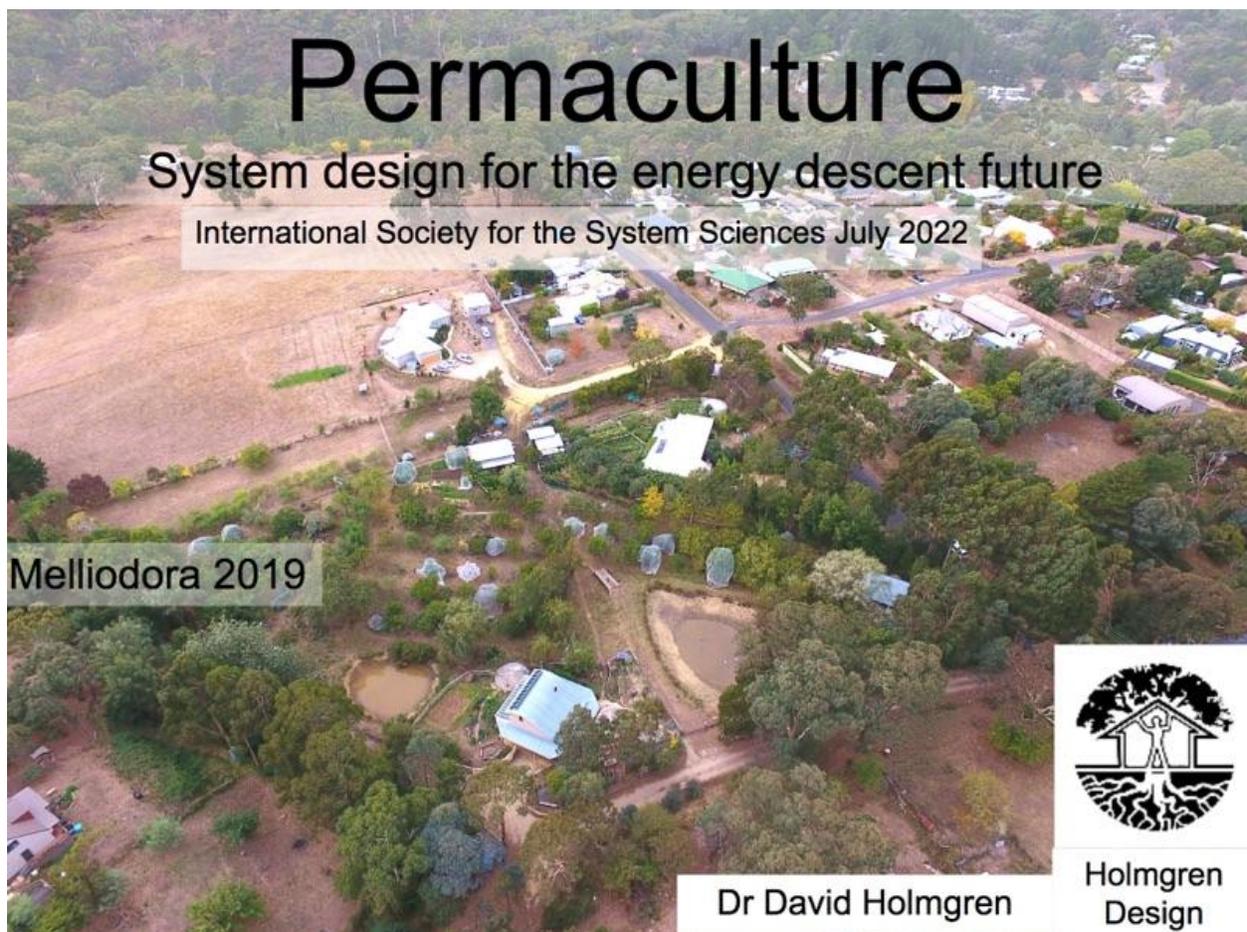


**International Society For The Systems Sciences**  
**Keynote address**  
**Dr David Holmgren**  
**July 2022**



**Slide 1 Caption: Aerial view of Melliodora 2019**

As the co-originator of permaculture, I am honoured to be invited to present this keynote address to the world's oldest system science society. I want to first acknowledge that I am speaking to you from Melliodora, Hepburn Springs about 120 kms NW of Melbourne. This is Djadjawurrung country and like the rest of Australia, it was never ceded by the indigenous people who were displaced and dispersed by squatters (illegal graziers) in the 1840s and, from

the 1850s, by a surging population exploiting the world's richest gold region. Wool and gold contributed to Australia becoming (by 1900) the richest country in the world (per capita).

## **Fryers Forest Vic. 2001: Integrating eco-forestry & residential amenity in the heart of the Box-Ironbark biome**



**Slide 2 Fryers Forest: forestry in an ecovillage**

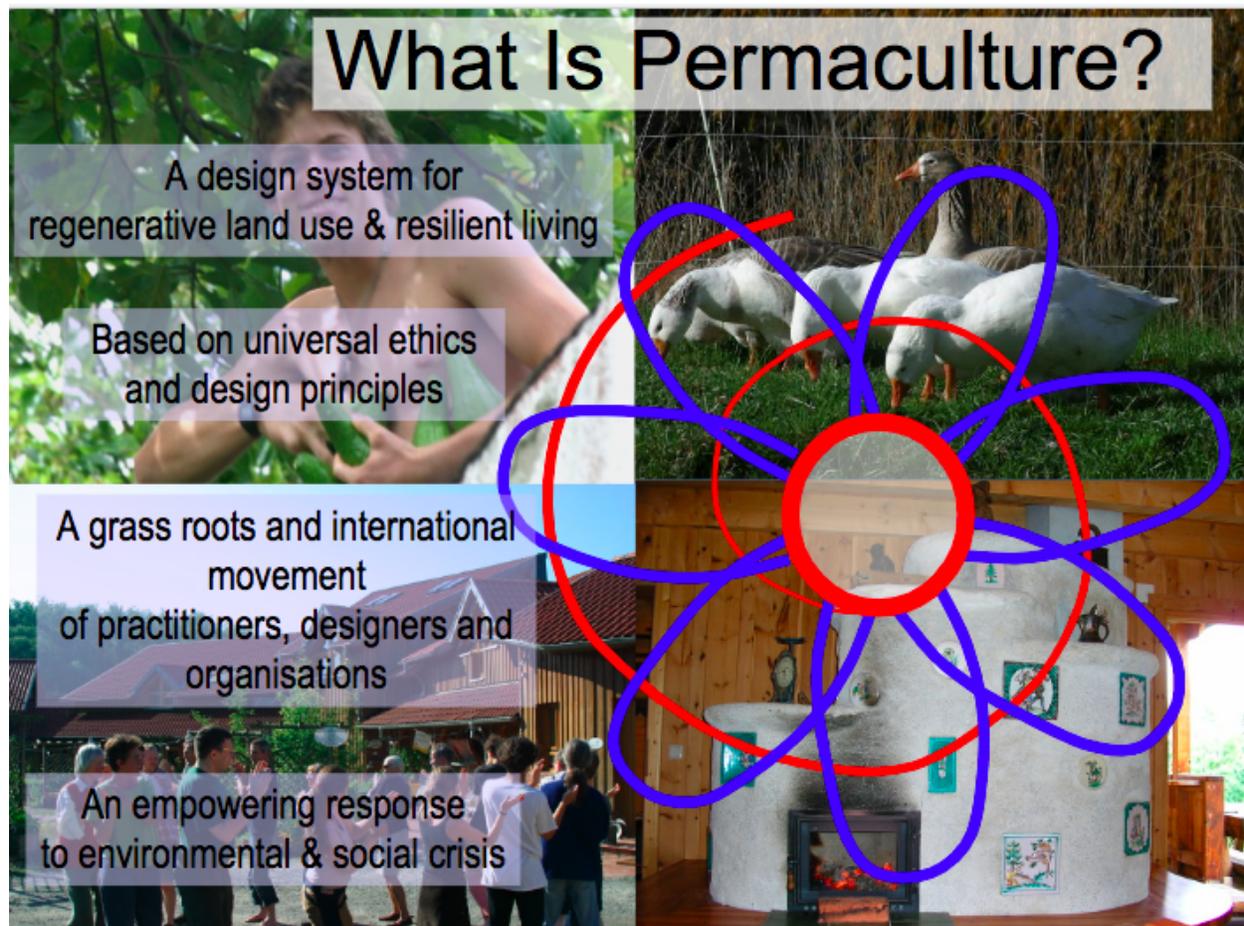
I am a generalist jack-of-all-trades permaculture designer, teacher, writer, ecological builder, farmer and forester. While I grew up with a strong faith in science and excelled in school, my grasp of scientific method and especially higher maths is rudimentary at best. My limited higher education in the arts (BA Environmental Design) was a unique one through which I co-created the seminal articulation of permaculture.

