"Sustainable Development Theory: Critical Applications to Amazonia" Lawrence A. Herzog

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Introduction

Amazonia is surely the most valuable ecosystem on earth. The Amazon rainforest constitutes about one-third of all rainforests in the world, some 2.3 million square miles. It generates 20 percent of the world's oxygen. Its main waterway, the Amazon River, contains 20 percent of the volume of all rivers on the planet. It may be the most ecologically diverse bio-region on earth, with more than 56,000 species of plants, and thousands of species of birds, amphibians, mammals, and reptiles (da Fonseca and Vogel, 2008). Its plant life contains natural remedies for some of the worst diseases plaguing mankind.

Despite the evolution of technologies that allow for greater monitoring of globally valuable ecological zones, the dangers Amazonia faces from encroachment and economic development (the subject of other chapters in this volume) remain. Sustainable development theory offers a critical blueprint for debates about the future of Amazonia. With this is mind, this article reviews core principles and theories of sustainability and sustainable development, as they apply to the case of Amazonia.

Sustainable development theory evolved as a tool for critically analyzing Western models of growth, which too often proved to be wasteful and inefficient. In cities, industrial-led growth was poorly regulated and generated air and water pollution. In the hinterlands, vast tracts of land, water, and mineral resources were consumed without attention to their long term preservation. Cattle ranches have destroyed tropical rainforests. Croplands in floodplains have been poorly managed. Insecticides, fertilizers, and other chemicals obliterated soils and fragile ecologies. The "modernization" paradigm for development posited the idea that the ills of industrial growth could eventually be mitigated by more and better technology (Rostow, 1960). But, scholars have shown more recently that technology cannot always undo the devastating effects of unsustainable growth. For example, agricultural expansion has depleted soils, while insecticides killed fish stocks near agricultural land (Wheeler, 2004, 19-27).

Amazonia is one of the egregious examples of a larger development pattern that has played out throughout Latin America. Timber production, ranching, and soybean cultivation are wiping out the Amazon rainforest. In Mexico, ranching, which once dominated the northern part of that nation, has begun to sweep across the tropical rainforest regions of the southeast. Over the last 25 years, more than one-fourth of Central America's rainforest has been turned into grass—to feed cattle that supply beef for U.S. hamburger chains (Faber, 2001: 114). Agroindustry throughout Latin America produces animal feed for export, while alienating the bioregion where the agriculture is located. Waste and pesticides are dumped locally; workers are often underpaid, or exploited, and exposed to unhealthy, toxic work environments.

Sadly, Amazonia's plight is yet another example of the legacy of "dependency" in Latin America. "Dependency theory" was a structural explanation of underdevelopment (Cardoso and Falleto, 1979) which ascribed poverty and inequality in less developed nations to a "core/periphery" metropolis/satellite relationship It argued that poverty is, in fact, systematically maintained by a process of social polarization that makes less advantaged nations (the periphery) dependent on "core" countries. This process operates both on a global scale, and within nations. Within Latin American nations, the "core" took the form of the large metropolis—usually also the national capital—where powerful political officials and economic leaders (plantation owners, investors, bankers, merchants, etc.) lived or had homes. The "periphery" remained in the hinterland—either rural areas where the poor lived, or squatter settlement zones where marginalized rural migrants moved to try to improve their circumstances (Gunder Frank, 1967).

In Amazonia today, we continue to observe a core-periphery dynamic played out on several scales. Within Brazil, the country with the largest amount of Amazonia territory, the Amazonia region's major states (Acre, Amazonas, Para, Rondonia, Roraima, Mato Grosso) remain as a kind of "periphery"-- considerably weaker politically than the "core" powerful states of Sao Paulo, Rio de Janeiro, or the southern coastal states of Rio Grande do Sul or Santa Catarina. At the micro level, much of Amazonia's wealth is now concentrated in and around the core metropolis of Manaus, which now contains nearly two million people. It is striking that while Manaus boasts four elegant shopping malls, air conditioned hotels, and foreign-owned

assembly plants, much of the rural hinterland of Amazonia continues to be the domain of marginalized indigenous settlements lacking basic health care, nutrition, education or the ability to participate in the political-economic system (Cockburn and Hecht, 1989).

