A Critical Review of Permaculture in the United States

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Abstract

Permaculture involves the systematic design of ecological systems that sustain human communities and the natural environment. Since its introduction in the United States in the 1980s, it has spread via publications and educational workshops. The author was trained in permaculture design in 2000, and spent seven years developing a permaculture project in Urbana, Illinois that focused on community gardening and education. However, when looking to supplement his first-hand learning with scientific research, the author found scarcely any dialogue between environmental science and the grassroots movement for permaculture in the United States. Recent permaculture literature in the United States does not often cite scientific research, and environmental scientists do not often test permaculture ideas. Permaculture has served an important function in catalyzing action aimed at solving environmental problems in communities across the United States, and further benefits would likely result from refereed reporting of permaculture results.

Keywords: activism, community, environmental science, permaculture, sustainability.

Introduction

Numerous environmental problems are undermining the ability of human society to meet human needs. These problems include the overuse and pollution of natural resources, as well as social-ecological crises such as famine and water shortages (Millennium Ecosystem Assessment, 2005). Solutions to these environmental problems will involve numerous changes in private and public life, in production and consumption, and in technology and materials use. If human needs are to be met in a sustainable manner, alternative systems will be necessary. One alternative system is permaculture.

"Permaculture is the conscious design and maintenance of agriculturally productive ecosystems which have the diversity, stability, and resilience of natural ecosystems. It is the harmonious integration of landscape and people providing their food, energy, shelter, and other material and non-material needs in a sustainable way" (Mollison, 1988). Bill Mollison and David Holmgren (1978) coined the word "permaculture" to refer to their system of "design principles" for constructing sustainable human settlements. These permaculture principles were based on principles of environmental science (Odum, 1971), coupled with an ethic of "earth repair" and "people care". The premise was to design human settlements modeled after natural ecosystems in order to decrease

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waste, work, and pollution, while maintaining or increasing their fertility, biodiversity, and sustainability. The word permaculture was a conjunction of "permanent" and "agriculture" or, more broadly, permanent culture. Mollison copyrighted the permaculture concept and spread it around the world by teaching courses, while establishing a set of protocols by which practitioners and teachers could be certified to spread the permaculture movement for themselves.

Mollison brought permaculture to the United States in the early 1980s, teaching a course at The Evergreen State College in Olympia, Washington in 1982 (Carey, 2005), but it was spread in the United States by a handful of Americans who subsequently studied with Mollison in his native Australia. This group of ambitious ecological designers launched an organization called the Permaculture Institute of North America (PINA), and a publication entitled the *Permaculture Activist* in 1985 (Jackson, 2005). The second International Permaculture Conference (IPC2) brought Bill Mollison back to the Pacific Northwest in August 1986; dozens of permaculture projects grew out of these initial meetings with Mollison. Also present at IPC2 was Masanobu Fukuoka, who had developed a natural method of rice agriculture in Japan, and Wes Jackson, who was beginning to research native grasses for developing a perennial grain-based agriculture in the Midwest.

What distinguished Mollison's permaculture from other alternative agricultures was its emphasis on integrating all the components of a human settlement: building construction, farm layout, transportation, hydrology, energy management, and community relations in addition to food production. Where Fukuoka (1978) had suggested a return to the traditional Japanese rural community, Mollison proposed to construct new communities based on new principles. Where Jackson (1980) had proposed to re-design agriculture, Mollison proposed to re-design the whole production process, including architecture, energy, technology, economics, urban design, and governance. When Mollison published his seminal *Permaculture: A Designers' Manual,* it included a chapter on "strategies of an alternative global nation" (Mollison, 1988). His most concise book *Introduction to Permaculture* included a chapter focused on permaculture design for urban areas (Mollison, 1991).

Today there are more than a dozen English books (see Table 1) that offer variations on the permaculture design principles originated by Bill Mollison and his student David Holmgren (1978; 1979). Reading all of these texts closely, one finds that there have not been major additions or revisions to the principles laid down by Mollison (1988). Toby Hemenway's *Gaia's Garden* (2001), the only US-based book-length introduction to permaculture, provides design principles and examples very similar to those in Mollison (1991). Stating in the introduction that "most of the ideas in this book aren't mine" (Hemenway, 2001, p. xvi), Hemenway wrote a permaculture book for temperate climate areas of the United States whereas Mollison (1991) drew most of his examples from sub-tropical Australia. Hemenway also focused on gardening to the exclusion of the extra-agricultural

subjects that distinguished Mollison's permaculture. *Gaia's Garden* is useful for contributing a detailed portrait of permaculture gardening in the United States, but the proliferation of permaculture textbooks with differing emphases may make it unclear which book is best for introducing students to permaculture design. It also raises an important question: has permaculture literature been adequately revised with new information about its effectiveness over the past three decades?

Permaculture One (1978) by Bill Mollison and David Holmgren
Permaculture Two (1979) by Bill Mollison and David Holmgren
Permaculture: A Designer's Manual (1988) by Bill Mollison
Introduction to Permaculture (1991) by Bill Mollison
Permaculture in a Nutshell (1993) by Patrick Whitefield
Earth User's Guide to Permaculture (1993) by Rosemary Morrow
The Permaculture Garden (1995) by Graham Bell
How to Make a Forest Garden (1996) by Patrick Whitefield
Basics of Permaculture Design (1996) by Ross Mars
Permaculture (2000) by David Holmgren
Gaia's Garden (2001) by Toby Hemenway
Earth Care Manual (2004) by Patrick Whitefield
The Permaculture Way (2005) by Graham Bell

Table 1: Books containing Permaculture Design Principles

In 2002, it was estimated that 500 to 1,000 teachers have trained 100,000 people in permaculture worldwide (Bane, 2002). The central mechanism by which new people have learned permaculture in the United States has been through two-week long Permaculture Design Certificate (PDC) courses based on principles and practices outlined in the books described above. The protocols of the course were first established by Mollison at the Permaculture Institute of New South Wales, Australia. The PDC course focuses on the construction of human settlements, permaculture design principles, the study of model systems (including traditional and indigenous examples), and hands-on work to implement permaculture designs on-site. The course includes theoretical, creative, and practical components, though the balance of these elements depends on who is teaching the course. Most PDC courses will introduce issues of farm layout, soil management, building materials, alternative energy, and human needs such as clean air and water, sanitation, food and shelter.

