

BIOMIMICRY CASE STUDY

SUSTAINABLE ISSUE: FASHION & TEXTILES

- The production and processing of materials entails sustainability considerations around land degradation and resource extraction.
- Fabric processing, including the printing and dyeing of textiles and the application of finishes, also use significant quantities of water, energy and chemicals, and produces substantial amounts of effluent.
- Garment production waste can be both pre- and post-consumer. Pre-consumer waste includes by-products from fibre, fabric and garment production. Post-consumer waste includes clothing and household textile waste to landfill.

PANGOLIN BACKPACK

"Without teeth and without any turn of speed, the pangolin has to be well protected. It has an armour of horny scales that overlap like shingles on a roof. At the slightest danger the animal tucks its head into its stomach and wraps itself into a ball with its muscular tail clasped tight around it. In my experience, there is no way in which a pangolin, once rolled, can be forced to unwind."
David Attenborough

Designed by **Cyclus**, the Pangolin backpack is a day pack that has overlapping scales like the pangolin. This makes it more durable, having a longer life, and protects contents better than a cloth pack. Instead of using zippers, it's kept closed using magnets. In addition to lasting longer, the material is made of recycled tubes from trucks which reduces the need for, and consequent impact, of extracting and producing resources for new materials.

BIOMIMICRY CASE STUDY

SUSTAINABLE ISSUE: ENERGY IN THE URBAN ENVIRONMENT

- Currently 73% of our electric energy in Australia is supplied by burning coal, a fossil fuel that when combusted releases carbon emissions into the atmosphere.
- Solar panels are a source of clean renewable energy but they take up a lot of space. This is not always functional in dense urban environments where competition for access to direct sunlight can be challenging.

As many ground plants vie for coveted food sources, ivy has found a niche that allows it to get enough sunlight and nutrients without having to compete with its fellow ground plants. By growing vertically using another structure for support, ivy receives direct sunlight without having to compete with other plants.

SOLAR IVY

A Brooklyn-based firm, **SMIT (Sustainably Minded Interactive Technology)**, has created a product called Solar Ivy. Mimicking the look and function of ivy, this mimic has wind and solar power generating photovoltaic leaves that can be attached to building facades and other vertical spaces. Solar Ivy system has a modular design allowing for many types of customisation, including leaf color, spacing, orientation, and photovoltaic type. Each 4 foot by 7 foot strip of the GROW system generates 85 Watts of solar power, producing renewable energy while also helping provide shade for buildings that can potentially reduce heating & cooling costs for the consumer.

BIOMIMICRY CASE STUDY

SUSTAINABLE ISSUE: POLYSTERENE PACKAGING

- Polysterene and other plastic packaging is derived from crude oil which is a non-renewable fossil fuel.
- The burning of fossil fuels to make plastic releases CO2 which is a greenhouse gas.
- Polysterene packaging is a single-use product that is generally not recyclable. It is not known how long it takes a polysterene material to break down in landfill.
- Packaging often ends up in our waterways and ecosystem. It can travel long distances and harm wildlife upon ingestion.

Eben Bayer and Gavin McIntyre were fascinated by mushrooms growing on wood chips, and observing how the fungal mycelium strongly bonded the wood chips together.

MUSHROOM PACKAGING

Ecovative Design has re-envisioned our relationship with waste, whereby waste becomes a resource. Their product involves a biodegradable cycle where they grow a natural material to replace plastic packaging, and instead of the material being disposed of in landfill, it can break down naturally in compost. Growing fungi is far less energy intensive than producing polystyrene and the designers recognised that the function of industrial resins in plastic, which has polluting impacts, could also be avoided. As well as countering the environmental impact of conventional polystyrene foams, this invention creates a whole new paradigm where composite materials are literally grown, then biodegraded, harnessing the incredible efficiency of nature.

BIOMIMICRY CASE STUDY

SUSTAINABLE ISSUE: ACCESS TO FRESHWATER

- Freshwater is one of our most precious resources. While nearly 70% of the earth is covered in water, only 2.5% is fresh water and only 1% is accessible for human use.
- Water scarcity affects over 40% of the global population. Over 1.7 billion people are currently living in river basins where water use exceeds replenishment.
- Approximately 70% of all water abstracted from rivers, lakes and aquifers is used for irrigation, highlighting the link between access to freshwater and food security

Sourced from the United Nations Sustainable Development Goals, 2017

Designers were inspired by the form and function of bromeliads. The plant's foliage arrangement serves to collect water and the structures called trichomes that are found in the epidermis of the plant, serve to store water.

