

*Prometheus in the  
Forest: the case for  
strong sustainability  
principles in STEM*

Bob Kreiken, TPM ethics





*Biodiversity* describes three levels of Earth's natural variability: in genes, species, and ecosystems.



Audio: Frederic Lionel

Picture: Gregoire Dubois



## Convention on Biological Diversity

- Adopted in 1992 at the Rio Earth Summit
- 193 Parties (4 non-Party)
- Wide variety of topics
- Leading and framework biodiversity convention



Picture: Gregoire Dubois

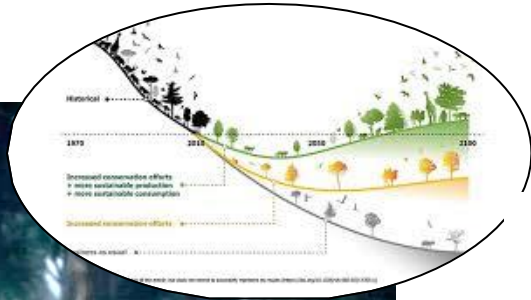


## Convention on Biological Diversity



1. The conservation of biological diversity
2. The sustainable use of the components of biological diversity
3. The fair and equitable sharing of the benefits arising out of the utilization of genetic resources

# Access and Benefit-sharing





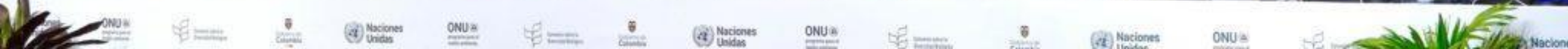
# CONFERENCIA DE LAS NACIONES UNIDAS SOBRE BIODIVERSIDAD

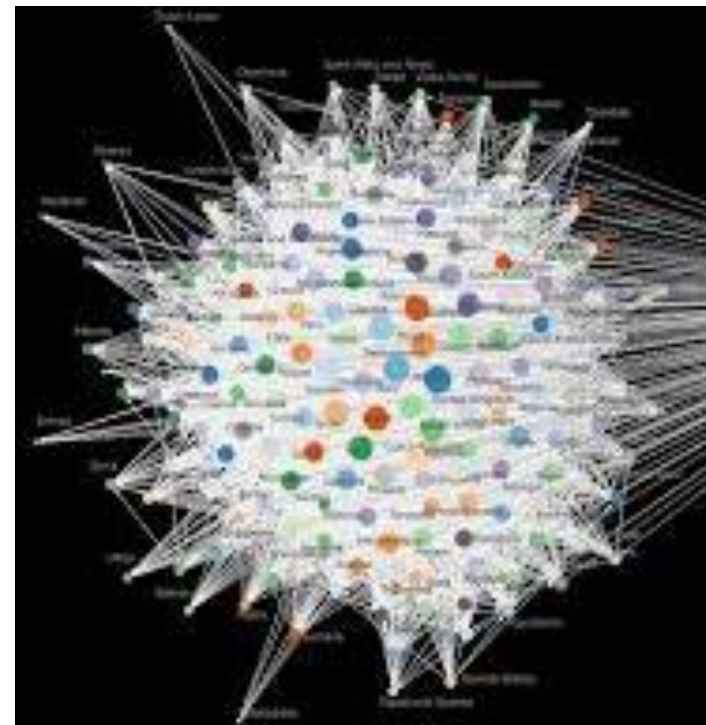
## COP16

CALI · COLOMBIA

Paz con la Naturaleza

COP16 / CP-MOP 11 / NP-MOP 5  
CALI - COLOMBIA 2024





**Bigger question for us today: how do you give back to nature and people that you never meet?**

# Your lunch today

---

