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Analog Forestry as an Art Form

"Art is not what you see, but what you make others see", Edgar Degas (1834-1917)

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Abstract:

Analog Forestry (Senanayake 1987) arose from a need to expand habitat for biodiversity within anthropogenic (human managed) ecosystems. It is a form of ecological restoration that seeks to design ecosystems processes and structures that mimic the original. It is an intentional activity that initiates or accelerates the recovery of an ecosystem with respect to its health, integrity and sustainability as defined by Ecological Restoration (SER 2004) but has also been described as containing elements that could lend itself as an art form (Senanayake and Palihawadana 1999). Indeed in the traditions of modern art, attention to the designs in nature in a conceptual way has given rise to conceptual art where the idea or concept is the most important aspect of the work. When an artist uses a conceptual form of art, it means that all of the planning and decisions are made beforehand and the execution is a perfunctory affair (LeWitt 1967). The idea becomes a machine that makes the art. Often, a natural process is understood as art, only when it is frozen in time and appears in a museum. Works of Art, even conceptual works, tend to be embedded in some form of object or structure. The depiction of Sri Lanka in the 'Lagoon Cycle' (Harrison 1986) is a case in point

Analog Forestry requires creativity from the designer so that a monotony of form and function does not manifest. The knowledge of the various physical and ecological attributes allowing the designer to select for color, texture, presence of birds, butterflies etc. in addition to utilitarian functions such as provision of food, medicines, fiber etc. (Senanayake and Jack 1998). It requires the designer to consider the texture of the forest by considerations such as the relative proportions of emergent, canopy or sub-canopy species in the design or the presence and proportions of growth forms such as epiphytes or lianas. It requires the designer to consider the capacity of the design to sustain populations of native biodiversity etc., but it also requires the designer to be creative. Aspects such as color and placement depend much on the vision of the designer, especially as the full design may not manifest for many years after establishment. This design, being analogous to nature would seem to produce aesthetically and functionally superior landscapes. Analog Forestry provides a tool with which to do so.

Keywords: Landscape Aesthetics, Analog Forestry, and Conceptual Art

Introduction :

Analog Forestry, is a system of restoring the tree dominated ecosystem in any area, mimicking the structure and functions of the original 'forest' that once existed in that area (Senanayake 2004). The design is guided by twelve principles (Table 1) of which the most pertinent to this discussion is principle 12: 'Respond creatively'. This suggests both the creative use of the other eleven and freedom to express the generation of aesthetics on the landscape. It relies greatly on the ability of nature to respond to the imperative of maturing into a forest As Harrison (2011) notes: 'To begin, you have an idea, based upon a lot of knowledge, that when you apply it in a construct like an analog forest, nature acting opportunistically, will use it to self-complicate. Therefore there is a theory of how nature behaves that permits analog forestry to work."

Table 1.

Principles of Analog Forestry.

Principle 1 Observe and Record
The mature ecosystem of any area represents the outcome of eons of experience in dealing with the climate and impacts at that place. Record the species and ecosystems present in the area under treatment. The initial data will assist in setting a baseline against which future observations their changes can be evaluated.

Recording is also of importance in evaluating the structure and texture of the original, which provides the model towards which we must design. A physiognomic formula of the vegetation types on the land. Identifying the structure of the system will demonstrate a wide range of different architectural responses varying from trees to lianas and point towards the end goal in design

Principle 2 Understand and Evaluate
Understand the ecosystem being observed in as many perspectives as possible. A synthesis of many variables will always yield better choices of the species and patterns to be used in design. This is when the observations and records must be synthesized with as much scientific and traditional information as possible. The generation of the database on the vegetation species that are (were) present in the area and the potential new species to be considered is a critical part of recording and should be initiated at the inception of the project.

Principle 3 know your land
A powerful tool, in understanding the land is a carefully drawn out map that identifies the most pertinent features of the land. Mapping the land is best done if developed as a series of overlays. Once the physical boundaries have been mapped, overlays that demarcate the contours, the hedges, fence lines, vegetation, soils, wind direction and water flow are some useful variables. The landscape map or the Forest Garden Farm Plan (FGFP) should reflect not only the current situation but also the desired future condition.

