Sustainable Solutions Workshop

July 15, 2015 - Webinar #5

Agenda:

- ✓Intent of Class
- ✓iSite sharing
- ✓IBD review
- ✓Life's Principles
- ✓Evaluating your Design
- ✓Using a systems approach
- ✓Update on in-person session
- ✓Team Homework for in-person session
- ✓Phone meeting options
- ✓September report-out webinar
- ✓Questions and comments

iSite – Survival

“It has yet to be proven that intelligence has any survival value”.

Arthur C. Clark

Integrate Biology into Design

How to incorporate biology into the creating phase:

- **Biologize the question**
- **Discover natural models**
- **Abstract design principles**
- **Emulate the best models** and
- **Thank Nature**

Integrating Biology into Design
Abstracting

The abstracting steps:

1. distilling the biological mechanism
2. translating them into design principles

Abstracting is one of the most critical components of practicing biomimicry and also one of the most difficult.

Integrating Biology into Design

Creating: an exercise in pursuing creative design solutions for your challenge.

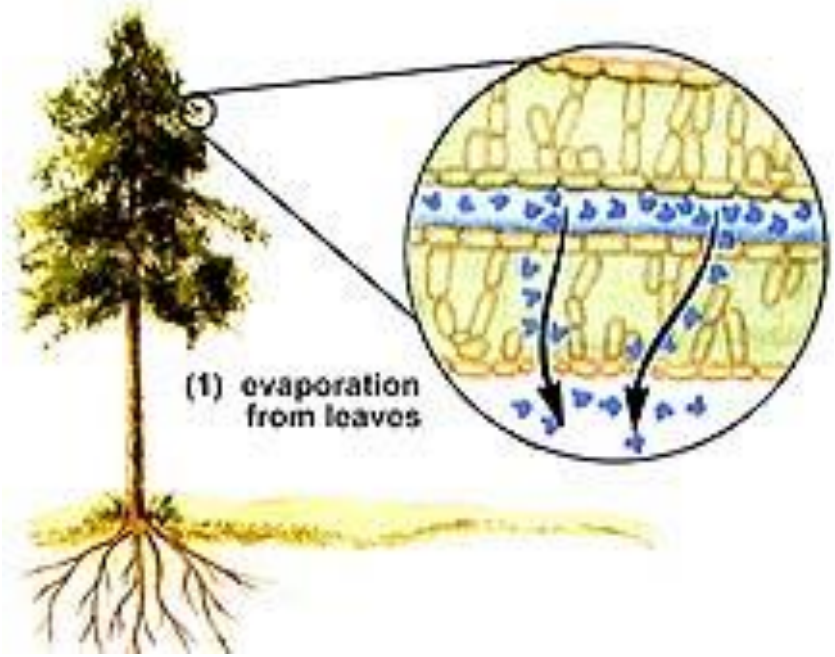
Brainstorm:

- Ideas from abstracted biological strategies
- Design concepts form Life's Principles
- Techniques for translating biological concepts into design

What are Life's Principles?

- Powerful strategies for survival
- Important tools for strategic design
- What biomimics use to both drive and evaluate the sustainability and appropriateness of our designs.

Grooves on spikes of thorny devil lizard provide drinking water by drawing condensed dew to mouth by capillary action. (Asknature)



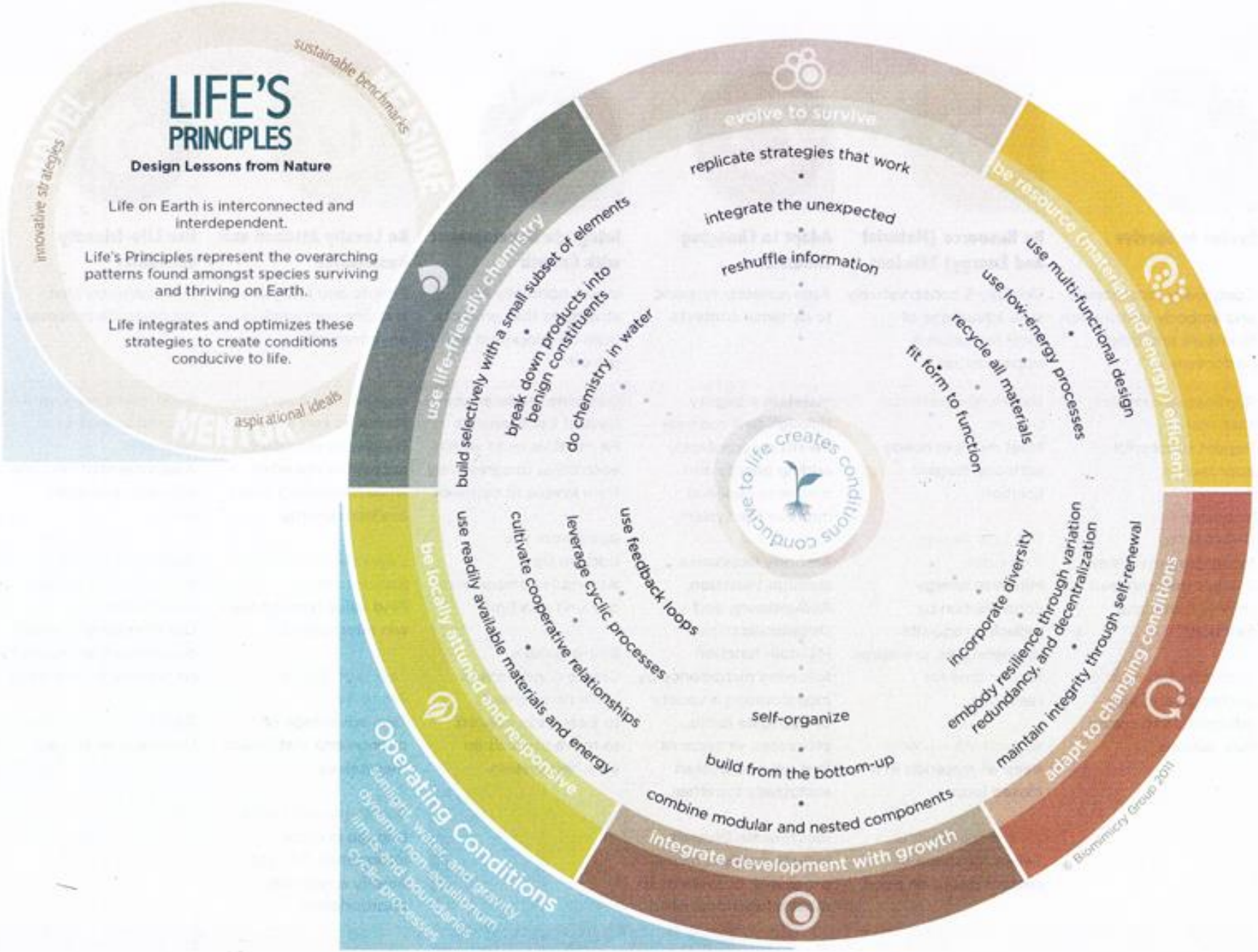
Capillary Action

Seeds of Biomimicry

To succeed at biomimicry requires a kind of mindset, a connection to nature and a guide.