**1. Nature is an inspiring place for our science and teaching**

---

**2. Biodiversity considerations are currently weakly embedded in STEM**

---

**3. We need to reflect about the human-nature-technology relationship**

---



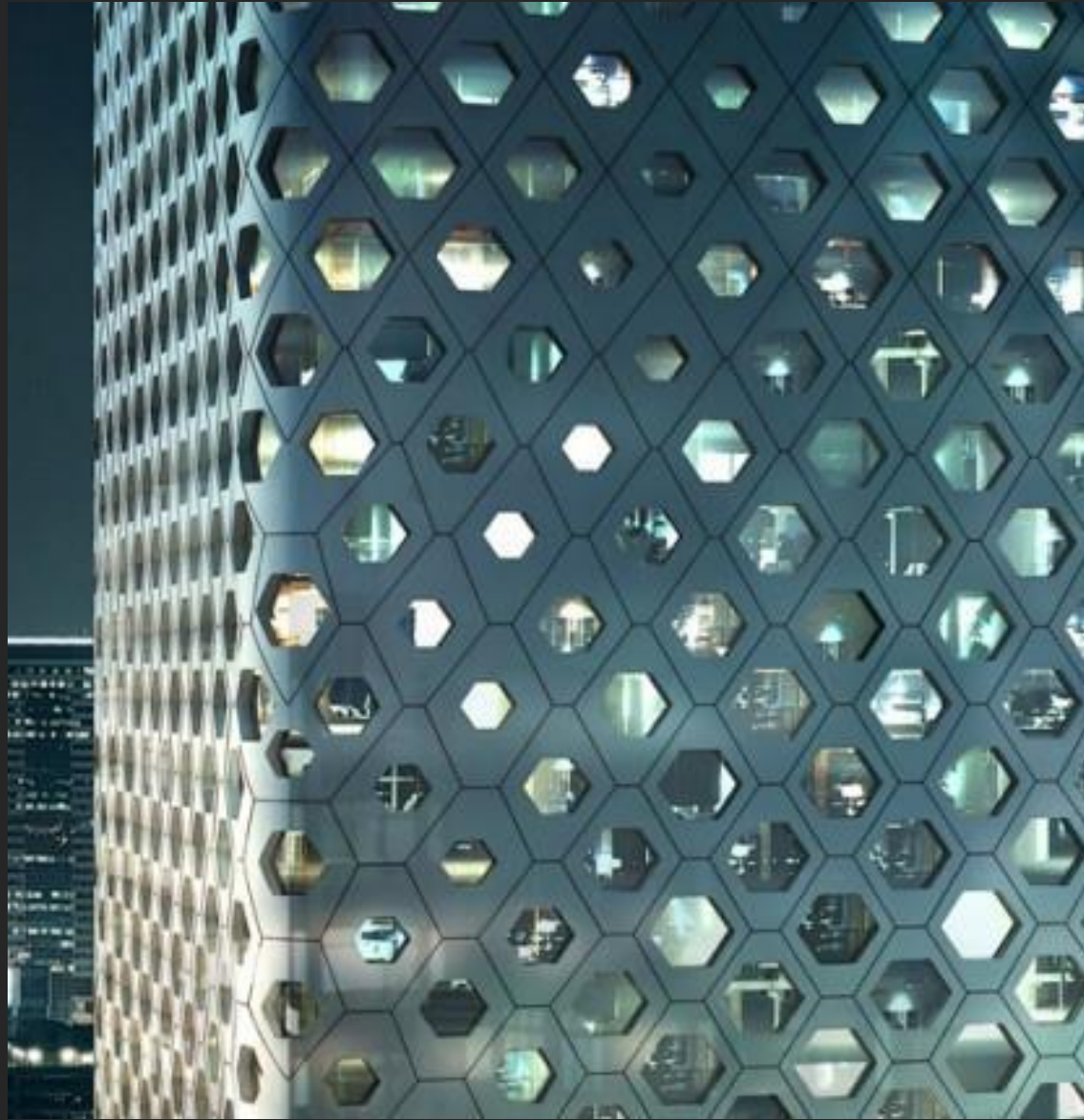


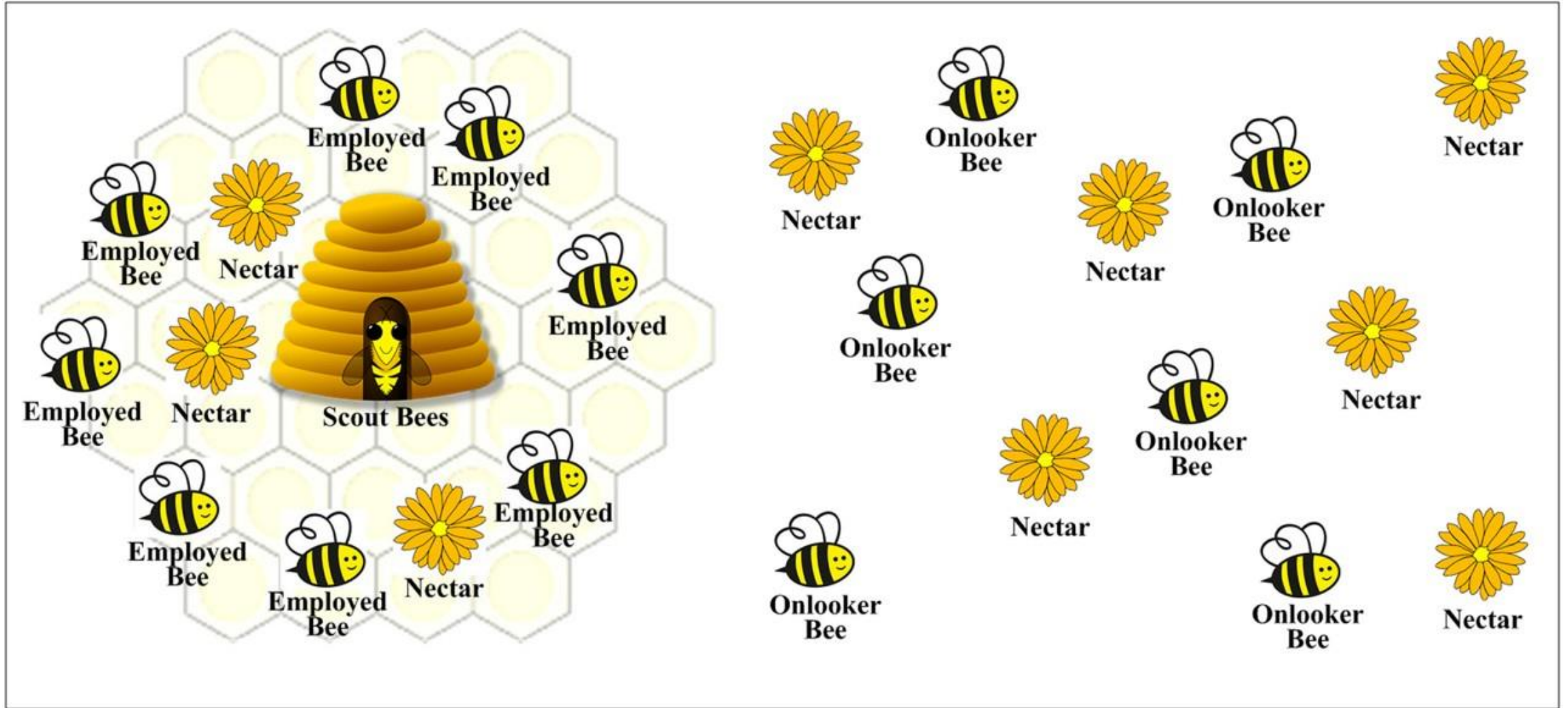


Van 't Hoff verdedigde in zijn oratie het goed recht om in de studie van de natuur naast de waarneming ook de verbeeldingskracht te gebruiken. Hij was ervan overtuigd dat ‘de verbeeldingskracht bij de geschiktheid voor wetenschappelijk onderzoek, zoowel als bij den drang om daarvan gebruik te maken, een rol speelt’.