Since then I have turned down opportunities for further formal study. I used to somewhat arrogantly joke that I was waiting for the honorary doctorate. While I graciously accepted the honorary doctorate when it did come from CQUniversity in 2017, the year before was perhaps a more important milestone in academic recognition of my life as a public intellectual outside of academia. In my home town of Fremantle, Western Australia, I was invited to present the [2016 Keith Roby Memorial Lecture](#) in Community Science at Murdoch University.

In a different way, I see this invitation as a sort of conceptual homecoming and acknowledgement of my work, and permaculture generally, as being novel vernacular applications of, at least some of, the power and potential of systemic thinking and science.

In focusing on the influence of system science on the origins and evolution of permaculture, I will use a combination of personal anecdotes and perspectives to contextualise some of the geopolitical, socioeconomic and psychosocial factors affecting the evolution and adoption of permaculture over the last four decades. In the process, I hope to show how these factors have both highlighted and hampered recognition of the power of system science to elucidate, and permaculture to creatively respond to humanity's energy descent future.

In an extended version of this presentation, I have provided some further anecdotes and references, but some of my claims may be just clues for historians to track the chequered pathways by which abstraction finds application, and in the process, changes the world. Those changes are more often in small, subtle and hidden ways, happening at the geographic and conceptual fringes rather than through influencing centralised power. This all reflects the permaculture design principles of "Use small and slow solutions" and "Use edges and value the marginal".



### Slide 3 Definitions of permaculture I have been using in my education work for many years

So what is Permaculture?

It's about food and how we produce it

It's about a working relationship with nature

It's about tools and technology and

It's about people and community

But in essence: Permaculture is a design system for regenerative landuse and resilient living.

While the impact of permaculture in the monetary economy may have so far been marginal, its contribution to restarting and retrofitting household and community non-monetary economies of self and collective provision, is one of the hallmarks of the design system, and the associated social movement that has grown to replicate and adapt this thinking to very diverse contexts.

#### Permaculture Ethics

-  Care of the Earth
-  Care of People
-  Fair Share

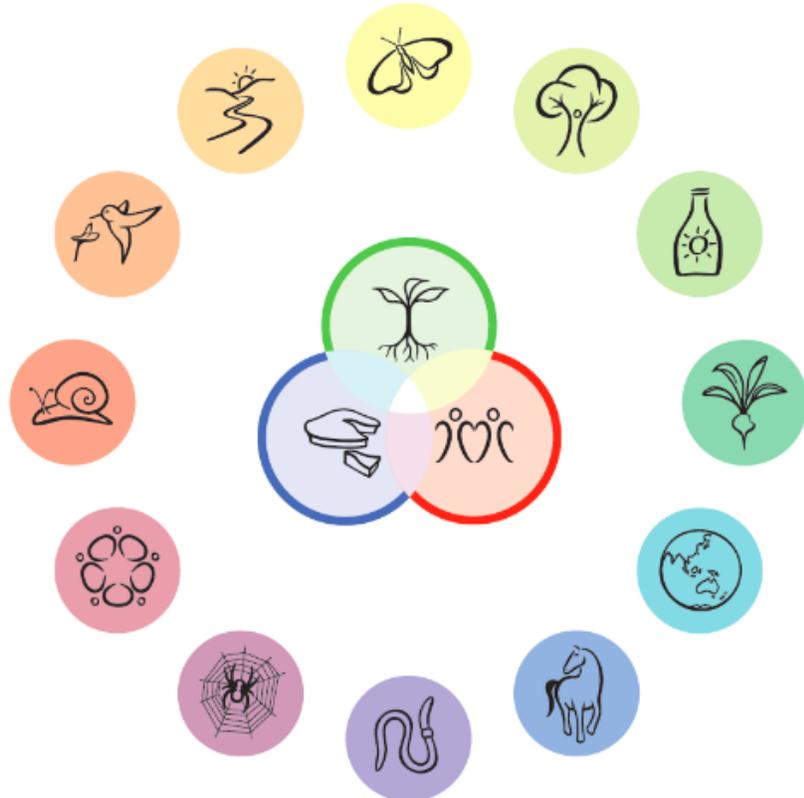
#### & Design Principles

-  1. Observe & interact
-  2. Catch & store energy
-  3. Obtain a yield
-  4. Apply self-regulation & accept feedback
-  5. Use & value renewable resources & services
-  6. Produce no waste
-  7. Design from patterns to details
-  8. Integrate rather than segregate
-  9. Use small & slow solutions
-  10. Use & value diversity
-  11. Use edges & value the marginal
-  12. Creatively use & respond to change

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### Slide 4 Permaculture ethics and principles

The three ethics Care of earth, Care of people and Fair Share distinguish permaculture from any purely scientific endeavour or design tool kit. These align with values of connection that are common to all traditional cultures of place. The twelve design principles each encapsulate an

aspect of systems thinking that work in tension like the spokes keeping a bicycle wheel true and rolling (around the hub) formed by the ethics.

## **9: USE SMALL & SLOW SOLUTIONS**

***The bigger they are, the harder they fall***



***Slow and steady wins the race***

## **11: USE EDGES & VALUE THE MARGINAL**



***Don't think you are on the right track just because it is a well-beaten path***

---

**Slide 5 Two examples of principles with their icons and adages**

With each of the 12 design principles we use an icon and relevant proverbs from vernacular culture that show how systemic thinking is not so novel or alien.

# Agriculture & Architecture: Taking the Country's Side

<https://agriculture-architecture.net/>

Display panel from Lisbon Architecture  
Triennale 2019 by Sebastien Marot  
acknowledging influence of Meadows et al  
in environmental thinking generally and  
specifically permaculture



**Slide 6 Display panel from Lisbon Architecture Triennale 2019 by Sebastien Marot acknowledging influence of Meadows et al on environmental thinking generally, and permaculture specifically.**

Permaculture draws strongly on the science of ecology, especially systems ecology, and also geography, to understand and redesign both human settlement and husbandry of nature at multiple scales from the backyard to the bioregion. This primary focus has led to some recognition as it being central in the search to reunite two primary activities of humanity: [agriculture and architecture](#). This recognition is part of a thesis that this separation is the source of the Limits to Growth crisis facing humanity in the Anthropocene.

Design, as both a noun and a verb, is completely central to architecture and derivative professions, but the application of design to agriculture and natural resource use more generally was, at best, marginal before permaculture. Today the idea that farm design might be as important as cultivation and husbandry in any vision and practice of ecological agriculture, has been normalised.



