Building a Cradle for Nature: A Paradigm for Environmental Reconstruction.

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Unfortunately, surface mining consumes land. It falls to the reclamation professional to return that land to some kind of socially acceptable condition through the process of land reclamation. However, as in the case of the recycling of other materials used by industry, recycling industrial land is far from routine. The enterprise is in its infancy. Land reclamation has yet to mature far beyond its initial 'propaganda' phase. Meanwhile, although the successes of the enterprise are trumpeted, its oversights, failings and outright failures tend to be ignored. For all the bravado expressed by the reclamation agencies, the fact remains - no-one is entirely sure how to reconstruct opencast lands effectively. Environmental reconstruction remains, as Scherer (1995:379) agrees, a monumental expression of faith. The question this note explores is only: where should that faith be placed? Reflection upon several decades of on-going research into the environmental dynamics of reclaimed surface coal lands in Wales, the Balkans and USA (e.g. Plamping et al. 2008; Haigh and Gentcheva-Kostadinova, 2007; Haigh, 2007) suggests a new strategy for reclamation design – building a cradle for Nature.

Land reclamation has many pitfalls; there are mistakes made as well as successes achieved. Hidden in the closets of the mining industry are thousands of hectares of land that were never reclaimed and hundreds that were never reclaimed successfully or not managed properly so that they have fallen into a spiral of land degradation. The author has the misfortune to have large tracts of degraded, but officially ‘reclaimed’ land, in his home area, South Wales, and through several decades has witnessed the creation of new ‘reclaimed’ lands that seem vulnerable to falling into the same path (Haigh, 1992). However, it could be argued that the greatest environmental impact of surface mining is the production of reclaimed lands, for unlike the products of the mining, reclaimed land does not disappear, it remains ‘reclaimed land’ forever. Even in the case of coal mining, which consequentially adds

to the atmosphere Carbon dioxide; this is eventually consumed by solution into the oceans or incorporation into plants, soils and eventually carbonate rocks (Lovelock, 2006).

However, the real source of the land reclamation's problems, like most of the troubles that afflict our habitats, lie not with the environment or the vagaries of Nature but the human mind. Reclaimed land is a human creation, a product of human design. Some have explored land reclamation as a branch of sculpture (Morris, 1998). Heyd (2007) admits three alternatives for land reclamation agencies: to leaving the land alone, to restore it to a condition resembling their original state, or to transform them into artworks and goes on to wonder whether such artistic reclamation can really redeem these blots on the landscape. Strange such statements may sound but they confirm the fact that reclaimed land reflects a state of mind. It and its problems are set by the way societies view the processes of mining and land reclamation, its timescales and the mining agencies' sense of its responsibilities to the future… not just to the letter of the law, to the future. The psychology of land reclamation causes most of the problems of reclaimed lands, not least the attitudes that still conceive reclamation as an after- thought or as an action rather than an ongoing process. David Orr (1994, p120) argues that greatest problem of our age is to make human minds fit for the biosphere. A former UN Secretary General adds that *"Our biggest challenge in this new century is to take an idea that seems abstract - sustainable development - and turn it into a reality for all the world's people"* (Annan, 2001, p2).

Sustainability, however, is not a quality that mining agencies especially value. Sustainable, from its roots, means to hold up from below. This is a very different thing from project closure and the ability to walk away. Project closure is becoming harder to achieve in a legislative environment, which is increasingly reluctant to set mining companies free from the consequences of their work and where the evidence of poor quality reclaimed or unreclaimed lands remains extant in the landscape.

Nevertheless, land reclamation is a human value-based activity (Davis & Slobodkin, 2004), and there remain three psychologies of project closure and sustainability. The

first is based in meeting legal requirements. A project is designed to meet contractual requirements and to pass inspection after a set period of aftercare. The second is economic, the land is designed for a new economic use, which will keep the local community happy and fund any maintenance costs for the foreseeable future. The third is design for Nature, which means the land is restored to a state where Natural processes take over the control and management of the land. This is especially useful in situations where there are no suitable economic alternative uses for the land. These three psychologies of design manifest on the land as three styles of land reclamation design.

The first and most disreputable is cosmetic land reclamation. This is the kind of reclamation that is designed only to pass inspection after a set period, but not necessarily to have properties that subsequent land users are able to sustain, either for economic or technical reasons. This is the land reclamation of expensive engineering structures, of concrete drains and of thin soil carpets that survive only because of heavy fertiliser application. In general, if such lands are not rescued by luck or a new land user, the land is destined to degrade.

