Nature's Principles

Understanding the Operating System

For nearly 4 billion years, all organisms living on earth have faced the same basic conditions, and to survive have followed three basic rules:

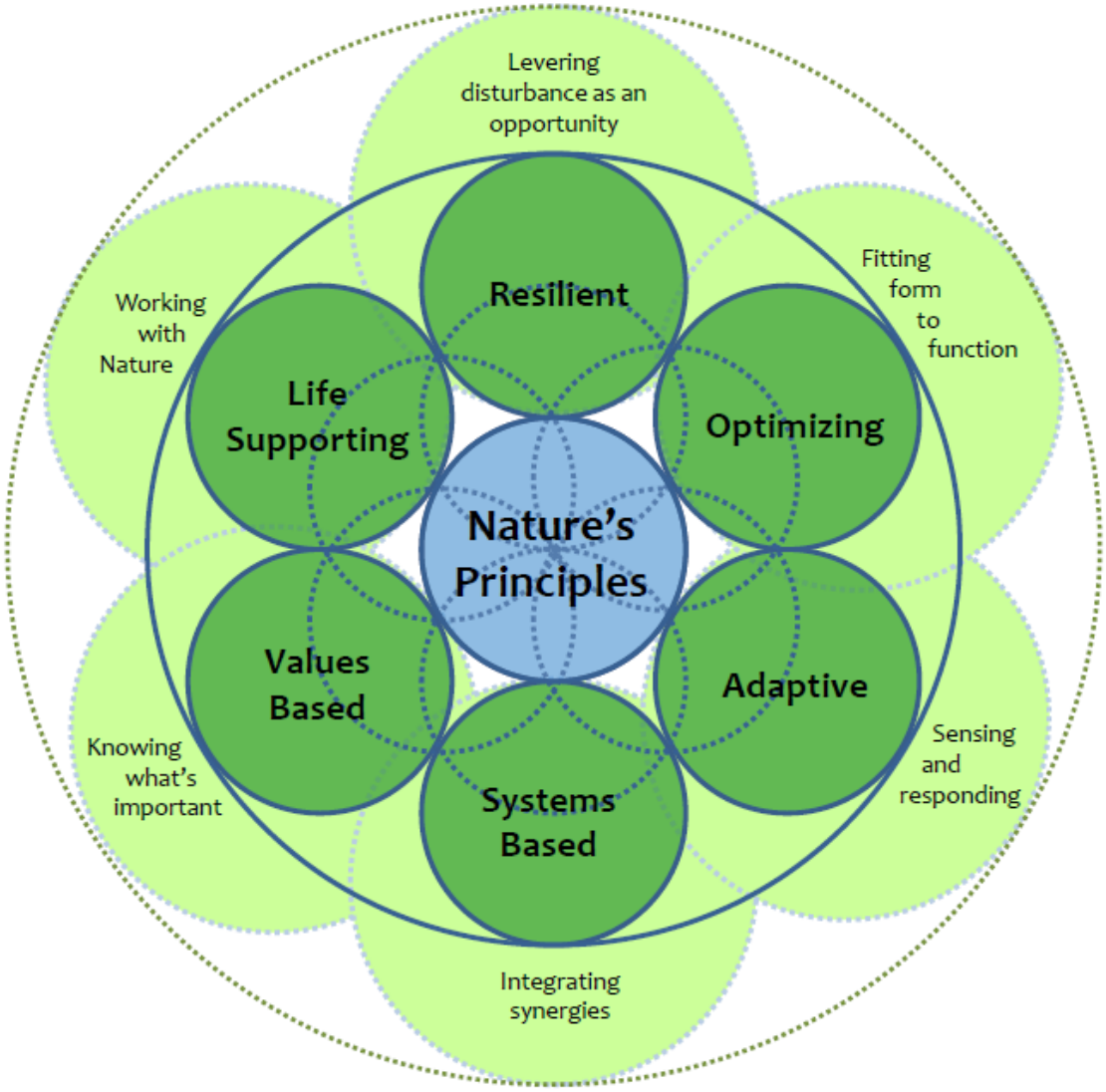
1. Sense, respond, and adapt to changing conditions.
2. Live within the limits of Earth's systems.
3. Support their ecosystems while supporting themselves.

Through the process of evolution, nature has evolved a set of 'principles' that allow organisms to follow these rules, live sustainably, and survive times of radical upheaval. Successful organisms in nature are resilient, optimising, adaptive, systems-based, values-based, and life-supporting.

