Enabling Redesign for Deep Industrial Ecology and Personal Values Transformation: A Social Ecology Perspective

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"*Most new initiatives start with a 'planning' process; and the outcomes are frequently disappointing. Underneath planning lies 'imagination and creativity', and underneath this lies 'passion and feelings' -- all within an internal context of 'values and worldviews', and a specific external context. Engaging first with these latter areas generally leads to innovative plans and programs that are genuinely progressive and transformative.*

Similarly, most initiatives focus on 'efficiency' and 'substitution' strategies. These predictably fail to address the causes of problems. What is needed is a 'whole system design/redesign' approach that aims to make systems problem-proof and that enable health and wellbeing.

Furthermore, problems tend to be addressed in fragmented ways, and within the confines of disciplines and specialties. Again, what is needed is a holistic, integrated, whole system approach…. To be able to do this external redesign it is usually necessary to also engage in some liberating internal redesign -- in terms of our understandings and ways of working and collaborating." (Statement by the author for a proposed position of 'Provocateur' with the Department of Primary Industries, Government of Victoria, Australia; 13 Oct 2004).

What I am arguing above, and in this chapter, is that the redesign, design and innovation that is needed at the industrial and business level needs to be 'enabled' by supportive changes in our institutional structures and processes (at the political and socio-cultural level), and that changes at both of these levels can, in turn, only be effectively 'enabled' by radical (deep, root level) transformation at the personal level. Such personal change usually involves healing and liberational processes that result in empowerment, expanded awareness and visioning, clarification and transformation of values and worldviews, and an ability to live more fully and more relationally in place and in the present, while also having much greater concern for other humans, other species, ecological processes, and the long-term wellbeing of all life. To put it negatively, psychologically wounded individuals will always tend to design and manage structures and processes that will, sooner or later, result in problems. Such personal change can be enabled by psychotherapeutic processes that support natural recovery and healing from past psychological wounding (from which we have all suffered, despite our tendency towards adaptive denial), and through the provision of supportive present environments. Without this necessary internal level of transformation and redesign, all external innovation and change is likely to be compromised, adaptive of the *status quo*, and consequently 'shallow' (*vs.* the much needed genuine 'deep' ecological transformation). Far from being depressing, I find this perception incredibly hopeful in that it opens up numerous as yet untapped opportunities as we learn our way forwards into the future. I should also add that my assumption is that at every moment all of us are doing the best we can (which may include rejecting much of what I am arguing for here), given our natural potential, the 'positive' and 'negative' effects on us of our past experiences and the nature of and level of support within our present environment.

To introduce this personal level of understanding I will first share some of my own experiences that led me to taking this multi-layered approach to enabling innovative and effective redesign for a 'deep' industrial ecology.

My personal journey from science and technology to psychology and beyond

My earliest experience of working in industry was in the late 1950s as a chemist and trouble-shooter in an electroplating and light engineering company. In an early effort to improve efficiency and reduce resource consumption and pollution I investigated the use of ultrasonics in enabling improved deposition of protective coverings. Although the concept was good, and has subsequently been further developed, at that time I was confronted by the common challenge of costs, various issues relating to practicality, and to

largely unknown health and other side effects of the new technology. These are common experiences facing innovators. I eventually had to settle for less radical innovations and focus on improving the efficiency of current systems.