The second is reclamation designed to meet a contract with the local community. This is the reclamation of industrial sites, housing estates, parks, lakes, airports, golf courses and so forth; the classic land reclamation of the engineers (e.g. Griffiths, 1992). Its objective is to give the new land users something they will value and maintain for themselves and its key word is sustainability. The idea is that the new land users will pay the costs needed for repair and maintenance for the foreseeable future.

The third is reclamation design that seeks to restore control of the land to Nature, to restore ecological functions and encourage natural processes to undertake the role of rebuilding the land, perhaps with a view for recycling this land for future use. This is the best option for all those lands that do not have a high value after-use and for lands where the economic potential for repair and maintenance is relatively low. It is the land reclamation of forestation, ‘green’ channel design (Sawatsky & Beckstead,

1996) and ecological preserves. Its key word is self-sustainability (SER Science & Policy Working Group. 2002).

So, there are three psychologies of reclamation – one aims to defraud the innocent and gullible, one is aims to add to the built environment and effectively use engineering to postpone the necessity for ecological reconstruction, while the third is environmental reconstruction through ecological restoration. For the more reputable two approaches, Skabelund (2005, p.1) contrasts land reclamation, defined as making a site or landscape useful after resources have been extracted, with ecological restoration, where he mentions the restoration of ecological functions, and defines as returning the land: *"to a close approximation of its historic trajectory or to its remaining potential while accounting for the limitations imposed by dynamic, natural, and cultural factors"*. However, it is the first two of these approaches that have already been practised to near perfection in many parts of the world while the last remains a research area, which creates a practical a challenge shared by all engaged in environmental reconstruction and engineering education, namely that of finding an appropriate technology (Thakaran et al., 2005).

Here too, industrial psychology creates a problem. Miners, by and large, are believers in the myths of technology. Most are engineers, trained technologists, and share the faith that the Natural world can be created and controlled. One of the great handicaps for land reclamation is a belief that the solution is an engineering or technological fix. This may be appropriate for the cosmetic and 'sustainable' styles of reclamation. However, engineering and technology create artefacts. Artefacts do not look after themselves.

The extent of this delusion is exposed in every environmental management textbook. These, for example, tell that natural soils are intricate biologically controlled systems that evolve over centuries as a precise accommodation to their context, which is explained in terms of six factors: topographic location, lithology, climatic processes, biology, time, and human interference (Van Breemen, 1993). However, the reclamation engineer creates soils by scarping away some surface layers, mixing them into a heap, and then and then rolling them back across whatever landform has been

created (Haigh, 2000). A landscape geosystem is a complex whole that integrates billions of tightly coupled animate & inanimate components, all integrated at scales from the microscopic to the drainage basin. The reclamation engineer assembles the reclaimed landscape using the subtle instruments of a bulldozer, some bags of fertiliser and some concrete. Everyone knows that human artifice is not yet, despite the work of the genetic engineers, capable of assembling the simplest living organism from its constituent parts. How could it possibly be expected to assemble an entire geoecological system? Of course, this cannot be done.

Of course, there is a second pretension that exists in the ecological restoration enterprise, where scientists talk about reconstructing functioning geoecological systems using the metaphors of machinery (Bradshaw, 2002; Davis & Slobodkin, 2004). This work also contains the conceit that the science of ecological restoration has the skills needed to diagnose the qualities of a particular habitat and control its evolutionary trajectory. Here too, the tools are lacking in subtlety. The ecological restorers apply a small mix of macro-species, usually out-sourced from commercial nurseries, grass, herbs and of course trees. Occasionally, they may supplement these with some biological assistance in the form of inoculations of earthworms or soil organisms and they will certainly help the system get started by applying some kinds of fertiliser, maybe pesticide.

In the case of foresters especially, the results of these early interventions and sustained management may achieve a designed result that persists for decades. However, in most cases, what actually happens is rather different. Sooner or later, if the land does not degrade, the geoecological system begins to operate autonomously, a process that Devdarijani (1954) nicely described as ‘wild-becoming’. The system survives and evolves, less and less because of the species that were introduced and more because of those that introduced themselves, the volunteers. The end product is something that may contain some of those ecological building blocks but which is dominated by volunteers.