CHAAC HA WATER COLLECTOR

Team Panteras' award-winning design, the Chaac-Ha water collector, is a sustainable solution to water catchment. Its form is based on the bromeliad's foliage arrangement and emulates the plants method for capturing and storing water. The collector is made of a hydrophobic fabric that's also bacteria-resistant and flexible. During the night, the dew forms on the fabric, and its inclination will head the water to the tank. It can accumulate a few litres of water each night. The supporting structure too "emulates the structural characteristics of the spider web". Specifically it is based on the radial distribution system of forces of the spider web, and is constructed from bamboo which is a locally grown natural material.

Nature
uses
energy
efficiently



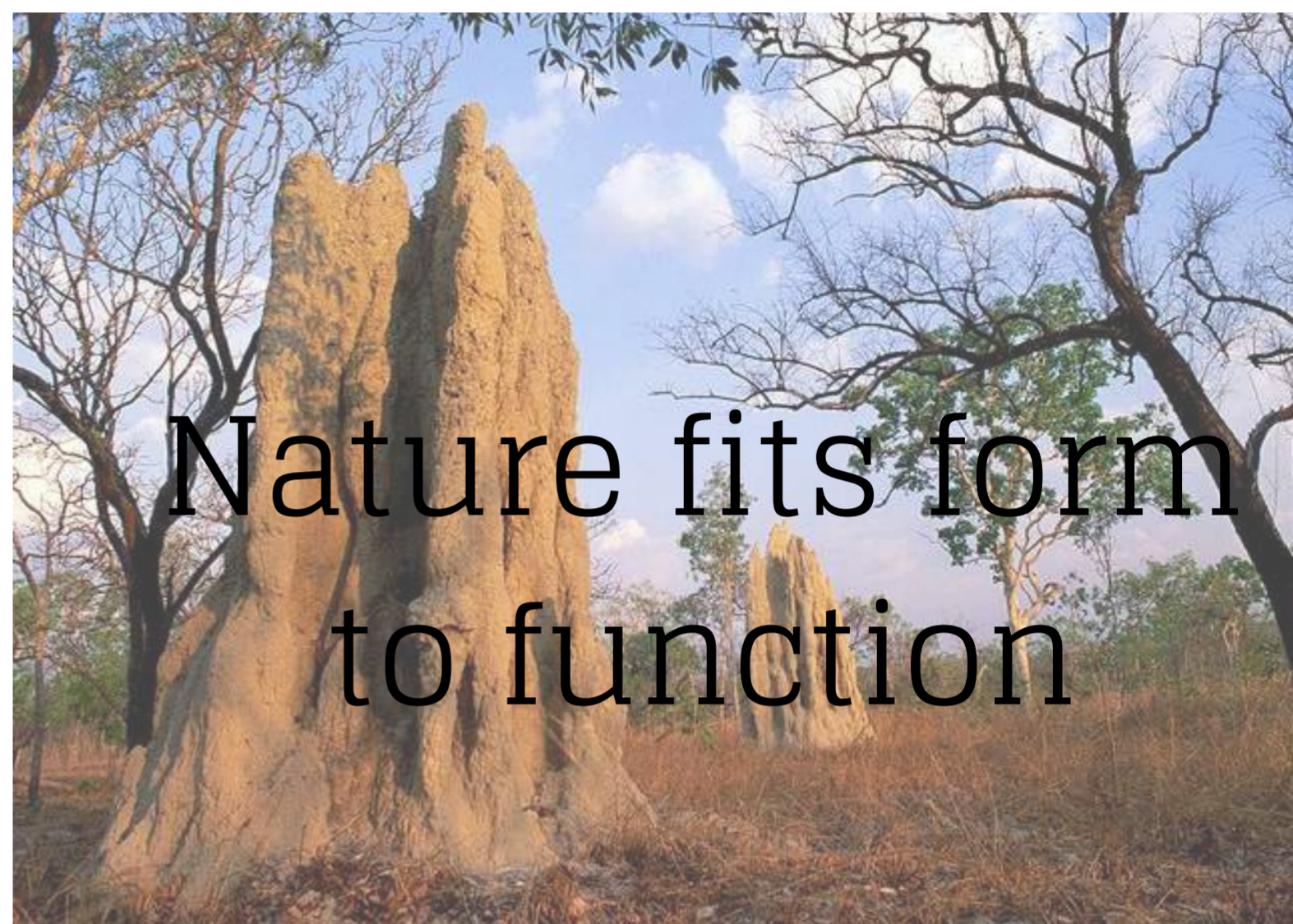
Nature runs
on sunlight



Nature banks
on diversity



Nature fits form
to function



Design Principles
and Strategies in
Nature

Nature recycles
everything



Nature
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local
expertise

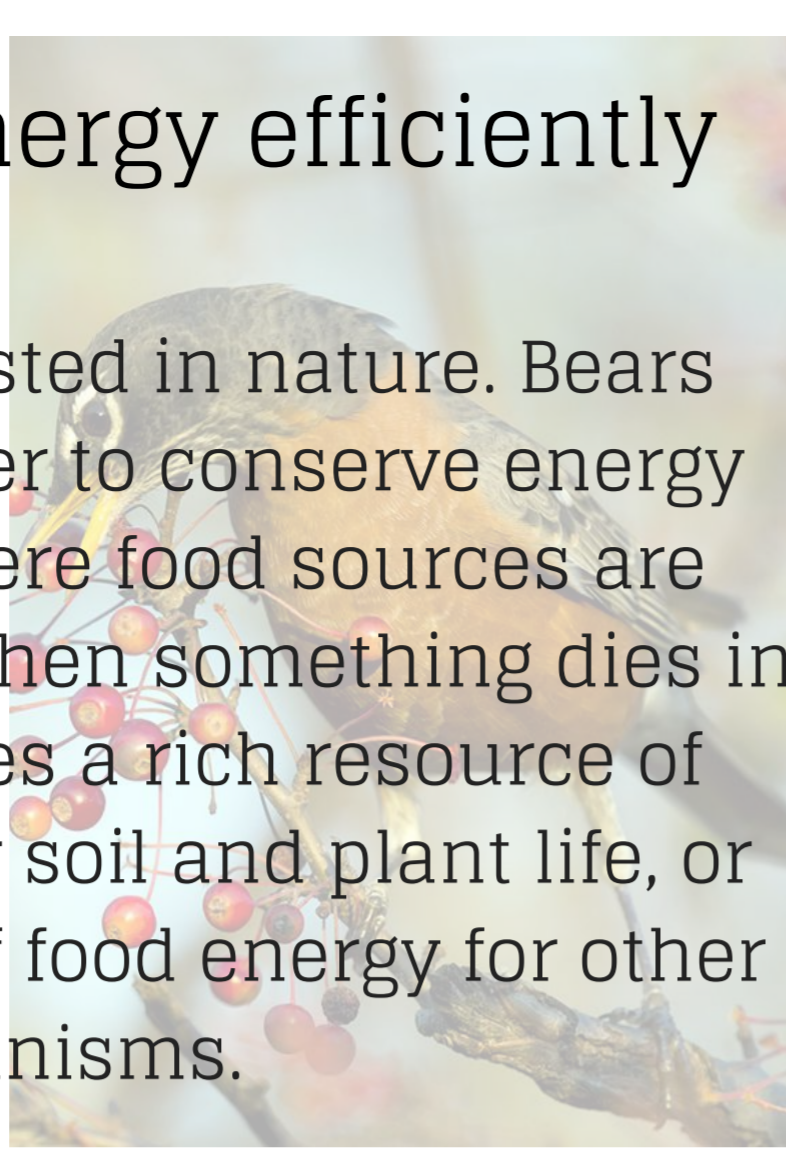


Nature rewards
cooperation



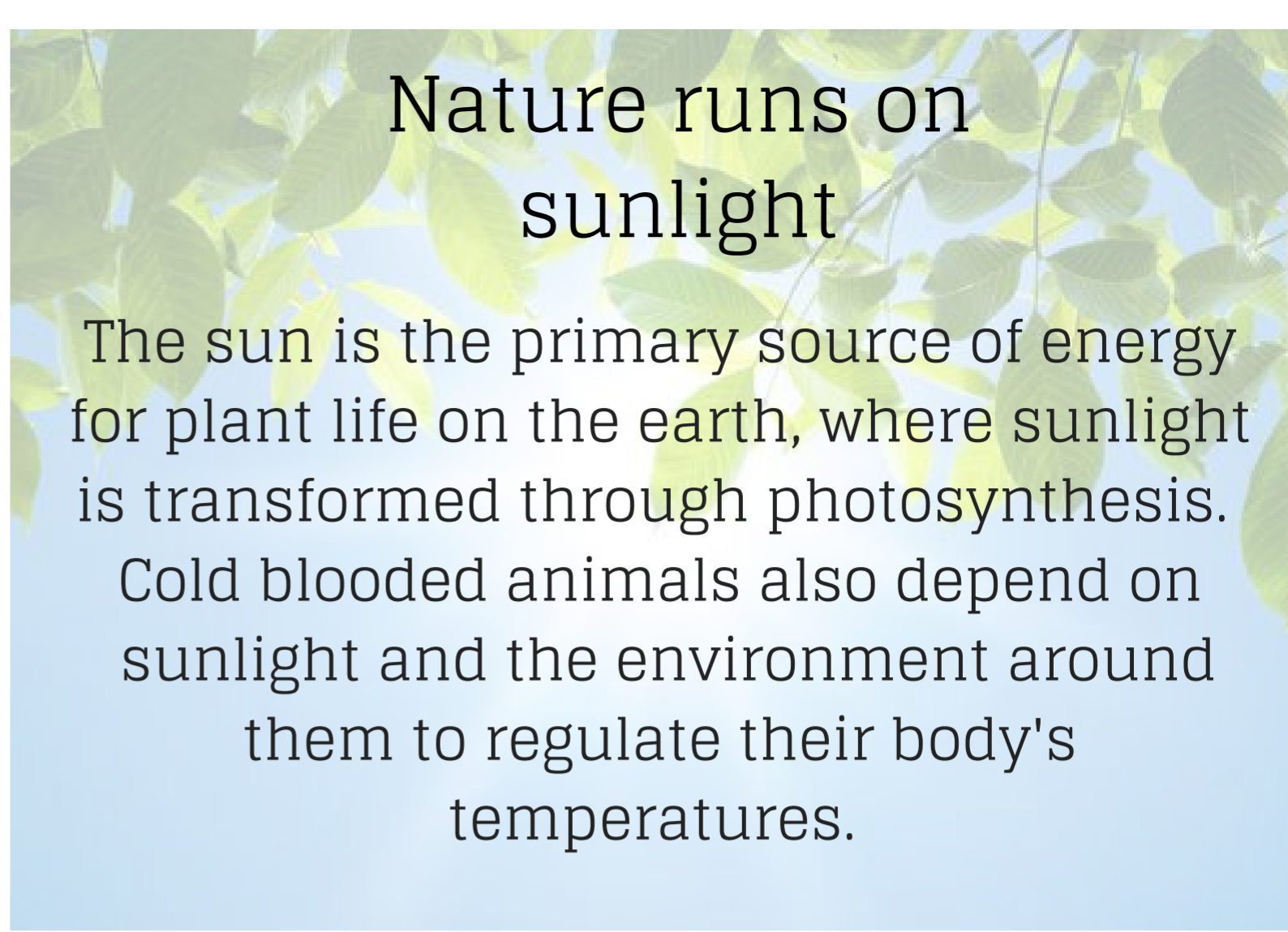
Nature uses energy efficiently

Energy is not wasted in nature. Bears hibernate in winter to conserve energy over months where food sources are scarce. Similarly, when something dies in nature it becomes a rich resource of organic matter for soil and plant life, or indeed a source of food energy for other organisms.



Nature runs on sunlight

The sun is the primary source of energy for plant life on the earth, where sunlight is transformed through photosynthesis. Cold blooded animals also depend on sunlight and the environment around them to regulate their body's temperatures.