This chapter details some of the ways in which sustainable development theory applies to the specific case of Amazonia. It begins with an overview of the concept of development, reviewing how traditional theories of regional development have evolved to favor a "bottom-up" or grassroots approach. It then tracks various challenges to sustainable development in the Amazonian case, including the problem of the time dimension, how knowledge is organized, and the concepts of limits and of 'place.' It's argued that there are inherent conflicts posed by the increasing globalization of the Amazonian region. However, despite these obstacles, several paths toward sustainable development policy for Amazonia in the future are suggested.

Rethinking "Development": the Sustainability Paradigm and the Amazon

The first task of adopting a sustainable approach to Amazonia is to question the idea of "development." During much of the twentieth century, it was assumed that development was a linear process—growth was projected to occur when labor and capital were applied to natural resources to create production and greater wealth. In traditional economic theory, growth was measured by Gross National Product (GNP), and economists used formulas to measure goods, markets, price, and scarcity, then determining optimal outputs with different combinations of these variables.

There are at least two major problems with this approach. First, it assumes that all resources are divisible and can be owned. But this really covers only private goods. Much of a nation's resource base, however, lies in its "public goods": water, air, or rainforests—in short, the natural landscape. If nature is not protected—in the form of ecological planning and conservation-- a nation's economy and social well-being may suffer in the long term. Second, GNP statistics and linear models of development do not take into account income distribution and inequality.

A sustainable approach, therefore, must revisit the idea of "development." Development must be viewed as a combination of productivity, social equity, and ecological preservation.

Nature must become more central to our understanding of capitalism, production, exchange and the meaning of value in a region's economy (Redclift, 1995). We might call this alternative approach "eco-development", economic development tied specifically to cultural/ecological regions and local contexts, thus consistent with the potential of specific regions, with their unique people, geography, and resources (Herzog, 2008).

Eco-development implies that the defining unit of development is based on the rules of nature—that unit is often referred to as a "bio-region". A bio-region is an area defined by nature and culture—a valley, the watershed of a river, a desert basin, a coastal port region, a rainforest. Eco-development is then measured by planning for a bio-region's "carrying capacity." Carrying capacity as a policy objective demands that elected officials and regional planners assess the natural resource impacts of different human behaviors (economic practices) within a bio-region.

Amazonia is precisely the kind of "mega-bio-region" that screams out for an "ecodevelopment" approach, rather than an "economic development" one. Amazonia's myriad wealth of resources—its biodiversity, its flora and its fauna, the medicinal uses of its plants have been well documented (Timmons Roberts and Thomas, 2003, da Fonseca and Vogel, 2008). These resources have immense value at both the national and international scales; as such, they demand that politicians and managers adopt an "eco-development" growth strategy in order to preserve them.

More recently, it has been argued that the Amazon has critical value to the world ecosystem and to the prevention of further global climate change (Kirby, et. al. 2006; World Wildlife Fund, 2011). The Amazon sustains some 60 percent of the world's tropical rainforests. It stores billions of tons of carbon within its biomass and soils; if these biomass resources are erased by deforestation, they have at least two effects. First, when mass vegetation is burned, it emits greenhouse gases, and second, as less rainforest covers the land surface, less moisture is fed back into the atmosphere. This lowers regional and supra-regional humidity, and means less global rainfall, thus further contributing to global warming, as well as to loss of vegetation (Laurence, Powell and Hansen, 2002).