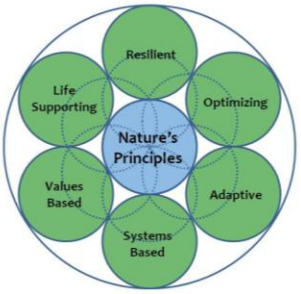
Organisations face the same conditions as all other living things on earth, as well as the unique complexities of human-based systems. Organisations inspired by nature learn how to embed principles and strategies from nature into their products, processes, policies, and practices in order to survive and flourish, seek out emerging opportunities, and create greater abundance for themselves and their ecosystems in times of rapid change. Organisations inspired by nature are resilient, optimising, adaptive, systems-based, values-based, and life-supporting.

This document describes how each of Nature's Principles works and why it is important, and then gives examples of each from nature and from business.

Nature's Principles



Resilient



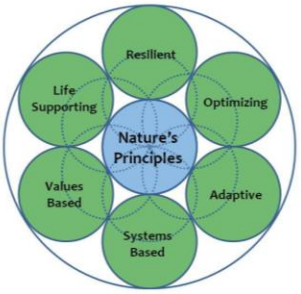
It's more effective to build resilience than to correct poor decisions made with partial information of risk.
Nature builds resilience by:

- Using change and disturbance as opportunities rather than fearing them as threats
- Decentralising, distributing, and diversifying knowledge, resources, decision-making, and actions
- Fostering diversity in people, relationships, ideas, and approaches

Many organizations operate on a risk-based approach, with risk assessed using the basic equation [risk = probability x consequence]. The predict-and-protect approach provides certain benefits when probabilities can be calculated and consequences can be determined with sufficient confidence. The benefits of the risk-based approach are generally focused on, and sometimes limited to, reducing negative consequences. The risk-based approach fails when probabilities and/or consequences cannot be determined with sufficient confidence, or at all. The daily news highlights just how increasingly common it is for events to be unpredictable and/or have unfathomable consequences. With the world becoming increasingly interconnected with complex interdependent systems, these events are also causing cascading global consequences.

Nature is composed of innumerable complex interconnected and interdependent systems and is continuously experiencing unpredictable events with cascading consequences. How does nature survive and thrive under these conditions? Nature builds resilience. Resilience is the ability to recover to more-or-less the same state after a disturbance. Nature builds resilience into every level of every organism and system by embedding redundancy (functioning and responding in more than one way), being decentralized and distributed, and fostering diversity. The resilience-based approach not only allows recovery after unpredictable events, but also allows full leveraging of the unique individual and collective capacities of your workforce and extended value network and, as a result, becomes a driver for innovation.

Resilient: examples from nature



Resilience through dynamic diversity

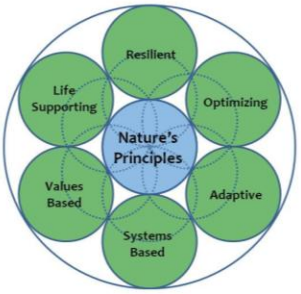
A healthy vibrant forest maintains a dynamic diversity of development stages within its ecosystem. Some parts of the forest are in a state of rapid new growth or re-growth, while others parts are maturing, and yet others are fully mature and ageing. There is continual cycling through these stages, with disturbances (such as fire or flood) driving release of resources which, in turn, lead to re-organization and re-growth. By maintaining constant cycling at different locations and at different scales of time and size, the forest is able to survive and leverage short term disturbances as well as long term change.

[photo from: http://t1.gstatic.com/images?q=tbn:ANd9GcRGWO98lvg514t94_PKK9Z0g3mciDqA5xYs8UXqy3qkotdaFS6]

Resilience through decentralization and distribution

Plants are the primary producers of nature. Photosynthesis is the mechanism that plants use to convert solar energy into forms of energy that become useable to the rest of us. Without photosynthesis, there would be no life as we know it here on earth. Because plants are absolutely crucial to maintaining life on earth, nature ensures that they, individually and collectively, are resilient. One of the ways nature is sure that something is always able to photosynthesize somewhere is to be sure that plants are decentralized and distributed throughout each ecosystem and across scales of time and size.