## 2: CATCH AND STORE ENERGY

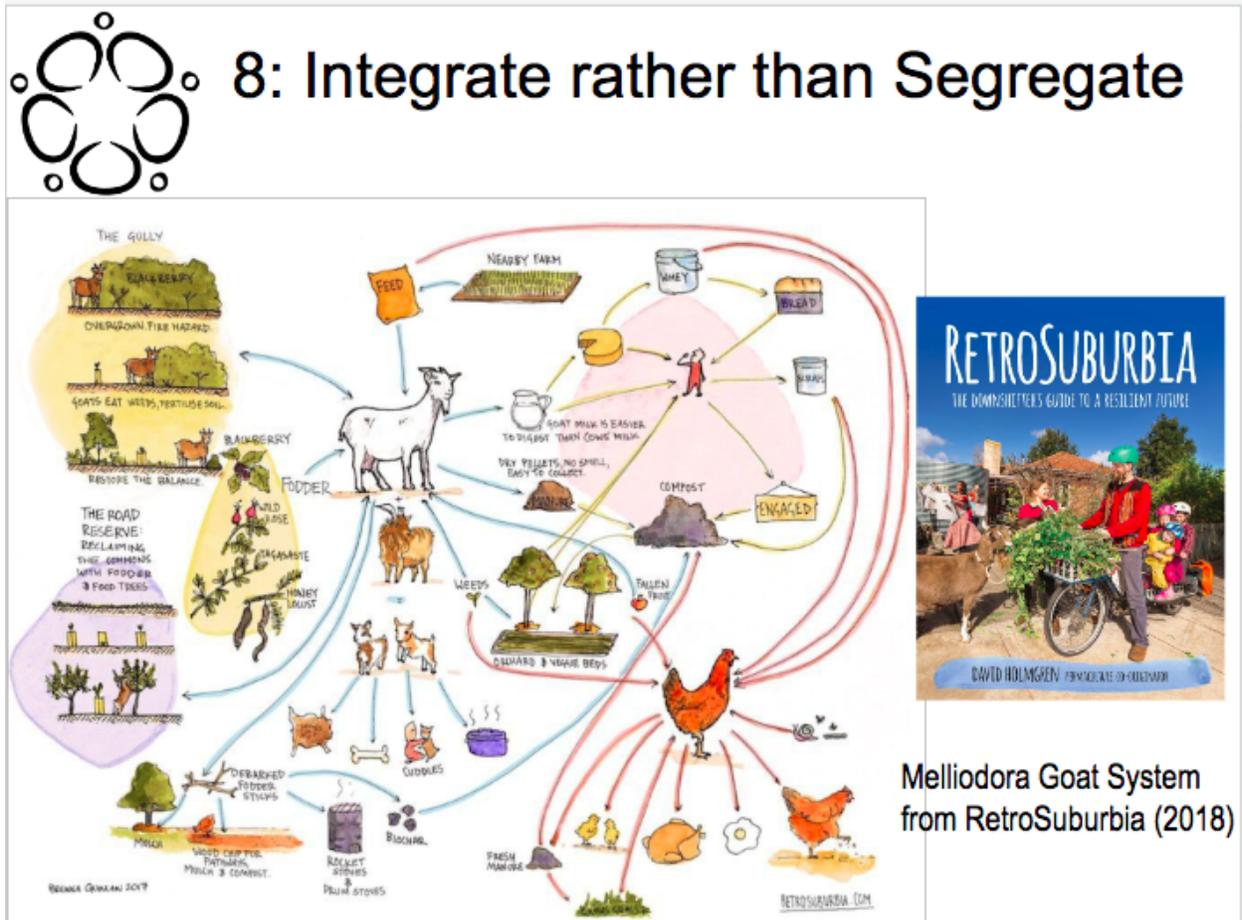


**Slide 7 “Forever Growing” permaculture nursery, Glenlyon, Vic. 1996: catching and storing of water in dams and tanks.**

The modest examples of permaculture redesign of farm and forest hinterlands to harmoniously accommodate more people is just beginning to show the potential to create nurturing work environments with diverse design-, skill- and labour-intensive livelihoods. In the process, the first steps towards a relocalised and reruralised world can be seen as a realistic alternative to the globalised urbanism of the fossil fuel era (see [Norberg-Hodge 2019](#))

In my view, the future will be one of energy descent in which the permaculture principle “Catch and store energy” will become normalised as (recovered) common sense. From the seasonal restocking of the household larder, to storing water from seasons of abundance to those of scarcity, catching and storing energy in diverse forms will become a defining pattern of degrowth economies as reliable free flowing energy and resources from depleting stocks fade into history (see [Alexander & Floyd 2017](#)). From a macro systems perspective, the shift to diverse, distributed, intermittent and low power density renewable energy sources appears to be non-negotiable.

Growth in the energy harvest, conversion, storage and distribution industries is one of the signs of (net) energy descent and consequent economic Degrowth. For most economists under the spell of GDP, this is counterintuitive because growth in any sector of economy equally contributes to GDP.



Slide 8 *Graphic from RetroSuburbia illustrating the interconnected nature of the elements of a permaculture system.*

The early permaculture vision of suburban and other urban habitats being retrofitted for food production and more home-based lifeways was a powerful expression of the permaculture aphorism “[The problem is the solution](#)”. This [rurualising of suburbia](#) remains one of the potent land use and economic changes for a prosperous way down.



# 1: OBSERVE AND INTERACT



**Slide 9 Peter Harper observing and interacting in the display garden at the Centre for Alternative Technology, checking cabbages for parasitic wasps controlling aphids, Machynlleth, Wales, 1994**

While academia provided a nursery for the germination of the permaculture concept, it was shaped by direct observation and working relationships in and with nature. This direct experiential learning reflects both ancestral self-reliance that was essential to survival in societies with less specialised and segregated ways of life, as well as modern DIY culture that has become one pathway of lifelong learning, at least for the modern middle class. This direct experiential learning (encapsulated in the principle “Observe and interact”) is an antidote to the prevailing thinking that observation is detached and objective while interaction is by default driven by animal spirits for short term economic gain.

The emergence of a network of teachers, designers, activists and practitioners simultaneously made permaculture into a social movement. This populist culture pathway to influence occurred without significant government, corporate or institutional support. It also survived through the ups and downs of multiple waves of environmental thinking and activism over the last 50 years, during which radical ecological and systemic approaches to the Limits to Growth

have been alternatively considered as progressive responses, or marginalised and derided as regressive and Luddite reactions.

## Conceptual influences on permaculture



- Indigenous cultures
- 19<sup>th</sup> Century economic botanists
- Organic farming pioneers
- *Limits to Growth*, Meadows et al
- Ecological energetics of H.T. Odum

### Slide 10 *Examples of some of the many influences on permaculture*

Indigenous and traditional cultures of place have directly informed and inspired the conception and the ongoing evolution of permaculture through aspects of unbroken lineages, recovered knowledge and practice, and historical records. The ongoing destruction of those patterns by the pulses of governance and exploitation from the centres of urban power over the last few thousand years are accelerated by fossil fuelled industrial modernity.

Permaculture has also undergone continuous evolution and emergence through cross-fertilisation with kindred concepts and networks. This is especially so in the age of the internet, which has seen it benefit from a flexible and generalist response to new information and opportunities. At the same time the “jack of all trades, master of none” issue has made permaculture very hard to study academically (see [Ferguson and Lovell 2015](#)). Likewise, it is hard for permaculture networks to focus on refining ecologically designed systems to prove them robust and productive. This lack of scientific rigor and evasion of the hard lessons of both

nature and market forces in determining economic viability have seen permaculture often dismissed as eco-fashion.

Some of the most potent and creative criticism of permaculture has come from within the movement and focused on that mysterious heart of permaculture: the design process. Colleague Dan Palmer’s critique (in the blog [Making Permaculture Stronger](#)) is that the design processes most widely used in permaculture aggregates elements to create systems based on an industrial assembly model rather than a process that progressively differentiates existing wholes based on the living design model of nature, as outlined by visionary architect Christopher Alexander. Most of this debate about design is in the humanities. I assume there is a parallel debate about mechanistic and living system models in systems science? Much of this action and reaction to permaculture reflects the context of discretionary middle class affluence in overdeveloped nations.

## Chikukwa Project: 3 decades of permaculture in Zimbabwe



Table 1: Enough food by ward

Ward	Monthly Status (%) of households reporting Enough Food											
	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	July
Chakohwa	40	36	28	28	32	28	36	60	64	60	60	52
Chayamiti	50	46.2	38.5	38.5	34.6	46.2	42.3	50	65.4	69.2	69.2	65.4
<b>Chikukwa</b>	<b>83.3</b>	<b>83.3</b>	<b>79.2</b>	<b>66.7</b>	<b>70.8</b>	<b>70.8</b>	<b>87.5</b>	<b>91.7</b>	<b>95.8</b>	<b>95.8</b>	<b>95.8</b>	<b>95.8</b>
Chikwakwa	24	8	8	12	20	24	28	36	44	48	36	40
Manyuseni	72	68	60	60	52	64	72	72	84	84	84	79.2

**Slide 11 *The Chikukwa Project: a long running permaculture project helping to develop and feed a community in Zimbabwe***

However permaculture has also established influence and organisational networks designing and implementing systems with and by the most disadvantaged; ranging from rust belt cities of

the industrial north to traditional rural and indigenous communities attempting to navigate the adverse impacts of both local environmental degradation and modernity to refugees forced to create new life in alien and marginal places.

From this quick sketch of the origins, evolution and influences on permaculture, I now want to examine more closely the role of system science and specifically the Limits to Growth and work and lineage of HT Odum in the origins and ongoing evolution of permaculture.