The practice of biomimicry embodies three interconnected but unique realms:

ethos
(re)connect
emulate


innovative strategies
sustainable benchmarks
LIFE'S
PRINCIPLES
Design Lessons from Nature
Life on Earth is interconnected and interdependent.
Life's Principles represent the overarching patterns found amongst species surviving and thriving on Earth.
Life integrates and optimizes these strategies to create conditions conducive to life.
aspirational ideals
evolve to survive
replicate strategies that work
integrate the unexpected
reshuffle information
be resource (material and energy) efficient
use multi-functional design
use low-energy processes
recycle all materials
fit form to function
adapt to changing conditions
incorporate diversity
embody resilience through variation redundancy, and decentralization
maintain integrity through self-renewal
integrate development with growth
self-organize
build from the bottom-up
combine modular and nested components
be locally attuned and responsive
use readily available materials and energy
cultivate cooperative relationships
leverage cyclic processes
use feedback loops
use life-friendly chemistry
build selectively with a small subset of elements
break down products into benign constituents
do chemistry in water
life creates conditions conducive to
Operating Conditions
sunlight, water, and gravity
dynamic non-equilibrium
limits and boundaries
cyclic processes
© Biomimicry Group 2011

Life's Principles: Design Lessons from Nature

Life's Principles represent the overarching patterns found amongst species surviving on Earth.