The PDC course varies in different areas of the world, along with regional literature, institutions, and strategies for implementing and spreading permaculture. It is logical that countries with different climates, species, and social norms will practice permaculture in different ways. In this sense, permaculture is a general theory that is adapted to local environments. The international permaculture movement produces conferences, magazines, and permaculture teachers' manuals (Morrow, 1997; Goldring, 2000), while individual countries also develop their own permaculture

movements shaped by their unique constraints. Given the bioregional nature of permaculture, the remainder of this essay will focus on permaculture in the United States.

Permaculture has been spreading in the United States for twenty-five years. The *Permaculture Activist* magazine has been one of the most consistent sources of current information on permaculture in North America during this period. The Summer 2009 issue of *Permaculture Activist* listed 69 upcoming educational workshops and Permaculture Design Courses in North America, while their website listed 277 permaculture projects in the United States,[1] and more than one hundred books on subjects relevant to permaculture. The abundant informational resources (courses, projects, publications) appear to be matched by numerous sites of practice. There are unfortunately few well-developed farms and village-scale projects based primarily on permaculture, but there are at least 100 farms and landed communities in the United States that use permaculture in some aspect of their design.[2] They appear to be outnumbered by permaculture projects that focus on informational resources and education, which presumably aim to influence food-producers and/or specialize in non-agricultural aspects of permaculture such as sustainable technology. Given that permaculture grew out of an alternative approach to agriculture and the design of human settlements, it seems reasonable to ask: why does the permaculture movement in the United States appear to have a stronger tendency toward education than agriculture?

In the following section, I will explore the national trend toward education in permaculture by describing a single, local permaculture project that I helped to develop in Urbana, Illinois. While this project started as a gardening project, focused on ecological restoration, architecture and other subjects, it drifted in the direction of education, without ever acquiring or operating a farm. I will describe several lessons that were learned in the process of implementing such a permaculture project in an ever-shifting urban environment, and how that environment led the project to maintain its continuity via educational workshops rather than farming. I will then return to the issue of permaculture literature in the United States, taking a critical look at its relationship to the literature of environmental science in particular. Finally, I call for increased collaboration between permaculture and the scientific community, focused on areas of overlapping interest where research could address the global questions of sustainability, as well as the local issues encountered by small projects trying to make a difference.

The Urbana Permaculture Project, 2000-2008

The story of the Urbana Permaculture Project could be described as a learning process. A few dozen people worked on the project over the course of eight years, studying the theory and practice of permaculture design, undergoing much trial and error. Today, several community gardens, ecological buildings and other projects continue to populate the landscape, but the most lasting

resource may be the skills acquired by its participants. Many of those who worked on the project went on to pursue permaculture work in other cities, or to establish projects on their own terms. The project's evolution was dramatic at times, as it adjusted to changing circumstances. The story is presented somewhat chronologically in order to demonstrate how later patterns and practices developed out of earlier ones.

The story actually starts in India: I first learned of permaculture in 1999, when I met a woman studying permaculture there during a semester abroad. I was struck by her language: she could describe the major eco-social problems of India—famine, water shortage, poor sanitation, dependency on foreign banks and technology—in terms of design flaws attributable to local human settlements. She described how small changes in the design of an Indian settlement, such as a change in fuel use or plant husbandry or the simple relocation of a latrine, could save lives and empower people to have more alternatives when making choices about their community. I had no proof that she was right, but I agreed with the strategy of addressing social and ecological problems via applied ecological reasoning. After my semester abroad, I returned to the United States to study permaculture applied to temperate climate zones.

In 2000 I was the "permaculture intern" at an ecovillage in Wisconsin called Dreamtime Village. They had a nine-year old permaculture garden and orchard, as well as an old-growth sugar maple forest, a valley with beaver dams, and several old country buildings in various stages of rehabilitation. I worked in the garden during the day and read about permaculture at night. I learned a lot about food-production systems, including earlier proposals for "permanent agriculture" (Smith, 1953) and non-tillage-based gardening systems (Stout & Clemence, 1971). I also learned about projects that had developed independently of permaculture, which linked to it retroactively, such as Robert Hart's forest farming in the United Kingdom (Hart, 1984) and the struggle to save New York City's scarce community gardens (Wilson & Weinberg, 1999). In the summer of 2000, I decided to start a permaculture project in Urbana, a small city in central Illinois. A few years later I would complete a PDC Course taught by Peter Bane, but my initial permaculture training was at Dreamtime Village where I studied under Miekal And.

I chose Urbana because I had friends there, a few of whom had studied permaculture. We formed a group in the Fall of 2000 and we began to share readings and host organizational meetings aimed at starting a permaculture initiative in town. In December 2000, the Urbana Permaculture Project (UPP) became a non-profit corporation. We had no farm, and no funding, so we decided to start a few gardens where we could practice permaculture design in town. We had read about the broader issues of integrating landscaping, architecture and technology, but our initial efforts focused on plant husbandry and soil conditioning.