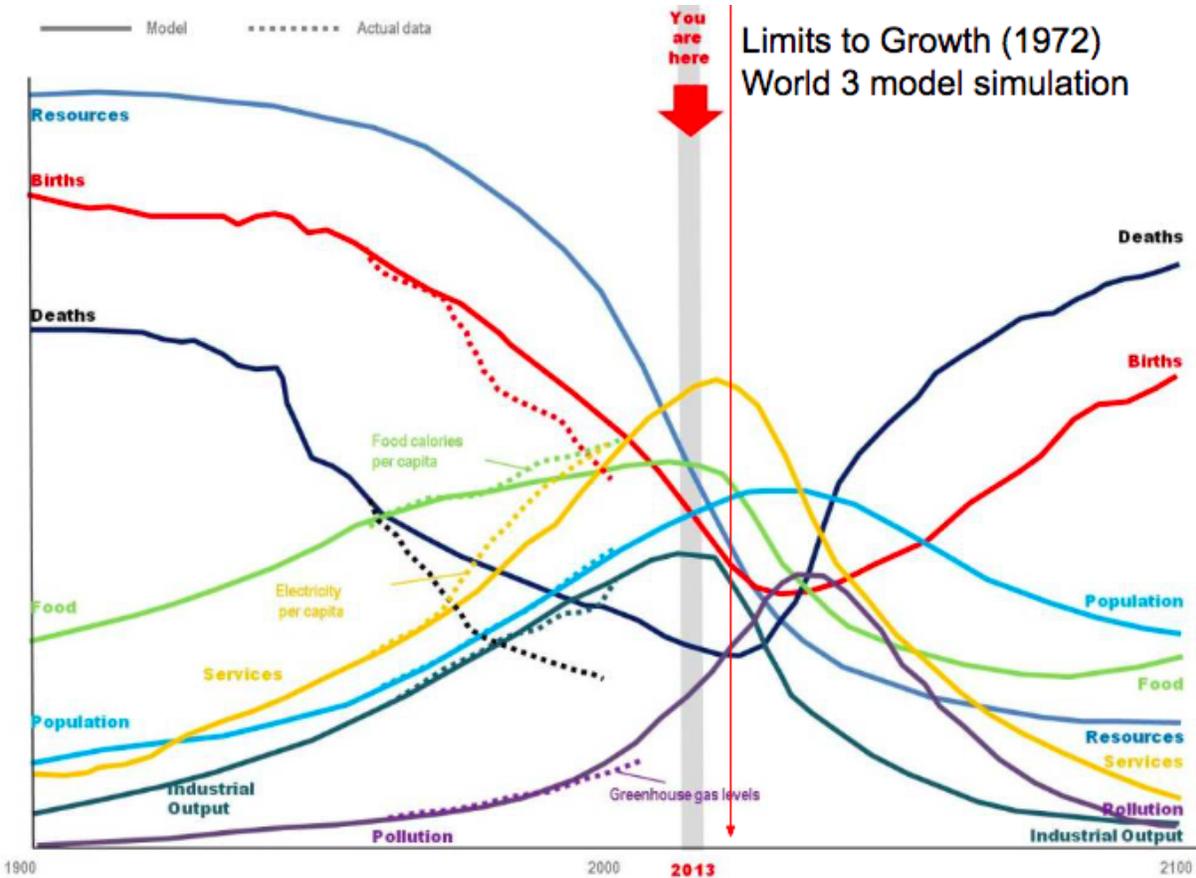


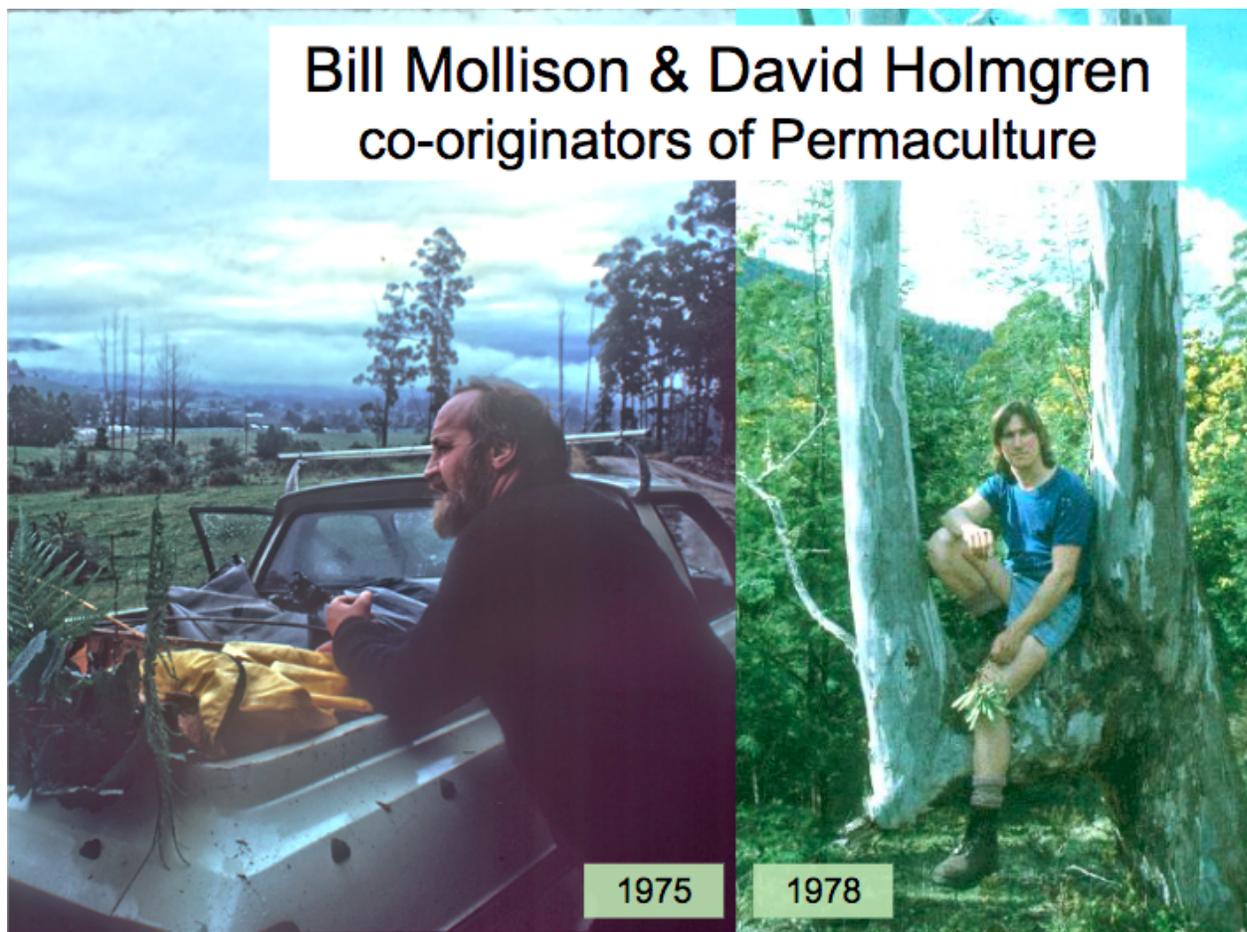
Image credits – Mahivuni.com

### Slide 12 Real world data collected up to 2013, compared to the World 3 modelling

I still regard the *Limits to Growth Report* of The Club of Rome (1972) as the most important and influential scientific report in history, more important by far than any of the IPCC reports. It shaped the conception of permaculture to restore and husband use of renewable resources to counter both the damage from, and depletion of, non-renewable resources. In that first great wave of modern environmentalism (that I date from 1972 to 1983), the focus was on depletion of resources, especially the king resource of oil, while in the second wave (1988 to 1992) the focus shifted to climate change and carbon emissions as the prime metric for “sustainable development”.

The World 3 model underpinning the *Limits to Growth Report* (created by Meadows et al) did not directly consider either Peak Oil or Global Warming but used macro modelling of resource depletion and global pollution to cover the myriad elements that might affect the human/environment system. With 50 years of hindsight, that the World 3 has been so useful, and even somewhat accurate, in modelling the state of the globe shows the extraordinary power of top-down modelling of complex systems. When compared with the huge resources required to model systems from bottom-up aggregation, such as the global climate models, I think the bang for buck is clearly with top-down macrosystemic modelling.

The fact that the World 3 model didn't even include finance, led to derision from economists and powerful interest groups keen to discredit the Limits to Growth. They were so successful that when the second wave of environmentalism took off in the late 1980s, sustainability activists, policy makers and almost all scientists made sure not to ever mention Limits to Growth. It was only around the turn of the millennium with the third wave associated with the rise in oil prices, was there renewed interest. I suspect that historical hindsight will show that the peak in food and industrial output per capita around 2020, in the standard run of the World Model 3, will prove to be spot on; as will the climb in the death rate.