# ENGINEERING DESIGN INSPIRED BY NATURE

A POST-PRIMARY ENGINEERING CURRICULUM



*Bio-inspired innovation. Student creativity. Sustainable solutions.*



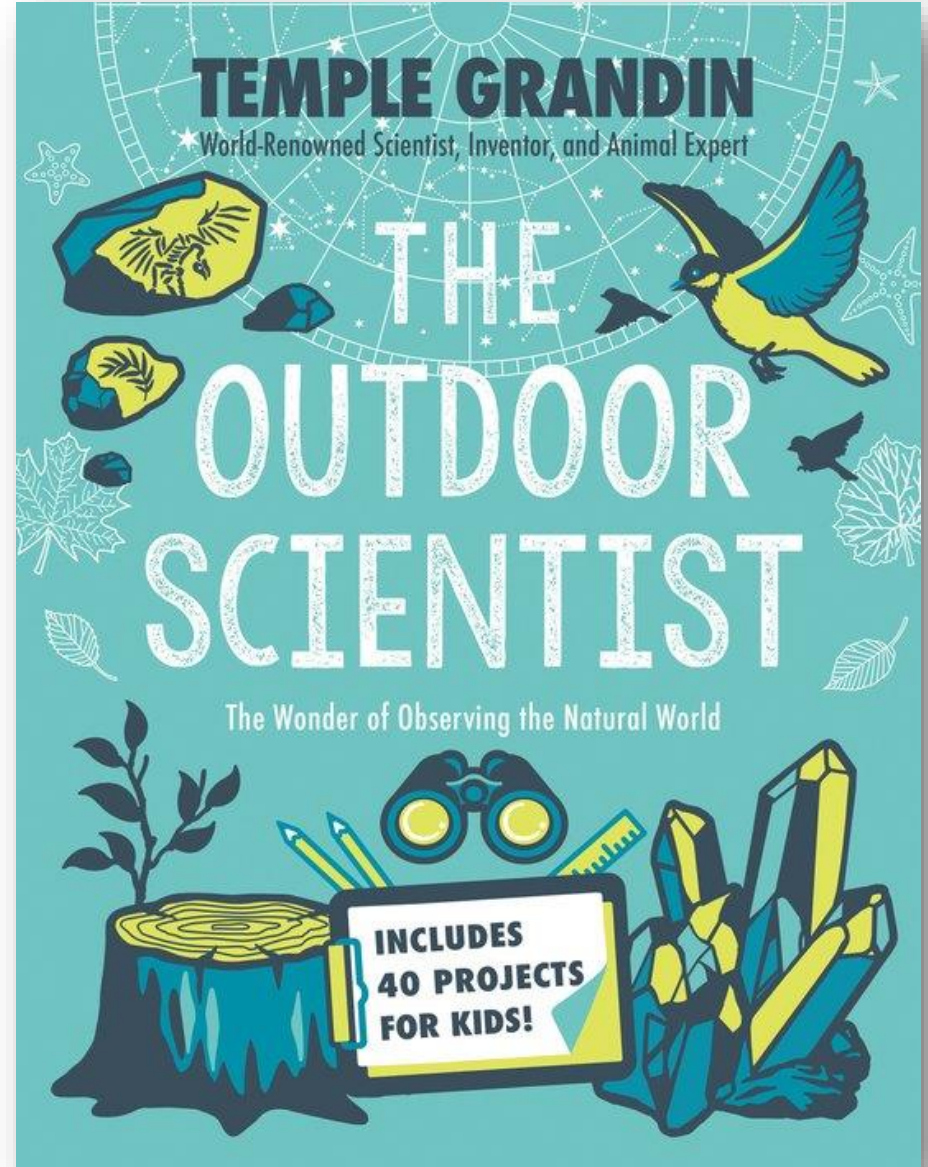
THE CENTER FOR  
LEARNING WITH NATURE