Resilient: examples from business



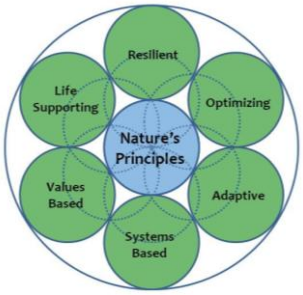
Resilience through the ability to respond in more than one way

In 2000 a fire at Phillips NV disrupted supplies of computer chips to Nokia and to its competitor Eriksson. Nokia responded quickly by mobilising a global trouble-shooting team which secured all remaining spare capacity at Phillips and appointed alternative suppliers globally. By contrast Eriksson were unprepared for disruption and failed to react creatively were unable to secure alternative supplies. As a result, within 6 months of the fire Nokia had taken 3% of the global mobile handset market away from Eriksson, attributing this success to its speedier recovery from disruption.
http://www.resilience-engineering.org/RE3/papers/Stolker_Karydas_Rouvroye_text.pdf

Resilience through decentralization and distribution

In early 2008, before the global recession, Tata predicted there would be an imbalance in the soda-ash market following the Beijing Olympics and created a programme within its chemical division called ADAPT (Action plan for Downturn Alleviation and Profiting in Turbulence). When the global financial crisis started the programme's scope was extended across all divisions with a remit to strengthen the group's cash position via cost control. Tata deliberately empowered its employees to be part of the solution by integrating them fully into the ADAPT programme. Apart from the intended improvement in cost control, Tata now benefits from a strong workforce who have gained experience by facing bad times and who have learned through being part of the solution.
http://www.tatachemicals.com/media/interviews/201001jan/201001_human_touch.htm

Optimizing



Optimising delivers better -- and more -- results than simply maximizing or minimizing.
Nature optimises by:

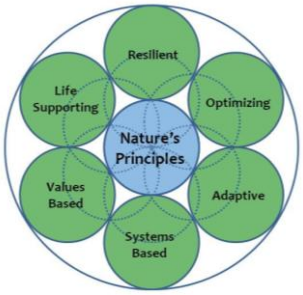
- Creating forms that fit functions, not the other way around
- Embedding multiplicity into both functions and responses
- Creating complexity and diversity using simple components and patterns

Most organizations measure performance based on the simple and easy-to-measure metrics of money and time, and are driven to maximize (profit, productivity) and minimize (cost, time-to-deliver). Most also expect people (from employees to clients) to function using pre-determined forms – whether it be a product, process, policy, or structure. Because each person and situation is unique, we experience frustration when trying to function with a form that doesn't work well for us. The maximizing/minimizing approach can generate easily measureable benefits, but also generates less easily measured costs – and creates blinders and blockages to far greater potential benefits.

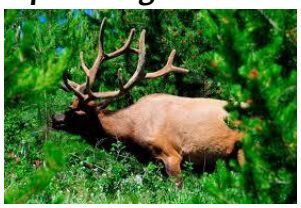
In Nature, evolution has honed every form – from material structures to shapes to organizational systems – to optimally perform many functions. Nature recognizes that designing for superlatives -- biggest, smallest, fastest, strongest – actually limits functionality, particularly multi-functionality. Nature also ensures that each component and system – as well as whole organisms and systems –is designed to perform multiple functions. Nature accomplishes elegant multiplicity of efficiency and effectiveness by optimizing across and among all components, organisms, and systems. The benefits here are obvious –one component that can do several jobs simultaneously is far better than needing several different components, each of which is maximized for one function.

Science and technology tends to strive to create ever more complicated compounds and components to create the complexity and diversity we seek. Nature, by contrast, creates all of the immeasurable diversity of life with only a handful of molecules and following instructions embedded in only 4 base pairs that make up DNA. You and me and a piece of lettuce were not only created from the same basic parts (carbon, nitrogen, hydrogen, oxygen, phosphorus, sulphur, calcium, and magnesium, plus a few others), we were also created using essentially the same set of instructions.

Optimizing: examples from nature



Optimizing rather than maximizing

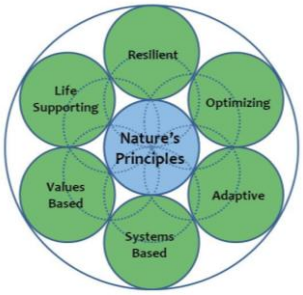


The stag with the biggest antlers will win the fight for the doe – unless its big antlers become entangled in branches before it makes it to the mating grounds. For the stag, maximizing antler size must be balanced against agility as well as the burden of carrying a heavier load. The rabbit with the biggest ears will hear the best thus be first to hear an approaching predator, but maximizing ear size will also mean that the rabbit is more easily seen. Rabbit ears are also sized for cooling and non-verbal communication. Evolution has found that the most successful stag antlers and rabbit ears are optimized –rather than maximized -- across all functions in order to be perfectly fit-for-purpose for the organism's unique location. [photo from: http://t1.gstatic.com/images?q=tbn:ANd9GcQyJe-ClkYeg-a3wCOvmKu-Kuh7jm6zeF_8j6Obmfi5PQPXA9EM]