In 2001, the UPP started three community gardens, each planted with more than thirty species of annual and perennial plants. Following the permaculture principle of biodiversity (Mollison, 1991, pp. 24-26; Holmgren, 2000, pp. 203-222; Whitefield, 2004, 16-22), the UPP established a polyculture of plants: herbs, vegetables, fruiting vines, cane fruit and shrubs, fruit and nut trees, edible groundcovers, tubers, legumes for nitrogen—a veritable ecosystem of plants. All sorts of organic matter (leaves, grass clippings, newspapers) were collected for use as mulch and compost. The aim was to convert lawns into ecosystems, such that the entire space between the house and the yard was comprised of productive species planted as densely as a forest. These sites, however, would not last. The UPP was evicted from these sites in 2002, 2003, and 2004 respectively when landlords refused to renew leases. Ironically, the garden that was lost in 2002 continued to function as a community garden up to the time of this writing (2009) with most of the perennials still in use, including semi-dwarf apples, a twenty-five foot tall apricot tree, a hedge of bush cherries, and a dozen other useful perennials (see Figure 1). The other two sites were converted into lawns. What could be learned from this? Rental property in an American city is inherently unstable, and rushing to

Figure 1: A garden started by the Urbana Permaculture Project in 2001. Today there are reportedly four different groups of people who work, play, and have barbeques in the garden. The main tree pictured here is an Illinois Everbearing Mulberry (*Morus alba* x *Morus rubra*), surrounded by shrubs, vines, annual plants and perennial herbs.

start a garden may not be lead to good selection of a long-term site. This was perhaps the most profound lesson of the early years of the UPP: all of the frustrations in the daily trial-an-error of gardening was small and insignificant next to the calamity of being permanently evicted from the garden itself. It was demoralizing, but it was a lesson about US cities that we had to learn.

Educational work, though less emphasized at first, was initiated at the same time as the gardening work. In 2001, the UPP produced a few local radio reports on permaculture design principles, water conservation, and gardening. I composed a short text on edible plants of the native Illinois prairie flora, and published it as an informational pamphlet under the title *Free Food Production Prairie*. We hosted workshops in Urbana, and at a neighborhood summit in St. Louis. Through these efforts, we found an audience for permaculture information, but we didn't yet have many concrete examples of permaculture in the Midwest. The investigation of native edible plants, for instance, showed that people rarely eat plants that are native to Illinois. The most useful vegetable species is probably Jerusalem Artichoke (*Helianthus tuberosus* L.) and the most focused information on useful Midwest prairie prairie plants is likely Kindscher (1987; 1992). In short, the early phase of the education effort primarily involved members of the UPP educating themselves.

In the effort to incorporate permaculture into the local community, the UPP worked to develop a permaculture project with the City of Urbana. In 2002, the UPP worked with the Department of Public Works to install deep-rooted plants along the main downtown waterway (the Boneyard Creek) to stabilize the soil along the riverbed. Unfortunately, the level of illegal garbage dumping that occurred on-site eventually terminated the project. In 2003, the UPP submitted a Social Service Grant to create a new community garden in the low-income area of town, in accord with the City of Urbana's stated goal of alleviating poverty.[3] The proposal was rejected. The relationship with the city administration began to decay as neighbors called the city to complain about permaculture gardens. We learned that it is a violation of the city code for a resident to keep large piles of brush/mulch/compost except for immediate use; lawn grass taller than nine inches in height is technically illegal; standing water is considered a health hazard; garden sculptures may be cited as "visual blight" if they bother the neighbors, and so on. We received no fewer than nine such citations, and many came with fines of up to $100. These episodes made it clear that the relationship with the City of Urbana was to become one of tolerance rather than collaboration. The UPP wanted to grow food and develop ecosystems in Urbana, but cities make rules to outlaw farming and ecological succession.

Nevertheless, the UPP continued to grow in 2002. Permaculture work was initiated at two additional sites. First, the Kalyx Center (a twenty-seven acre retreat center near Monticello, Illinois) became a site of gardening, house-building using recycled materials, installing a wood-burning stove, and processing firewood. Another new garden became the first site in Urbana (to our knowledge) to

raise laying hens within city limits. During the 2002 growing season, there was daily activity in the community gardens. The UPP had established several sites with hundreds of plant species on a very low budget, all without owning any land as an organization. The permaculture designs were experimental and there were ample gardening mistakes from which to learn. Mistakes were embraced, with the worst consequences (so far) being city citations and the occasional dead plant or chicken. New permaculture designers joining the UPP were encouraged to try things that hadn't yet been attempted, adding to the collective knowledge.

In 2003 the previous year's work crystallized in a new UPP brochure announcing a "pool of freely propagatable plants" and a network of community gardens that would support an "internship" in permaculture design. There were indeed many perennial plants at various sites that could be propagated via divisions. Though one community garden had been lost in 2002, there were several others capable of sustaining UPP expansion. Interns who could not afford to invest money in the project could thus focus on existing perennial species as a source of new plants (via seeds, cuttings, layerings, rhizomes, etc.) that could be used in further permaculture design work.

As a consequence, six new garden sites were initiated in 2003, with only three additional interns working on them. While perennial plants were propagated extensively, the UPP was trying to grow too quickly. Only one of the six gardens became a lasting community endeavor; the others were overshoot. The distant effort at the Kalyx Center (near Monticello, Illinois) began to fade out, in spite of a UPP mushroom log workshop in spring 2004, because the thirty mile drive from Urbana became prohibitive. The garden with laying hens became a private (rather than communal) garden, while the most well developed UPP community garden was put on the real estate market at the same time. By Spring 2004 there were just two UPP gardens, one of which would be bulldozed by a landlord in June 2004. The UPP proposal for a "network of community gardens" had largely been a fantasy invented in language. Community gardens emerge out of years of work and building up relationships, and the UPP movement to spread community gardening back-fired. By Fall 2004 there was only one UPP garden remaining.