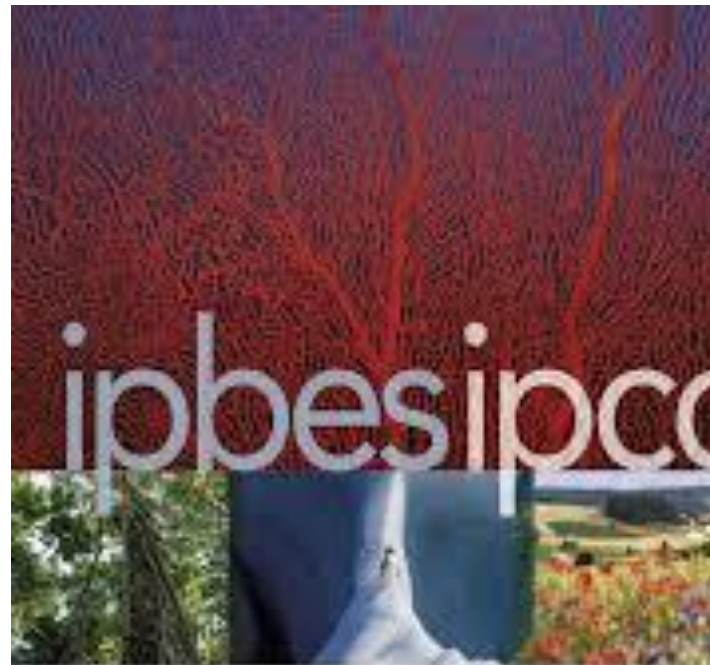
# TEMPLE GRANDIN

World-Renowned Scientist, Inventor, and Animal Expert

# THE OUTDOOR SCIENTIST

The Wonder of Observing the Natural World





IPBES-IPCC CO-SPONSORED WORKSHOP  