Using more than one approach to get the job done

In sexual reproduction, a new organism is created by combining the genetic material from two separate parent organisms. This mixing provides opportunities for genetic mixing, diversification, and "hybrid vigour". In asexual reproduction, an organism can reproduce itself (creating a clone), which is much faster and uses far less energy than sexual reproduction. Most species stick to one or the other approach, but some optimize chances of reproduction by using whichever approach is most suitable given current conditions (an ability called heterogamy). For example, the freshwater crustacean *Daphnia* reproduces asexually in the spring to rapidly populate ponds, and then switches to sexual reproduction as the intensity of competition and predation increases.
[photo from: http://t1.gstatic.com/images?q=tbn:ANd9GcR5hOq9x1cKFx8o_jl_1GmjPxYuouewnN39UYoj7qRbSvnRBwcQeA]

Optimizing: examples from business



Fitting form to function -- the right structure for the right circumstances

After trying public ownership briefly in the 1980's, Virgin's owner – Richard Branson – decided that stock market obligations and shareholders' pressure for short-term profits did not suit the business. Back under private ownership Virgin has thrived as a decentralised conglomerate of loosely linked autonomous teams making business decisions appropriate to their local conditions, but also able to access the benefit – when needed – of scale and cross-fertilisation within the wider Virgin group of companies. Branson himself says "Contrary to what some people may think, our constantly expanding and eclectic empire is neither random nor reckless. Each successive venture demonstrates our devotion to picking the right market and the right opportunity". Virgin's resulting low business failure rate demonstrates that Virgin has skilfully optimised its structure and investment strategy.
http://www.virgin.com/about-us/

Deriving multiple benefits from resources

Adnams uses practices inspired by nature to solve their sustainability challenges. By building its brewing depots from Hemcrete, Adnams leverages natural temperature regulation at a constant 11˚C above and beyond the structural functions of the building. With the addition of two solar panels and other functional improvements a square metre saving of 55% of electricity and 30% of gas have been obtained. The UK's largest living roof on Adnams' distribution centre provides natural insulation, a means of grey-water capture and a natural habitat. By choosing resources carefully and using them cleverly it is possible to derive multiple benefits per unit of resource input.
http://preview.tinyurl.com/3cdfmev

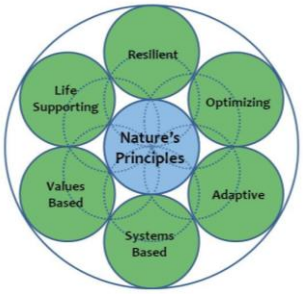
Operating with closed loops

B9 and its business ecosystem have established a Clean Port Power Network that aims to improve the air quality in ports. This is achieved by harnessing waste outputs and converting them into valuable inputs elsewhere in the value chain. For example, waste from cruise liners is converted by B9 into biogas which is used by B9 (and other operators) to power their engines. There have been resulting savings in fuel and waste management costs and new revenues gained by selling surplus energy to the national grid.
http://www.b9energy.com/B9Shipping/tabid/4036/language/en-US/Default.aspx

Adaptive

Being adaptive pays back better than "staying a fixed course". Nature adapts by:

- Creating feedback loops to sense and respond at all levels of the system
- Anticipating and integrating cyclic processes
- Being resourceful and opportunistic when resource availability changes

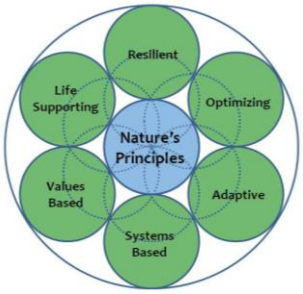


Technologies, cultures, politics, resource availability, populations, and even climates are changing at ever-increasing and sometimes alarming rates [for examples, see http://www.worldometers.info/]. In times of radical and unpredictable change, organizations have two choices: adapt or die. Those that attempt to protect against change and "stay the course" with pre-determined plans, policies, and strategies will suffer and perhaps fail. To survive and thrive, successful organizations of the future need to be able to sense changes in conditions, context, and systems and respond quickly and appropriately at all levels. With the increasingly complex and interconnected world, this can seem a daunting task.

Nature has survived radical as well as long-term changes in conditions and context over the past few billion years (droughts, ice ages, meteor hits, tsunamis, volcanic eruptions...) by continuously sensing, responding, adapting, and evolving. Organisms and systems are able to adapt by embedding effective responsive feedback loops at all levels and scales, by anticipating and becoming part of cyclic processes and by opportunistically leveraging resources based on availability.