While the number of gardens was going down, the education efforts had begun to grow. There was a ten-week course offered in Spring 2003, and another in Fall 2003. A national permaculture speaker named David Blume gave a highly publicized series of talks in Urbana. In Fall 2003 there was a symposium for local green architects and builders to meet with the local permaculture designers. Follow-up events in 2004, 2005 and 2006 were organized under the title "Ecological Construction Symposium" and today the Annual US Passive House Conference organized by the Ecological Construction Laboratory in Urbana, IL continues the tradition independently.[4] The educational work became a place to put the energy that would have otherwise

gone to the community gardening. The multiplicity of sites had dispersed the efforts of the UPP, but the classes, workshops, and conferences brought the group together.

By the end of 2004 the permaculture work was located at personal homes (as opposed to community gardens); locals were using the UPP as a source of ideas for their home sites. This fit well with Bill Mollison's proposal that people start doing permaculture outside their own front door (Mollison, 1991, pp. 9-13, 95). There were exceptions, for instance a neighborhood collaboration to plant a yard with a variety of dwarf fruit trees. There was also the one remaining community garden site managed with permaculture practices at a collective house in East Urbana, which to date has been successful. It seems obvious now: the cooperative house is a good place for community permaculture projects, the private home is a good for personal permaculture projects.

The year 2005 saw a trend toward research and specialized projects. The population of the UPP was almost completely different from the original group, and the new group was older, more grounded, and more interested in refining ecological designs by analyzing data. One participant with an engineering background conducted energy audits on several local houses and buildings. The UPP also began to track the survival rate of certain plants, such as Pawpaw [Asimina triloba L.] and Bamboo (*Phyllostachys* spp.) that had been imported at considerable monetary cost. Mollison's (1993) permaculture book oriented people toward fermented foods as a means to diversify the diet without refrigeration or cooking. Using home-grown produce, a dozen fermented foods such as sauerkraut and pickles were produced, and the results were documented. The collective house developed a group of people interested in fermented beverages and made fruit wines. Also competing for attention was Urbana's new "Backyard Chicken Effort" (founded in 2005, a descendant of the gardens with laying hens). For my part, I wrote a Masters Thesis submitted in December 2005, on permaculture methods applied to the Illinois bioregion (Scott, 2005).

In 2006, one could observe the effects of specialization upon the UPP. The six board members included a farmer, a carpenter, an engineer, an architect, and the manager of the local food cooperative. Each had their own projects, sites, and in many cases non-profits attached to their work outside of the UPP, but no one was using the word "permaculture" to describe their work outside of the context of the UPP. I continued to work on the garden at the collective house, and I presented my permaculture research at local workshops and at conferences outside of Urbana. This reaffirmed my sense that there is an audience for permaculture information amongst young adults in the United States, but I was also dismayed by what I perceived to be a shortage of long-term permaculture projects. The UPP was an example: the most long-term site was a three year old community garden on rental property, and I was the only remaining member of the original UPP group.

In 2007, I called a meeting of the Board of Directors and asked if anyone planned to use the non-profit organization to fulfill its mission to design sustainable human settlements. I was

continuing to teach ecological design at a local alternative school in Urbana, but I was no longer using the phrase "Urbana Permaculture Project" to describe my work. The board decided to "recycle" the non-profit status into a board member's sustainability project where the UPP had once worked near Monticello, Illinois. In 2008, the organization was renamed the Kalyx Center for Sustainability, and I was replaced by a new board member with closer ties to the Kalyx Center. The mission of the organization remained the same: to promote perennial sustainable food production systems, and educate the local community in permaculture design practices.

Some general lessons may be drawn from the financial decisions of the UPP as a whole. The UPP raised $21,536.06 over seven years, about 75% of which came from a pair of landscaping jobs, the remainder coming from donations. The UPP never paid wages or salaries, and never ran out of money. About 60% of the funding was spent on garden supplies, the remainder going toward workshop expenses, literature, paperwork, and other auxiliary expenses. The UPP spent at least $12,276.06 on garden materials such as plants, and there were certainly some investments that did not give a speedy return of commensurate value (see Table 2). Many permaculture designers encourage a primary emphasis on the selection of native flora and fauna, with a second-choice population of tried and tested exotic species (ones that are known to not be harmful to the local ecosystems), before thirdly, a limited experiment with untested exotic species.[5] Thus the UPP purchased native Pawpaw (*Asimina triloba* L.) and American Persimmon (*Diospyros virginiania* L.) trees which may bear their fruits sometime in the next decade, if they survive the urban environment. Native fruit trees for Illinois are expensive, and low on short-term yield. Following the lead of bamboo-based permaculture work (Henderson, 1996), the UPP invested in a variety of bamboo species, though it is hard to know the value of a bamboo grove. They are beautiful, large hedges that provide windbreaks, visual privacy, stakes, fencing material, and light construction materials in Illinois' temperate climate. Ironically, the most successful species has proved to be one freely transplanted from a neighbor's yard in Urbana. Perhaps locally naturalized bamboo is prone to yield sooner than expensive and untried species from out-of-town. Having read about the integration of mushroom cultivation into permaculture (Stamets, 2000), the UPP invested in spawn and mushroom paraphernalia, plus many hours of labor sawing and inoculating valuable oak logs. Hundreds of dollars worth of Shiitake mushrooms were produced, though the other mushroom species rarely if ever fruited. After reading Mollison's (1993) permaculture book on fermented food, various fermentation equipment was purchased (mainly large glass carboys and stone crocks). Fruit wine fermentation gave an immediate return on the investment, though the value of wine tends to increase with age. With a small annual input cost for yeast, sugar, and corks, this has been an enterprise that substantially led to self-reliance in alcoholic beverages for those who produced them. I also found that neglected fruits that could be sourced locally, such as Elderberry (*Sambucus canadensis* L.) and

Chokeberry (*Aronia melanocarpa* Michx.), resulted in decent table wines (Scott & Skirvin, 2007; Scott & Sullivan, 2008). Fermented vegetables such as pickles were more prone to spoilage. Though these may be described as investments, the UPP was not a commercial enterprise (none of the above were ever sold), thus the value produced in all cases was "use value", the inherent value of living things, the relationships, and the information. For better or worse, the decision not to sell produce guaranteed the UPP would not become a farm.