Slide 13 *Mollison and I in the mid-70s*

The first oil crisis of 1973 (triggered by the Yom Kippur War between Israel and its Arab neighbours), was the global event that expanded interest in *Limits to Growth*. I met Bill Mollison in 1974, when back-to-the-land self-reliance and prepping for a world of less, were popular (partly in response to high energy costs and economic recession). Mollison and I were not alone in believing that the strength of evidence in the *Limits to Growth Report*, combined with the warning provided by the 1973 crisis, would lead to rapid changes toward a conserver society with re-ruralisation, organic agriculture and appropriate technology.

Sentiments, if not major moves in that direction, explain at least in part how the work of a little-known and cantankerous academic and a complete unknown graduate student attracted so much interest that in 1977 we had offers from 15 publishers to publish our manuscript. The second oil crisis of 1979 (triggered by the Iranian revolution) was a significant factor in the success of [Permaculture One](#) (1978), the movement and the first permaculture design course taught by Mollison in 1980. Ironically, we had too much faith in the intelligent foresight of markets to keep pushing up the price of oil and all other depleting resources, thus reversing economic growth and strengthening the logic for permaculture.

The election of neoliberal governments in the UK (1979) and US (1981), the “third world” debt crisis, and flow of oil from new super giant fields of the Alaskan North Slope and the North Sea, all combined to depress commodity prices, and thus boost western world economies into the “greed is good” culture of the 1980s. By intent or otherwise, this simultaneously crashed the credibility of both the *Limits to Growth* and countercultural innovations, including permaculture, as hippy nonsense.

Here in Australia, we had a federal election in 1983 fought over the proposed damming of Tasmanian wilderness rivers, which environmentalists saw as the dawning of an age of environmental enlightenment. In fact, it marked the end of the First Wave as we had the Thatcherite/Reaganite neoliberal revolution with a green tinge and a human face under the Hawke/Keating Labour government.

Most significantly, the deregulation of the banking system and more globalised free trade kicked off the property bubble and other expressions of debt-based fake wealth, further accelerating resource depletion, pollution and other expressions of systemic dysfunction. These changes collectively nipped in the bud the popular interest in permaculture across suburban Australia and led to a decline in rural resettlement, organic agriculture, intentional communities, appropriate technology and other aspects of the conserver society (see [Trainer, \*The Conserver Society: alternatives to sustainability\* 1995](#)).

# Ecological energetics

H.T. Odum



- Expanding systems ecology  
(towards a theory of everything)
- Energy as a language & currency to measure value
- Maximum power principle and productivity.
- Ecosystem services of self-organising nature

## Slide 14 *Odum's key themes*

While the Limits to Growth story is the best known example of this massive setback in the application of system science to issues critical to humanity's future, a similar story played out with the system science that underpins permaculture as design science.

HT Odum's *Power Environment and Society* (1971) was the first reference in *Permaculture One*. I remember being fascinated and inspired by Odum's energy circuit language even if I found it somewhat difficult to fully understand the method behind the numerical evaluations of the sources, flows, storages and sinks. Here was a way to comprehend human/environment systems grounded in the patterns and processes governing all of nature. Even if only of qualitative value, this unified systems view was for me, the bedrock for permaculture design that had enduring potential. As I remember, my interest in Odum was stronger than Mollison's. Although he was deeply grounded in the practical world, the Mollisonian aphorism "the yield(s) are only limited by the imagination" at least in part reflected the dominant view of modernity that wealth is primarily a result of human creativity, while I was more of the school that nature is the source of both renewable and non-renewable wealth and that, in nature and human affairs there is "no free lunch".



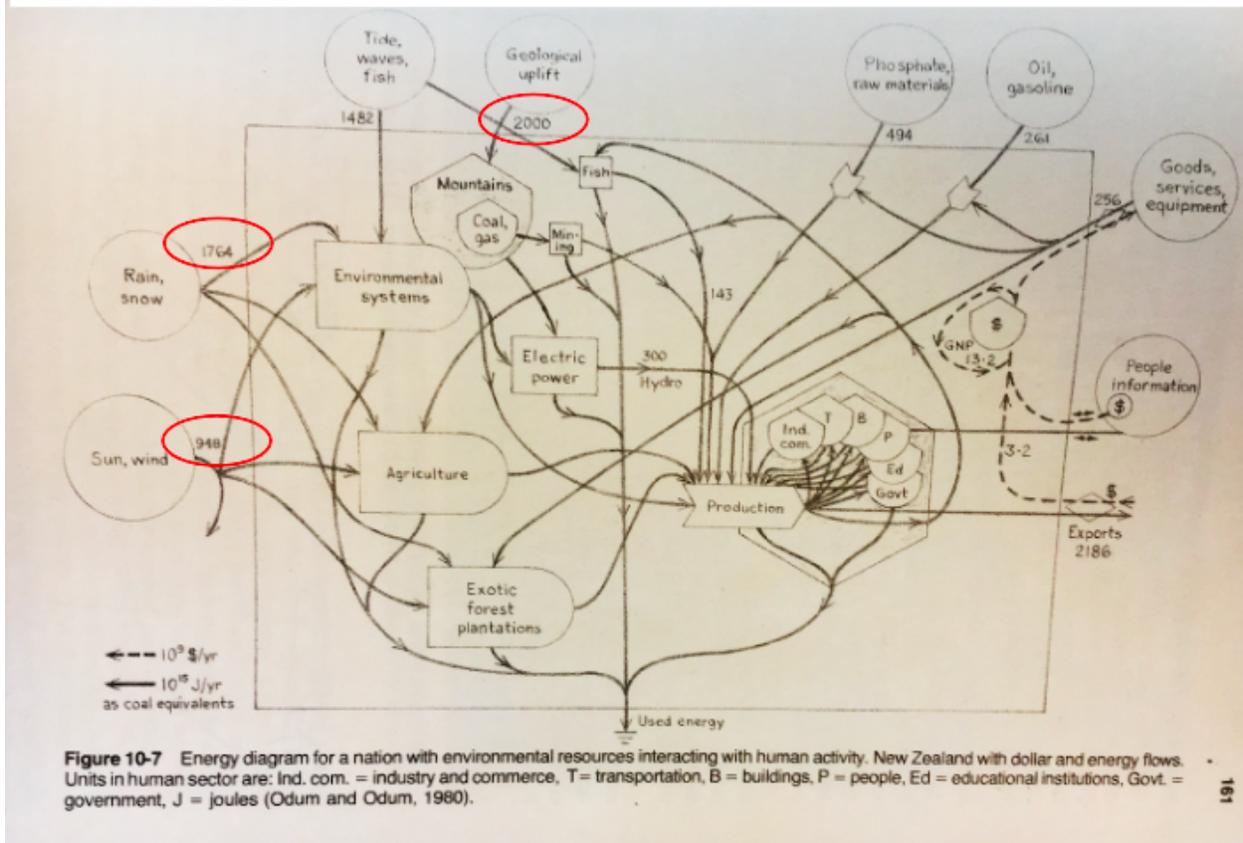
**Slide 15 Haikai Tane in Waitaki Basin, New Zealand**

In 1979 I travelled to New Zealand (NZ) to work with Haikai Tane, who I regard as my second mentor in permaculture. I remember Tane referencing some of Odum's more heretical land management ideas, from his then recent teaching visit to NZ. For example, Odum suggested that the gorse and briar rose, running wild over the sheep grazed hill country of the South Island were useful soil stabilising pioneers, and that direct seeding with suitable tree species could accelerate succession to productive mixed forest rather than burning or herbiciding, which led back to the same pioneer colonisation. That one of the founding fathers of systems ecology had the same view we held on practical land management of hated and legally declared "noxious weeds", was heartening.