Nature doesn't resist change, resist the flow, or even just "go with the flow" -- it is the flow. Instead of building responsibility, nature builds "response-ability". Instead of focussing on survival of the fittest taken to mean the strongest/biggest/toughest, nature focuses on survival of the fittest, meaning the one who is best at fitting, best at being able to adapt and to fit into new conditions and context.

Adaptive



Case studies from nature:

Adaptive Leadership

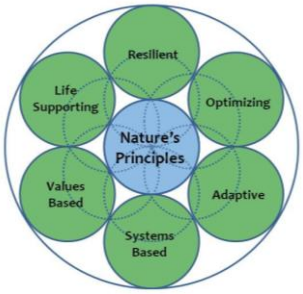
Geese fly in a v-formation in order to minimize the collective effort of flying over a long journey, with each goose benefitting from the draft of the goose in front. The goose at the front – the leader – not only does more work than all the others but also knows where to fly. At some point in the journey, the lead goose will tire and/or no longer know the way and will fall back, letting a fresh goose take over – one that is both strong enough and that knows that part of the journey. Not all geese in the formation will lead – some are simply not strong or knowledgeable enough. This rotating leadership, a form of heterarchy, means that at any given point in the journey the leadership is always fit for purpose. [photo from: http://t3.gstatic.com/images?q=tbn:ANd9GcTGAOmqlOC0H6jiPoI8wBoH-HH79wr30rer0Gj-Z60-Lnx6AAU62w]

Fit-for-purpose

"Survival of the fittest" is often taken to mean survival of the biggest/strongest/fastest, when in fact it means that organisms that are best at fitting – best at adapting to their environment – are most likely to survive. Evolution has led to innumerable examples of unique adaptations, some of which are quite curious. The reef squid uses chromatophores in its skin to rapidly change its own colour to match its environment, successfully camouflaging itself as it swims around. [photo from: http://to.gstatic.com/images?q=tbn:ANd9GcRfj_HokMjLC2UgT1pBPXqDcgYHWa-5zqwszs1SY1P_S9VEj5fY }

Adaptive

Case studies from business:



Resourceful and opportunistic

Adnams Southwold (UK brewer) believes that doing the right thing makes good business sense. In 2010 an anaerobic digestion plant was opened using waste from their brewery and from local food suppliers to make bio-methane (the equivalent of up to 4.8m kw-hours per year) which powers Adnams' buildings and fleet of lorries. Surplus bio-methane is injected into the UK's national gas network. A second production by-product – liquid organic fertiliser – is distributed to local barley growers thus creating a closed production loop.
http://adnams.co.uk/news/environment/adnams-bio-energy-the-first-renewable-gas-to-grid-anaerobic-digestion-plant

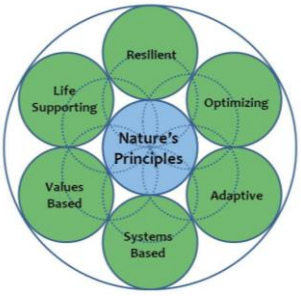
Embracing innovation

Ranked 17th in Bloomberg Businessweek's "World's most innovative companies 2010", Tata takes innovation so seriously that it has developed a tool called the "innometer" to spark and nurture innovation and ultimately to build and foster a culture that encourages new idea generation and implementation. Specifically, the innometer provides a means of measuring the rate and quality of innovation, it helps to mainstream innovation into core activities and to integrate creativity into corporate culture.
http://www.tata.com/media/articles/inside.aspx?artid=1pPYF0M8Bc4=

Creating new ways to do business

Unilever has created a new approach to doing business in rural areas of India by developing micro-enterprise programmes that create opportunities for women to sell Unilever products door-to-door in local communities. There are now approximately 60,000 entrepreneurs selling its products to millions of households in a largely untapped but hard-to-reach market. The scheme provides employment for under-privileged rural women who become local ambassadors for the Unilever brand and product set, selling via personal relationships they develop with rural householders. The approach offers Unilever a low-cost and low risk opportunity to test an unknown market whilst also delivering CSR benefits.
http://www.hul.co.in/sustainability/casestudies/enhancing-livelihoods/Shakti.aspx

Systems-Based



With reduced resources and a changing environment, it's better to be systems-based rather independent. Nature works with whole systems by:

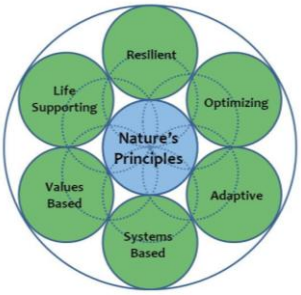
- Fostering synergies within communities
- Fostering synergies within energy, information and communication networks
- Creating extended systems to continuously recycle wastes into resources

Reductionism is based on the assumption that a complex system is nothing more the sum of its parts, and seeks to explain complex things by reducing them to simpler parts and interactions. When faced with increasing complexity, most of us will seek a reductionist approach – we seek to simplify and reduce a complicated problem into parts that are small enough for us to understand and address. This can be a great strategy for some challenges, it is insufficient when understanding, addressing, and leveraging the complex interdependent interconnected systems in which all organizations operate.