Principle 4 identify levels of yield
The yield required will differ depending on the priorities of the landowner or manager. If the goal is conservation the yield will be measured by increases in the target species, if the goal is economic gain the yield will be measured in terms of income or production. If the demand for yield is focused on a single crop the higher the yield required the more the production system would move towards a single species monoculture

Principle 5. Map out flow and reservoir systems
Every landscape has flow systems, solid, liquid, gas and genetic that produces distinct patterns. Usually the direction of flow in solids, liquids and gasses is governed by gravity, resulting in the very characteristic drainage patters of water or soil flowing on land. Similarly wind moving across the landscape produce some significant patterns, while genes usually follow existing corridors of ecosystems conducive for that species.

The understanding of the flow systems across the farm or land area to be managed is important to setting the design. Cutting across flow systems is usually not productive. Following, augmenting or ameliorating flow systems to enhance the ecosystem under management will improve productivity.

Principle 6 Reduce ratio of external energy in production

All ecosystems use energy to maintain their identity. In agricultural ecosystems, productivity is a goal and energy is expended at meeting this goal. Often energy subsidies from outside the farm have to be provided. As an increase in the flow of energy tends to organize and simplify the system, increases in external energy inputs impact both biodiversity and sustainability. Increases of energy to an ecosystem represent a measure by which ecosystem modification can be addressed.

Principle 7 be guided by landscape needs.

All farming land will be a part of a natural landscape. The boundaries of which are often set by definition. A common criterion to delineate a landscape is on a watershed basis. Once identified, each landscape is divided into various replicating units, such as open fields, tree covered areas, homesteads, roads, streams etc. A landscape will often have many vegetation components ranging from mature native vegetation to open meadows. The patches of remnant vegetation often being the only habitat left for native biodiversity.

In design, defining the species of tree to be used in a revegetation context and knowing its ecological role ensures that the species chosen will be a resource for another group of organisms not addressed by mere revegetation needs. A similar recognition of the value of hierarchical structuring using abiotic, biotic and cultural subsystems can provide a planning framework.

Principle 8 Follow ecological succession

In the development of a forest system maturity brings changes in the trophic web, which are demonstrated by changes in species composition. These successional series all maintain about an equal level of species at each level, but the composition of the species represented changes with the change in vegetation.

In designing for structure, the seral stage that is best suited for the crops chosen provides the model. Thus, if the crops in question are annuals, such as cereal grain, beans, squashes etc. the pioneer stages provide the model. If the crops in question are perennials such as coffee, fruit etc, the later seral stages provide the model. The pioneer stages in most ecosystems are diverse and incorporate a range of plant types capable of high productivity, a pattern often reflected in traditional agriculture. The early seral stages of forest ecosystems, provide the next growth or building up phase

Principle 9 Utilize ecological processes

Incorporation of ecological processes into design always contributes to further stability. All ecosystems are driven by a series of processes some of which are significant important and contribute to maintaining stability and productivity. Ecological processes in every ecosystem, allow for increases in efficiency through management.

The identification of key ecological processes such as edge effects, where the ecotone or the boundary between two ecosystems facilitates a higher biodiversity measure. Keystone species referring to species on which the persistence of a large number of other species on the ecosystem depends and whose impacts are greater than would be expected from its relative abundance or total biomass. The use of indicator species, organisms that correspond to a certain level or state of biodiversity, are processes that will enable the design of an effective and elegant model.

Principle 10 Value Biodiversity

Biodiversity has been perceived in many ways over the ages. It reflects the pattern wrought in biomass. It provides the variety of our living world and has been the source of human inspiration across cultures and ages. Biodiversity provides both the material as well as the indicators for sustainable land management. In modern times it is invaluable as a management tool, as the level of biodiversity is an effective measure of the health of ecosystems. Biodiversity measures have also been correlated with environmental stability as well as the sustainability of agricultural and forestry practices.

Biodiversity is an issue today, because that human inspiration cannot be appreciated by a non-human system. The beauty and wonder of the living world cannot have meaning in the marketplace, one consequence, is that biodiversity has retreated before the onslaught of the monocultures of economic expediency.

Principle 11 Respect Maturity
Maturity is the end condition all ecosystems tend to develop towards. It represents the ability to stay sustainable in a given geographical site. Seral succession or the gradual changing of species and structures in an ecosystem as it moves towards maturity is a singularly important consideration in design. Maturity is a process more than an end condition. Mature ecosystems are usually higher in biomass, though not necessarily in biodiversity than more immature systems. As maturity confers stability, every element of a landscape that can mature should be encouraged to do so.