In the early 1960s I went off to University to study marine biology and – through learning how to effectively 'farm' the sea – save the world from starvation (having been regularly told as a child about the 'starving Chinese', mostly as a way to persuade me to eat my food). This led to my second major industrial experience when, as a summer student, I went to work for Bayer in Germany testing pesticides. Although Bayer's scientists were extremely thorough and efficient in their testing methodologies, on reflection I quickly became aware of the conceptual flaws and of the numerous problems associated with such curative, and what I have subsequently come to refer to as 'back-end', approaches to problem solving. This eventually led to the development of my 'efficiency-substitution-redesign' model for evaluating problem-solving initiatives (Hill 1984, 1985, 1998, Hill and MacRae 1995). The essence of this insight was that the most effective way to solve problems is to redesign the systems involved to make them, as far as possible, problem proof. This design approach is ideally done proactively rather as a reactive response to problems and crises. Although 'efficiency' and 'substitution' strategies may reduce resource dependence and environmental impact, by not addressing the causal design flaws they can, usually unintentionally, protect and perpetuate the very design features that are responsible for the problems. Because of this, 'efficiency' and 'substitution' initiatives are best conceived as transition strategies toward whole system 'redesign', or as second choice and emergency strategies. It should be noted that redesign/design initiatives often paradoxically result in much greater gains in efficiency than when efficiency is the limited focus of an innovation (Fletcher and Olwyler 1997). I have subsequently further developed these ideas and applied them not only to pest management (Hill 2004), but also to soil, landscape and natural resource management (Hill 2003a), as well as to numerous other areas including learning and education (Hill, Wilson and Watson 2004), health and wellbeing, peace, community and organisational development (Hill2005), and now industrial ecology (Hill2006).

What also emerged from these experiences was a realisation of the importance of gaining a better understanding of bio-ecological processes, which I argue comprise the real bottom-line of our survival and wellbeing over the long term (Hill2005, Mulligan and Hill 2001). I was able to considerably progress this understanding through an opportunity in 1965 to go to Trinidad to do a PhD on the total ecology of a bat-inhabited cave (not because I was particularly interested in bats and caves, but because the cave could serve as a 'model' ecological system in which it would be easier than in more open systems to measure and track ecological processes). This particularly expanded my appreciation of the complexity of bio-ecological processes, and of the need to always take into account implications for the functioning of whole systems over the long term, and also of distant, indirect effects of even apparently minor interventions. With this whole systems understanding, I was developing my competence to approach design in a much more holistic and holographic way than was common at the time (Wilber 1982).

My first academic appointment was in 1969 as a Research Associate with the outstanding soil zoologist Professor Keith Kevan, who was Chair of the Department of Entomology in the Faculty of Agriculture of McGill University in Quebec. There I became increasingly horrified by the way agriculture students were being taught – with little recognition of agriculture as a bio-ecological system, and nothing included on design or on system maintenance – the focus was just on management for maximizing productivity and profit.

I started collecting critical literature relating to the design and implementation of an ecological approach to agriculture, and in 1974, with the support of a benefactor, David Stewart of the Macdonald-Stewart Foundation, Ecological Agriculture Projects was established. This quickly became Canada's (and possibly the world's) most comprehensive resource centre for information on ecological and sustainable approaches in agriculture. During my 20-year Directorship of this centre – as well as producing numerous papers (www.eap.mcgill.ca) our group obtained a contract with the Department of Agriculture in Quebec to service and support extension agents in that Province in their efforts to enable producers to become more ecologically sustainable (Hill and MacRae 1992). This subsequently led to my doing similar work throughout North America and in many other parts of the world. This extensive experience, and access to

numerous case studies, repeatedly confirmed my earlier insight, that it is possible to design systems that are both ecologically and economically sustainable. It also became clear, however, that flaws in our economic system – particularly the biased rewarding of marketable yield, and lack of rewards for the rehabilitation, construction and maintenance of 'healthy' systems; and growing economic globalisation, with its bias towards cheapness, the short term, and single commodities (vs. whole systems) – put ecological producers at an economic disadvantage (Hill 2001a, 2006, MacRae, Hill, Henning and Mehuys 1989a, MacRae, Henning and Hil1 1993). This became particularly evident in the first major comparative study of organic farming in North America, which found that although both organic and conventional farms achieved roughly the same levels of profit and productivity (organic having an advantage in wet years – because herbicides don't work well when it is dry), the organic producers were able to achieve this on 20 % of the amount of energy required by the conventional group, i.e., they were not rewarded by the market or by government for the 80% saving in fossil fuel consumption (Lockeretz, Shearer and Kohl 1984). Clearly, if we are to design and manage ecologically sustainable industries, such market-based inequities must be addressed, through appropriate political and economic instruments (MacRae, Hill, Henning and Bentley 1990). Furthermore, it should be noted that these farmers achieved these remarkable outcomes with virtually no research and extension support. This highlighted the need for the funding of more appropriate research and extension (MacRae, Hill, Henning and Mehuys 1989b).