Item	Expense	Yield to Date
American Persimmon (*Diospyros virginiania*)	$180.00	0
Bamboo (*Phyllostachys* spp & others)	$939.49	garden stakes
Fermentation Equipment	$373.07	435 bottles of wine
Pawpaw (*Asimina triloba*)	$414.00	0
Various Mushroom spawn and equipment	$445.34	buckets of Shiitakes

Table 2: Some UPP expenses and yields, illustrating the varying rates of return on attempts at cultivating biological resources using permaculture. Other items such as popular culinary herbs, fruit trees, and vegetable seed were swapped amongst gardeners to a degree that clean data on expenses and yields are unavailable.

The Urbana Permaculture Project was not the only permaculture effort in Illinois or the Midwest, and a few nearby projects are worthy of mention. The longest running permaculture project in Illinois is "The Permaculture Project" started by Wayne Weisman in association with Dayempur Farm near Carbondale, Illinois.[6] Weisman was certified by Bill Mollison and The Permaculture Institute of Australia to teach the PDC Course in the United States. Mark Shepard's New Forest Farm near Viola, Wisconsin is designed to be a large chestnut and hazelnut forest ecosystem. In 2007, the publisher of Permaculture Activist magazine and founding member of Earthaven Ecovillage initiated a new suburban scale permaculture site on the edge of Bloomington, Indiana. These sites demonstrate permaculture principles and continue to educate the public in permaculture design practices in the midwest.

The UPP is not alone in never having committed to a single-site approach where a piece of land functions as a farm or homestead for the project participants, nor is its decline unique.[7] The decision to start practicing permaculture before acquiring land, modest fundraising, and the refusal to sell produce, led the UPP away from farming. The UPP instead tried to work on leased suburban lots, but the effort was spread thin and most of the community gardens did not last more than a few years. The greatest resource of the project seems to have been the enthusiasm of new, young participants — enthusiasm which led to overshoot in 2003 when more garden projects were initiated than could realistically be sustained. Workshops, reading, and other educational venues became the

unifying mechanism of the UPP. This trend has likely been experienced by other permaculture projects. Similarly, it was easier for the UPP to dabble in green architecture workshops, than it would have been to seriously get into the business of building. The greatest potential for a profitable business might have been in locally produced berry wines, but there was no interest in sales, nor did the UPP have a liquor license. Though not representative of the entire permaculture movement, the UPP illustrates an avenue of permaculture movement in the United States where backyard gardening and educational workshops become more prominent than farming and scientific research.

Permaculture and the Scientific Record

If there are truly thousands of people who have been educated in permaculture (Bane, 2002), and the story of the UPP is not unique, then where is the rigorous accounting of the lessons learned, the research completed and replicated? The permaculture movement in the United States does not have a college campus, endowed professorships, or a peer-reviewed journal. It does have the *Permaculture Activist* magazine, launched in 1985, which is still in print today as the longest running, continuously published source of information on the permaculture movement in the United States, and possibly the world. The Twentieth Anniversary August 2005 issue of *Permaculture Activist* listed more than one hundred permaculture education offerings for the latter half of 2005. That's enough environmental education to fill a small campus, and to generate articles for research journals. While oftentimes permaculture sites are themselves the "campus" for permaculture educators, one is hard pressed to find the research articles commensurate to the number of permaculture teachers.

Below I describe the scientific research that uses permaculture and the permaculture literature that uses scientific research. I searched scientific literature for permaculture terminology, and I searched *Permaculture Activist* for the citation of scientific research. I found very little communication to be taking place between the world of scientific research and the world of permaculture design and education. I describe this in greater detail below, and then I make some suggestions as to how the two could better use one another.

In November 2007, I searched for the keyword 'permaculture' in five most important academic databases for scientific research: ISI Web of Knowledge (1980-2007), AGRICOLA (1970-2007), AGRIS (1975-2006), Biological Abstracts (1969-2005), and the Zoological Record (1978-2006). I scanned the resources for US-based original research, all of which fell between 1980 and 2006. The ISI Web of Knowledge search listed 4 journal articles based on research in the United States. The AGRIS search had 10 publications from the United States, of which 4 were journal articles. The AGRICOLA search had many of the same titles, as well as 35 additional publications from the United States, of which 6 were journal articles. Biological Abstracts and Zoological Record searches did not add any new publications from the United States.

From all the databases searched, only 49 original publications from the United States mention permaculture in any way, and only 14 of those are journal articles. I was disappointed to find such a scarce application of the scientific method to permaculture ideas. The quantity of research articles is dramatically out of proportion to the number of permaculture textbooks written over the same period (see Table 1). Although the word permaculture occasionally shows up at scientific meetings and conferences (Mogen, 2006), and in agricultural extension documents (Ball & Popiel, 2005), peer-reviewed literature that explicitly mentions permaculture is intermittent and disconnected. Recent papers that mention permaculture address agroforestry in the United States (Scott & Sullivan, 2007; Jordan, 2004), energy and sanitation in Netherlands (Van Timmerein, Sidler, & Kaptein, 2007), urban vegetable farming in Austria (Vogl, Axmann, & Vogl-Lukasser, 2004) and rural water harvesting in Australia (Yuen, Anda, Mathew, & Ho, 2001). Many of the US articles that contain the word permaculture make only tangential reference to it.

