been popularised for use in forest gardening; often to the extent that it has helped preserve the viability of the species. For example, North American plants such as Apios Americana or 'Hopniss' (Medik, 2012) and Sagittaria Latifolia or 'Wapato' (Willd, 2012) have been largely preserved through domestication.

In addition to food staples, plants grown by indigenous peoples are used in a vast range of medicinal and other uses and are integral to their cultural heritage (Mahapatra, 2017). Promoting the use of such plants can play a critical role in helping preserve this heritage alongside helping to promote food security for often marginalised groups in a changing climate (Mahapatra, 2017). Small-scale programs have also been set up by indigenous peoples planting forest gardens to regain access to plants that used to be found in the wild but which have been lost due to climate change and offer potential to improve their food security and maintain their cultural traditions (Gamble, 2019).

The Utility of Permaculture Methods for Indigenous Peoples

Permaculture is derived from long-held knowledge of plant and animal systems that combine ecology and environmental sustainability and as such its foundation is in traditional ecological knowledge (Gomez-Baggethun et al, 2013). Historically, indigenous agricultural knowledge, the cultural significance of food and the specific nutritional needs of indigenous populations have been ignored by efforts to introduce non-traditional agricultural techniques. The lack of acknowledgement of the holistic nature of indigenous food insecurity has resulted in a failure of an adaptation of the western type of cultivation practices (Deur & Turner, 2005).

The lack of access to nutritious food has become a critical issue in marginalised and indigenous communities (FAO, 2010; Vivas, 2014). For instance, in the First World reservations of North America, pover-ty, unemployment and food deserts are major

drivers of food insecurity (Sarche & Spicer, 2008). Food security research in these communities is primarily focused on access to food, including the distance needed to travel to reach adequate food and the abil-ity to afford nutritious food, rather than the ability to grow food (Sarche & Spicer, 2008). Yet there is a growing shift in food security research to encompass community agriculture as a possible solution to food insecurity in marginalised communities (Hallberg, 2009). In the context of a rapidly changing cli-mate, permaculture design systems present a useful framework, which indigenous communities can use as a tool for community schemes towards this end.

The foundation for traditional ecological knowledge (TEK) as is with permaculture is that everything is interrelated and both knowledge systems teach to work in partnership with the land (Krohn, 2007). For example, within the context of North America, Elders in "Indian country" define wealth as having strong cultural traditions, having access to traditional foods and medicines, as having knowledge of how to gather and prepare the foods and medicines (Krohn, 2007). Bruce Miller explains,

> "We call the plants the First People. They were the first created in our oral tradition before the animal, before the fish, before the birds, and their duty was to hold the earth together and live their life as a teaching for those who would be created in the future (Bruce Miller, no date; Krohn 2007).

It is an example of the oral traditional ecological knowledge that is used to depict the interconnect-edness of the ecosystem. Table 2 lists the different aspects of Tribal food sovereignty:

Table 2:

Tribal Food Sovereignty (Native Food Systems 2017)

Communities that exhibit tribal food sustainability and food sovereignty are those that:	
1	Have access to healthy food
2	Have foods that are culturally appropriate
3	Grow, gather, hunt and fish in ways that are maintainable over the long term
4	Distribute foods in ways so people get what they need to stay healthy
5	Adequately compensate the people who provide the food

Tribal communities are implementing food sovereignty; they are taking control of their food supply by planting culturally appropriate, tradition-al foods and medicinal plants. They are also working to regain and retain the rights to tribal lands so that they can hunt and gather their foods (Native Food Systems, 2017).

Some initial studies have been made to inves-tigate the efficacy of permaculture to aid in this Native Food Systems. Research by McCleary (2016) assessed the socio-cultural viability of communi-ty sustainable agriculture projects with a focus on permaculture and the use of traditional knowledge and practices as examples of this by American Indian communities in the Pacific Northwest of the U.S. The fieldwork focused on the introduction of a permaculture community project with participants creating a community permaculture food forest with the integration of TEK, historical agricultural prac-

tices and tribal cultural practices. Permaculture principles were utilised as a framework to create a small-scale sustainable agriculture project, which was designed to honor the patterns and history of the traditional agriculture of the tribal peoples.

Conclusions & recommendations for further research

In summary, permaculture is forwarded as a possible way to establish Indigenous Food Security and Food Sovereignty, which allows for communities to be able to control their whole food systems and to lessen their dependence on industrial food systems while maintaining the ecosystems for future generations (Mollison & Holmgren, 1978). Research by Ray, et al. states that Indigenous food and food systems are intrinsic to the health and well-being of Indigenous people (Desmarais and Wittman, 2014), but in the past there has been little research that specifically addresses Indigenous food and food systems. Given the interconnectedness of food systems, Indigenous health and climate change, this paper advocates further research in this area to assist indigenous communities in maintaining their Food Sovereignty and cultural traditions in a rapidly changing climate.

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ABOUT THE AUTHORS

Coran Moran

Cora Moran is an experienced researcher with degrees in Anthropology & Environmental Sustainability who has worked in the Built Environment & Renewable Energy sectors for a number of years. She writes about a range of environmental issues for journals & press publications; her main research areas are Permaculture & Urban Sustainability with a focus on the UN Sustainable Development Goals.

Susan McCleary

Susan McCleary is an independent researcher with an MRes Degree from Scotland's University of Edinburgh School of Geoscience. In her detailed essay *An Introduction and Long-Term Viability of Community Sustainable Agriculture Projects within Marginalized Communities* Ms. McCleary applies multidisciplinary theory and methods to reveal the complexities of applied Salish traditional knowledge in the management of small-scale agriculture in the Pacific Northwest of the United States and Southwest Canada. Her article illustrates a demonstrated example of blended Fourth World science and conventional science focused on food sovereignty and food security.