The other thing that became clear was that psychological factors, which are commonly largely neglected in most redesign and social change initiatives, must be addressed to achieve significant sustainable progress (Hill 2001b). These insights were deepened through my own personal 'healing work', and subsequent training as a psychotherapist. This is the most challenging area to discuss, and the one most subject to rejection and denial, particularly because denial is a primary strategy for surviving trauma in the absence of support for healing (through discharge and recovery). The late Scottish psychiatrist R. D. Laing (1969) characterised this as an adaptive double hypnosis in which a constructed pseudoreality replaces the reality, and then we deny that this has happened. So, it is very difficult to engage in meaningful dialogue about this, because its very mention commonly triggers a, largely subconscious, retreat into denial. To challenge such denial, so that we can move on to discuss the topic on hand, I sometimes encourage workshop participants to engage in a two-minute exercise in which pairs are asked to face each other, hold hands, make eye contact, and take turns to talk only in the present. For most people this is virtually impossible (especially for men, and for deeply wounded individuals, for whom it may be perfectly sensible to not participate), yet for a psychologically 'well' (unwounded or healed) person, being fully aware in the present, and able to clearly communicate experiences gained through our sensory systems from outside and inside, would be easy to do. To some extent this simple exercise provides us with an indication of the extent of our woundedness, and of our subconscious preoccupation with negative past influences. Conversely, this also gives us some indication of our untapped potential and reason to be optimistic about the future. To be fully available to design and redesign systems for ecological sustainability (and all other noble goals), we must either first recover from these hidden undermining, limiting and distracting influences, or be provided with such powerfully supportive environments that there is no chance of any of these potential influences from being reawakened and restimulated (Hill 2003b). Although my particular pathway to improved clarity was primarily through radical psychotherapy (Hill 2003b) and 'co-counseling' (Jackins 1978), there are examples of the enormous power of having access to a benign and supportive environment. The most impressive case of this that I know of was the Peckham Experiment, in which the provision of such an environment – essentially a community centre in which the locals in that part of London were free to pursue their own learning and activity agendas – enabled the participants (over 1000 families over 12 years) to behave in ways that had both personal and social benefits that were unprecedented, and that included an enhanced innovative capacity (Stallibrass 1989, Williamson and Pearse 1980) [http://www.thephf.org.uk]. Clearly there are lots of implications here for the redesign/design and management of the workplace (and also all centres of learning, and our homes); and of the potential of improved access to, and use of, appropriate and diverse psychotherapeutic services.

These, and other related, experiences enabled me to be appointed to my present position as Foundation Chair of Social Ecology in the School of Social Ecology and Lifelong Learning at the University of Western Sydney in Australia (I currently define social ecology as: *the study and practice of personal, social and ecological sustainability and progressive change based on the critical application and*

integration of ecological, humanistic, relational, community and 'spiritual' values; Hill 1999). This also enabled me to renew my interest in agriculture, particularly in the extremely innovative work of the late P. A. Yeomans, who developed the 'Keyline' system for landscape management, as well as an award-winning chisel-type plough, an improved method for making farm ponds (called dams in Australia), and a system of livestock management that dramatically increases soil organic matter, soil formation, soil fertility and productivity (Yeomans, K. 2002, Yeomans, P. A. 1958, 1971, 1978). For me, Yeomans embodied and exemplified most of what I have been arguing for in my approach to industrial ecology. What he lacked was particularly the psychological component, and this has, I believe, subsequently limited the more widespread adoption of his brilliant innovations (Hill 2003a, 2006). This will be discussed further below. A forthcoming book by his middle son, Allan Yeomans, may help remedy this (Yeomans, A. 2005). Allan has further developed the Yeomans plough and has shown how its widespread use may enable us to capture as much carbon dioxide, and store it in the soil as humus, as the amount that is being released into the atmosphere as a result of burning fossil fuels. Although this would not provide a permanent solution to the 'global warming' problem, it could buy us time to develop non fossil fuel based technologies, while addressing this potentially devastating challenge. The contributions of P. A. Yeomans will be discussed in more detail as a case study below.

