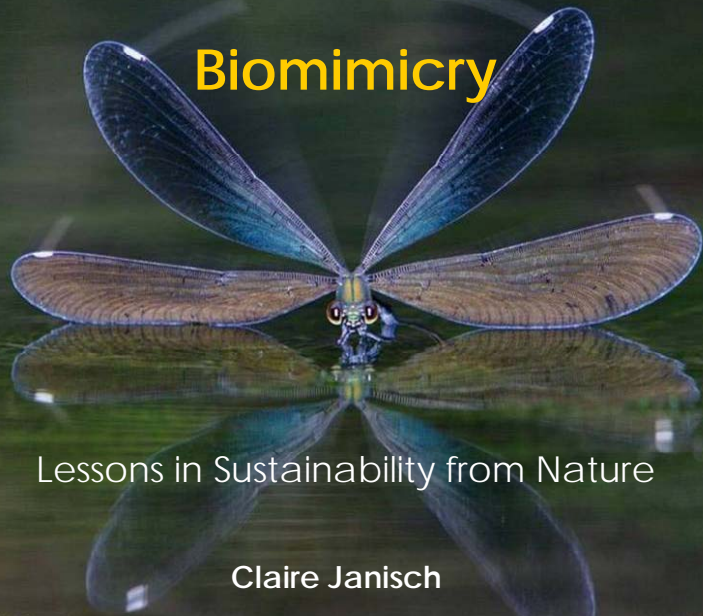


# Biomimicry



Lessons in Sustainability from Nature

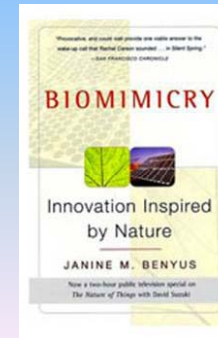
Claire Janisch

Photograph by József L. Szentpéteri

Dragonflies  
National Geographic, April 2006  
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# Biomimicry

Studies nature's best ideas and then imitates these designs and processes to solve human problems



## What nature can teach us



- Earth's design R&D lab = 3.8 billion years
  - Failures are fossils
- What's flourishing today are the best ideas

- **We ARE nature**

- A very young species among species
  - Still trying to find our way
- Everything we make and do is **natural**
- "Is it **well-adapted** to life on earth
  - **over the long haul?**"





## The Secret to Survival

- Animals, plants, and microbes
- **Consummate researchers, engineers & designers**
- Have found:
  - **What works**
  - **What is appropriate**
  - **WHAT LASTS**



## Mimicking Natural FORM

- Level 1
- Mimic form of owl feather: silence/fibre
- Sustainable?

## Mimicking Natural PROCESSES

- Level 2
- Mimic **how it is made**
- **Self-assembles at body temperature**
- **Without toxins or high pressures**
- Nature's chemistry
- **Green chemistry**