Principle 12 Respond creatively
Nature does not produce identical patterns at an ecosystemic level. Every landscape and its associated ecosystems have unique characteristics, some at a level significant for design, others not. Every landscape, every ecosystem has nestled within it many more. Working at the vegetation scale, every designer can be an artist whose limitation is the palette at hand. The database may be incomplete, the range of species available may be poor, data on the region may be lacking. Familiarity with the landscape or ecosystem is often superior to poor data. The choice of species and their pattern of placement will reflect on landscape aesthetics as well as biodiversity distribution. All this requires the designer to respond skillfully and creatively.

In practice, all ecosystem restoration should be approached with a spatially explicit landscape perspective in order to ensure the suitability of flows, interactions and exchanges with contiguous ecosystems (SER 2004). A systematic understanding of a landscape is essential to this endeavor. The recent work on 'Landscape Ecology' (Foreman & Godron, 1986) suggests that there are many ways of perceiving the landscape in planning processes and provides useful definitions. But, as observed by Rackham (1991) there are fashions in land use, which tend to generate fashions in landscape. However, as these landscapes depend on the growth of trees and other long-lived plants, they can never catch up with a fashion before it changes. The 'new landscapes of 1970 for instance, are no longer new in 1990, but we are saddled with them for the rest of our lives (Rackham op. cit.). This consideration in landscape planning should entail a

resistance to fashion and higher concentration on meaning. Moving to achieve meaning in landscape design is movement towards art. However there is the thorny issue of aesthetics. Aesthetics was well defined by Emanuel Kant when he applied it in accordance with its classical meaning "the philosophy of sensuous perception" (anon 1966). But the meaning has been narrowed in today's use to denote some element of beauty (anon 1973 a,b). Often the landscape of one's origin sets the yardstick of beauty.

In Australia, the ancient traditions suggest ways to interpret such meaning. The land is an entity and communicates its status to the human observer. An experience recounted by journalist Micheal Leunig (2008) illustrates this. On returning to tribal lands that had to be abandoned for government use, a Pitjanjarra elder commented 'Oh you poor bugger'. The comment was made three times, once at a billabong (waterhole) that was choked with debris, once in a grassland thick with *Acasia* thorn scrub and once when he came across a number of Kangaroos some of which were very sick. When questioned about the comment and whom it was directed at, it became evident he was speaking to the landscape. When he was a hunter on the land, he would clear any debris and rubbish from the billabong making it easier for him to hunt, it would also allow animals easy access to the water, now it was choked and sick: similarly, he would burn the grassland to stimulate growth of grass and food plants while discouraging the establishment of woody, thorn scrub, as he would take out the slow animals long before sickness could set in. He had an awareness of landscape health and would use indicator species or states to identify its condition.

It is plain; ecosystems condition the values of societies that are found within. Traditional societies find beauty in the expression of natural ecosystems. Modern society with its anthropogenic landscapes reflect this appreciation of beauty in the biotic expression but often this concept of beauty is rooted in our socio-cultural backgrounds and may, as often as not, produce unwanted effects on the new landscape.

Europeans arriving in Australia set about cutting the native forest to produce, open, meadows, much like those in England. Despite records of traditional custodians commenting " We are worried. We need our land. We want it to stay spotless. We don't want to see a tree cut down..." Davis (1983). In a similar vein, when indigenous people and farmers were taken to the plantations of Pinus at Lake

Eildon in Australia they commented on the ugliness of the forest and bemoaned the lack of native wildlife. However when a group of new immigrants from northern Italy were taken there they were astounded by the beauty of the same landscape. This seems to confirm that landscapes of ones formative pleasant experiences often set aesthetic standards.

Thus aesthetic landscaping requires extending our concept of community to include all the species of life, our aesthetic informed by the ecosystems around us. As Leopold put it--'Quit thinking about decent land use as solely an economic problem, but examine each question in terms of what is ethically and aesthetically right, as well as what is economically viable. A thing is right when it tends to preserve the integrity, stability and beauty of the biotic community. It is wrong when it tends otherwise' (Leopold 1949).

Landscapes have been defined as heterogeneous land areas composed of clusters of interacting ecosystems that repeats in similar form throughout. Landscape development or formation is a result of three mechanisms operating on the landscape boundary; specific geomorphologic processes taking place over a long time, colonization patterns of organisms and local disturbances of individual ecosystems over a shorter time (Foreman and Godron 1986). In considering conservation of ecosystems in Sri Lanka, two other definitions are of utility. One is a 'pleisoclimatic landscape', containing ecosystems that have matured without the influence of man; the second is, 'anthropomorphic landscapes', containing ecosystems that have been modified or formed by the influence of man.