Based on the above, other experiences and the extensive literature relating to ecological sustainability and the process of change, I have complied a set of assumptions that, I consider, should be taken into account when developing and implementing ecological initiatives, including those in industry.

Some assumptions (discussed in more detail in Hill 2006)

Nature functions according to **ecological 'laws'** and processes that involve limits and opportunities, cycles, non-linear and threshold relationships, complexity and high functional biodiversity, widespread mutualism, with competition usually being a last resort, and most resources being used for maintenance (sustainability) and regulatory processes, with 'production' being a by-product of this (Commoner 1970, Hill 1991). **There can never be a non-ecological long-term future** for our species, including our industries. Because we are products of nature we are all subject to nature's limits and opportunities.

Industry, like economics, politics and religion, is a social construct. **Designed and used appropriately, industry can serve us in supporting the wellbeing of both people and the planet**. Conversely, with personal disempowerment, lack of awareness and vision, undeveloped worldviews and confused values, we are susceptible to being enslaved by industry (as we are by any of our other social constructions). The more powerful the social construction, the more powerful and clear we need to be to not become victims of such enslavement. In this regard, for industrial ecology initiatives to achieve their full potential they must focus on fundamental whole-system eco-design and redesign, and not be regarded as add-on or fine tuning activities.

Sustainability is concerned with the **long-term regeneration and maintenance of living systems**. It has a paradoxical relationship with progressive change and personal and ecosystem development, for which it is a co-requisite. Ecological sustainability affects the survival and wellbeing of all life. Social and cultural sustainability relates only to human groups, and personal sustainability to individual wellbeing. Because money and economic systems, like politics, technology and even religion, are human constructions (in a sense, merely 'tools') that enable us to act on our values, they should not be accorded similar status to the environment or personal wellbeing when considering sustainability. Like all tools, they must be regarded as subject to being changed as needed, and their appropriateness must be judged against a broad range of life affirming values. To allow any of them to assume the role of a higher value, as we have for growth, wealth, ownership and global trade, is paradoxically an indicator of our collective disempowerment (it is a predictable, associated compensatory behaviour) and of the loss of our humanness, and/or of its untapped potential. Consequently, for me, any **triple bottom line must relate to ecological, personal (including 'spiritual') and social (including economics, politics etc.) sustainability**. If we are to survive, then economics and money must eventually be put in its place, and not allowed to dictate our values or be the sole factor in determining our decisions.

Change is a natural **whole-system process** that in nature mostly occurs gradually (with occasional bursts) in a highly integrated way that is adaptive over the short term and co-evolutionary over the long term (Norgaard 1994). Effective sustainable and psychosocial evolutionary change in human societies is supported by being based on this awareness, by having shared emergent and contextually appropriate goals and agendas, being clear (not naive) about the contexts within which one is operating, and having the knowledge, skills and psychosocial maturity to collaboratively implement our visions and bring about progressive changes (deMause 1982, 2002). We must constantly be open to change in direction (including paradigm shifts; Kuhn 1970) as we sensitively and imaginatively learn our way into the future. One key to effective change is to focus on **small meaningful initiatives** that can be accomplished with the widest possible sense of ownership, and to publicly **celebrate progress** (to acknowledge achievements and facilitate copying by others). The importance of this approach to change cannot be overemphasized. Mega-projects 'owned' by experts and those with positional power are the least likely to succeed, and the most likely to experience low compliance and, over time, lead to unexpected negative outcomes, and be ultimately unsustainable (Hill 2001b).