Nature is composed on innumerable complex dynamic interactive interdependent systems. Nature, through evolution, has found that functioning as an active part of a system is more efficient and effective than attempting to function as an independent and strictly competitive organism. In nature, each organism can rely on the system to perform many crucial functions – and conversely, each organism provides crucial functions for the system while focussing on its own self interest. In gathering nectar from a flower for its own self interest, a bee provides a crucial step in reproduction of that plant. Your body only needs to house half of your respiratory system, the half that takes in oxygen and eliminates carbon dioxide – you rely on nature's plants for the other half, the half that takes in carbon dioxide oxygen and provides you with oxygen.

Systems in nature are based on networks of relationships that allow continuous cycling and recycling of energy, materials, and information in such a way as to benefit each participant while benefitting the whole system.

Systems-Based



Case studies from nature:

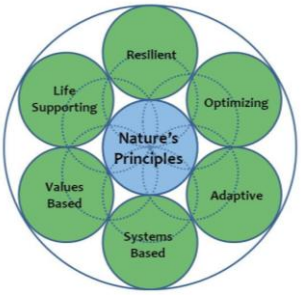
System-focused and Self-focused

A small patch of grass contains hundreds of one type of organism living in the same location with the same resource needs. Each blade of grass must be self-focused to survive, competing with its many neighbours for the limited resources available. Yet evolution has led to all these blades of grass living together more successfully as a system than as individuals spread out over the landscape, so each must also be systems-focused. Every organism that lives in close association with many others – be it forests, swarms, or schools – has found success by being both system-focused and self-focused. This works so well because whatever the organism does to benefit itself also benefits the system, and by working to benefit the system it also benefits itself. [photo from: http://www.faqs.org/photo-dict/photofiles/list/116/2609grass.jpg]

Making the system work for you

Many organisms benefit from their systems-based approach by creating conditions that allow the system do work for them. The familiar mushroom shape serves many purposes, one of which is to act as a aerofoil. As the wind blows by, the combination of the rounded top and flat bottom creates a 'lift' effect on the downwind side of the mushroom. The wind, combined with the lift, helps distribute the tiny spores that are housed in the protective underbelly of the mushroom much farther yet with no energy expended by the mushroom itself.

Systems-Based



Case studies from business:

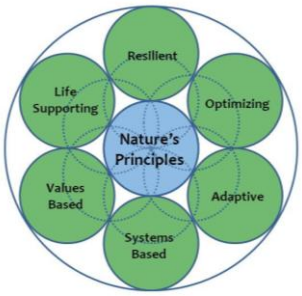
Harnessing the power of systems-thinking

Employees within Unipart are able, at any time, for form a quality circle with other staff members from all levels and parts of the Group who possess the skills and/or knowledge required to deliver the objectives of that particular circle. Within Unipart these are called "OCC" circles, with "OCC" standing for "Our Contribution Counts". Unipart clearly believes that system-thinking offers benefits greater than the sum of its parts and actively empowers the circles to deliver change, innovation and resilience. The programme has also been extended to Stakeholder Circles which enable employees to work collaboratively with suppliers, customers and communities on issues such as environmental concerns, quality and customer service.
http://unipart.oxi.net/Home/AboutUnipartGroup/OurContributionCountsCircles/tabid/83/language/en-US/Default.aspx

Leveraging mutually beneficial relationships

Interface recognises that its ability to provide the highest possible value to society is heavily dependent upon its relationship with stakeholders, including employees, customers, investors, suppliers and the communities in which it operates. Interface develops mutually beneficial relationships with its stakeholders that deliver competitive performance, meet customers' needs and also deliver the targeted improvements in sustainability. Inspiration, communication and consultation are the primary methods of developing and maintaining healthy relationships within a broad yet integrated business ecosystem.