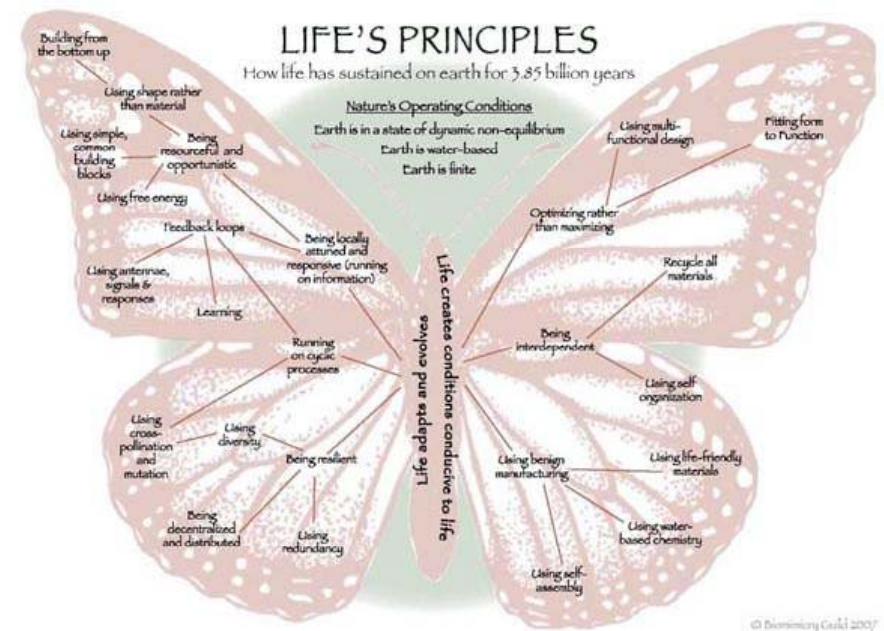
## Mimicking Natural SYSTEMS

- Level 3
- Owl – Ecosystem - Biome - Biosphere
- Product - Larger economy - Biosphere
- Restore/deplete the earth and its people?



## Creating Conditions Conductive to LIFE

- Levels 1+2+3
- Keep the habitat lush and livable
- Not optional
- A rite of passage to fit in here long-term



## Nature's Life Principles

- Runs on sunlight
- Uses only the energy it needs
  - Fits form to function
  - Recycles everything
  - Rewards cooperation
    - Banks on diversity
  - Demands local expertise
  - Curbs excesses from within
- Filters water, cleans air, builds soil

### NATURE AS MODEL



Biomimicry is a new science that studies nature's models and then imitates or takes inspiration from these designs and processes to solve human problems.

### NATURE AS MENTOR



Biomimicry is a new way of thinking and valuing nature. It introduces an era based not on what we can extract from the natural world, but on what we can learn from it.

### NATURE AS MEASURE



Biomimicry uses an ecological standard to judge our innovations. After 3.8 billion years of evolution, nature has learned: What works. What lasts.

## NATURE AS MENTOR



Instead of seeing nature as a source of raw materials  
See nature as a source of ideas  
A new era based not on what we can extract from nature,  
but on what we can learn from her

## NATURE AS MEASURE



- A standard for “rightness” of our innovations
- Does it have a precedence in nature?
- Is it life promoting?
- Does it fit in?
- Will it last?
- **Natural selection is wisdom in action**

## NATURE AS MODEL

- Emulating nature’s **time tested**:
  - designs
  - chemical recipes
  - ecosystem strategies



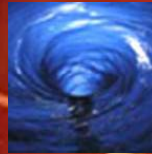
“Pentads” = solar batteries  
Mimic the leaf’s reaction centre  
Molecular in size  
Light-activated “power packs”  
Power hydrogen fuel cells?

Help catalysts assemble and disassemble chemicals?  
Chemistry in pure water, using sunlight and no toxins



## Spiral-inspired Fans & rotors

- Reduce energy 10-85%
- Reduces noise by 75%
- [www.paxscientific.com](http://www.paxscientific.com)