Redesign. All existing systems can benefit from fundamental redesign based on the creative application of our understandings of life, particularly in relation to ecology and psychology. An initial list of such understandings in ecology with some of their social implications is provided in Table 1. This deep approach to industrial ecology, natural resource management and change is profoundly different from the more usual tinkering approaches that aim to improve efficiency within flawed designs (such as monocultures in agriculture, forestry and fisheries), substitute inputs (such as renewables and biologicals, now including genetically modified organisms, for non-renewables and synthetics), and that focus on problem solving and symptoms (usually regarded as 'enemies' instead of feedback from poor designs and mismanagement). Instead, deep redesign initiatives **aim to use bio-ecological and psychosocial insights to create self-maintaining and self-regulating, optimally productive, sustainable, healthy systems.**

Knowledge. Despite the extent of our accumulated knowledge and technological power, our species has still only scratched the surface of its potential in terms of personal and cultural development, and of our understanding of the workings of nature. **Most of what is remains unknown** (e.g., Voisin 1959; see especially his Fig. 1, p.3), and, in any event, because all knowledge is constructed, it can never be absolute or complete and must always be regarded as provisional, open to revision, refutation and elaboration. Paradoxically this is cause for hope, because the opportunities for improvement and progress are enormous. This will be realized, however, only if we are willing to become much less arrogant about our 'knowing', and much more imaginatively proactive in our psychosocial and cultural evolution, and in our learning from and working with nature. In particular, this will require us to courageously let go of dysfunctional and life-threatening assumptions, biases, visions, preoccupations, designs and practices.

Humans are not "good" or "evil"; rather they are potentially both. However, the life force within each of us, together with our social nature, biases us towards the **benign and relational** end of the spectrum, as evidenced by our passion for learning and improving, and caring and collaborating (Hill 2003b, Josselson 1996, Shem and Surrey 1998). Contextual factors, particularly busyness, inappropriate reward systems, and lack of supports and regulations can be major barriers to the expression of these qualities. **Spontaneity and being in the present** are the most reliable indicators of psychological and emotional wellbeing (Williamson and Pearse 1980), which are prerequisites to genuine progressive change.

Communication. Because of the factors referred to above under "Humans", most communication about change is predictably relatively shallow and ineffective. Feelings of really being listened to are rare and **misunderstanding is widespread**. Effective communication is made particularly challenging as a result of our enormous individual variability. This may be related to differences in personality preference (Keirsey 1997), gender (Tannen 1986), age, cultural background, lifestyle preference, knowledge, skills and psychosocial development (Beck and Cowan 1996, Josselson 1996, Lauer 1983, Wilber 1998), our past experiences, including both those that were liberating and developmental, and those that were wounding (Hill 1991, 2003b, Jackins 1978), as well as our substantial biological differences. As a consequence, much communication is adaptive and is concerned with negativity (or, conversely, with ungrounded and 'patterned' positiveness), trivia, tiptoeing around issues, rather than dealing with them (and other postponing strategies), and reactive defensiveness and power games. Dysfunctional communication is, in my experience, a much more common barrier to making progress in most areas of industrial ecology than is

the need for technological innovation. Because of this, it is imperative that much greater attention be paid to improving communication.

Prevailing assumptions and practices	**Ecological understandings and biases**
• Wait for crises	• Responsive to early indicators
• Linear material flows	• Cyclical, regenerative relationships
• Unlimited growth (unsustainable)	• Growth subject to limiting factors
• Production overemphasized	• Most resources used for maintenance
• Reliant on fossil fuels and nuclear power	• Based on solar and renewable energy
• Competition emphasized	• Mutualism favoured
• Simplified, highly controlled systems (dependant and unstable)	• Functional diversity and complexity confer stability
• Few specialists and roles valued	• Rich diversity of specialists, generalists, roles and niches within communities
• Structures and processes universalised (everything the same, everywhere, all the time)	• Uniqueness of time and place (reflected in all structures and processes)
• Rapid, forced change with few beneficiaries and many 'casualties'	• Gradual co-evolutionary structural change, with occasional bursts of creativity
	<u>Cultural and personal imperatives</u>
• Inequitable and accumulating personal wealth (unsatisfiable and unsustainable); living off the capital	• Building personal, social and ecological capital and well-being, and a sense of enough; living off the interest
• Growing consumption (increasingly emphasizing compensatory wants)	• 'Conserver Society' (equitably meeting basic and aesthetic needs)
• Mega, powerful resource consuming; structures process and technologies that are waste producing and impacting	• Appropriate scale, resource efficient (solar, renewables); structures processes and technologies minimizing waste and impact
• Market forces (political and consumer manipulation through advertising and exclusion; short-term narrow focus, with neglect of externalities) – monetary system of values (economic rationalism)	• Values-based decision making by an informed, participatory population (public education, access, transparency and inclusion) – for the greatest good (social justice)
• Transglobal corporate managerialism and hierarchical control; homogenized designs, products and services	• Regional self-reliance, shared leadership and responsibility; and context sensitive and specific designs, products and services
• Mobile, disposable workforce (loss of sense of purpose, meaning, connection to place and community)	• Right to meaningful work (sense of purpose, place and valued roles within vibrant communities)
• Controlling and problem solving, specialized science and technology (understanding science and arts as disposable luxuries)	• 'Understanding', creative, and design-focused science, technology and arts, and their integration