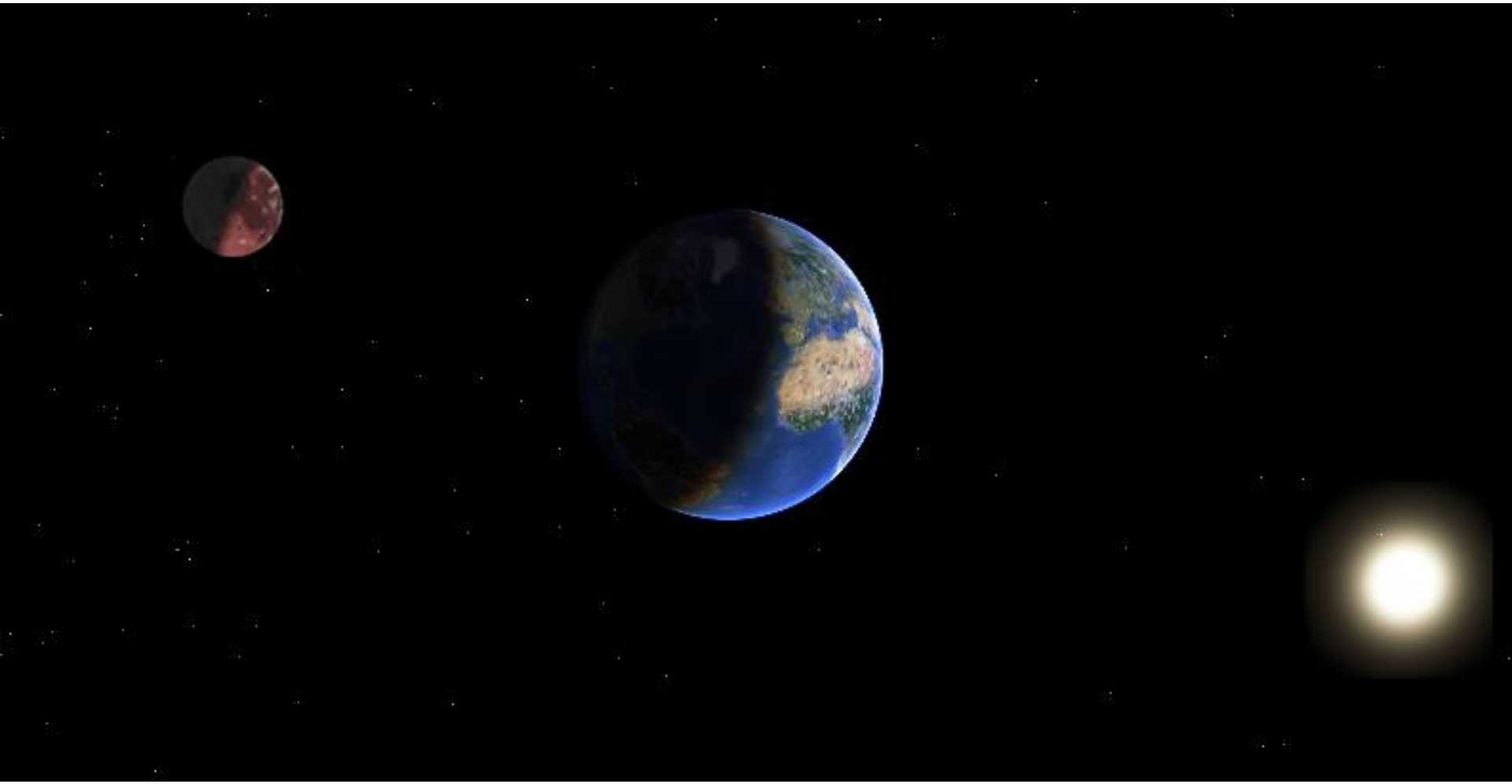
Nature as Mentor = Aspirational ideals

Nature as Model = Innovative strategies

Nature as Mentor = Sustainable benchmarks

LIFE CREATES CONDITIONS CONDUCIVE TO LIFE

Earth's Operating Conditions

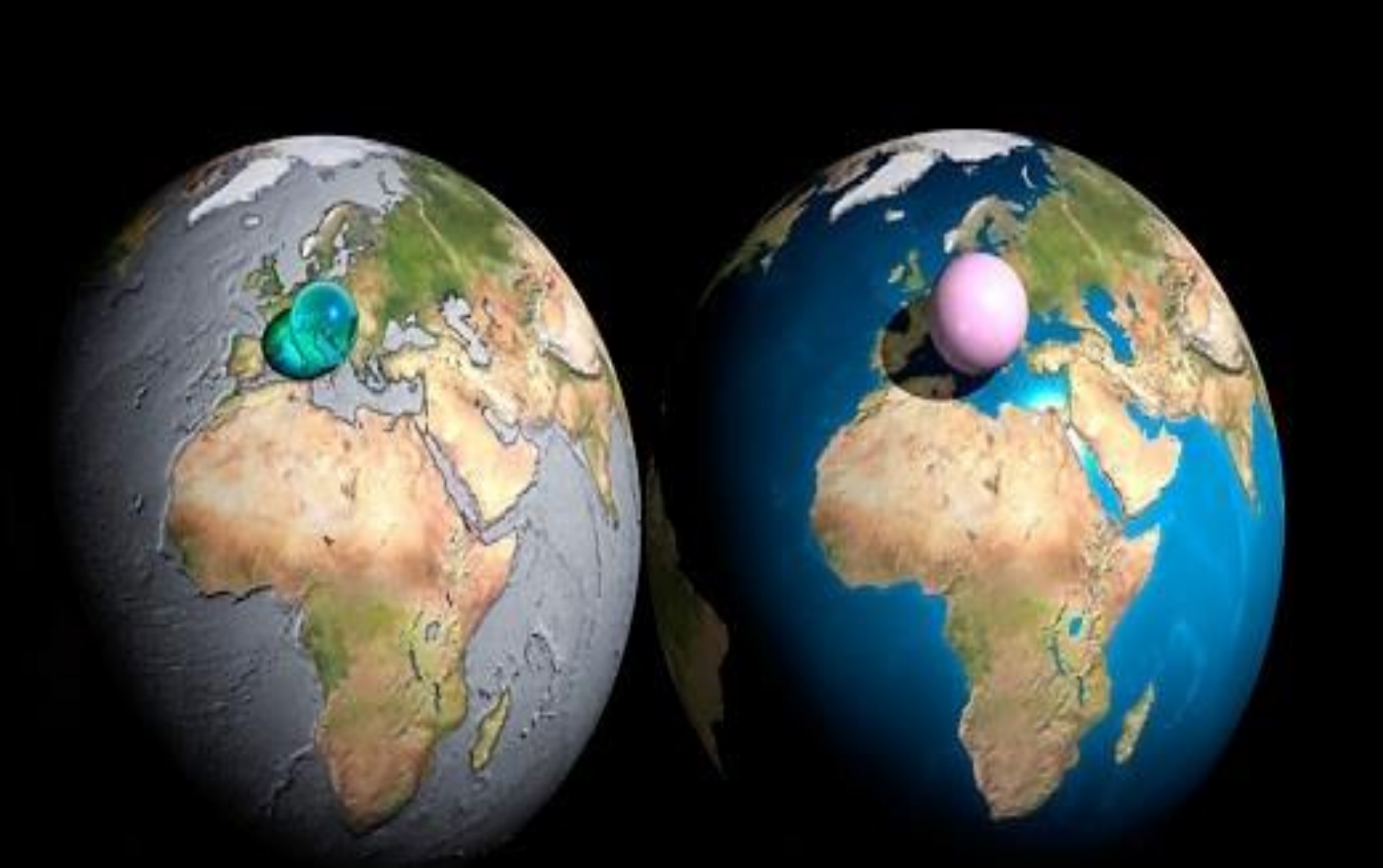


*sunlight
*limits and boundaries

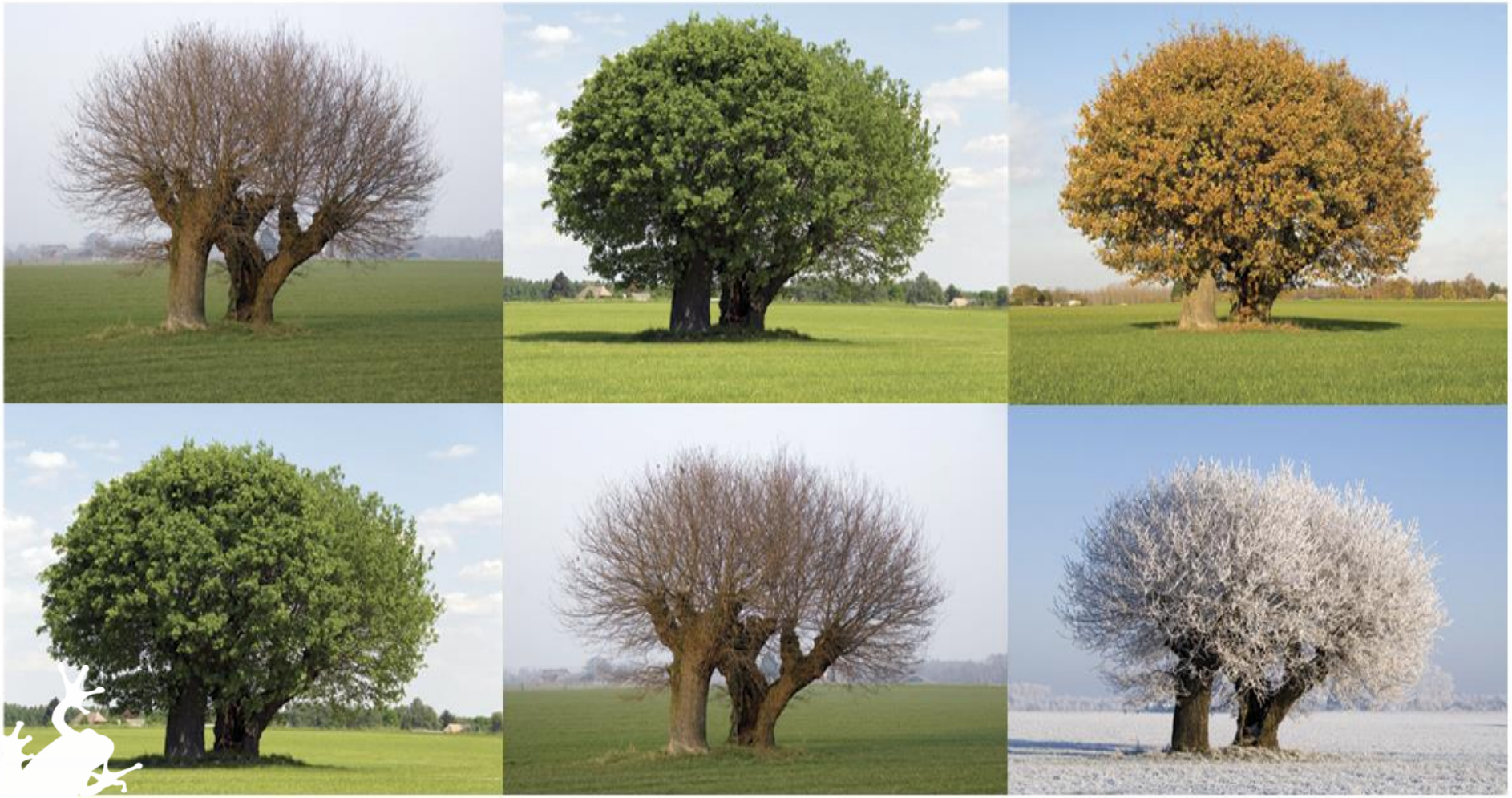
*dynamic non-equilibrium
*cyclic processes