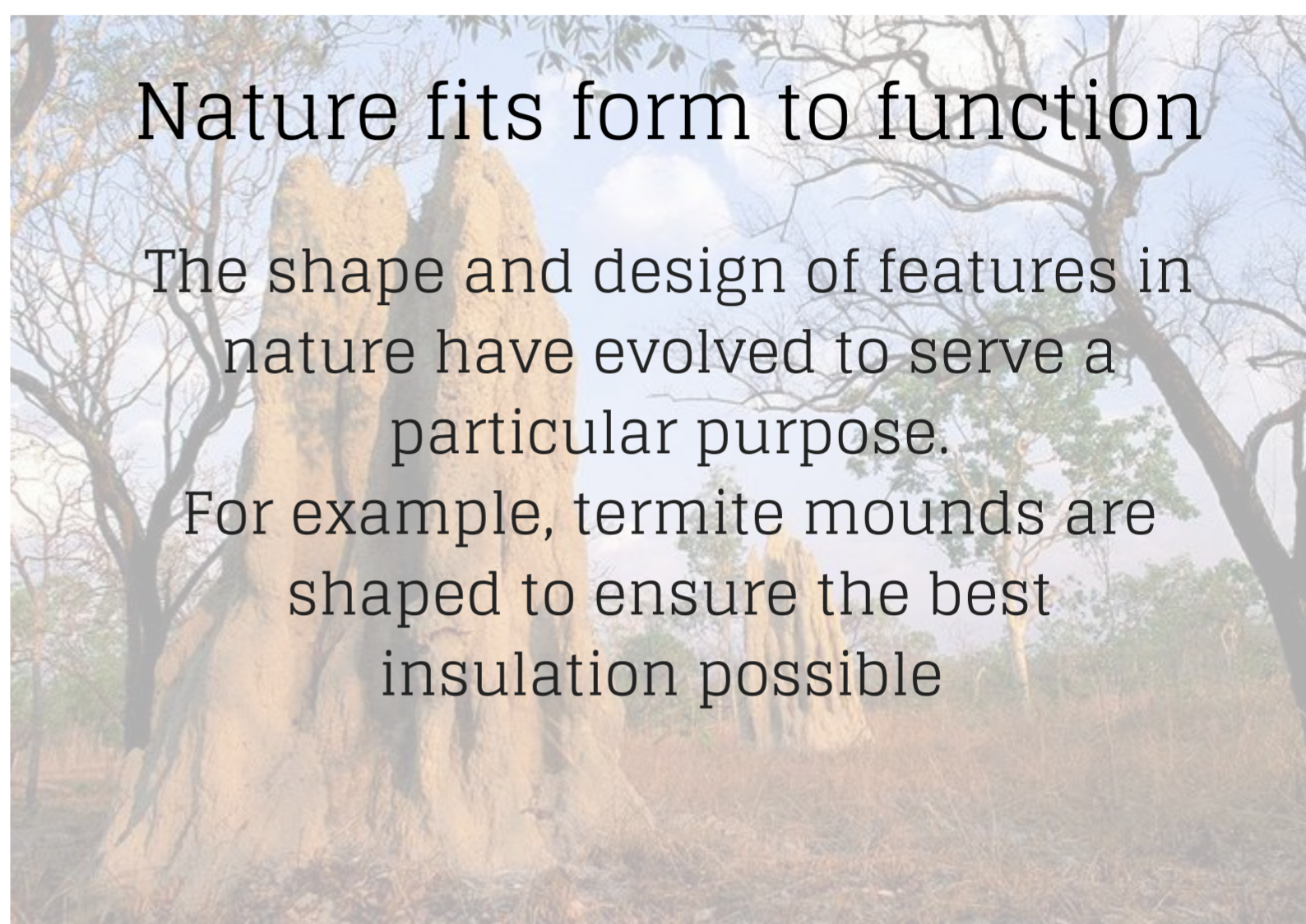
Nature banks on diversity

Biodiversity is the variety of plant and animal life in the world in a particular habitat. A high level of diversity is considered desirable as each part can play a complementary, even essential, role in each others survival



Nature fits form to function

The shape and design of features in nature have evolved to serve a particular purpose. For example, termite mounds are shaped to ensure the best insulation possible