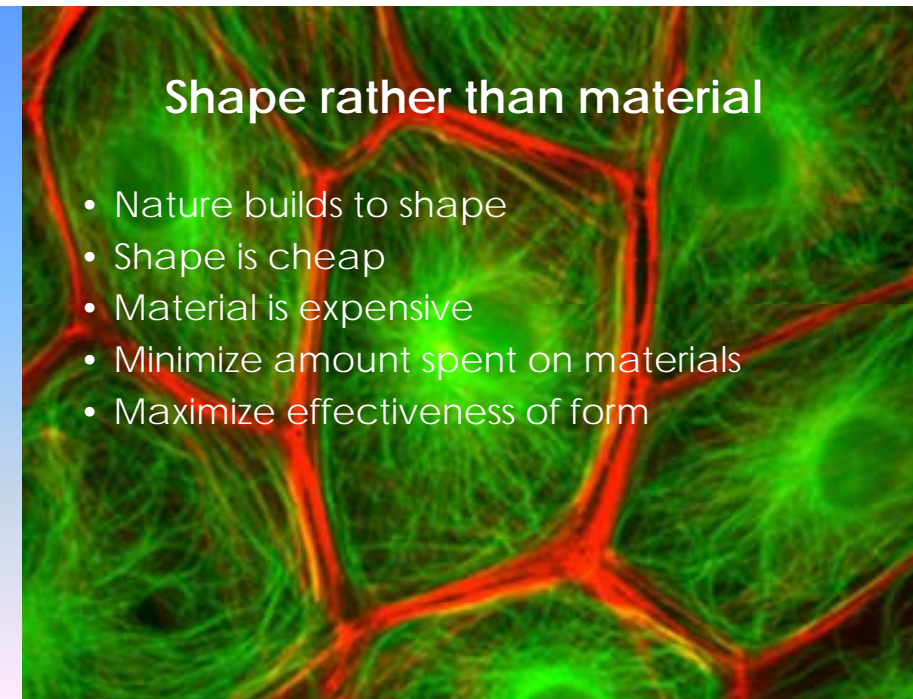
## Whales Power

- Flippers with tubercles
- Airplane wing with scalloped edges
- 32% reduction in drag
- Wind turbines: blade can rotate in very low winds



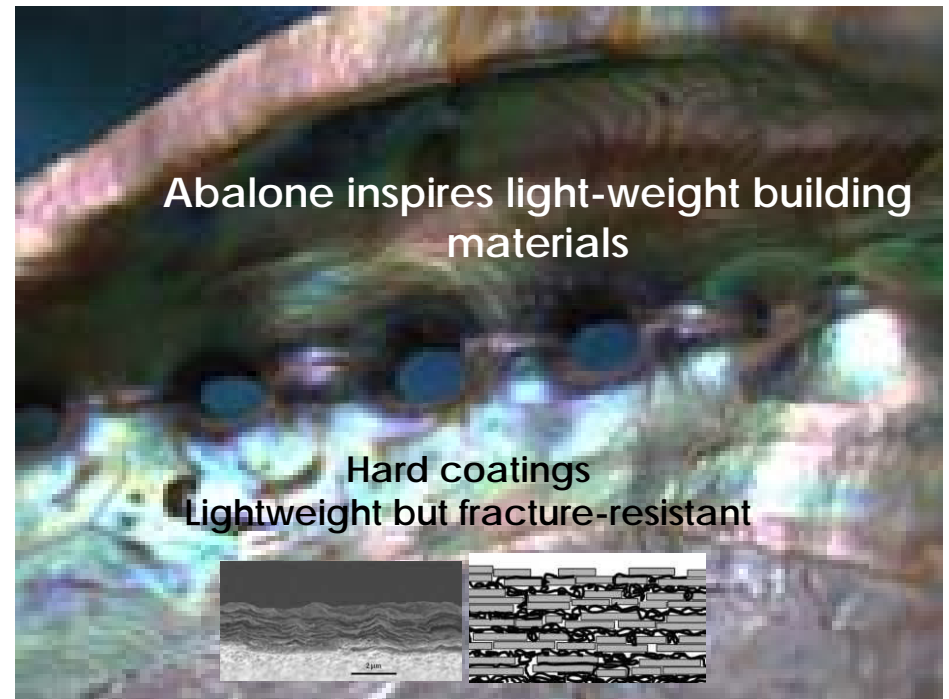
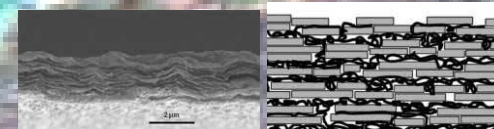
## Shape rather than material

- Nature builds to shape
- Shape is cheap
- Material is expensive
- Minimize amount spent on materials
- Maximize effectiveness of form