In NZ I was struck by how different the landscapes, soils and vigour of familiar plant species were at exactly the same latitude as in Tasmania, the seat of my years of intensive learnings about nature (See "Impressions of New Zealand" in [Collected Writings & Presentations: David Holmgren 1978-2006](#)). Working with Tane, I began to understand how those differences were expressions of geologically old (Tasmania) and young (NZ) landscapes. Mollison and I had been inspired by J Russell Smith in the belief that fruit and nut tree crops could grow on apparently marginal rocky landscapes unsuited to arable agriculture but it was not until I went to NZ, especially the cold dry intermontane basins of the South Island, that I saw the full expression of

that potential. I understood tectonic uplift, volcanism, resultant glaciation and active alluviation were the source of landscape potential that also explained where dense populations and great civilizations arose before fossil fuels scrambled the patterns of the past. And as the last significant vegetated land mass colonised by humans, NZ was, as Tane said, “the Japan of the South Pacific but with a few rather than 135 million people.”

## New Zealand human/environment system Odum & Odum 1981



**Slide 16 Diagram from Odum (1981) – red ovals are my notations**

The second edition of *Energy Basis for Man and Nature* (1981), included an energy diagram of the NZ environment and economy that resonated with my recent experience there. That diagram showed there was double the energy (in coal equivalents) coming from geological uplift than from the sun and wind combined, and an almost as large a flow coming from rain and snow (driven by interaction between solar and earth energies).

Beyond my gut feelings from reading the landscape, Odum’s chart also resonated with Tane’s telling of the Maori creation story about Father Sun and Mother Earth being locked in sexual embrace such that there was nowhere for their children to live until Tane Mahuta, the god of the forest and ruling god in the Maori mythology, tore his parents apart and so created the world. Father Sun fled to the sky in anguish, but life flourished. I saw this so-called primitive

creation story as more accurately describing our world than the conventional scientific view that a largely passive earth (apart from the tiny amount of energy from nuclear decay in the core) is brought to life by the sun's energy.

Building on this patriarchal science story about potent sky energy and a passive earth, solar power advocates speak of limitless free energy (when measured in joules) without acknowledging the energy quality issues that constrain the potential of solar energy, whether converted through nature's solar cells (green leaves) or the silicon alternative manufactured with vast energy and technical complexity.

The convention of converting all energy sources to heat and measuring as joules was clearly a nonsense that undermined the potential of energy analysis to make sense of the world. I saw Odum's embodied energy methodology (later renamed eMergy) provided the conversion factors (Transformity) to measure real (embodied) value and power on nature's terms.

Whether or not Odum's methods passed muster in terms of reductionist science, I could see how they were reflecting the wisdom built into indigenous, traditional and vernacular knowledge systems from the past. That wisdom had been scrambled and discarded in the modern era by the novel impacts of fossil fuels that were the end product of tens of millions of years of immense photosynthetic productivity, followed by hundreds of millions of years of compression and distillation by the tectonic cycles of the Earth.

In the following years, funding for research in embodied energy collapsed and Odum and his colleagues lost the battle over methodologies as academics tried to salvage something from the bloodletting. It was tragic that the most holistic methodology was sidelined.

In Odum's methods, I saw the potential of system science to push the nonsense of economics off the hallowed pedestal our culture gives to numerical valuations of the world.

In a culture of quasi-religious faith in numeracy and quantitative valuations, I saw little chance that the ecological, ethical or spiritual concerns about destruction of nature or unfair economic relationships could compete with the sacred numeracy created by the masters of fiat wealth (bankers) or the economics profession that provided the fig leaf of intellectual respectability to this collective cultural delusion about the nature of wealth and wealth of nature.

At every opportunity in the 1980s I would spruik the gospel of Odum, mostly getting blank responses including from those driving the emergence of Second Wave sustainability thinking. In Australia, before the internet and international travel, I met almost no one in Australian academia who had heard of Odum, let alone understood the import of this work.

## Jerusalem Artichoke: potential ethanol crop



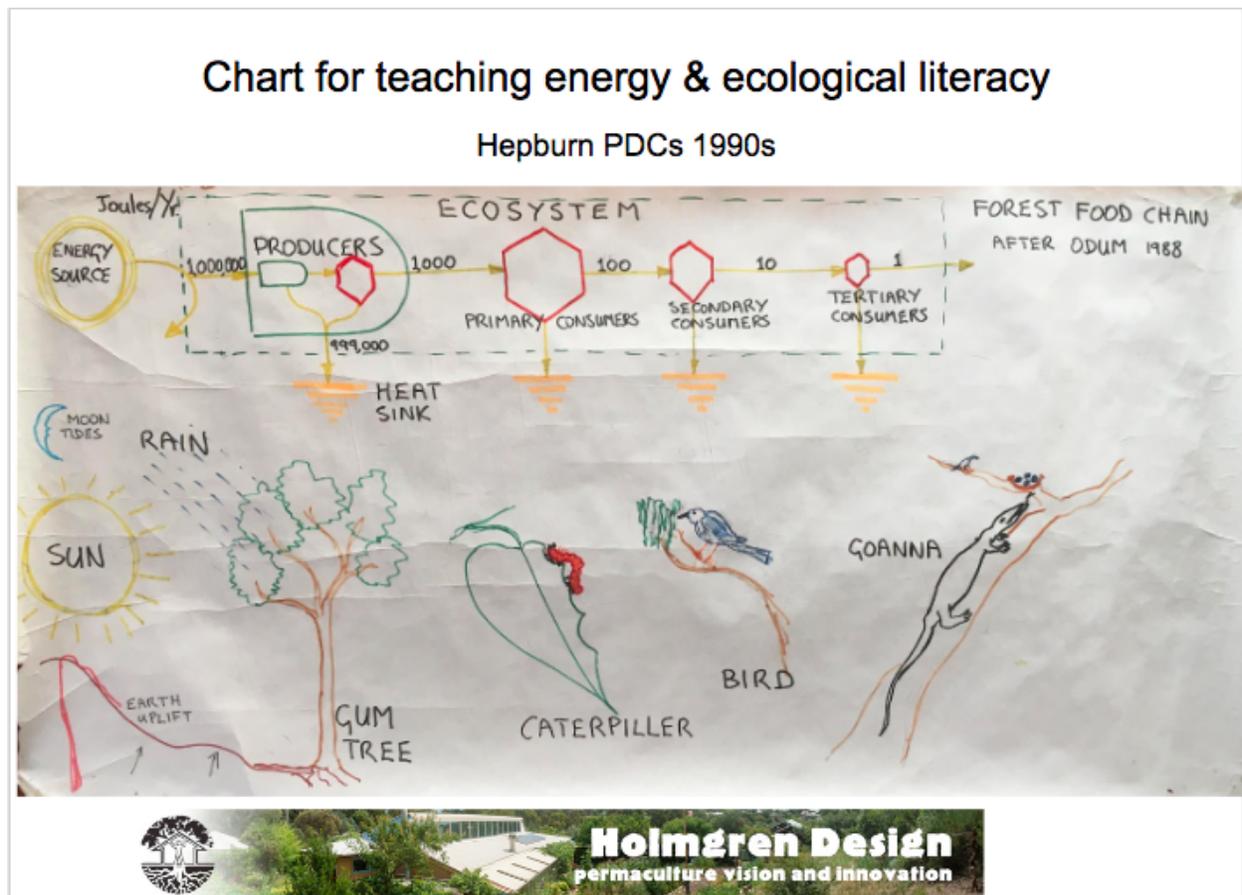
**Slide 17 *Broadacre Jerusalem artichoke crop***

In 1985 I had another experience that confirmed my trust in Odum's methods. The Solar Energy Council of Victoria had published a draft report on the potential to produce (by 2000) 10% of the state's liquid fuel demand from crops. The proposal involved growing Jerusalem artichoke on the riverine plains of the Murray River irrigation district which then supported dairy cattle, to be processed in ethanol plants spaced at 100km intervals. When the irrigation schemes were set up earlier in the 20<sup>th</sup> century, these soils were deemed too poor in structure for cropping but suitable for dairy pasture. One of the criteria for the project was to produce the fuel without reducing current agricultural productivity. The proposal assumed that the mash left over after ethanol distillation still provided most of the nutritional value needed by the cows.

I wrote a response to the draft report commending the selection of artichokes as a more prospective crop than sugarbeet but questioned the sustainability of the land use system. Growing a knobby root crop on poorly structured clay soils is not wise and I noted that it would at least require pressure washing, creating mud that should be returned to the fields as one minimum step in soil conservation. The report did not address where the cows would be during the growing season but whether they were relocated to feedlots around the ethanol plants or yarded on the farms, there was an issue of transporting either wet manures or wet mash back

to the soil for nutrient and organic matter cycling. It appeared that the consultants writing the proposal had not grasped the fundamentals of sustainable agriculture.