Values-Based



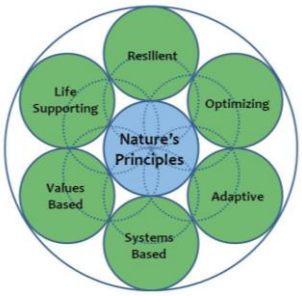
In uncertain times, it's better to be based on a compass of values rather than a set of pre-defined metrics or fixed destination point. Nature reflects values by:

- Knowing what's really important to the communities in and with which you live , interact, and impact
- Putting values at the core and using values to drive towards positive outcomes
- Measuring what is valued rather than valuing what is measured

"All's fair in love and war" and "The end justifies the means" are concepts that dictate the behavior of many organizations, particularly in times of uncertainty and stress. Strategies based on these concepts may be successful in the short term, but they inevitably damage the system's capacity to support the organization and/or damage the organization's internal capacity to support itself. Being values-based requires knowing what is deeply and fundamentally important to you, your organization, and the communities in which you live, operate, and impact. Being values-based means understanding and then always driving towards collective positive outcomes. It requires measuring what you value, rather than valuing what is easily measured.

Values in nature are different from human values. Rather than being founded on explicit ethics or moral codes, in nature values are implicit and founded in collective survival – which can mean collective survival of the family unit, the species, the ecosystem, or the entire collective of life on earth. Being values-based in nature means being attuned to and aligned with the ecosystem and each unique organism within it. In nature, everything plays a role in moving towards common positive outcomes.

Values-Based

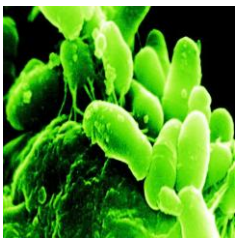


Case studies from nature:

Looking out for each other to support the species

Predators and disease function to cull the weak and feeble from a population, thus keeping the collective population healthier; however, in some of nature's organizations, even the wounded or weak are valued and the organization will work to ensure their survival, too. Baby elephants are dependent on their mothers for many years – they drink their mother's milk for at least 4 years. If a baby elephant is orphaned, it will be adopted by one of the family's lactating females or suckled by various females. When danger is sensed, the mothers collectively circle around all young to keep them well protected. Even older elephants that are sick and wounded will be cared for by the group. [photo from: http://imagecache2.allposters.com/images/NGSPOD04/109871.jpg]

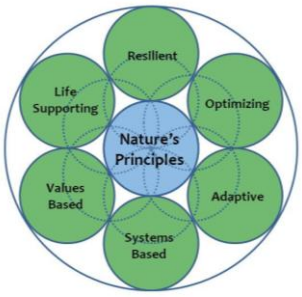
Mutualism



It is argued that there is no "altruism" in nature; however, nature is full of one organism or species thriving by taking care of one another. Within the typical human body, there are more non-human cells than human cells, mostly due to the large numbers of beneficial bacteria that live in our guts. Without these little helpers, we would be unable to extract crucial nutrients from the foods we eat. We happily feed them and they, in turn, happily feed us. [photo from: http://microbewiki.kenyon.edu/images/f/fa/Bifido_on_colon.jpg]

Values-Based

Case studies from business:



Merging corporate and personal moral principles

Adnams believes that moral principles should be continuous between work and personal life. It has designed its corporate structure to maximise employee engagement and it encourages the integration of personal morals into the principles driving the company. Adnams works closely with its entire value chain (customers, employees, suppliers, community etc) to ensure that the chain's impact on society is positive and has built its corporate brand upon its excellent CSR performance.

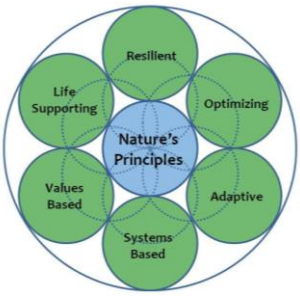
Provide employees with conditions in which to positively thrive

Innocent has deliberately nurtured a non-corporate, entrepreneurial ethos with a strong environmental and social conscience that attracts top people to the business. In fact Innocent has been named The Best Workplace in the UK by both The Guardian and The National Business Award. Employees are encouraged to develop their professional capabilities via a range of scholarships, become deeply integrated with the business via company meetings and an annual nature weekend and also benefit from a range of benefits that optimise the work/life balance, improve health and nurture team-spirit.
http://www.innocentdrinks.co.uk/careers/your_career/life/

Nurture trust and communication

SAS consistently rates as one of Fortune's "Best Companies to Work for" in large part because they nurture trust and communication between employees and management. Employees are empowered rather than monitored, given great equipment to work with and permitted to try new things. The company keeps its employees happy and healthy by trying to limit stress:- it encourages staff to limit working hours to 35 per week and provides excellent recreational and health benefits. Staff turnover is much lower than industry average (at 4% vs 20%) saving an estimated $70m annually.
http://tinyurl.com/3j9kwed