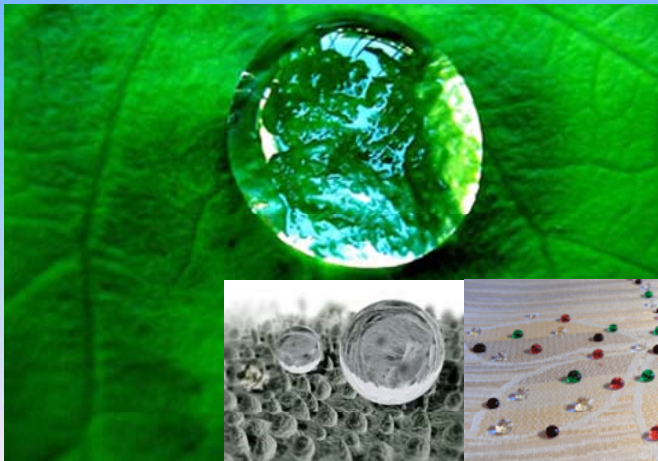
## Abalone inspires light-weight building materials

Hard coatings  
Lightweight but fracture-resistant





## Self-cleaning surfaces



**GreenShield™**  
Liquid-repelling  
nanoparticles

No need for  
dangerous  
fluorocarbons

## Spider Web Fibre



- Benign manufacturing
- No high heat, high pressure or toxic chemicals
- Stronger & more resilient c.f. kevlar

## Mollusk-inspired Epoxy



- Rivals any "super-glue"
- Remains intact in seawater
- Created at low temperatures
- Environmentally safe

## Beetle-inspired Water Harvester



- Namibian Beetle fog-catching device
- **10x** more water than nets
- Bumps with water-loving tips and water-shedding sides
- **QinetiQ (UK)** plastic water-harvesting sheets

## Glass-wing butterfly inspires Design of Iguana Enclosure



## Zoo Pharmacy



Consult animals and insects  
Used plants for millions of years  
For health and nourishment

How does nature manage animal health?

## Learning from Seaweed to Repel Bacteria without Creating Resistance

- Red seaweed
- Repels bacteria
- Disrupting their communication
- New antibiotics - BioSignal Ltd.



## Grassland-inspired Food Crops



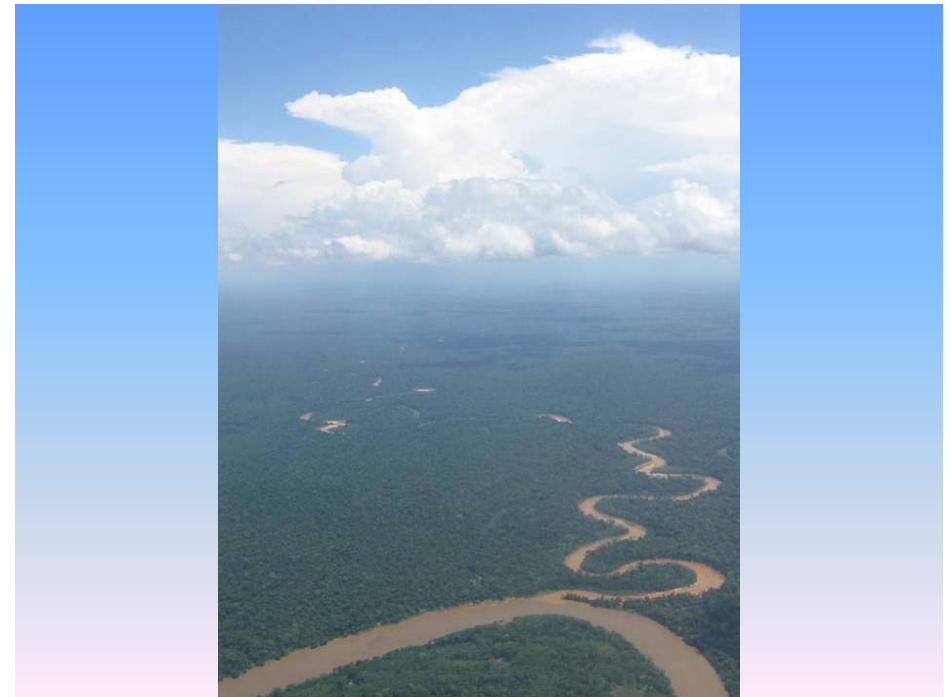
Self-fertilizing and pest-resistant



## Forests as model

- Closed-loop
- Runs on sunlight
- Reuses all its waste
- Industrial symbiosis
- Cities like forests