Finally, I asked for an explanation of their embodied energy methodology which showed a 10:1 net energy return ratio because this seemed very different from a study by Odum on a sugarbeet ethanol proposal in NZ that gave a 0.9 net energy yield ratio. I received no reply and 15 years later, in 2000, there was still no ethanol industry in northern Victoria (for many reasons). The question I had over the years was: which net energy methodology was more useful in predicting outcomes in the real world?



**Slide 18 One of the charts I used in teaching energy literacy**

In the 1990s I began teaching my own evolved version of the Permaculture Design Course (PDC), which Mollison and others had pioneered in the 1980s. I made a particular point of using Odum's energy circuit language to teach energetic and ecological literacy, amongst other aspects of permaculture I saw missing from the Mollisonian lineage.

To explain the difference between Odum's and more conventional methods of energy accounting, I would hold up a section of flooring from 25 year old Australian plantation grown pine and a section of old growth NZ Kauri pine that had been growing for at least 250 years.

Because the embodied energy (of logging, sawmilling and processing) is similar in both cases, conventional embodied energy valuations are similar. On the other hand, Odum's methodology accounts for the 250 years of sunlight, rain, wind and minerals absorbed by the old growth tree, leading to a much higher value. The common-sense judgement of an experienced woodworker, and maybe even the market price, might align more closely with Odum's valuation. With this simple example I captured the power of Odum's methods to incorporate the free services of nature and give figures more in line with vernacular, aesthetic and even spiritual values.

After the great hopes of the Rio Earth Summit in 1992, a combination of techno-optimism about the IT driven "weightless economy" and accelerating globalisation, the economic rape of the ex-Soviet Union republics, and cheap oil on tap from post-Gulf War Iraq (under "Oil for food" sanctions), teaching energy literacy was an uphill battle. This was even the case amongst the new wave of eager young, and not so young folk wanting a better and more environmentally ethical way to live with less dependence on centralised disempowering and unjust systems.

Giving the same explanations of energy literacy and accounting in 1994 during a six-month teaching and study tour of Europe, I mostly received perplexed looks, although sometimes from farmers and other nature grounded sorts, the "yes we already understand that" look. However, near the end of the tour, on a two-day advanced permaculture course in Sweden, I was asked a question by one of the participants: whether this was the same as "eMergy accounting". I was a bit perplexed but when I realised I was using a description of Odum's methodology that was a decade out of date, my thought was, "Damn those Swedes; so bloody well informed about everything!" The next day I was introduced to students and colleagues of Odum's at Uppsala University who provided me with more recent papers than my dog-eared copy of *Energy Basis for Man and Nature*. Such was life for an independent researcher outside of academia before the internet overcame the "tyranny of distance."

## Weeds or Wild Nature?



Willow deciduous riparian corridor forest  
Spring Ck Community Forest, Hepburn

**Slide 19 Spring Creek Community Forest: one of the projects that I have worked on over decades, both physically, and by documenting this novel ecosystem as an alternative to the 'war on weeds'.**

Practical projects were consuming more of my time than the arcane issues of net energy metrics. From documenting *Meliiodora*, to articulating more benign alternatives to the war on weeds, or the development of the Fryers Forest ecovillage, systemic thinking and design had become so foundational that I didn't see or articulate it as something separate from permaculture itself.

It is clear to me that the prevailing reductionist mentality to pull things apart to understand what makes them tick instead of standing back first and seeing them in their larger context (as articulated by the principle "Design from patterns to details") is at least in part reinforced by institutional punishment for thinking systemically in the demand to "Just do the job you have been given and don't worry about context".

Of course the concept of "context" is central to another land management tool: Holistic Rangeland Management developed by Allan Savory and others. This has considerable crossovers and complementarities with permaculture and has itself been generalised as [Holistic Decision Making](#), which has in turn been taken up as part of the tool kit of permaculture design.

More recently, Tyson Yunkaporta in *Sand Talk* (2019) has identified the crossovers between systemic thinking (including permaculture) and indigenous ways of thinking.

For me, the eMergy circuits and numbers generated by Odum and his colleagues around the world (but apparently not in Australia) made more and more sense when counter-checked with my grounded permaculture common sense (and bullshit detector). Consequently, they stimulated and challenged what I did as a designer and I sometimes dreamed of the resources to do eMergy modelling of my projects.

## Rob Hopkins: founder Transition Towns



**Slide 20** *One of the many activists who have been influenced by the principles framework; Rob went on to found the international Transition Towns movement*

During the 1990s, my teaching of permaculture design principles evolved from the Mollison lineage to the full articulation of the twelve design principles. Three overseas teaching and study tours to Japan (2004), Europe and the USA (2005), and New Zealand and Latin America (2007) allowed me to connect with many leading permaculture teachers and introduce the principles framework on Permaculture Design Courses, advanced courses and conferences. The feedback was that this framework re-energised their own teaching and made clear how permaculture was in essence a thinking tool to enable the retrofit of all disciplines and fields of action rather than just gardening and agriculture. In this expansion to “a theory and practice of

everything” there are obviously hazards and limitations that have also led to pushback from within and outside permaculture networks.

The gradually increasing recognition of the significance of permaculture by academics and researchers across many fields, including system science, is gratifying in countering the perception over the years, in the crowded market place of sustainability ideas, that permaculture is just eco-fashion, or worse still, a Luddite and anti-science cult (see Leahy, [Politics of Permaculture](#) 2021)

## Nature cover story May 1997

# The value of the world's ecosystem services and natural capital

**Robert Costanza<sup>\*†</sup>, Ralph d'Arge<sup>‡</sup>, Rudolf de Groot<sup>§</sup>, Stephen Farber<sup>||</sup>, Monica Grasso<sup>†</sup>, Bruce Hannon<sup>¶</sup>, Karin Limburg<sup>#</sup>, Shahid Naeem<sup>\*\*</sup>, Robert V. O'Neill<sup>††</sup>, Jose Paruelo<sup>‡‡</sup>, Robert G. Raskin<sup>§§</sup>, Paul Sutton<sup>|||</sup> & Marjan van den Belt<sup>¶¶</sup>**

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### Slide 21 Nature cover story

Within the world of academia, I am aware that making too strong a claim of the foundational nature of Odum's eMergy methodology providing quantitative validation of permaculture is itself a credibility risk, given the general lack of awareness outside the fields of systems ecology and environmental accounting and its controversial status (as I understand it) within those fields. Another personal anecdote provides context.

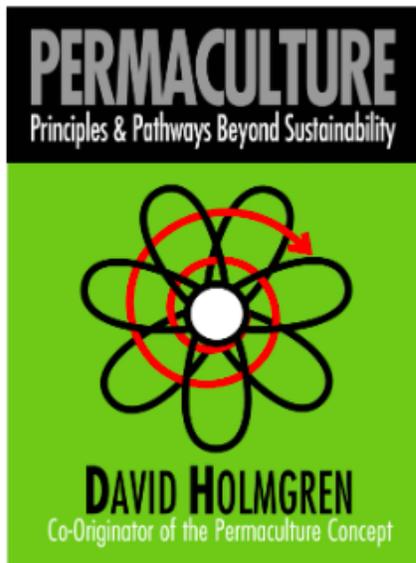
In 1997 a colleague alerted me to a cover story in *Nature* in which an esteemed list of authors led by Robert Costanza used a wide range of methods to put a dollar value on global free

services of nature, with it appearing to be somewhat greater than global GDP. My colleague was somewhat scathing that eMergy accounting was not even mentioned and he emailed to politely inquire of Constanza whether he had heard of eMergy accounting and if so, why was it not at least referenced in the paper. Constanza replied that he was indeed familiar with eMergy since HT Odum had supervised his own PhD and added the curt observation that “unfortunately Professor Odum has done more to discredit the field of ecological economics than anyone”!