Life is subject directly or indirectly to sunlight, water and gravity

Life is subject to dynamic non-equilibrium



earth is subject to limits and boundaries



life on earth is subject to cyclic processes

Biomimicry strives to emulate general patterns and processes found in Nature.
We refer to these as Life's Principles.

LIFE'S PRINCIPLES

Biomimicry DesignLens

Biomimicry.net | AskNature.org

Be Resource Efficient (Materials and Energy)

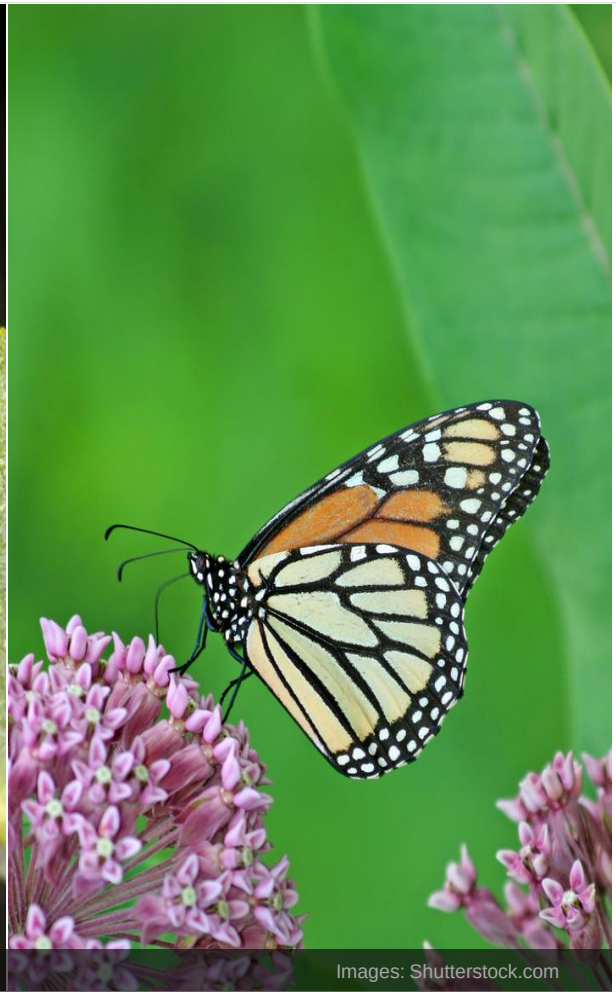
Skillfully and conservatively
take advantage of
resources and opportunities

Be Resource Efficient (Material and Energy)