Theories of Development

In the field of development planning, for too long, the dominant paradigms have assumed that growth proceeds outward from the center, and that management of growth must likewise proceed outward from the top of the political hierarchy. This approach has often been termed "development from above" or "top-down" development. Development from above approaches grew out of economic theory and the idea that development could be generated by introducing "growth centers" or industrial development poles into poor regions. The idea was that investing in industrial centers would create jobs and innovation that would "trickle down" to the less advantaged, ultimately transforming poor regions into export-oriented developing zones.

As a subset of top-down development, "growth pole" theory treats industries as the basic unit of analysis, one that exists in an abstract economic space. Economic development is viewed as a structural change brought about by investing in "propulsive industries." growth-inducing factories built in poor regions. According to the theory, these new complexes of industry would spark innovation that would then diffuse to the surrounding region and gradually transform it into a prosperous zone

In practice, experts have found that development from above often did not work in less developed nations. Innovations introduced in new towns or cities did not necessarily trickle down to indigenous people. Too often growth principles that work in industrialized, wealthy countries do not apply to poor agrarian or developing societies (Friedman and Weaver, 1979; Herzog, 1986). Thus, even when industrial development centers, or "growth poles", are introduced into less developed zones, elite entrepreneurs frequently control the profits, and pay out low wages to indigenous people. Marginal regions end up simply supplying commodities and cheap labor, while the economic power still remains either in the big cities on the coast, or with a small class of entrepreneurs who control development in marginalized regions.

This pattern has played out in Amazonia. The overall development strategy of building up Manaus as a rainforest economic growth pole has had mixed results. Manaus itself is a poorly planned, unsustainable metropolis (Magalhaes and Rojas, 2005). Most of the wealthy residents have moved outside the city, leaving behind an aging downtown whose buildings are falling into disrepair. Favelas have been built along the river and creeks with no attention to controlling the flow of sewage and uncollected garbage. Transportation within the metropolis is dominated by

automobiles and trucks; mass transit is poorly articulated (InterAmerican Development Bank, 2010).

Regionally, the river offers an excellent and potentially sustainable transport corridor for Manaus to connect with the hinterland. Yet, the use of the river transit for trade and infrastructure development seems to be overshadowed by the more damaging and unsustainable growth of roads and highways into the interior. And new roads have not offset the reality that much of the indigenous Amazon population continues to remain marginalized from the core.

Amazonia's economic base relies too heavily on either unsustainable industries (like electronic assembly) artificially placed in cities, or unsustainable uses of land in the rain forest that deplete the very resource that could transform Amazonia. "Development from below" or "bottom-up" development offers a more sustainable alternative model. It emphasizes growth tied to local ecology and culture. Development from below recognizes that a successful economic development strategy needs to empower poor, marginalized sub-regions and overcome the centralization of political and economic power that dominates countries like Brazil (Stohr and Taylor, 1981; Weaver, 1984). It further emphasizes the use of appropriate technologies and ecologically sustainable practices that manage the natural environment while allowing for economic development. I give examples of this further below in the final section.

Challenges to Sustainability: The Elements of Time, Knowledge, Limits and Place

Theories of sustainable development require new ways of thinking about the physical environment, space, and place (Wheeler, 2004, 34-40). Let me consider several important themes in sustainability theory, as they apply to a region like Amazonia. In western culture, we tend to emphasize immediacy and instantaneity. Our technologies provide rapid access to information—on computers, cell phones, I-phones, or Blackberries, where we use Google or surf the Internet, or on our televisions where we channel surf. We have developed a sense of entitlement to information. These cyber-electronic machines feed our thirst for speed—they make us expect information to be accessed quickly; we are, therefore becoming impatient with slowness and waiting (Honore, 2004).

This culture of immediacy spills over into the way we govern and into our perception of the politics of the environment. In formal governance circles, there is a tendency to think and operate in short-term frameworks. For example, we make our urban and environmental plans fit into relatively brief time spans-- 5, 10, or 20 year units. Meanwhile our elected officials hold offices in even shorter time frames, from 1 to 4 years, with re-election for perhaps a similar amount of time.