Watching this process at work during the course of an 18-year geoecological land restoration project on the Varteg in South Wales, finally, it became clear what was

happening and what was the real benefit of the tree planting and other works that had been undertaken. Certainly, the work had not constructed a new ecology. Far from it, in a hundred years or so, there would be very little of the original planting and other work that would survive - besides a top crop of Welsh Oak trees. As for the rest, the trees, herbs, grass, fungi, microorganisms, animals, birds and the whole soil ecological system would be made up of species that had moved in by themselves. If the project succeeds, and its ecological trajectory suggests that it might, this would be because a self-sustaining geoecological system had self-created in the conditions our work had provided. Our work had halted a downward spiral of environmental decline and kick-started the ecological system but the new geoecological system that would result, growing on the land we had closed and planted, would not be of our design or creation.

Looking around the world's land reclamation sites, it is common to see a similar situation. A project has succeeded because it had provided the conditions necessary for nature to become re-established. So, what had the work done? Well, it had provided a cradle, a cradle for Nature. Schaffer (2006) has commended thinking about ecological restoration in human terms, so here, the reclamation teams had given Nature enough protection to develop from helpless infancy to something that was, increasingly, able to look after itself, from something that was artificial and controlled, to something that had a direction of its own.

The point is again psychology. It is a different thing to build a cradle than to try and construct the infant creation that will inhabit it. It demands a different mindset. It also suggests a different duty of care that emphasises not the properties of the cradle, but that which is growing within it. So, the need is not for the psychology of the environmental engineer so much as that of the mid-wife and nursery nurse. Certainly, as with all successful ecological engineering, the approach means working with Nature, rather than trying either to dictate to it or control it, but the duties of the midwife and nursery nurse are different from those of your average co-worker. However, they may be the better model for real ecological land restoration.

So, self-sustainable land reclamation is neither about building new lands nor reconstructing the environment, nor building ecosystems from their simple component

parts – as constructivist 'restoration ecologists' claim. It is about building a cradle for nature. The hope is that the cradle will suffice to nurture an infant natural system and help it take positive and gentle, not destructive and violent, control of its habitat. The aim is to create the preconditions for nature to reconstruct the landscape, in a relatively short period, without turmoil. The ecological nurses may need to deal with the problems that develop in the decades after restoration, such as accelerated weathering, autocompaction and acidification due to the bacterial metabolism of pyrites (Haigh, 2000b). They also include the absence of suitable biological materials and seed sources. Like any parent, there is work to be done to keep the cradle secure and its contents healthy.

Meanwhile, at least this realisation destroys some of the arguments of the armchair philosophers who denigrate the qualities of reclaimed lands (Katz, 1992). For them, reclaimed land is an artefact and no better than any other technological product. It is not 'nature' and so has little intrinsic value (Elliot, 1982; Katz, 1996). However, self-sustainably reclaimed land is not a ‘faking of Nature’ but the real thing emerging from an artificial cradle. The philosophers’ arguments then collapse to debating whether an infant ecological system is of greater or lesser value that one that is older and the larger ramifications of that debate could keep them locked away for some time.

Of course, environmentalists also object to ecological reconstruction as an inherently futile attempt to show that human technology can control nature. In fact, those engaged in environmental reconstruction, passionately, do not want to control Nature because they cannot cope with a perpetual responsibility for management, repair and maintenance. The true measure of land reclamation success is the degree to which the land causes no trouble in the future, either because someone else is looking after it or because it is looking after itself.

So, to sum up, engineering, even environmental engineering creates artefacts. On a good day, their quality can be sustained by the investment of time, money, skilled labour in management, maintenance and repair. In reality, even much that is theoretically sustainable is not sustained. The consequence is degraded land, which is bad news for mining, for affected land users and their communities. These are

widespread problems. Of course, sustainability may be defined as an economic after use - but if it is not - and in many places the after-use value of reclaimed lands can be very small - then it must be defined in terms of natural control. So, there is a need to create reclaimed lands that can look after themselves – that are self-sustaining. Self-sustaining geoecological systems are not created by human artifice. They are only created by Nature. The real aim of such environmental reconstruction then is to encourage Nature to re-establish and thrive on the reclaimed land. This is a process akin to environmental midwifery or nursery nursing and it requires a similar approach. First build a cradle for Nature, assist its delivery into that cradle, and then look after the infant inside, try to guide it into directions that are positive and helpful but otherwise try to encourage it to develop its own independence. Once established, Nature can self-create a better environment for itself and keep it that way despite outside disturbance and environmental fluctuation. This is the ecological principle is contained by the theory of ecological succession. In land reclamation, all we need to do is lend a hand…

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