This allows addressing the landscape as a distinct measurable unit defined by its recognizable and spatially repetitive clusters of interacting ecosystems with their geomorphology, disturbance regimes and history. The significant characteristics of a landscape are:

1) Structure, or the spatial relationships among the distinctive ecosystems or 'elements' of a landscape, for example, the distribution of energy, materials and species in relation to the sizes, shapes, numbers, kinds and configurations of these ecosystems.

2) Function, or the interaction between these spatial elements, for example, the flows of energy, materials or species among the components of the landscape.

3) Change, or the alteration in the ecological mosaic over time in relation to structure and function

Analog Forestry embodies these characteristics and seeks to design, demonstrating knowledge of structure, function and maturity (change) in design. It always looks at the mature natural ecosystem as a guide and develops an idea or concept of how; something close to natural ecosystem could be established. This design must include elements of production, conservation and aesthetics. It requires an understanding of the ecosystems and the individual species that one is working with at the greatest depth, Here, all planning and decisions are made beforehand and the execution is a perfunctory affair, usually taking years to develop into the manifestation of the concept.

Landscape aesthetics is a fundamental design goal in Analog Forestry, However analog forestry often produces a 'hybrid' ecosystem comprised of both native and exotic species. The activity of ecological restoration has been criticized on the grounds that this activity is akin to art forgery. Just as a copied artwork could not reproduce the value of the original, restored nature could not reproduce the value of nature. (Elliott 1995)

Gunn (1991) suggests that there might be two types of restorative action malicious and benevolent bringing into question the goals of that 'restorative' action. However in benevolent restoration, if the restored bit of nature were a restorative component of a larger ecosystem, it would have some form of natural value in itself beyond its instrumental value. In this way the value of the original benevolent restoration—is more like art restoration than art forgery (Light 2011).

Though the art of landscaping is an ancient human endeavor, the mimicking of nature as landscaping can be attributed to Lancelot Brown (1716-1783) whose work was described as the "judicious manipulation of its components adding a tree here or a concealed head of water there. His art attended to the formal potential of ground, water, and trees and so gave to English landscape its ideal forms. The difficulty was that less capable imitators and less sophisticated spectators did not see nature perfected... they saw

simply what they took to be nature" (Wikepedia). In fact criticism of his work focused on the fact that it 'differed very little from common fields, so closely is nature copied in most of them (Chambers 1772)"

However, the modern placing of plants on a landscape specifically as art was initiated by Burle Marx (1909-1994) who organized native plants in accordance with the aesthetic principles of the artistic vanguard of the time, especially Cubism and Abstractionism. He created a new and modern grammar for international landscape design (Rothner 2009). Thus, when placing vegetation on a landscape for restorative functions, inclusion of the aesthetic principles of art becomes an obvious extension.

Considering its significance to art in this manner, it must be pointed out that the restoration of a forest ecosystem, can never attain exactly the same proportion of species nor the identical patterns of what existed before, in this sense, the restoration of a forest is not done to copy exactly that which was lost, it is done to restore the structure and functions that were lost. The addition of aesthetics reflects the designers personality, with the consideration that nature always moves a disturbed area to mature through ecological succession whenever possible (Ricklefs 1999). These considerations provide the future plan. Thus the restoration of the tree-dominated element of any landscape using Analog Forestry must be seen as a dynamic design that unfolds as it matures. Each predicted expression being meaningful to the ecosystem that it is in, but unique, reflecting the art of the designer.

For instance, The design and planting of a monoculture of even aged, early maturing Eucalyptus, to replace a lost natural forest demonstrates a extremely narrow understanding of the concept of the forest that was lost and its restoration; It bears little resemblance to the ecosystem that it replaced. In contrast, the design and planting of an analog forest requires a wealth of knowledge on many species and the broadest approach to restoration. There is meaning reflected at each tropic level. As design goals, the former seeks uniformity while the latter seeks diversity.