Nature recycles everything

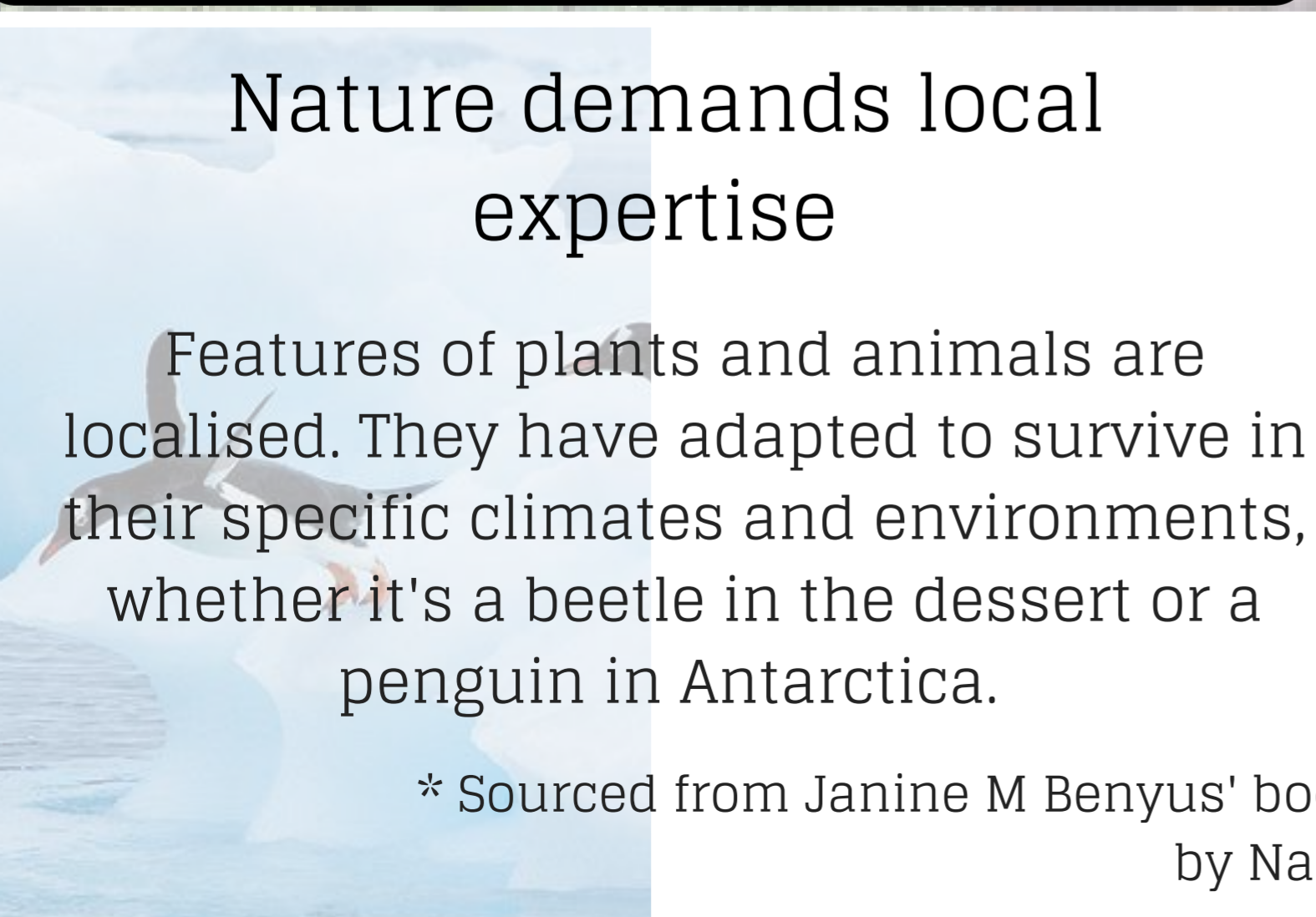
Waste materials in nature are biodegradable. They provide essential resources which include rich organic matter and soil, as well as habitat for other living organisms. There is no such thing as waste in nature!



Design Principles and Strategies in Nature

Nature demands local expertise

Features of plants and animals are localised. They have adapted to survive in their specific climates and environments, whether it's a beetle in the dessert or a penguin in Antarctica.



Nature rewards cooperation

Cooperation between plants and animals help support a thriving environment. One example of this is companion planting, whereby one plant may grow near another to naturally deter pests or provide complementary nutrients to the soil.



* Sourced from Janine M Benyus' book Biomimicry: Innovation Inspired by Nature