To explore how permaculture literature makes use of scientific research, I bought a complete set of *Permaculture Activist* back-issues, and reviewed the first twenty years (1985–2005). For each issue reviewed, I noted: (1) the number of articles listed in the table of contents; (2) the number of those articles with citations (including endnotes, works cited, and bibliographies) (3) the number of those articles with citations that fell into three categories: peer-reviewed science, popular writing, and

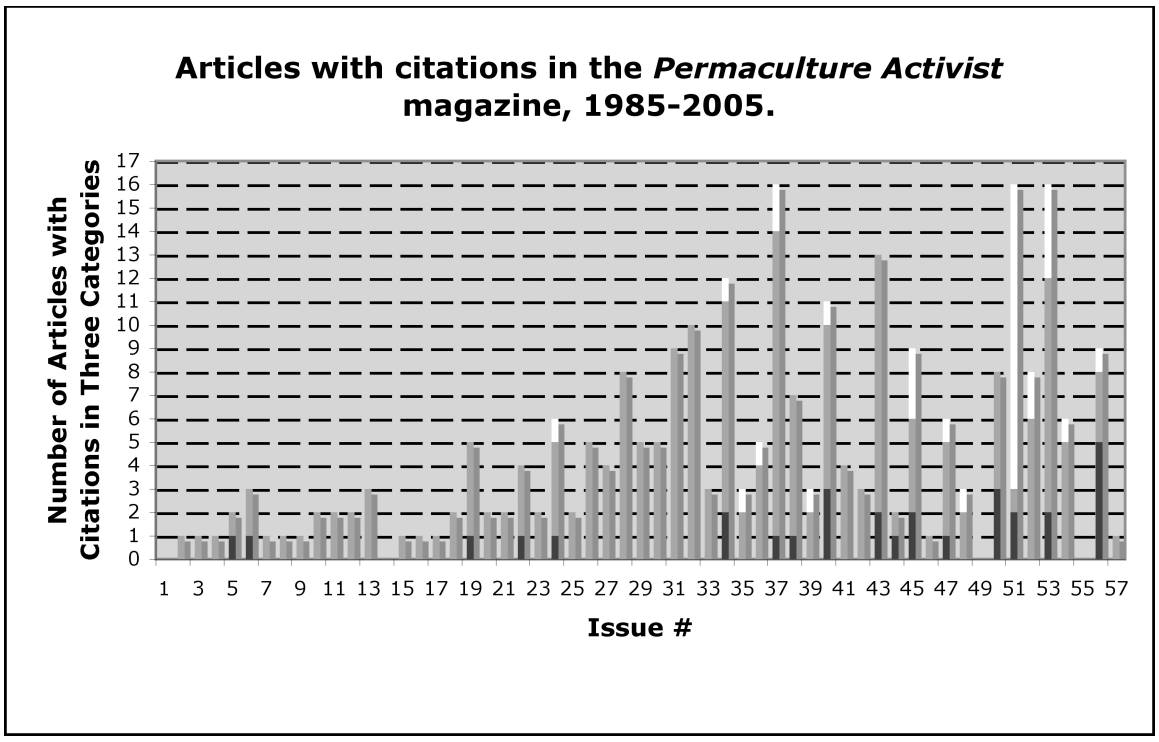

Figure 2: Citations in 20 years of *Permaculture Activist* magazine. Note that the size of the magazine itself grew over the years, which accounts for the increase in the number of total citations. Dark portion of the bars are scientific citations, gray indicates popular literature, white indicates cultural/traditional/spiritual literature.

cultural/traditional/spiritual. Websites, individuals, and projects were not counted as proper citations. Books referred to as "additional resources" were not counted as citations. Scientific reference books such as field guides and textbooks were counted as popular writing.

I found that in the first twenty years of *Permaculture Activist*, 709 articles were published, with 235 (33.1%) including citations. Articles without citations primarily reported first-hand experiences implementing permaculture ideas, or offered stories or opinions about subjects related to permaculture. Of the 235 articles with literature citations, 30 (12.8%) cited peer-reviewed scientific literature, 195 (83%) cited popular literature, and 30 (12.8%) cited cultural-traditional-spiritual references. Twenty articles cited more than one type of literature, thus the percentage sum for the three categories sum is >100%. The distribution of the different types of references was more regular during the first ten years of the magazine than the latter, (see Figure 2). The 30 articles that cited scientific literature used a total of 87 distinct scientific citations. When the number of scientific citations is plotted against the year of the article's publication, a slight upward trend in the use of scientific citations is revealed, (see Figure 3).