Solar Home

Use Life-friendly Chemistry

Use chemistry that
supports life processes



Images: Shutterstock.com

Nature's Chemical Defenses

Use Life-Friendly Chemistry

Integrate Development with Growth

Invest optimally in strategies that promote both development and growth

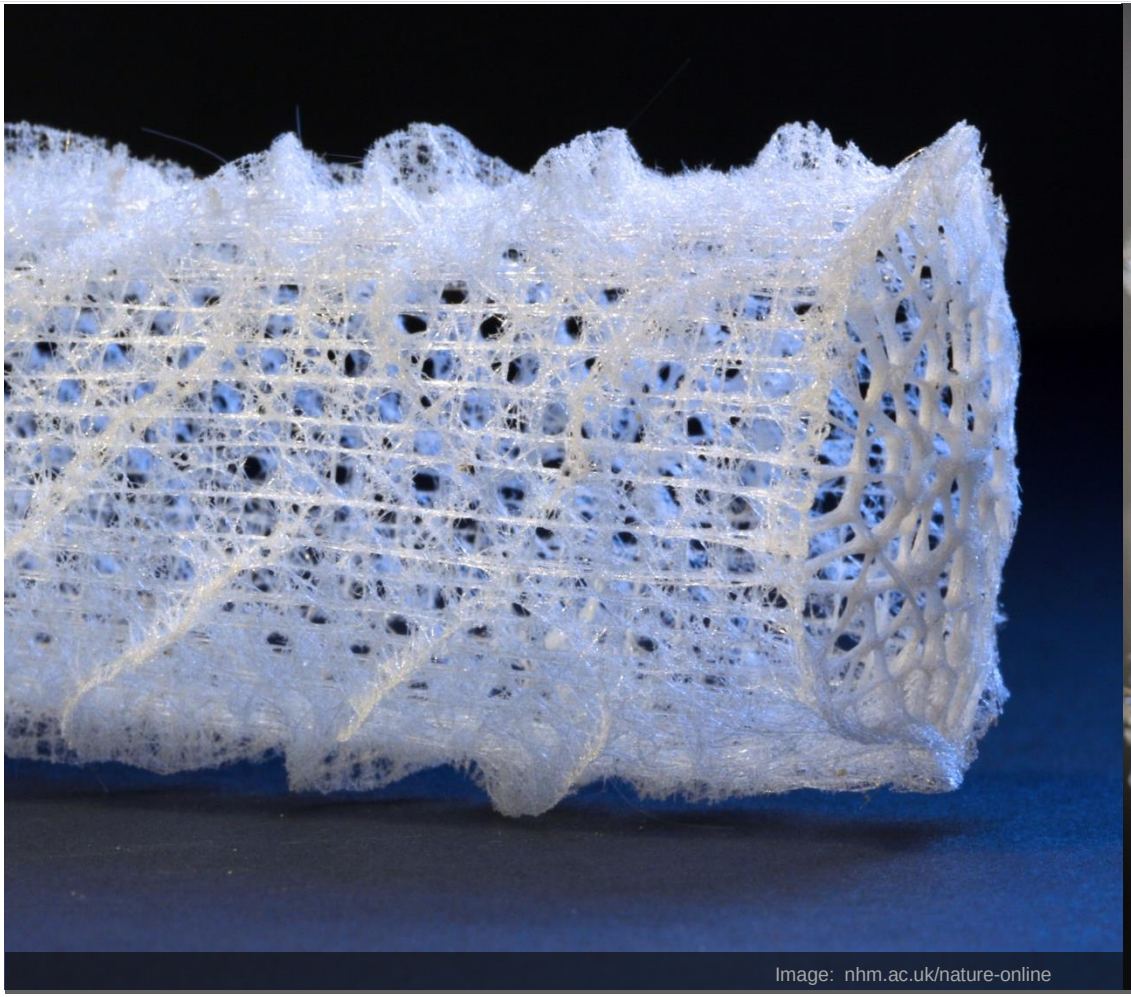


Image: nhm.ac.uk/nature-online

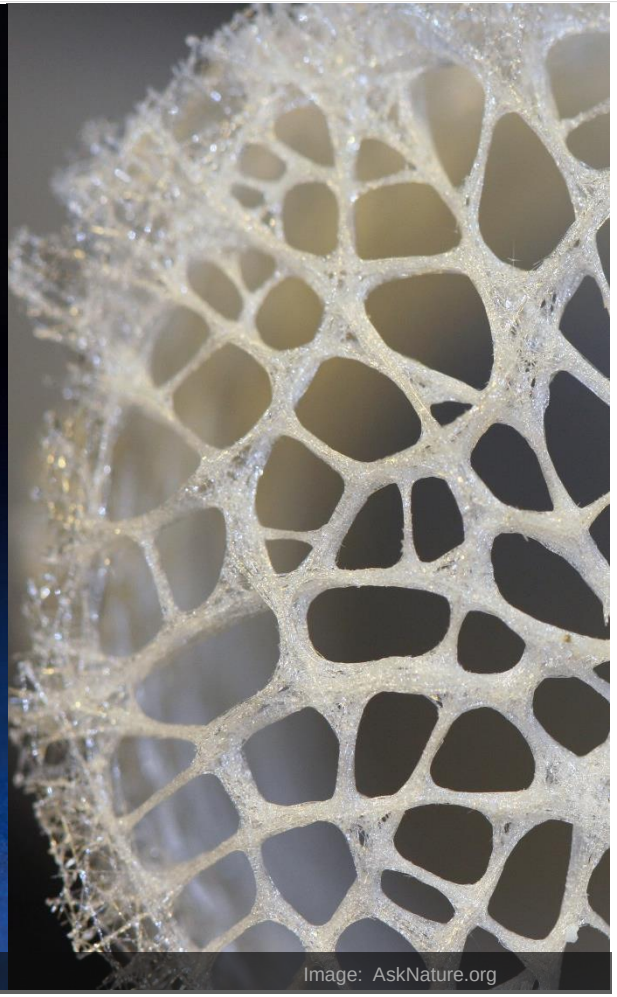


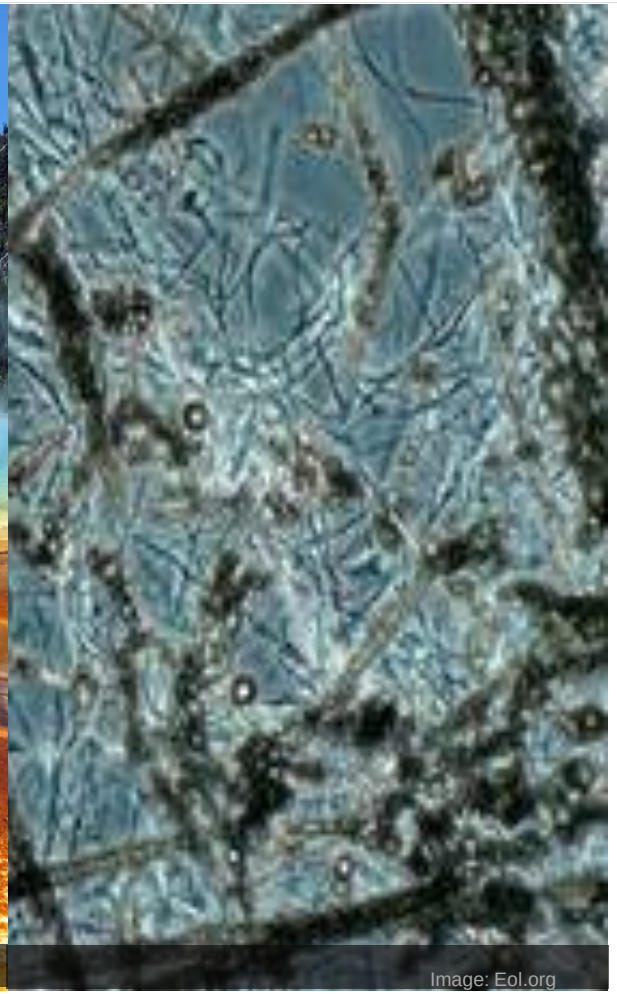
Image: AskNature.org

Glass Sponge from the Deep Sea

Integrate Development with Growth

Be Locally Attuned and Responsive

Fit into and integrate with the surrounding environment

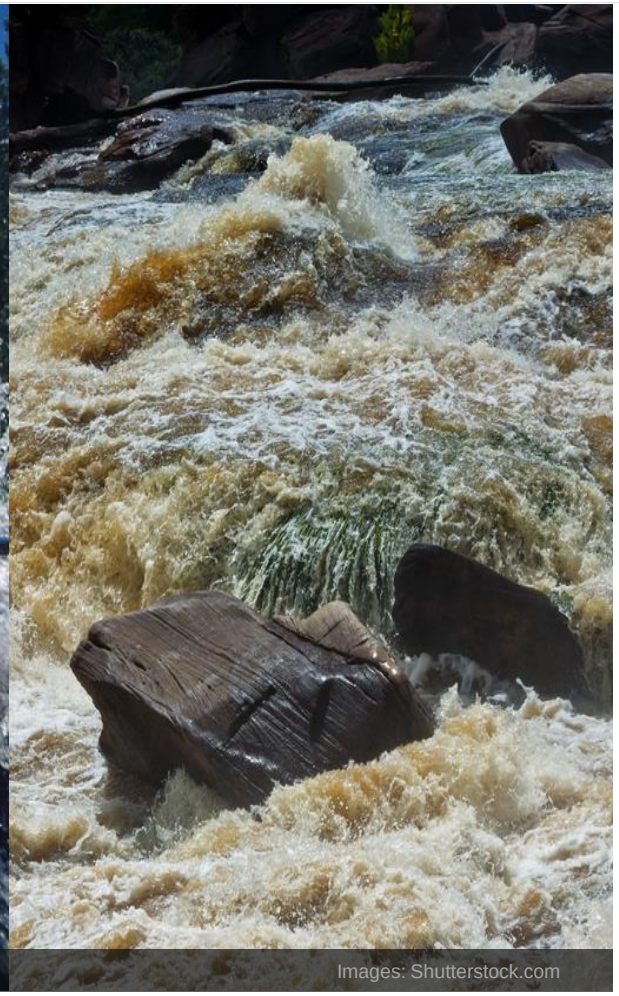


Extreme Bacteria

Be Locally Attuned and Responsive

Adapt to Changing Conditions

Appropriately respond to dynamic contexts



Images: Shutterstock.com

Go with the Flow

Adapt to Changing Conditions

Evolve to Survive

Continually incorporate
and embody information to
ensure enduring performance

Image: Diana Hammer, USEPA

Image: Milltownstatepark.org

Involve Stakeholders

Evolve to Survive

IBD - Evaluation