Table 1. Comparison between prevailing assumptions and practices and ecological understandings within industrial societies.

To complement the many examples and case studies from manufacturing industries, discussed in other chapters, I have chosen to briefly analyse the ecological initiatives of P.A. Yeomans, an innovative Australian farm landscape redesigner.

P. A. Yeomans, the prototype eco-redesigner and innovator

In the 1940s when virtually all agricultural experts and producers were busy finding ways to control and manipulate farm landscapes to make them immune from the vagaries of nature – through clearing of the land, the use of agricultural chemicals, invasive cultivation, 'improved' plant varieties and irrigation, P. A. Yeomans, with a background in mine engineering and earth moving, was boldly experimenting on his farm in NSW with ways to work with and effectively use nature's physical structures, rich biodiversity and ecological processes to develop a farming system that would not only be sustainable, but also build natural capital. P. A., as he was usually known, was a world leader in the application of ecology to the design of managed ecosystems. His story is illustrative of the complexities involved in the origin of great ideas, their development and application and the attitudes of others, particularly those with threatened positional power, to such challenging ideas and their originators. Yeomans was not only ahead of his time, but willing to work with complex systems in holistic ways using the energies of nature when the dominant focus was to simplify and control systems with powerful machinery and synthetic chemicals. His ideas are even more important today as we witness the results of what he referred to as the 'bastardisation of agriculture', which has resulted in widespread resource degradation, desertification, salinisation, pest and disease outbreaks and dependence on curative interventions, farm bankruptcies, the decay of rural communities, fights over access to water, increased dependence on subsidies, the slow death of the family farm, and a growing gap of misunderstanding between rural and urban communities. The widespread application of Yeomans ideas since the mid-1950s could have prevented some of these outcomes – yet this was not to be – and still his ideas remain unknown or only superficially known by most agriculturists in Australia and elsewhere. Because Australia's future will be increasingly limited by access to water – for drinking, industry and irrigation – and because Yeomans discovered how to most efficiently manage our water, as his ideas are implemented his name will likely become known to all. But this could still take a long time as we continue to trundle down the various paths of magic bullet curative solutions, the latest and most potentially dangerous being the narrowly conceived biotechnology path.

Yeomans was driven to find ways to design and manage landscapes to make optimal use of water ('*I was always interested in water control, and whether experimenting with "wild flood" or contour furrow irrigation or getting oneself saturated watching run-off in heavy rainfall, the flowing water seemed to hold many of the answers to the questions of land*', 1958, p. 262). This led him to design a new type of plough, now called the Yeomans Keyline Plow, a pattern of ploughing that optimally retains and distributes rainfall and irrigation water within the soil and across the landscape, an integrated series of farm dams, which he used for sheet irrigation (we could improve on this today), and a systematic way for planning the design of the farm and its operation. Later in his life he applied his water management plans to the design of cities and towns (Yeomans 1971). Put simply, his approach was to get the most out of the water that falls onto the land by making it travel the greatest distance across the landscape and do the maximum work on its journey to the sea ('*The floodwaters from prolonged heavy rains, which now go to sea within a few days, would still be in the soil and in the farm dams months later. Some of the water would remain there for a year or more. During this time the increased soil moisture would be feeding ground water supplies which flow as springs to feed creeks and rivers. Therefore, river flow would be more constant. Then the continuous but slow seepage from farm dams would be adding to these underground supplies. This would be clean and clear, as well as constant. The present silting up of rivers would cease and the constant flow of silt-free water would speedily regenerate them*', 1958, pp. 9-10).