Sustainability requires a different mode of thinking. It requires us to understand that the earth changes in long term cycles – geological shifts, riverbed transformation, watersheds evolution, and climate change all occur over massive periods of time. One of the problems of the debate on global climate change, or on the use of sustainable practices, is that politicians and voters are not accustomed to thinking in the long term. One reason for this, is it requires us to put aside our selfish needs in the short term, and consider the future of the planet, and of the impact on future generations. In short, we need an environmental-historic approach. This will allow citizens to understand that, as an example, cleaning up the environment can takes decades. But not cleaning the environment, or failing to understand the long term dangers of pollution, could permanently scar the planet in irreparable ways.

Time has been a great barrier to the protection of Amazonia. It has taken government officials far too long to craft adequate policies to protect Amazonia. Over the last two or three decades, there has been a creeping acceleration in the decline of ecological integrity in the rain forest. Yet politicians, thinking only within the framework of their political careers and time in office, are often not around to see the long term implications of their work. Meanwhile the rain forest's vulnerable environment becomes further imperiled.

During the 1960's, Brazil's military government initiated pro-development policies that accelerated the pace of deforestation, and environmental destruction of the Amazon. More recently, Brazil has strengthened environmental regulations in Amazonia, but even progressive president Luiz Inácio Lula da Silva has told the media that outsiders should not criticize Brazil's need to create jobs and profit within the Amazon. This leaves many observers skeptical as to whether the Brazilian government is serious about protecting the long-term sustainability of the rainforest.

Holistic vs. Fragmented Knowledge

Another important distinction must be made between what might be termed "holistic" approaches to environmental planning, as opposed to "fragmented" approaches. In our western culture, we have a tendency to compartmentalize knowledge; we have become an overspecialized society. We train ourselves in very narrow disciplines—law, biology, marketing, -- but fail to understand the larger connections between things. Conceptually, this problem is identified as one of "fragmented knowledge." It is sometimes also referred to as "reductionism." We have become a culture of experts who know a lot about one thing, but not enough about larger interconnections. This tendency manifests itself in the environmental and urban planning fields—where we train specialists in oceanography, housing, or land use law, yet not enough scientists who understand the larger picture. This larger picture is often referred to as "holistic knowledge."

We can also see reductionism in the way we create comprehensive urban or environmental plans, or regional plans. These plans tend to be sub-divided into separate categories, or general plan elements—land use, open space, housing, transportation, etc. Policy decisions are then made within each of these 'general plan elements;, often without recognizing the interconnections between them.

Fragmentation poses an especially large burden for Amazonia. The region itself is fragmented between different political territories (states) and competing interests (land extraction, beef production, vs. sustainable agriculture). The scale of the region and the diversity of forces at work simply magnify the problem of overspecialization and fragmentation.

Limits

Another important dimension of sustainability is the recognition of limits. In western culture, we tend to make a linear connection between growth and progress. A 1972 book, *The Limits to Growth*, tried to model the consequences of a rapidly expanding world population and finite resource supplies (Meadows, Meadows, Randers and Behrens, 1972). It argued that if we continued to grow at current rates on this planet, there might not be enough resources to house and feed projected future populations.

Western culture is deeply embedded in a period of heightened consumerism, in which citizens are constantly bombarded with subtle and direct messages that consumption is good, the more the better (Lasch, 1979; Sklair, 1991). Our theories of neo-classical economics are based on "growth is good" principles, reduced to concepts such as production, consumption, supply and demand. The fields of economic planning and regional development planning are all based on growth. After a century of unlimited growth, in some parts of the world, we are finally witnessing the introduction of government sanctioned limits—on water use (in desert regions) or on the exploitation of natural resources (in national forests, heavily fished seas).