- Evaluate- an exercise to measure, evaluate, or estimate the nature, quality, ability, extent or significance of a particular solution.
- Evaluating using biomimicry is an innovative way for humans to critique their project's appropriateness.
- Evaluations with Nature as the measure provide higher standards than conventional measuring tools – since they are based on natural models

How to Evaluate using Nature

- Life's Principles are the primary metric, looking for the ecological feasibility of the proposed solution:
  - ✓Does the design fit within the earth's operating conditions?
  - ✓ Does it draw on deep patterns and principles of the natural world?
  - ✓Will the design function like the other 30 million species alive today?

Life's Principles Checklist

- ❑ Evolve to survive
- ❑ Be resource (material and energy) efficient
- ❑ Adapt to changing conditions
- ❑ Integrate development and growth
- ❑ Be locally attuned and responsive
- ❑ Use life-friendly chemistry

"After 3.8 billion years of evolution, nature has learned what works, what is appropriate, and what lasts here on earth."

Janine Benyous

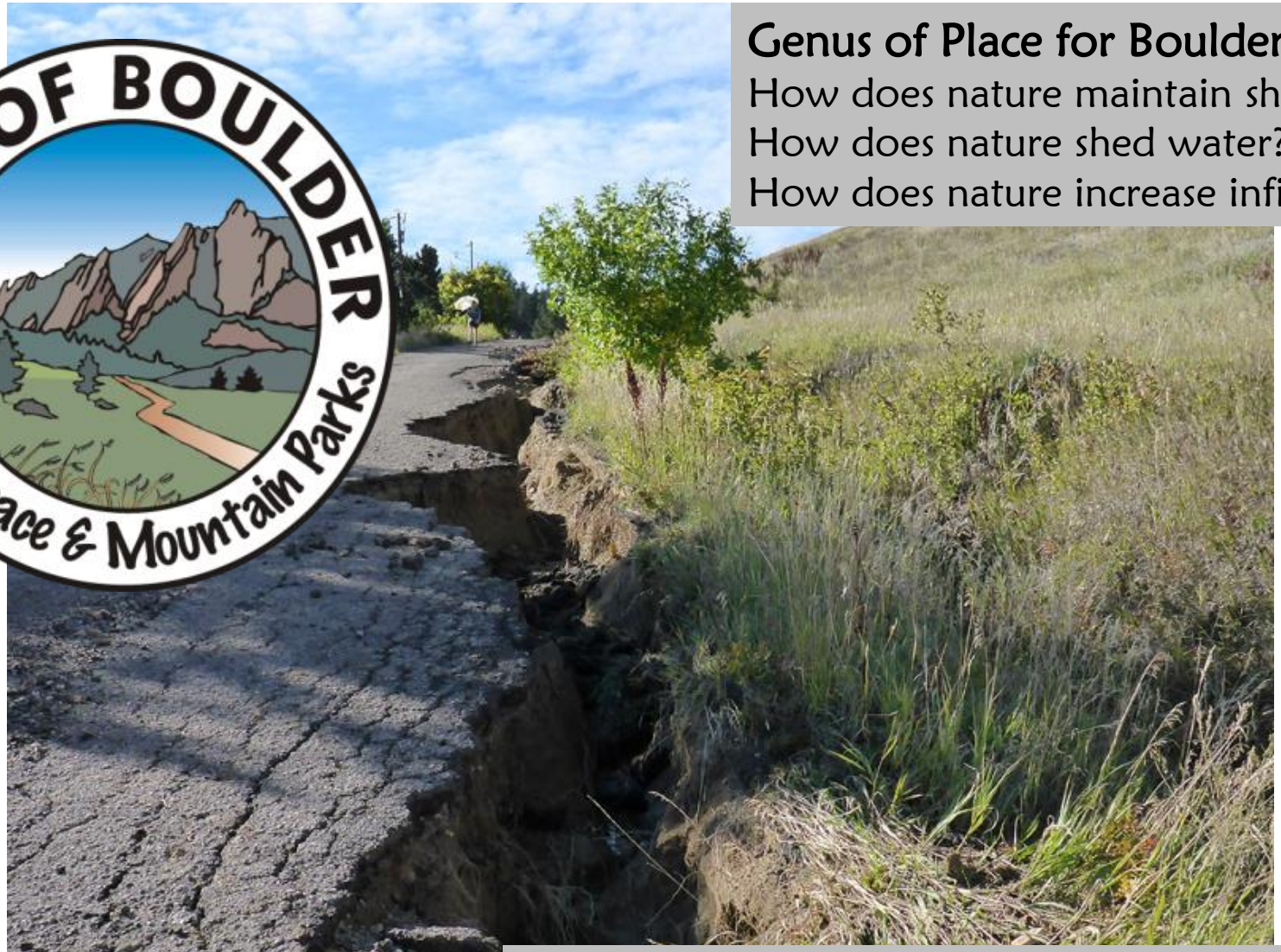
Why Integrate Biology into Design?