## Peru Design Workshop













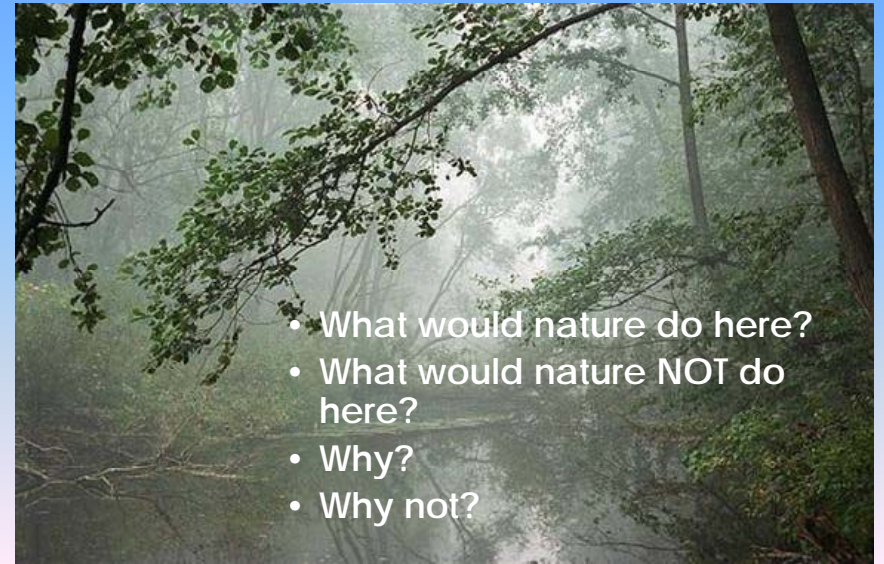




## Step 1: Quieting human cleverness



## Step 2: Listen to life's genius



- What would nature do here?
- What would nature NOT do here?
- Why?
- Why not?

## Step 3: Echoing What We Learn



- Emulating nature
- The blueprint, recipe, principle learnt

Photograph by József L. Szentpéteri

Dragonflies  
National Geographic, April 2006  
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## Step 4: Giving Thanks