Fig 1 Natural Forest with 100% native species

Fig 2 Analog Forest response with 90% exotic species

But does analog forestry in the words of Degas 'make others see'? Harrison (2011) questions the idea further, he asks, 'what is the work of the work? So what is the work of an analog forest?' He offers the following list (Table 2)

Table 2

1.	It is designed as an act of compensation perhaps for an abused area.
2.	It is designed from a perspective of architecture, with overstory, understory etc.
3.	It is designed from an understanding that Nature will self-complicate, given the opportunity.
4.	It is designed speculatively, based upon best understandings.
5.	Its design reflects the personal aesthetic preferences of the designer. For instance, another designer, with the same knowledge, might well create a somewhat different forest, but that had the same outcomes as another analog forest designer.
6.	It is designed as a piece of eco-social work. By this it is meant that, the species selected that in due course, self-complicate, are designed to be of use to society, with the express intention of giving society the task of protecting, enhancing and benefiting from this act of creativity.
7.	It creates a new class of labor in society. By this is meant, a person who is simultaneously, consciously educated to be both top predator and top conserver. (Harrison 2002-2009)
8.	The principal act of conservation, the understanding built into the education of the new class of people, is that the harvest preserves the system (Harrison 1986).
9.	Therefore, the very act of maintaining an analog system, be it aquatic, open-canopy forest, grass and shrublands, or any mixture, including closed-canopy forest, has similar properties in their creation and in their maintenance.
10.	This kind of work and this kind of husbandry precludes both monocultural activities on the ground and above all the kind of society that creates monoculture of the mind.

In Analog Forestry the designer uses the landscape features as the canvas and places various plant species to obtain production, function, texture and color. Creativity is encouraged, but the reference, must be the original mature ecosystem. An example can be seen in an AF design in Sri Lanka

To restore the lost forests of the Mirahawatte area of Central Sri Lanka, the model of the mature forest was taken from Knuckles

mountains (Figure 1). In this montane forest all of the vegetation is native, it has not been disturbed and is in a mature state. The structure and functions of this forest were assumed to be similar to that of the lost forests of Mirahawatte, which is at a similar elevation. An AF design was developed and planting was begun in 1983. The design reflected the need for flowering emergent species as seen in the natural forest, rising from a closed canopy. The emergent in turn, take time to rise above the canopy and this signals maturity. Emergent species are essential for large raptors and the Large Forest Bee (*Apis dorsata*) whose activities are critical in maintaining pollination of the forest trees. There was also the need to create splashes of color that would light the canopy. In this case the designer chose a bright yellow instead of the white of the model. The design called for a canopy of nitrogen fixing trees as the poor soils of the site needed to be built up, but their function as keystone species was also a design criteria. Many leguminous trees could have been used in implementation, but this design called for species that would improve biodiversity. Therefore, species were sorted by their ability to feed or attract native fauna. The result was to have a foreground to provide dark, purplish green foliage, with white flowers, backed by a light leaved Erythrina planting with orange flowers. A matrix of *Trema* (to feed wildlife) *and Persea* (fruit for consumption and market) and *Artocarpus* (fruit for consumption and market) were included in the design, to provide diversity to the canopy, provide income and improve habitat.

The canopy thus created frames the emergent *Schizolobium*, which rises well above the canopy and gives a burst of golden yellow annually (figure 2). By 2002 this emergent had attracted a pair of Forest Eagle Owls, never seen as residents in the valley before, confirming the original design goals of a forested canopy with emergents. Twenty-two species of birds have been recorded using the canopy trees (Senanayake and Jack op. cit.). Even today, the design continues to unfold. Currently, just below the canopy and about to rise out of it are the palms whose effects on the design will not be felt for another four years more, thus even after twenty years the design sill unfolds in the way predicted.

As energy dependent technology that lays claim to the basis of development and land management is designed on the basis of marketable productivity, the result is a monotonous landscape,

aesthetically poor and lacking in diversity. Ecologically it produces energy addicted production systems. As the concept of Sustainability becomes an increasingly important goal of development, the emergence of farming and production systems with increasing diversity and energy independent production systems, will become necessary. The landscape illustrated below (Figure 3) shows the conventional pattern of land use in the left and right foreground while an analogous design is shown in the right background. The biodiversity, biomass and aesthetic differences are obvious.

If the aesthetic design in the current work are 'seen' by others and if the 'work of the work' demonstrates the attributes as listed in table 2. The Analog Forest design at Mirahawatte could be seen as a work of art. Further, a construct like an analog forest, by demonstrating that nature acts opportunistically and will use any to self-complicate, confirms the theory that nature, given an opportunity will mature into diverse, sustainable states. Analog Forestry offers such an opportunity.

Fig 3. Comparison of landscape aesthetics with conventional land use (left) and Analog Forestry (right)

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