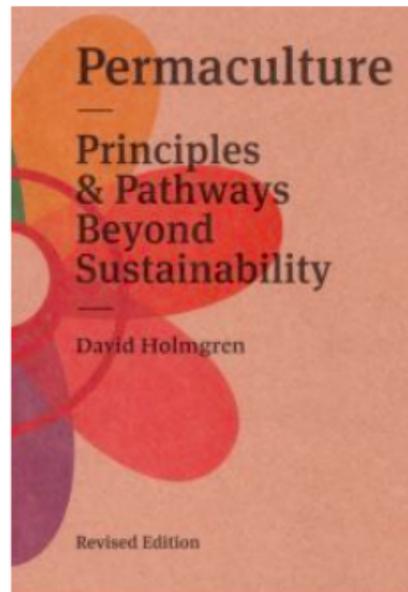
I interpreted this comment as reflecting the huge cuts to funding for energy-related research in the 1980s, and perhaps the views of some in the field of ecological economics that a modest academic territory with limited aims was more likely to lead to livelihoods and recognition than Odum’s revolutionary unified field approach that effectively overran the academic turf of other disciplines. In addition, the rubbery numbers generated by the ongoing changes as his methods evolved, and the general suspicion of top-down holistic systems modelling by the majority of scientists, appear to have been obstacles to acceptance. Outside of science I know many in the humanities and environmentalism were horrified by Odum’s accounting giving a monetary value to “a Southern Right whale” or a “300-year-old rainforest tree”, even if those notional dollar values made those resources too precious to use. And from all reports, his abrasive personality didn’t help in the cause of academic diplomacy.

This rich interplay between eMergy at the fringes of science, and permaculture at the fringes of environmentalism, could be interpreted to show why both remain fringe and that the heart of mainstream science remains uncontaminated by politics, markets, media, personalities and the accidents of history. I believe the opposite is true; that the ragged realities at the fringes indicate a deep systemic corruption in the culture of science reflecting the wider dysfunction in global industrial modernity as it crashes (in slow motion) into the brick wall of energetic and ecological realities.

# Permaculture: Principles & Pathways Beyond Sustainability



First edition (2002)  
3 print runs Australia, 1 UK,  
6 translation editions



Revised edition (2017)  
2 print runs Australia,  
translation editions pending 22

## ***Slide 22 First and second editions of Permaculture: Principles and Pathways Beyond Sustainability***

My [Permaculture: Principles and Pathways Beyond Sustainability](#) was dedicated to the memory of HT Odum, whom I never met. It is ironic that when I carefully chose the word “descent” as the most accurate word in English to describe what I thought were the most likely futures for humanity, I didn’t know that Odum had done the same. There is a further irony that while I can claim to have done more to spread awareness of energy descent futures than Odum may have achieved over his life, my efforts in that regard have been less influential than that of John Michael Greer, another American who I have never met, but whose prodigious writing and books on the subject are fundamental to understanding the diverse ways in which a world of less can play out.

It is perhaps a sign of the challenge to orthodox science from many quarters that Greer is a polymath of the humanities and the occult, credentials that have most trained in science holding up their scientific equivalent of crosses to protect themselves from unclean thoughts. While I have no knowledge of the occult, to help those amongst you now questioning the wisdom of inviting me to an august science society, Greer defines magic as the “art and science of causing changes in consciousness in accordance with will”, rather than anything that

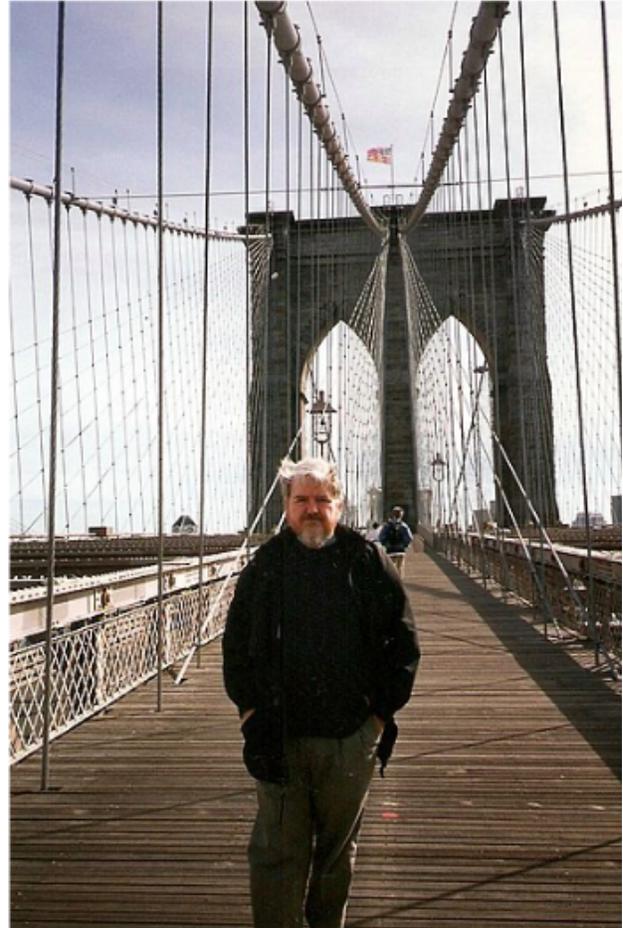
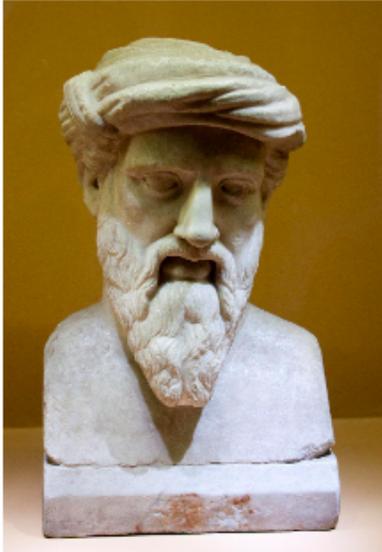
overturns the laws of physics. By this definition, advertising, and much of our culture and political discourse, are highly evolved forms of magic.

The tragedy is that we still have no agreed methods for evaluating how fast or slow industrial society is sinking into an energy pit of its own making or whether, conversely, it is on a path to free energy. Most of the policy discussion around the optimal speed and nature of the renewable energy transition continues to assume business-as-usual growth, although the widening cracks in that Tower of Babel are now accelerating.

If most of the content of industrial modernity is destined for the dustbin of history, let's hope that some of the deeper truths of modern scientific culture can survive the bottleneck through what could be a long dark age. As the Limits to Growth crisis bites harder, I see many signs of both the deepening corruption of science through disaster capitalism and the fervent articulation of a scientific fundamentalism (i.e. just follow "The Science"). At the same time, I see many signs of a holistic ecological renewal of the scientific lineage through a cultural fusion with lost ways of knowledge more adapted to energy descent futures. I trust that through permaculture and kindred pathways, humanity may just muddle through the middle of the Limits to Growth vortex without falling into the darkest possibilities that history shows can take root when any culture, let alone a global one, loses its way.

# Pythagoras

bridging ancient worlds



William Irwin Thompson 1938-2020  
photo on Brooklyn bridge 1996

## **Slide 23 Radical thinkers: Pythagoras and Thompson**

In the 1970s, the philosopher, cultural critic and poet William Irwin Thompson used his interpretation of the story of Pythagoras as an example of how, during times of cultural degeneration and dysfunction, radical thinkers can act as conservers of deep truths from the dying culture, and that they transform and project forward for a world that as yet doesn't exist. Thompson described Pythagoras as a radical initiate of the ancient Egyptian "mystery schools" that ruled the people through a ruthless theocracy. He took sacred arcane knowledge of these decaying institutions and set up the world's first university in southern Italy teaching mathematics and science. His followers, fleeing local political strife, settled in Greece. This was culturally fertile ground for the germination of what we call classical Greek culture and the origins of Western civilization. Thompson interpreted this story as a model for transformations in the current era.

I see permaculture and kindred design concepts could be the way that deeper more fundamental understandings and wisdom are condensed into seeds that can survive a long dark age before they sprout in the fertility left from the compost of industrial civilization. In doing so I remain detached about whether permaculture in name, let alone any particular project or organisation, will survive that transformation.

In 2016 I concluded the Keith Roby memorial lecture this way:

*So the challenge I leave for those still in receipt of the opportunities and remaining privileges of academia is to use permaculture as the most dynamic and robust conceptual framework for community science to provide the helpful monitoring and feedback for the households and communities that are already creating the models for a prosperous way down; and leave governments and corporations to use their remaining capacities to follow rather than lead.*

I make the same challenge to this gathering, in the belief that systems science can provide the holistic top-down modelling of existing and proposed permaculture systems to help designers and practitioners to accelerate the evolution and viral replication of successful models.

Maybe my dream of eMergy system mapping and metrics becoming tools available to permaculture designers retrofitting existing human ecologies is still possible. In my dream, systems science would become grounded through ethical practice, and permaculture would achieve its potential as design science for a prosperous way down.