The question of "limits" is fundamental to the debate about the ecological future of Amazonia. The international scientific community has passionately argued that the Brazilian government needs to limit the construction of highways in the Amazon rainforest, since research shows overwhelmingly that highways are the principal drivers of deforestation (Kirby, et.al, 2006; Laurence, Albernaz, Fearnside, Vasconcelos and Ferreira, 2004). Highways, it seems, are especially useful to what some have called "the most unsustainable land use in Amazonia -soybean cultivation" (Fearnside, 2001). The Brazilian government counters that scientists from mostly developed nations don't have the right to impose their will on a sovereign nation, especially when the Amazon rainforest development can create jobs and economic development for a nation on the rise. Brazil's government has also argued recently that improvements of frontier governance and environmental law enforcement will enhance the quality and management of Amazonian development. Scientists, however, are unconvinced. In the words of one group of scientists, since 2002, Brazil has still moved forward with the "largest infrastructure expansion (roads, power lines, gas lines, hydroelectric reservoirs, rail, river channelization) in the history of the Amazon" (Laurence, Albernaz, et. al, 2004).

Place and Sustainability

The emphasis on specialized science and rationality also spills into how we study nature and place. We tend to reduce the natural environment to scientific categories (air, water, land), and then study it with generic land use models. But places are not merely neutral spaces to be broken down into scientific or quantifiable categories—they are unique geographic zones, with their

distinct natural landscapes, histories, people, and local character. World cultural regions must protect their uniqueness, in part, because it is how they can develop competitive economies— for example in creating tourism activities, in attracting investors, workers and residents, and in building specialized economies around the mix of site attributes unique to each place.

One of the problems of protecting unique places is that global corporate interests often find it profitable to exploit either their natural resources (as in the Amazon rainforest) or their cultural resources— say, for tourism development. In the case of the latter, too much tourism development can destroy the very thing that tourists come to see. For example, too many cruise ships visiting Antarctica or the Caribbean, or too many eco-hotels and riverboat tours in Amazonia, may compromise the very environments visitors come to see.

Amazonia's value as a place lies in its pristine natural quality, as well as the spiritual and folk value of its indigenous cultures. In the last four or five decades, massive development has begun to compromise Amazonia's powerful sense of place. This can be illustrated using the example of Manaus. Manaus' phenomenal growth since 1960 is driven by its post-rubber boom re-emergence as an economic development region, beginning with the military government's "Brazilian miracle" strategies for the nation in the 1960's. Over the next decade the demographic boom in Manaus reflects the degree to which government investment drew migrants, corporate entrepreneurs and business interests. Manaus' 1960 population of 343,000, doubled to over 600,000 in 1970, and to one million by 1990 (Despres, 1991). That number has again doubled twenty years later to around two million inhabitants.

Manaus has become the urban economic engine for rain forest growth. It is a city that was once known for its quaint post-colonial buildings, highlighted by the iconic Teatro Amazonas, the turn of the century opera building, with a multi-colored dome roof, and neoclassical exterior, and a stunning decorative baroque interior. Today, Manaus can best be described as tropical urban sprawl-- a design and environmental nightmare, with very little "sense of place(Jackson, 1994). The river is congested with chemical plants, oil refineries, electronics assembly plants, and waterfront favelas. A massive exodus to the periphery has turned Manaus into a chaotic, frontier metropolis not unlike Mexican border cities such as Tijuana or Ciudad Juarez—full of crass commercialism and decaying structures in the increasingly abandoned city center. Despite the growth of regional tourism, the city of Manaus continues to have a highly underdeveloped tourism infrastructure. Given the importance of nature to the tourism boom, it is ironic that the hotel industry in Manaus has invested almost nothing in creating green or sustainable ecological designs.

Globalization

Globalization often tends to distort the protection of "bio regions." Because all countries participate in international trade and are part of the world market, as mentioned, national governments have tended to emphasize "growth" over resource conservation, renewable energy, and sustainability. This trend is exacerbated by the role of "foreign aid" – loans, grants, technical assistance, food aid and development projects—which further force nations to favor the creation of capital intensive projects that generate national profit to pay off foreign loans, or to buy goods needed for export-oriented growth. Meanwhile, resources and social needs are neglected (Carothers, 1999; Sachs, 2005; Willis, 2011).

