Original Concept Developed for 2009 Buckminster Fuller Challenge

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protoMetrics™: A Process for identifying TRENDS at all scales

protoSpace™: Areas similar to Galveston based on Global Characteristics
**protoPartner™ Connections**

Paul Hawken’s book *Blessed Unrest* and subsequent global NGO network, *WiseEarth* organizes agnergetic partnerships across scales to facilitate information sharing and solution development. The *protoSpace™* ecosystem overview globally scans *WiseEarth* using spatial patterns as seminal context for information sharing. Thus, ensuring establishment of geo-indexed partnerships informed by ecologic, climatologic, hydrologic and geologic factors.

**protoPartner™ **

A neutral party which connects knowledge from Universities, NGO’s, and Industry (Resource Partners) to develop green world promoting technologies

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**Greyworld**

**protoSpace™**

**Genesis**

as protoPartners™ connect at all scales, the world is able to transform from a greyworld to a green world.

**protoSpace™**

**Growth**

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**Greenworld**

**protoPartner™ matrix**

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**protoPartner™ Connections**

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**Greyworld Trends**

protoPartners™ use lifecycle technologies established by the life cycles of air, water, food, energy, and materials to transform grey world trends into green world trends.

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**Greenworld Trends**
Wetlands sequester on average 64% more carbon than cultivated land and 94% more carbon than urbanized areas.

Reestablishment of a wetland ecosystem along 367 miles of Texas Coastline would sequester 3.4 million tonnes of carbon per year, an average offset of 0.2% of annual US emissions.

**Energy Balance Systematics**

- **Source**: Capture
- **Transport**: Process
- **Distribute**: Use
- **Re-Source**: Embedded Balance

**Ecosystem Carbon Offset**

- **Ecosystem**: Wetland, Forest, Tidal Flat
- **NPP (gC/m²/yr)**: Wetland 1180, Tropical Forest 425, Human Area 100, Grassland 350

**Carbon Offset by Ecosystem**

- **Carbon Density (kg C/m²)**: Plant C, Soil C

**Assumptions**

- Coastline area calculated as length of coast multiplied by 3 miles inland
- Annual US CO2 emissions: 6,049,435,000 tonnes/yr
- Proportion of Carbon in CO2: 27.2%
- Annual US Carbon emissions: 1,649,845,909 tonnes/yr

**Land Areas to be Reforested**

- **Texas Coastline**: Wetland 195,596 km², Cultivated Cropland 70,448 km², Human Area 16,576 km², Grassland 58,016 km²
- **US Coastline**: Wetland 3,364,861 km², Cultivated Cropland 1,211,920 km², Human Area 285,158 km², Grassland 998,052 km²

**Total Carbon Offset by Ecosystem (tonnes)**

- Wetland: 1180 gC/m²/yr, Total Carbon Offset 195,596 km² = 3,760,417,260 tonnes
- Cultivated Cropland: 425 gC/m²/yr, Total Carbon Offset 70,448 km² = 5,936,360 tonnes
- Human Area: 100 gC/m²/yr, Total Carbon Offset 16,576 km² = 1,657,600 tonnes
- Grassland: 350 gC/m²/yr, Total Carbon Offset 58,016 km² = 20,355,560 tonnes

**Source-Rel DISCLAIM**

- SOURCE: DAMAGE
- REL: DAMAGE

**CO2 Balance Sheet**

- Carbon Source: CO2, Water, Energy, Material
- Carbon Use: CO2, Water, Energy, Material

**ECOBALANCE SYSTEMATICS**

- Source: Transport, Process, Distribute, Use, Re-Source

**ProtoSite™**: The place in which protoPartners™ demonstrate Life Cycle Technologies using prototypes.
Database Resources

- World Wildlife Fund
- National Geographic
- IUCN Red List
- ISI's Web of Knowledge
- Janine Benyus' AskNature.org
- Global Impact & Vulnerability Alert System

Pattern Finding Resources

- WolframAlpha
- Michael Lynch
- IBM's Stream Processing Software
- Autonomy
- Munich Re Group
- National Science Foundation
- Planetary Skin Institute
- CISCO / NASA
- Global Earth Observation System of Systems (GEOSS)

International Cooperation

Information Networking
Database Resources

WildFinder is a map-driven, searchable database of more than 26,000 species worldwide, with a powerful search tool that allows users to discover where species live or explore wild places to find out what species live there. Containing information on birds, mammals, reptiles, and amphibians, WildFinder is a valuable resource for scientists, students, educators, travelers, birdwatchers and nature enthusiasts alike.