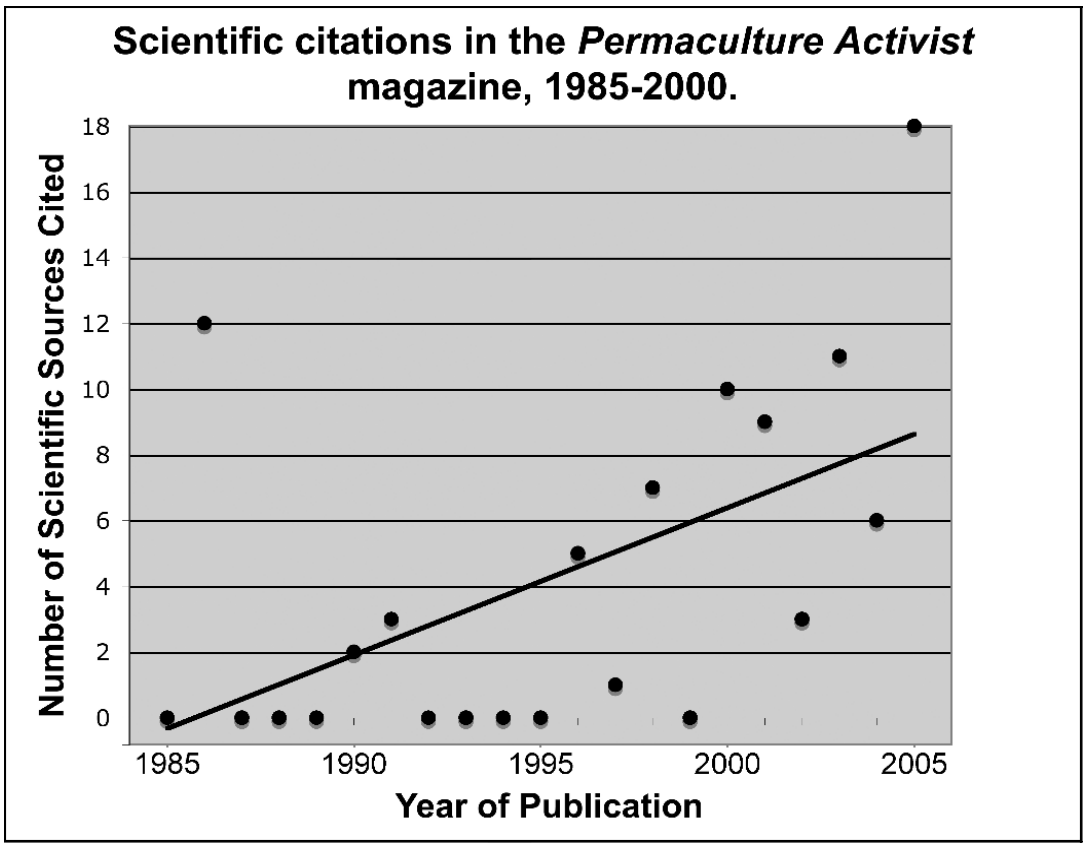

Figure 3: Plotting the 87 scientific citations in *Permaculture Activist* over time, a slight upward trend is found in use of science over the first 20 years of the magazine.

Discussion

Permaculture arrived in the United States in the 1980s and has been spreading ever since, with both national organizations such as PINA and *Permaculture Activist*, and local organizations such as the Urbana Permaculture Project. It is likely that many small permaculture projects have followed a course similar to that of the Urbana Permaculture Project: without a farm or research funding, initiating backyard gardens and educational workshops is a way to get started. Permaculture practitioners have written dozens of books, and filled the pages of several magazines, but they do not rely heavily on scientific literature. For its part, the scientific community in the United States essentially ignores permaculture. The entire body of peer-reviewed science on permaculture could fit in the first few chapters of one of the many permaculture textbooks currently in print. Two-thirds of the articles printed between 1985 and 2005 in *Permaculture Activist* magazine did not include citations of any kind, and those that did tended to cite popular literature.

The *Permaculture Activist* magazine has provided an invaluable service in documenting hundreds of projects initiated by Americans over two decades. There is a permaculture magazine published in the United Kingdom which has a similar focus on reports from enthusiastic new practitioners, and this European permaculture magazine contains fewer citations and more advertisements.[8] The longevity of the permaculture movement, and its ability to inspire new experiments in ecological design, suggest that it merits the attention of scientific researchers, and there is probably a wealth of data to be collected from already existing permaculture projects. *Permaculture Activist* is not a peer-reviewed scientific journal, but it reaches permaculture educators and practitioners with extension-type information, which is valuable in its own right. By serving as a clearinghouse for permaculture courses offered in the United States, *Permaculture Activist* serves a vital function for the movement. There is clearly an audience for permaculture literature, and the proliferation of PDC courses suggests that permaculture continues to inspire people to seriously study the permaculture design principles in the United States today. It is hard to imagine that permaculture education would not benefit from increased use of the scientific literature, and a willingness to test permaculture practices against controls, but this does not devalue the permaculture movement that currently exists and mobilized communities to ecological design.

What I have described as a "tendency toward education rather than agriculture" is inevitably a consequence of what has been observable in the specific areas I have chosen to look for permaculture. I have doubtlessly gravitated towards people and projects in the permaculture movement that have taken a path similar to that of the UPP. Backyard gardening and permaculture education are not the sum total of the permaculture movement, but perhaps only it's most easy-to-find aspect. There are surely farmers in the United States who have been influenced by permaculture without ever having heard of *Permaculture Activist* magazine. Nevertheless the permaculture projects

which network through courses, magazines, web sites, literature provide a portrait of one direction in which the permaculture movement has developed in this country.

Permaculture has developed during a specific era, in which environmental consciousness has become mainstream in US consumer culture. Permaculture has taken a community-based approach to education, relying upon texts that are accessible to the general public (Wages, 2004). The value of community-based environmental education has been well established (Niesenbaum & Gorka, 2001), but there is also a need to stay current in one's awareness of science and social affairs. Sustainability was not a mainstream idea when permaculture was created, but today it is the central marketing and public relations theme in certain sectors of the US economy, particularly the auto and fuel industries. Consider then the story of the recent book by permaculture educator David Blume entitled *Alcohol Can Be a Gas* (2007). Farm-produced ethanol fuel was too radical for television when Blume's 10-part documentary *Alcohol as Fuel* was cancelled by PBS-affiliate KQED in 1983. But in the interceding years ethanol production has entered the mainstream of agriculture (Hill et al., 2006). Environmental scientists have critiqued the environmental benefits of ethanol production (De Oliveira, Vaughan, & Rykiel, 2005), and human rights concerns have arisen as food prices have increased alarmingly in recent years with some blame being placed on the conversion of food crops to fuel crops (Pimentel et al., 2009; Dong et al., 2008; Mendoza, 2007). Blume is likely aware of these concerns, and a distinction must be drawn between the small self-reliant communities proposed by permaculture, compared to the current industry giants whose wealth is based on the anonymous exchange of agricultural commodities. Perhaps permaculture and environmental science have a common enemy in commercialism, which threatens to rob both of their calling to a higher ethic based on earth repair and people care, and not only the narrow pursuit of short-term profit.