- Protecting inspiration







Energy



Using free energy



Adapt and Evolve  
Responsive







## Epiphytes

Leveraging inter-dependence







Short feedback loops



Cycling Materials

Recycling centres EVERYWHERE



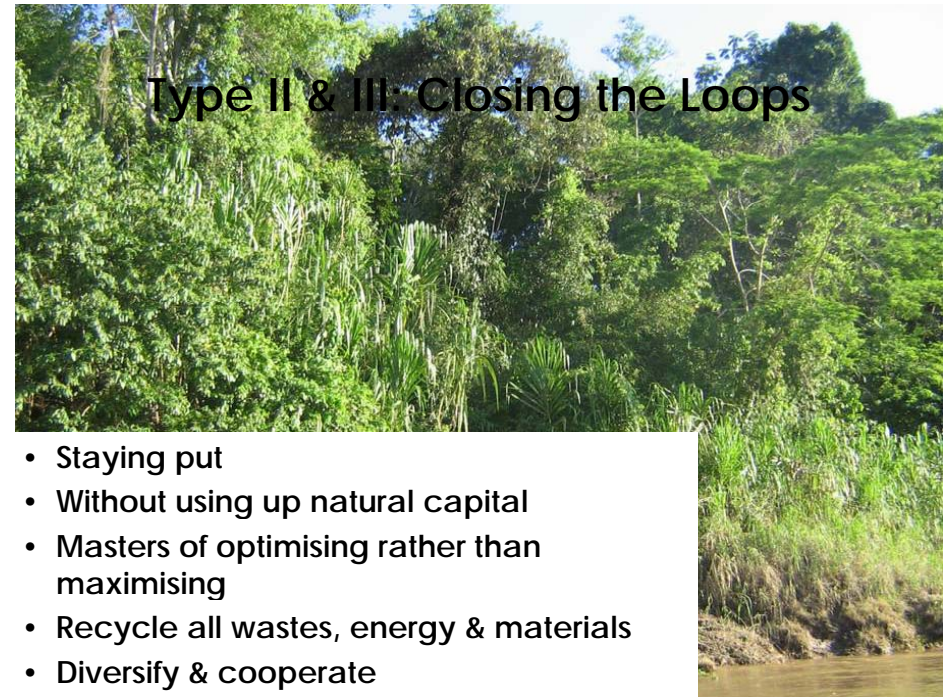
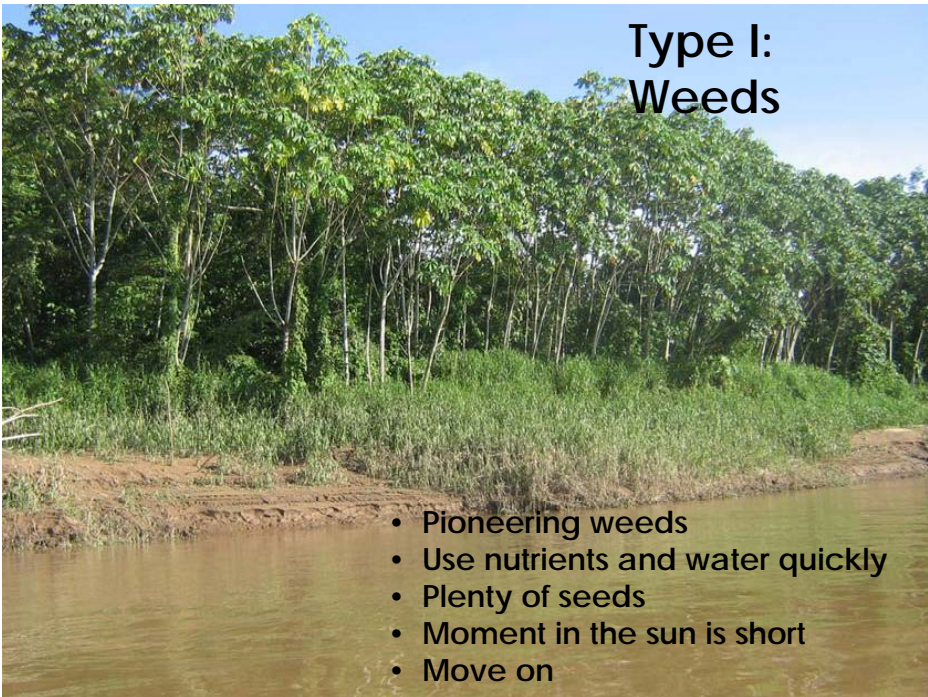
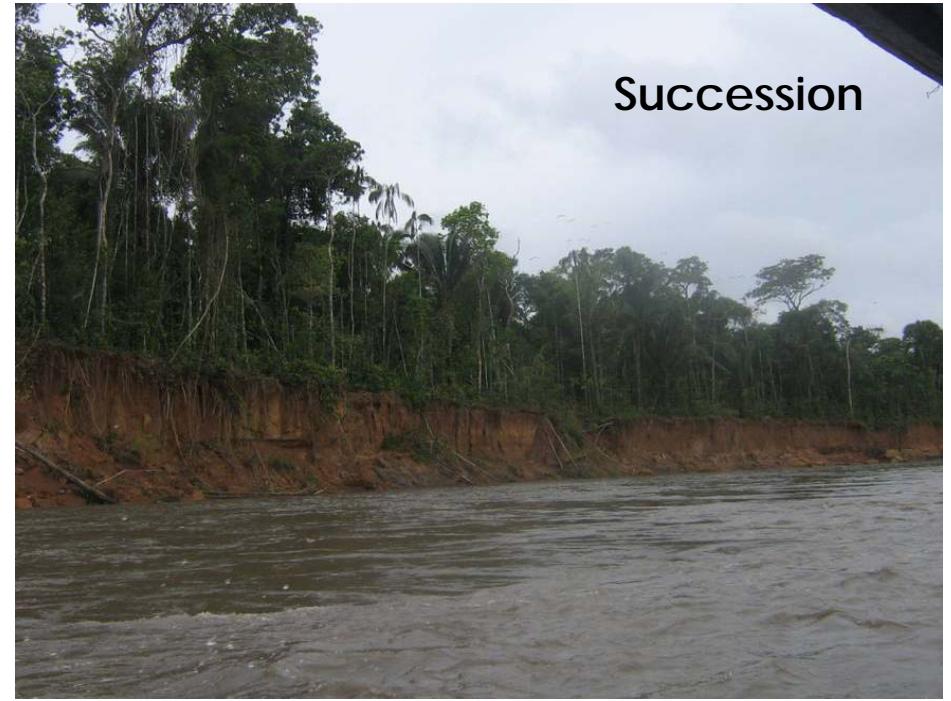
The Decomposers

