Another important layer of the globalization problem is the "monetization" of local economies. "Middle men" and elite entrepreneurs often control key national economic sectors (large-scale agriculture, commerce, mining), while the poor and working classes often remain trapped in low paying jobs (Redclift, 1995). Meanwhile, national governments try to avoid a debt crisis by using public monies to invest in profitable industry tied to low wages. Not enough public funding is allocated to building sustainable and equitable economies that employ the masses at decent wage levels.

Agriculture is a good example of a local economy that has been globalized to the detriment of poor farmers all over Latin America. "Agro-industry" involves the production, processing, marketing and distribution of food and fiber-products. These products acquire value depending on the global market. Because Latin America and other less developed regions of the world have become dependent on wealthy countries' consumers, they shift their agricultural policies to remain plugged into the buyers' markets in those nations (mainly in Europe, the U.S., Japan, and more recently in India and China).

All of the above forces have crystallized in the Amazonia region. Globalization facilitates a set of "transnational practices" (Sklair, 1991) – which have been imposed on poorer nations and regions like Amazonia—they include free trade agreements, international loans

through organizations like the World Bank or the Inter-American Bank, and consumer behaviors promoted through global media. These practices cause further dependency on powerful corporate interests or nations, and reduce local cultures' ability to produce and consume local products within sustainable bio-regions. Globalizing the Rainforest

Over the last 30 years, national and multi-national corporate interests and the Brazilian government have exploited the rainforest region for short term profit in activities tied to global markets (mainly the sale of beef from cattle ranching, the sale of lumber from logging, and more recently the sale of soybeans), while threatening its long term survival. Some 232,000 square miles of the Amazon have been deforested since 1978. It is a revealing portrait of the problems and politics of unsustainable development.

The most glaring unsustainable practice has been land clearing for cattle ranching. Cattle ranchers clear land to plant grasses to feed herds of beef cattle. The world demand for Brazilian beef has made it a very profitable short term use of tropical lands in the Amazon (CIFOR, 2010; Kirby, et.al, 2006). World demand grew during the 1980's and 1990's when Brazil devalued its currency, thus making beef even more competitive in the world market. Road construction, including the Trans-Amazonian Highway built several decades ago, opened forest lands and made shipping and packing of beef cheaper.

Equally, the Brazilian government itself has promulgated deforestation indirectly, by sponsoring programs for poor farmers to colonize jungle areas. Unfortunately, the government does not assist farmers in establishing ecologically sustainable best practices for farming. Peasant farmers use fires to clear land, then plant bananas, rice, maize, manioc and palms, which grow well in the short term, but ultimately deplete soils of their nutrients, thus causing farmers to move on to other lands and repeat the same land clearing and inefficient agricultural practices.

A third and critical factor is infrastructure. The Trans-Amazonian Highway, a federal government rainforest development project from the 1970's, provided for a 2,000 mile highway system that expanded into the massive rainforest to open land for farmers, timber, and mining. The government spurred interest by offering subsidized land, a half year's salary, and other perks. The highway was plagued with problems, including heavy rains, unstable soils, erosion and poor farming yields for settlers. The highway has allowed more access and thus more deforestation as land is cleared for truck farms, cattle, and other production.

Fourth, one cannot underestimate the pull of commercial agriculture. Large scale agribusiness arrived in the Amazon in the form of soybean cultivation. Brazilian scientists developed a new variety of soybean that grows well in the rainforest ecosystem. High demand for soybeans, driven by global markets, accelerated soybean production in the jungle.