- Benefits of Evaluating:
  - Identify missed limits and opportunities
  - Pre-test for success
  - Asks *"What Would Nature Do?"*

- A biology-based evaluation would improve the evaluating stage by bring survival strategies that are important in the natural world.

Genus of Place for Boulder OSMP

How does nature maintain shape
How does nature shed water?
How does nature increase infiltration?

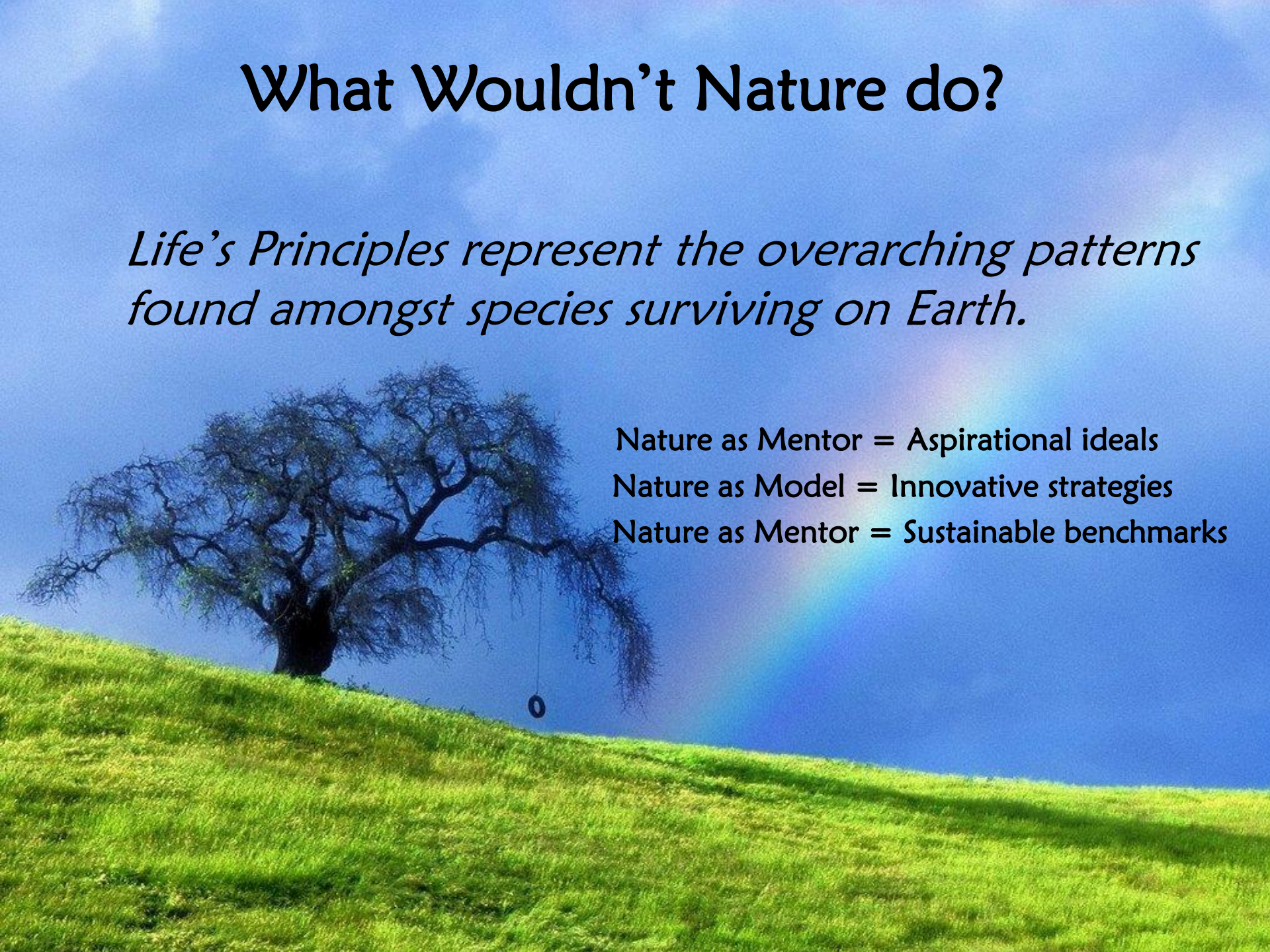


Evaluate using LPs:

- Use life friendly chemistry
- Use readily available materials & energy
- Incorporate diversity
- Combine modular and nested components

What Wouldn't Nature do?

Life's Principles represent the overarching patterns found amongst species surviving on Earth.



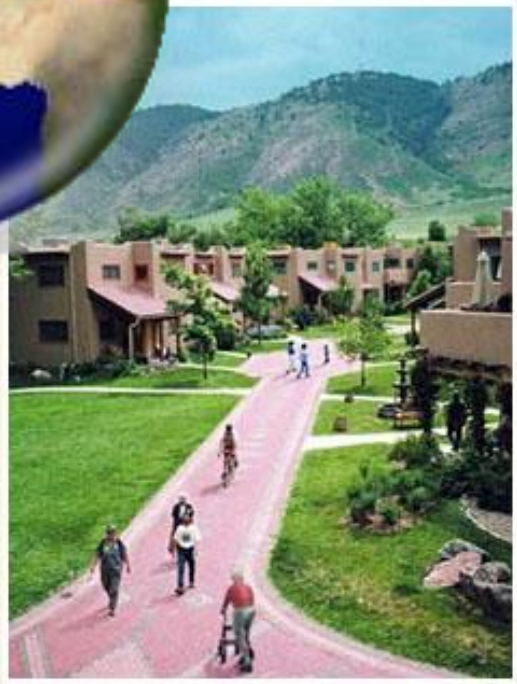
Nature as Mentor = Aspirational ideals

Nature as Model = Innovative strategies

Nature as Mentor = Sustainable benchmarks

What is a system?