Thank You

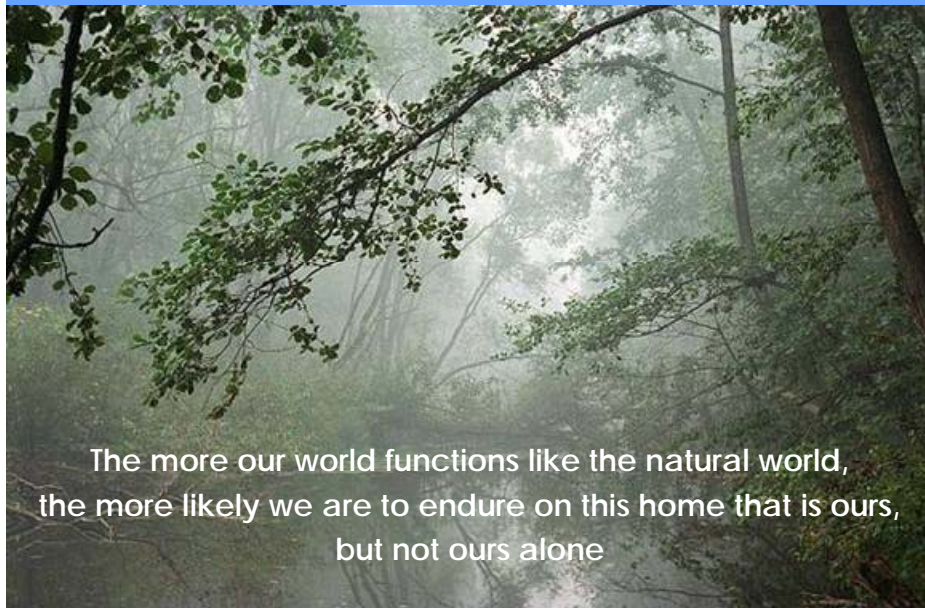


## Costa Rica Workshop

### WHEN & WHERE

- *Thursday through Thursday*
- **April 10 - 17, 2008**
- *La Cusinga Lodge,  
Pacific Coast, Uvita,  
Costa Rica*

[www.biomimicryguild.com](http://www.biomimicryguild.com)



The more our world functions like the natural world,  
the more likely we are to endure on this home that is ours,  
but not ours alone

## Less of this/More of this

- |                                   |                                       |
|-----------------------------------|---------------------------------------|
| • Linear production               | • Cyclical systems                    |
| • Win-lose                        | • Win-win                             |
| • Extraction/exploitation         | • Symbiosis/Harmony                   |
| • Mechanistic                     | • Organic                             |
| • Mass produced/Large inventories | • Just-in-time/ Just-in place quality |
| • Market driven                   | • Community/context oriented          |
| • Uniformity                      | • Celebrate diversity                 |
| • Economy of scale                | • Ecology of scale                    |
| • Compartmentalised               | • Systemic                            |
| • Profit as End                   | • Profit as Means                     |
| • Hierarchical                    | • Self-organising                     |
| • Fast-paced/hurried              | • Rhythms of life                     |
| • Bottom-line accounting          | • Integrated/FCA                      |
| • Near-term focus                 | • Future cognisant                    |