Finally, there is the logging. The biggest problem with logging is that, although there are laws in the Amazon controlling lumber production, the laws are not sufficiently enforced. There is a great deal of illegal logging in the Brazilian Amazon. Logging is closely tied with road building, so the more the government creates road access into the interior of the Amazon, the more loggers will get in to cut out trees. Those same roads then encourage poor settlers to colonize the interior for temporary agriculture, access to building materials, fuel wood, and hunting game for food. Closer to cities and towns, roads allow favelas and unplanned settlements to expand outward into ecologically sensitive lands.

Sustainable Policy-making: New Ways of Thinking about Amazonia's Future

It can be argued that Amazonia's future development should be subject to barometers of sustainable practice. Consider, for example, the concept of "land ethics". Ethics refers to the relations between individuals and land, and is derived from the larger definition of ethics as "relations between individuals and society" (Leopold, 2004). In Western culture, there is a tendency to over-value private land ownership over the "public interest" (air, water, flora, fauna) (Gore, 2006; Calthorpe, 2010) Western culture placed great value on private property during the 19th century industrial revolution and the economic boom of the 20th century (De Soto, 2000). In the new millennium we are beginning to realize the danger in ignoring the larger public interest of nature. We need to develop a "land conscience" which would expand the notion of "community" to include the public interest and above all, nature.

In western culture, we also too easily accept the idea that our capitalist market economy should operate like a roller coaster, where profit is best achieved within a cyclical economy, and through boom/bust shifts. This fits the mold of traditional economic theory based on growth. But there are those who argue for a "steady state" approach to economics where governments would regulate the consumption of resources, based on their availability. Since the ecosystem exists in a "steady state" of finite dimensions, it makes sense that the human economy should evolve toward a steady state condition, as opposed to one of limitless growth and unstable booms and busts (Daly, 1973).

Perhaps the most powerful theoretical tool with practical applications to Amazonia is "natural capitalism". Natural capitalism is based on several innovative ideas:

- The environment is not a minor "factor of production," but an envelope containing, provisioning and sustaining the entire economy.
- Economic development should be mediated by "natural capital," that is, it must balance natural resources against the goals of growth and development
- The loss of natural capital creates wasteful patterns of consumption, population growth and badly designed businesses (for example those that pollute)
- "Resource productivity" must be mediated by human, industrial, financial, and natural capital. (Hawken, Lovins and Lovins, 1999).

Conventional capitalism is based on bigger, more efficient factories; it assumes human well being is achieved by the "highest and best use" of land and that resources should be used to maximize production and profit. It stems from the idea that "environment" is significant only as it balances against economic growth to maintain high standards of living. Natural capitalism argues that we can no longer operate our economy under the assumption that we need to build bigger factories, create unlimited growth, drain all land and resources in the interests of maximizing growth, and underestimate the natural environment. On the contrary, natural capitalism argues that the environment must become a central factor that drives our economy.

These ideas are critical to the future of Amazonia. The region is inundated by "old school" economic development infrastructure— roads, highways, ports, gas lines, in which the purpose is to maximize temporary growth in lumber, soybean cultivation, and beef production. While these land uses may yield profit in the short and medium term, they are not sustainable in the long term, since they lead to deforestation, which ultimately depletes the region of its self -sustaining natural vegetation, climate system and eco-biological

conditions needed for survival and economic sustainability. At some point, scientists have shown, deforestation will significantly endanger rainforest ecology, thus slowing the new economic activities, upon which the Brazilizan (and other) government is counting. Meanwhile, global and local entrepreneurs, as well as governments, have not sufficiently explored the massive potential in alternative economic development sectors, including pharmaceutical, herbal and health benefits from the natural landscape of the rain forest.