**BIODIVERSITY AND  
CLIMATE CHANGE**  
WORKSHOP REPORT



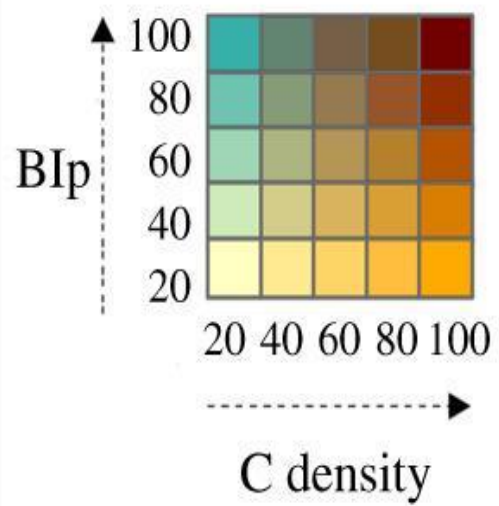
Climate-  
biodiversity  
nexus

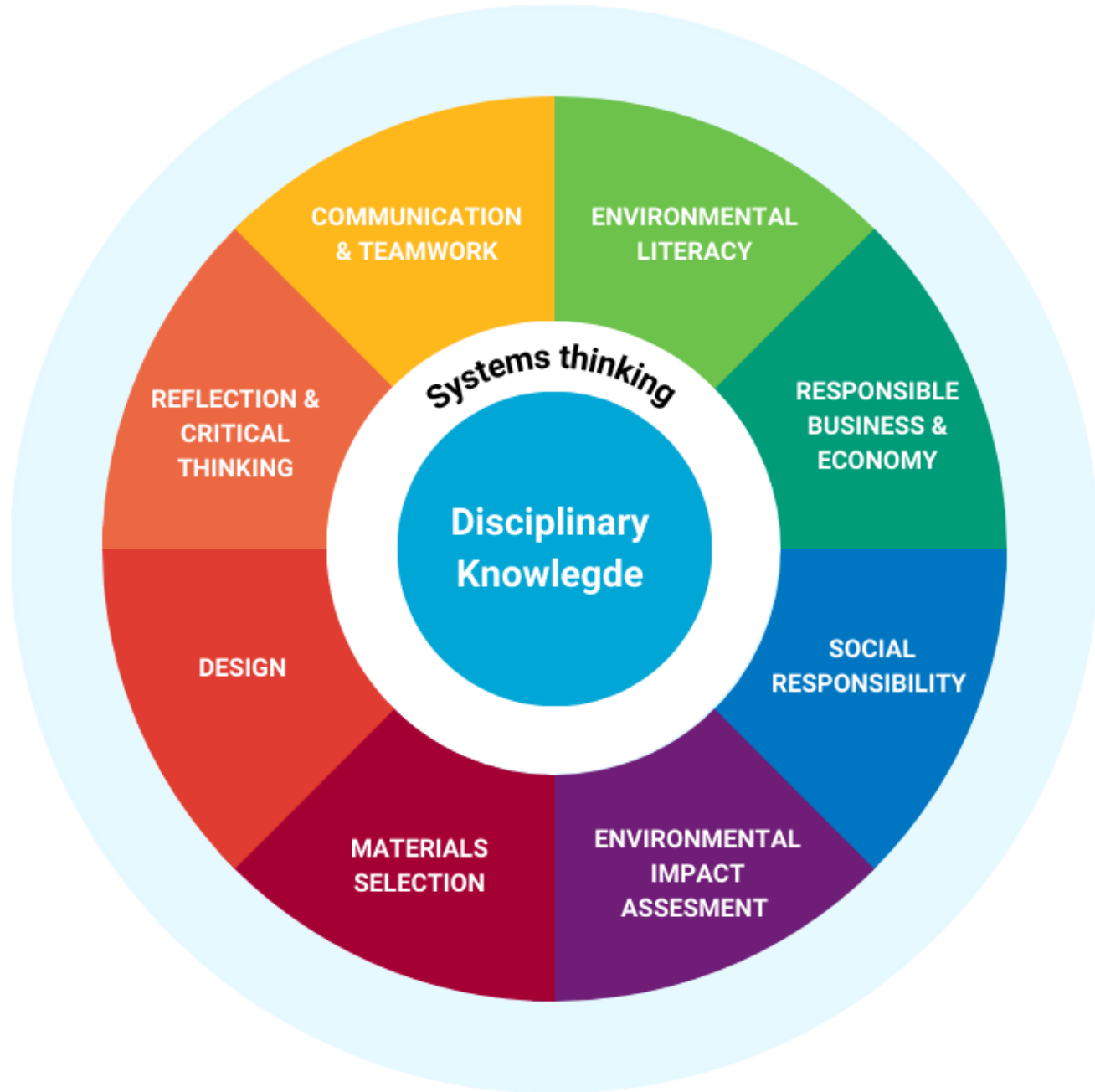




© 2022

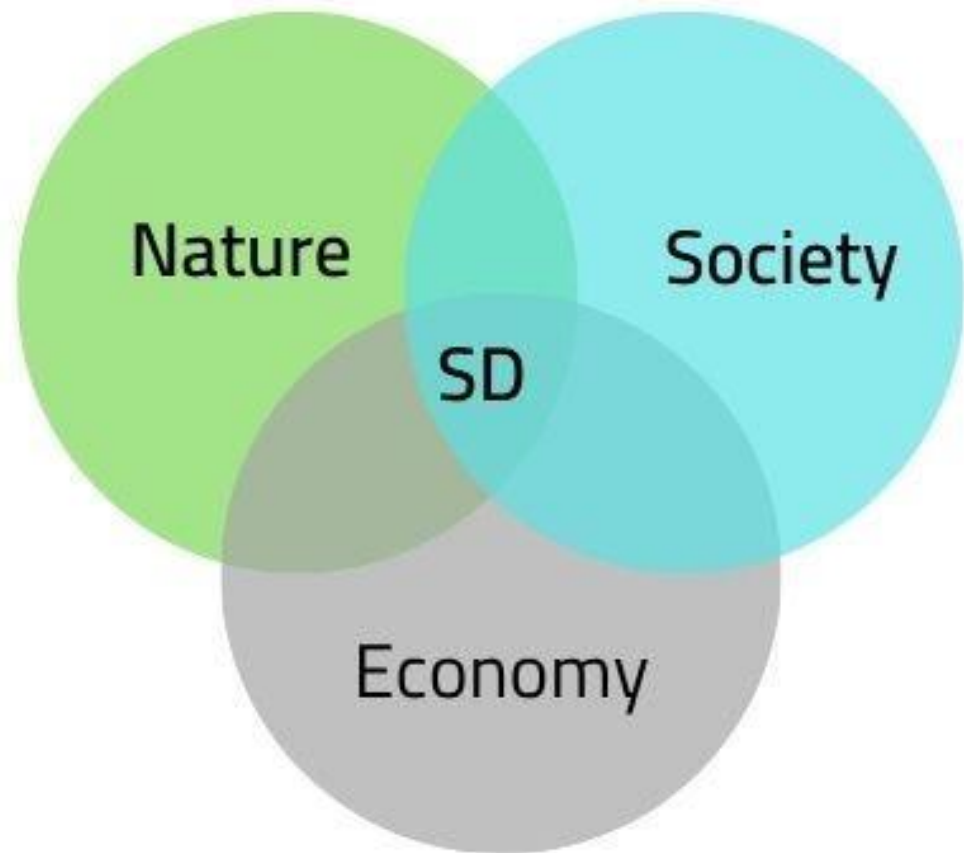
(a)