National Geographic’s Wild World maps and makes them interactive, adding profiles and photos of more than 1,000 ecoregions, multimedia features, and more. Scientists have mapped 867 land-based ecoregions across the globe. Instead of being defined by political boundaries, each is distinguished by its shared ecological features, climate, and plants and animal communities.

The IUCN Red List of Threatened Species™ is widely recognized as the most comprehensive, objective global approach for evaluating the conservation status of plant and animal species. The goals of the IUCN Red List are to: identify and document those species most in need of conservation attention if global extinction rates are to be reduced; and provide a global index of the state of change of biodiversity.

ISI Web of Knowledge provides one platform for access to objective content and powerful tools that let you search, track, measure and collaborate in the sciences, social sciences, arts, and humanities.

WiserEarth is a free online community space connecting the people, nonprofits and businesses working toward a just and sustainable world. WiserEarth helps the global movement of people and organizations working toward social justice, indigenous rights, and environmental stewardship connect, collaborate, share knowledge, and build alliances.

AskNature, the online inspiration source for the biomimicry community. Think of it as your home habitat—whether you’re a biologist who wants to share what you know about an amazing organism, or a designer, architect, engineer, or chemist looking for planet-friendly solutions. AskNature is where biology and design cross-pollinate, so bio-inspired breakthroughs can be born.

The GIVAS links together existing early warning systems and attempts to make better use of new innovative ways of collecting real time data. The system is both intended to show impact (i.e. what’s happening right now) and raise alarm bells as to potentially dramatically worsening vulnerabilities (i.e. what could happen if we don’t act). It’s main purpose is to ensure that we have the information and analysis needed to protect our most vulnerable populations against crisis.

International Cooperation

Pattern Finding Resources

WolframAlpha’s long-term goal is to make all systematic knowledge immediately computable and accessible to everyone. We aim to collect and curate all objective data; implement every known model, method, and algorithm; and make it possible to compute whatever can be computed about anything. Our goal is to build on the achievements of science and other systematizations of knowledge to provide a single source that can be relied on by everyone for definitive answers to factual queries.

Autonomy can almost be thought of as an intelligent operating system, sitting on top of the actual operating system. The core technology (IDOL) provides a platform for the automatic categorization, hyperlinking, retrieval and profiling of unstructured information, thereby enabling the automatic delivery of large volumes of personalized information. Autonomy’s technology is used across virtually every software application handling unstructured and semi-structured information - whether Enterprise Portals, CRM, Business Intelligence, Knowledge Management or E-Business Applications - and in virtually every industry vertical market.

As the amount of data available to enterprises and other organizations dramatically increases, more and more companies are looking to turn this data into actionable information and knowledge. Addressing these requirements require systems and applications that enable efficient extraction of knowledge and information from potentially enormous volumes and varieties of continuous data streams. IBM’s System S provides an execution platform and services for user-developed applications that ingest, filter, analyze, and correlate potentially massive volumes of continuous data streams.

The EarthScope scientific community is conducting multidisciplinary research across the Earth sciences utilizing the freely accessible data from geophysical instruments that measure motions of the Earth’s surface, record seismic waves, and recover rock samples from depths at which earthquakes originate.

NATHAN presents the most up-to-date geoscientific expertise and provides services such as interactive maps of natural hazards, extracts from the MR NatCatSERVICE database and country profiles that include socioeconomic and hazard data.

GEOS will be a global and flexible network of content providers allowing decision makers to access an extraordinary range of information at their desk. This ‘system of systems’ will proactively link together existing and planned observing systems around the world and support the development of new systems where gaps currently exist. It will promote common technical standards so that data from the thousands of different instruments can be combined into coherent data sets.

Planetary Skin Institute will research, develop and prototype an approach to provide near-to-real-time global monitoring of environmental conditions and changes. This will deliver the required decision support capabilities to manage global resources, risks and build environmental markets.