Life-Supporting



In the long run, it takes less effort and less resource to support life-building activities than to be damaging or toxic and pick up the cost later. Nature supports life-building activity by:

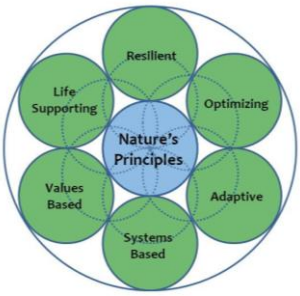
- Making products water-based, renewable, bio-based, and biodegradable
- Leveraging information and innovation rather than energy and materials
- Creating support for individual components that can support the whole ecosystem, and support the ecosystem so that it can support the individual.

We all recognize (or should at least) the benefits of manufacturing and disposal that emulate or are aligned with natural processes. If we only manufacture products using water-based chemistry and renewable, bio-based, biodegradable and otherwise sustainable materials then we can eliminate most of the problems of waste, pollution, toxicity, global warming, etc. If we design leveraging information to accomplish functions, rather than materials and energy, we can dramatically reduce the negative impacts of both products and manufacturing. That part makes simple sense.

What is less obvious is how vitally important it is for us, as humans and organizations, to be fundamentally life-supporting in everything we do. Humans are part of life, part of nature. We are intimately, intricately, incessantly part of all of life on earth, and when we are life-supporting we are not only supporting nature, we are supporting ourselves – and, of course, the reverse is true. Life has managed to survive on earth for billions of years because life creates conditions conducive to the continuation of life.

Life-Supporting

Case studies from nature:



Interconnected and Interdependent

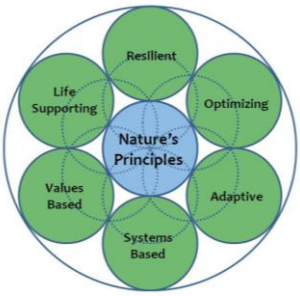
Your body is a healthy successful organism because it is life-supporting with and within the ecosystems in which you live. Your body is a unique organism, with the boundary of your body defined by your skin. You have your own set of organs, your own mind, and – from a biological point of view – are free to move anywhere you like. But you are completely interconnected with and interdependent on, supported by and supportive of, the rest of life on earth. Every molecule of your body has been recycled countless times through countless living things over the past 3 or 4 billion years. With each breath, you take in 10 sextillion atoms that were previously exhaled by every person that has ever lived. Your metabolism is completely dependent on the bacteria that you host in your gut – in fact you have more bacterial cells in your body than human cells.
[photo from: http://t2.gstatic.com/images?q=tbn:ANd9GcTK07arvajhMbiLX6ErCzBoKhF8xF8rFGZfrIZASe-fKvBEuTqR]

Life-Friendly manufacturing

When organisms in nature manufacture the materials they need, they use water-based chemistry, locally available and abundant ingredients, generate no waste, and need no massive amounts of external energy. One familiar example is spider silk. On a weight-for-weight basis it is far stronger than steel yet is made from ingredients like dead flies. Sea shells can be far stronger than man-made ceramics, yet require no mining and no kilns, relying instead on the self assembly of calcium carbonate within a protein matrix.
[photo from: http://t2.gstatic.com/images?q=tbn:ANd9GcSZTrBGDGNH5wVYD-E6wsCURKLEiDjQMuSH1qLzDYuJ45r_wYiT4w]

Life-Supporting

Case studies from business:



Having a net positive impact

Interface's "Mission Zero" has placed sustainability at the core of the business and aims to deliver full sustainability by 2020. The eventual aim is not just to avoid negative impacts caused by their people, products and processes but ultimately to have a positive impact by restoring the environment in greater measure than it consumes resources. "Mission Zero" is amongst the most ambitious projects of its kind and demands that Interface considers itself to be an integral part of the natural environment in which it operates as a business and in which its human elements survive. Since starting this initiative sales have increased by two-thirds and profits have doubled in line with Interface's corporate vision of "doing well … very well … by doing good".
http://tinyurl.com/2609b5t

Create abundance for societies in which the business operates

Tata has a long history of philanthropy and today 65% of the main holding company is owned by charitable trusts. Tata companies have always believed in returning wealth to the societies they serve by extending social welfare activities to communities around their industrial units, by providing aid to NGO's working in the areas of education, healthcare and employment and also by creating national institutions for science and technology, medical research, social studies and the performing arts. The combined expenditure as a force for good amounts to around 4% annually of Tata Group's net profits.
http://www.tata.com/aboutus