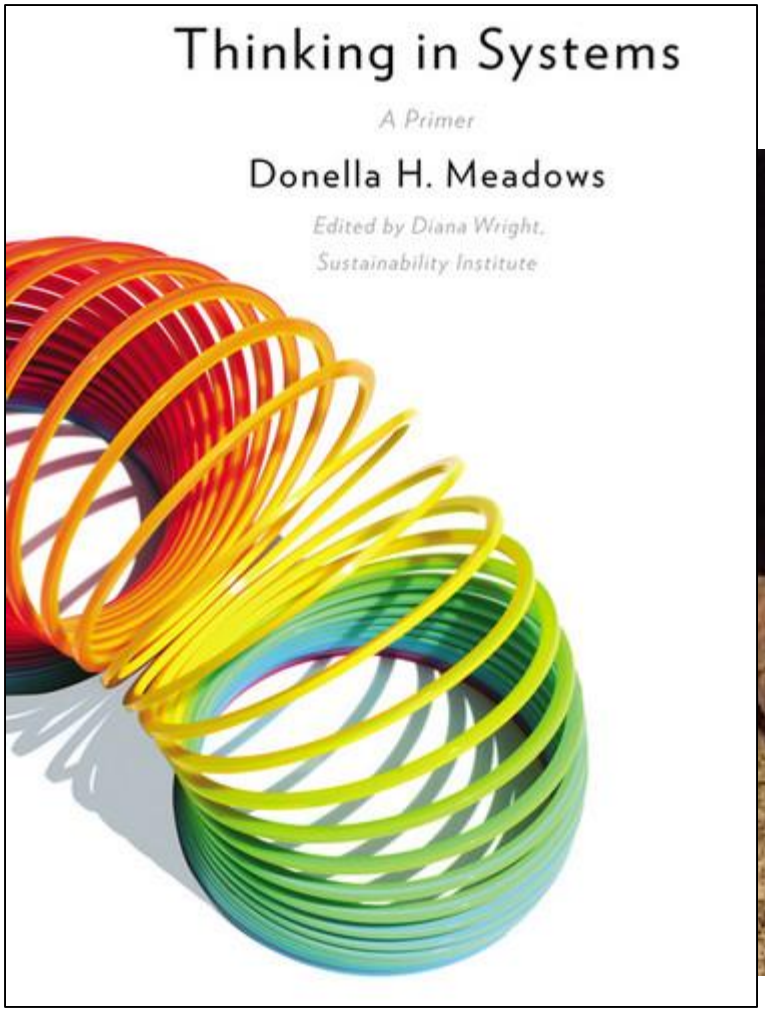
A system is a group of independent but interrelated elements comprising a unified whole.



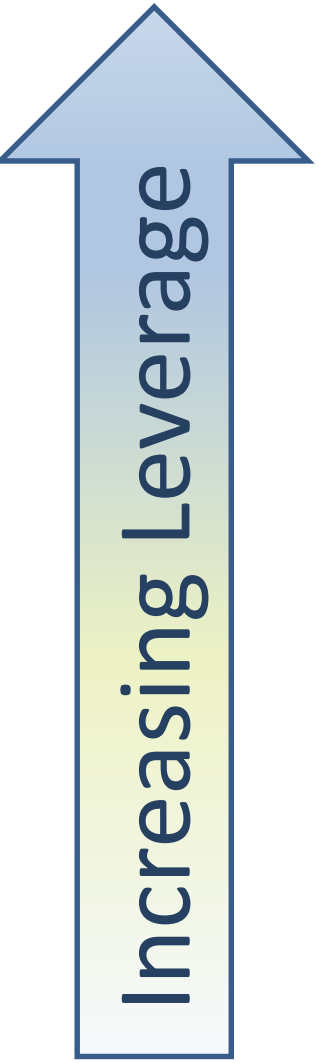
Paradigm Shift – *thinking in systems*

- In order to change behaviors, we need to first change mindsets.
- A paradigm shift is a complete change in core values and belief systems that facilitates a new condition.

Donella Meadows
http://www.donellameadows.org/



Places to Intervene in a System



1. **THE POWER TO TRANSCEND THE PARADIGM**
2. Mindset or **PARADIGM** out of which the system – its goals, structure, rules, delays, parameters – arise
3. **GOALS** of the system
4. **Power to CHANGE**, add, evolve, or self-organize system structure
5. **RULES** of the system (e.g., incentives, penalties)
6. Structure of **INFORMATION** flows
7. Gain around driving **POSITIVE feedback loops**
8. Strength of **NEGATIVE feedback loops**, relative to the impacts they are trying to correct against
9. **Length of DELAYS**, relative to the rate of system change
10. **STRUCTURE** of material stocks and flows
11. **Sizes of BUFFERS** and other stabilizing stocks, relative to their flows
12. Constants, **PARAMETERS**, numbers

August Homework

- Continue work with your team on your challenge, researching nature and abstracting strategies.
- Develop a summary of your team's work to-date:

  It is critical that these summaries are completed by August 4th
- In-Person session logistics:

  Complete the registration form & send to Sheridan by July 31st
- iSite
- Optional:
  - Listen to optional radio show: 2011 Bioneers Conference interview with Dayna Baumeister and Marie Bourgeois
  - Read *Leverage Points: Places to Intervene in the System* by Donella Meadows

Check-In Phone meetings

- Diana and Marie are available to answer questions or discuss any issues you are having during these 2 optional phone-in meetings:
- July 22 at 9:00 – 10:00 MST
- July 29 at 9:00 – 10:00 MST
- Call in number: 866-299-9141
  - Access code: 908-79-663

In-Person Session – Livingston, MT
August 9 – 13, 2015

Final Case Study Reports are due to Diana and Marie by September 11, 2015.

Final report out webinar is scheduled for:
September 16, 2015
9:00 – 10:00 MST

Questions?

Remember to submit your reservation form for the in-person session in Montana with biomimicry experts!