Information Networking
Austin Green Building Program:

BaseLine Green™:

BASE LINING GREEN
A BASELINING PROCEDURE FOR GREEN BUILDING

G. NORRIS, P. FISK III & R. MAC MA TH, BILL BAVINGER, JASON MCCLENNAN
ALONG WITH THE STAFF AT THE CENTER FOR MAXIMUM POTENTIAL BUILDING SYSTEMS

National Ranking
Industry Name
1. Food & beverage
2. Manufacturing
3. Construction
4. Wholesale trade
5. Transportation & warehousing
6. Professional & business services
7. Retail trade
8. Arts, entertainment & recreation
9. Educational services
10. Health care & social assistance
11. Public administration
12. Governmental affairs

Construction Sector Ranking
Sector
1. Housing
2. Commercial building
3. Institutional building
4. Industrial building
5. Energy
6. Transportation
7. Water supply
8. Waste disposal
9. Other

Specification Ranking
Category
1. Structural
2. Architectural
3. Mechanical
4. Electrical
5. Plumbing

Component Ranking
Component
1. Concrete
2. Steel
3. Glass
4. Wood
5. Insulation
6. Energy systems
7. Water systems
8. Waste systems
9. Other

Green Building Programs Across the Country
Future Trend: Remineralizing the World

PERIODIC TABLE

PLANTS/SOIL
Ca, Fe, Al, Si, H, Na, Mg, K, Ca, C, N, O, P, S, Mo, Mn, Zn, B, Ti, V, Ru, Rh, Os, Ir, Pd, Pt, Co, Ni, Cu, Cd, Hg

HUMANS/ANIMALS
Ca, H, Li, Na, K, Mg, V, Cr, Mo, Mn, Fe, Co, Ni, Cu, Zn, C, Si, Sn, N, P, As, O, S, Se, F, Cl, I

AQUATIC LIFE
Li, Mg, Ca, Sr, La, Ti, V, Ta, Cr, W, Os, Co, Ir, Pt, Au, Cd, Hg, Al, Ga, In, Si, Sn, Pb, N, P, As, Sb, Bi, S, F, Cl, Br, I, H, Na, K, Mo, Mn, Fe, Cu, Zn, B, C, O, Se

MICRO ORGANISMS
H, Na, K, Mg, Ca, V, Mo, Mn, Fe, Co, Cu, Zn, B, C, Si, N, P, O, S, Se, F, Cl, Br, I, Mn, Ni, Cd, Hg

POISONOUS MINERALS
Cs, Fr, Sr, Ra, Ac, Th, Pa, U, Np, Pu, Am, Co, Po, I, At, Rn, Na, Be, Ti, Zr, Cr, Mn, Fe, Ni, Cu, Zn, Cd, Hg, B, Al, Sn, Pb, N, As, S, Se, F, Cl, Br

Source: PERMACULTURE- A Designer's Manual by Bill Mollison
Produced Water:

Refineries, Oil Platforms, & Pipelines in the Gulf of Mexico

Produced Water Facilities in Texas

211 billion gallons of produced water per year

Desalination Plants in Texas

48 billion gallons of water are desalinated per year
protoOne:

**BUILDING SYSTEM MATRIX**

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**PACKER 2000 - SHREDDER PROCESS**

- Bricks
- Lumber
- Drywall
- Insulation
- Sand
- Recycled materials
Conclusions
- Reinforced CMU and solid concrete are out-performed by all other alternatives.
- We assumed all Portland cement and no SCM
- Traditional wall uses much more material and environmental resources
- The new concepts use not only less material, but less energy and CO2 intensive binder
- Substitution of EPS seems to be a good strategy
Neighborhood Industrial Ecosystem:

sample block: MgO cement manufacturer

miller and bagger
of ce and sales
conveyor surface
water storage

PV grid
electrolysis tubes
MgO firing by
solar concentrators

stacked brine mats
presses

EcoBalance diagram of
full community

source
- rain catchment & storage
- photovoltaic grid
- solar concentrators
- brine mats shipment
receipt

process
- electrolysis of water
- solar kilns concentrate heat
- PV power used in electrolysis
- brine mats pressed

use
- minerals, brine, and water mixed
- cement is fired in kilns

resource
- excess heat is transferred
- waste MgO used to re-mineralize soil

EcoBalance of the
MgO cement manufacturer

source
- MgO community

process
- MgO cement manufacturer's resource life cycles within the industrial ecology community

MgO cement manufacturer's
resource life cycles within
the industrial ecology community

full community includes:
- Asian fish farms
- Biochar stove manufacturers
- Community gardens
- Glass bottle recycling facilities
- Living machine production centers
- MgO cement manufacturers
- Produced water and brine facilities
- Solar drier producers
- Residential neighborhoods
- Wastewater-treating living machines
Industrial ecology is the shifting of industrial processes from linear (open loop) systems, in which resource and capital investments move through the system to become waste, to a closed loop system where wastes become inputs for new processes.