A fuller version of Yeomans' story has been published earlier (Mulligan and Hill 2001), as has an analysis of the lessons that may be learned from the process of his innovations and their adoption (Hill 2003a, 2005b). Below is a summary of some of those findings.

Yeomans' personal qualities that enabled him to be so innovative included the following:

- Exceptional powers of observation and creativity
- Deep and broad interests, commitment, rebelliousness, 'drivenness' and 'stickability'
- Diverse complementary enabling experiences and competencies, and extensive reading
- Cross-boundary, integrative, lateral and paradoxical thinking
- Ongoing experimentation and careful record keeping

- Implementation of small, meaningful initiatives (including small risks) that could contribute to larger, longer-term plans
- Passion about communicating his ideas, through books, a magazine he established, letters, farm open days and talks

He was also limited by the following personality and psychological characteristics:

- Somewhat intolerant, low level of patience, isolated in some ways, some difficulties with collaboration, and a challenging writing style

In addition to this, the usual range of social factors limited Yeomans:

- Most of society was in a relatively uncritical phase of fascination with deceptively simple 'magic bullet', technocentric solutions to complex ecological, social and personal problems
- Unavailability of affordable enabling technologies (e.g., electric fencing)
- Lack of access to funding for research and development (this needs to be long term and include transdisciplinarity)
- Lack of supportive government policies and programs and interest by researchers in universities and government laboratories (and even ridicule by some of these individuals)
- Lack of consumer demand and markets for his ‘green’ products, and low public awareness of ecological imperatives

Possible strategies for addressing these limitations might include the following:

- Personal development work (recovery, therapy, self-knowledge, relationship counselling, group support)
- Collaborating more widely to achieve shared ownership and enrichment of the project (with those in the region and beyond, those in university and government, public interest and consumer groups)
- Linking his radical innovation to one(s) that has(have) already achieved some level of acceptance (capitalizing on the existing trends)
- Working with a smaller part of the enterprise as a more intensively managed experiment (with controls for comparison), and so generate better data, and an operation that can be maintained over the long term
- Working with others with better communication skills (possible use of signage, well-written pamphlets, articles and books, grant proposals and submissions to government)
- Seeking access to all of the resources listed above as limiting factors
- Greater effort to form alliances and linkages with others to achieve a shared sense of ownership, and greater collaboration in achievement of aims
- Greater use of the media for public education and for influencing political and cultural change
- Going further in mimicking and working with nature
- Being willing to 'become the other' as a strategy for deepening one’s understanding of limiting factors, influencing variables, relationships and opportunities

My hope in relation to the above is that others concerned with landscape design and management will now investigate and further develop Yeomans’ innovative approaches.

Conclusions

The central message here for those involved in industrial ecology initiatives is that to achieve sustainable progress we must pay much more attention to the factors discussed above, which are commonly neglected when working with change. Key among these are the broad range of personal and psychosocial limiting factors, whole-system design/redesign approaches, cross-boundary and transdisciplinary thinking, being more open to working with the unknown, and with the full spectrum of co-factors involved in change. This includes, in addition to focusing on innovations, to be also simultaneously working with others to facilitate enabling structural and institutional transformation, based on the kinds of assumptions discussed above. If we are willing to risk doing this (and I acknowledge that for many it will involve a significant challenge and risk), then I believe that significant progress can be made. If we persist in denial, postponement, and in focusing on reactive and limited approaches (e.g., just efficiency and substitution strategies), rather than on broad, integrated, whole-system, deep design/redesign approaches, grounded in our understanding of

nature, ecology, psychology and culture, then progress will remain slow and much of the change will be counter-productive. The choice is ours. Because effective change is limited by our awareness, empowerment, vision, values and worldviews, and by the contexts within which we are operating, these are the areas where I believe that most attention will need to be applied.

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