In addition to environmental science, many other fields today have their own sustainability narrative, trajectory, specialists, and research journals. Much of today's work on sustainability did not exist when Mollison proposed the permaculture concept. There are now shelves of books and journals on sustainable agriculture, green architecture, environmental policy, and urban ecology. These fields do not link to each other using permaculture, though ostensibly they have the common goal of finding long-term solutions to environmental problems. The research that has been published in various fields allows today's permaculture practitioner the opportunity to make choices with great precision of focus, informed by the work of countless others who may never have heard of permaculture. Those who use refereed literature may also be more inclined to cite it, and to their writing through the peer review process. I myself have written for *Permaculture Activist* (Scott, 2004); I have also published essays in refereed journals that come directly out of my permaculture work in Urbana, IL (Scott & Sullivan, 2007; Scott & Sullivan, 2008). Permaculture may be most at home in small communities throughout the United States, but it has not yet entered the larger societal

discussion on sustainability. Research publications may provide a path to wider awareness of permaculture, while avoiding some of the diluting tendencies of commercialism.

I suspect that the heterogeneous nature of permaculture is a barrier to entry into the world of professional scholarship. The combination of plant growing, architecture, and social concerns, implies a wide variety of methodologies that contain structural incompatibilities for an academic system with inherited departmental divisions. It would seem that permaculture could be the perfect subject for inspiring a multidisciplinary approach, but thus far it has fallen into the blind spot of scholarship. This is unfortunate because although backyard gardens and educational workshops are a fine place to start, they are not in themselves sufficient to test the diverse and transdisciplinary claims made by permaculture textbooks.

Ironically, it may also be this very multiplicity of foci that explain permaculture's ability to inspire people to try to do something about environmental problems. The number of permaculture courses offered annually in the United States is a testament to the number of people inspired by the concept. The Urbana Permaculture Project is one of hundreds and perhaps thousands of decade-long efforts in community-based ecological design. Still, beyond inspiration someone has to make sure that permaculture "works" via revised and improved permaculture methods and techniques, as well as keen attention to the shifting construct of "sustainability" in the age of peak oil, climate change, and the commercialization of environmentalism. One step in this direction would be the development of a common measure of sustainability (perhaps based on energy analysis) that could be applied to both conventional systems and permaculture systems.

A common question for permaculture design and environmental science is how to satisfy human needs in a sustainable way without assuming the profit driven infrastructure that has contributed so greatly to environmental problems. The recent *Edible Forest Gardens* (Jacke & Toensmeier, 2005) is an example of the potential to merge the descriptive language of environmental science with the action-orientated rhetoric of permaculture. Further research will have to push permaculture principles to prove themselves capable of helping communities of people meet their needs, or submit to reformulation. Evidence must be empirical and not only anecdotal. Thus the permaculture movement could attain its place as an important force in implementing local solutions to the environmental problems which environmental scientists research. Hopefully permaculture will continue to evolve, while bridges are built to the many fields of sustainability that have been sown in its environs.

Acknowledgements

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Endnotes

1. It should be noted that these permaculture "projects" range from full-scale farms, to individuals selling a book. Many of the projects appear to be groups of people offering physical or educational resources. See: http://www.permacultureactivist.net/pcresources/NorthAmerica.htm - USA

2. This claim is based on a scan of the above-mentioned 277 permaculture projects, looking for one of three things: (1) mention of farming, or possession of a farm; (2) mention of a nursery, harvested woodland, or other broad scale land production system; (3) a gardening practice applied to sites totaling 1 acre or more. I found that 108 of these projects satisfy one of these three criteria. Though this is an informal observation, there are, no doubt many other sites in the United States that have been influenced by permaculture. Nor does the Permaculture Activist online directory claim to be exhaustive.

3. Based on the Comprehensive Plan for the City of Urbana, which is available here: http://www.ci.urbana.il.us/urbana/community_development/planning/comprehensive_plan/Main.html

4. The 2003 event was entitled "Build Your Own" and we invited local Passive House Architect Kat Klingenberg. The events in 2004, 2005 and 2006 events were entitled "Ecological Construction Symposium" and were organized with the assistance of Klingenberg. In 2006, Klingenberg also organized the "1st North American Passive House Conference" which was advertised in tandem but offered separately. Each year since, Klingenberg's Ecological Construction Laboratory has organized a North American Passive House Conference. These events were organized independently of the Urbana Permaculture Project, but they descend from a lineage of conferences that were organized by permaculture designers in Urbana.

5. I've never found this idea in a permaculture textbook, but it is in the notes from both permaculture design courses I have taken, and can be found variously in the discussions about permaculture on listserves and on the Internet; for instance here, on a Permaculture listserv: http://lists.ibiblio.org/pipermail/permaculture/2002-October/016705.html

Also here, in the context of another Midwestern permaculture group: http://www.midwestpermaculture.com/MREA-Aug08-Advanced Design/MREA Final Design 8-08.pdf

Also here, referring to information presented at a permaculture design course in the UK: http://iamthou.wordpress.com/2008/07/

6. Wayne Weiseman is one of only three registered permaculture teachers recognized by the Permaculture Institute of Australia and listed on Bill Mollison's website at: http://www.tagari.com/?page_id=19

Weiseman's work in and around Carbondale, Illinois, can also be found at: http://www.permacultureproject.com/

7. Two more examples from Illinois are "La Casa Verde / EcoLogical Designs" in Peoria, Illinois and the Chicago Urbanland Permaculture project. Unfortunately, both seem to have disappeared, or transformed in a manner similar to the Urbana Permaculture Project.

8. This claim is also based on the evaluation of a complete set of back issues of the UK Permaculture magazine. Another valuable magazine, which similarly disseminates information on permaculture courses taught in English in the Europe, and distributes books in addition to publishing titles under the Permanent Publications label.

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