One of the main strategies of natural capitalism is what is termed "radical resource productivity," obtaining the same utility (or more) from a product or process while using less material and energy. "Radical resource productivity" suggests technology and creative design can make a product far more ecologically friendly than we currently imagine. This is supported by a second essential element of natural capitalism -- "bio-mimicry," the idea that industry should be "green"-and more attuned to the natural environment. Instead of building Amazonia's industry around "frontier" strategies of assembly or "free trade zones" (which are footloose and can leave at any time, and are heavy polluters), Amazonia should be concentrating on expanding natural production of biological products taken directly from the local flora. Local products include natural rubber, lumber, Brazil nut, fruits like guarana and acai, and medicinal plants (Mongabay.com). Government officials need to look more closely at these activities, and support agricultural practices that are sustainable, while carefully managing those that are not (lumber and rubber, for example). Further, the economic development potential of activities like medicinal plants must be supported. Greater attention to the use of land for sustainable economic activities could provide incentives to reduce deforestation, which has indirectly contributed to global warming. Since 1970, over 230,000 square miles of rainforest has been destroyed (mongabay.com); this had the dual impact of lowering rainforest capacity to convert carbon dioxide to oxygen (which reduces the greenhouse effect), while increasing burning of the rainforest, which, in turn, adds more carbon dioxide to the atmosphere. (Fearnside and Laurence, 2004).

In traditional manufacturing, it has been argued that we have tended to operate with what is termed a "cradle to grave" approach. Products are designed for profit, and with little thought about longevity or about how they impact the environment after they are no longer used. In our traditional industrial culture, products are designed to become obsolete. They move from "cradle" (production in the factory) to "grave" (disposal in a landfill, or incineration), with almost no thought put into sustainable product design. An excellent example is the cell phone. Cell phones are disposed of every few years, as new ones are introduced into the market. Seemingly, because they are so small, cell phones are not necessarily recycled, but rather thrown into enormous disposal yards where billions of cell phone and other old electrical technologies lie. Cell phone production is one of the important electronic assembly activities in Manaus, Amazonia.

This kind of manufacturing can be termed a "monocultural approach"-- one size fits all. We produce homogenous products that are the same everywhere despite different bio-regions. A good example of a monocultural product is the house. Most houses are built in the same manner: First, scrape the site, then construct a house, and finally, landscape with grass and trees, etc.-The problem is that different regions require different approaches due to their unique climates, geography, and resources available for building. Yet most developers use "one size fits all" housing prototypes for suburban housing construction all over the world.

An alternative to "cradle to grave" development is what is termed a "cradle to cradle strategy." This approach to manufacturing would: a) Emphasize use of local material, local geography, and "eco-efficiency"; b) Use local flora/fauna to craft economic development strategies; c) Consider natural energy flows: wind towers, solar waves (McDonough and Braungart, 2002). These elements point squarely toward Amazonia, where such sustainable manufacturing seems ideally suited to one of the most potent ecosystems on earth.

To facilitate the transformation of Amazonia's development, international agencies can play an important role. The United Nations Environmental Program is poorly funded and has no jurisdiction over sovereign nations. Non- governmental organizations (NGO's) have stepped up to address environmental issues—for example, the World Wildlife Federation, Green Peace, and others. The World Conservation Union has stated three ecological strategies that must be followed to make agriculture more sustainable: a) carefully measure tradeoffs between crop management and cattle ranching; b) better crop management; c) protection of watershed forests. Mechanization and the globalization of agriculture are huge threats to preserving local farming.

One hopeful trend is the recognition of "biosphere reserves". A biosphere reserve is an international conservation unit created by the United Nations Educational, Scientific and Cultural Organization (UNESCO) under its program on Man and the Biosphere (MAB). According to "The Statutory Framework of the World Network of Biosphere Reserves," biosphere reserves are created "to promote and demonstrate a balanced relationship between humans and the biosphere." Biosphere reserves serve in some ways as 'living laboratories' for testing out and demonstrating integrated management of land, water and biodiversity. The Amazonian rainforest is one of several biosphere reserves in Brazil, though its designation is mainly for scientific purposes, and thus far, has not yielded to international agreement or monitoring of its effectiveness. One must hope that international development agencies, NGO's, Brazilian planners and environmentalists, and the new frontier of natural capitalism entrepreneurs will all ban together and begin to rethink the development strategy for the future of Amazonia.

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