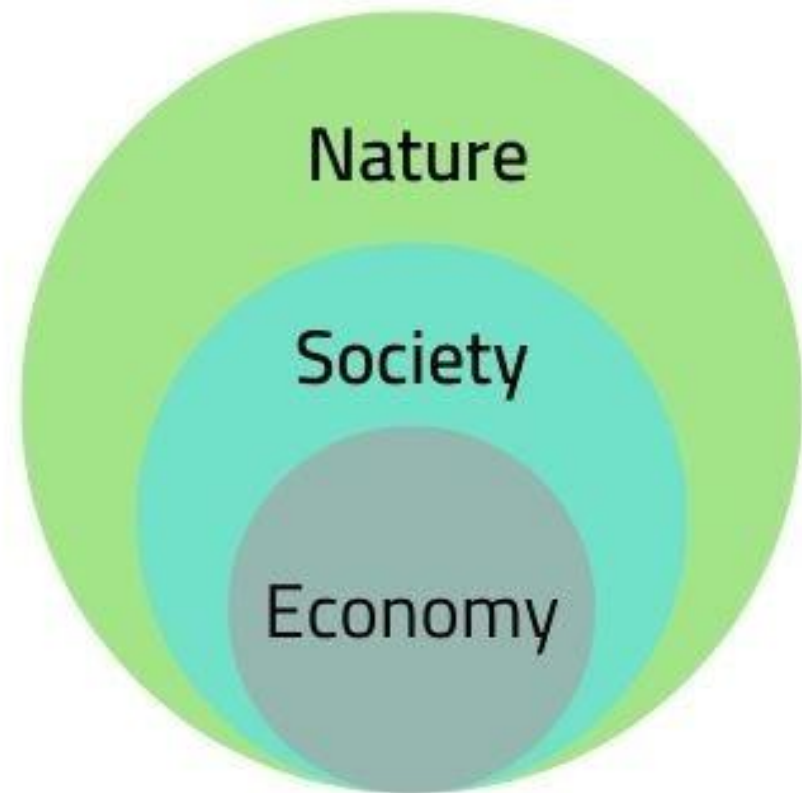


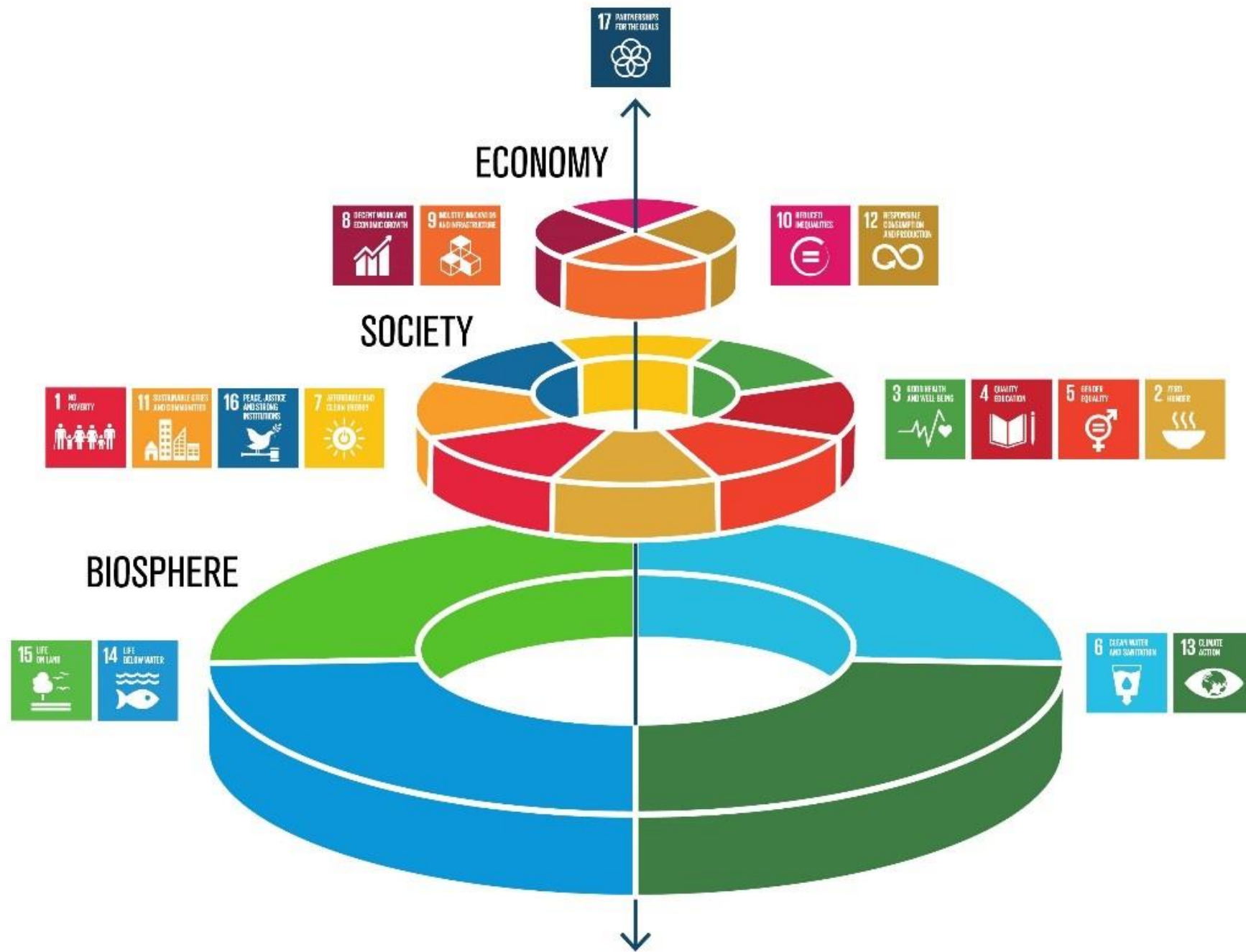
# Engineering for One Planet Framework

*Weak*



*Strong*





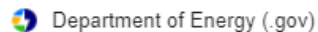




## How a false claim about wind turbines killing whales is spinning out of control in coastal Australia

Windfarm critics claim projects will harm marine life. Scientists say that's not backed by credible evidence.

11 nov 2023



## Addressing Misinformation on Offshore Wind Farms and Recent Whale Mortalities

As of now, there is no evidence to support speculation that noise resulting from wind development-related site characterization surveys...

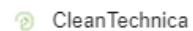
28 apr 2023



## Whale deaths exploited in 'cynical disinformation' campaign against offshore wind power, advocates say

A dozen New Jersey mayors have said offshore wind turbines could be the cause of whale strandings. Experts say that's essentially...

11 feb 2023



## Hiding Behind Whale Fatality Disinformation, Big Oil Works To Slow Offshore Wind Projects

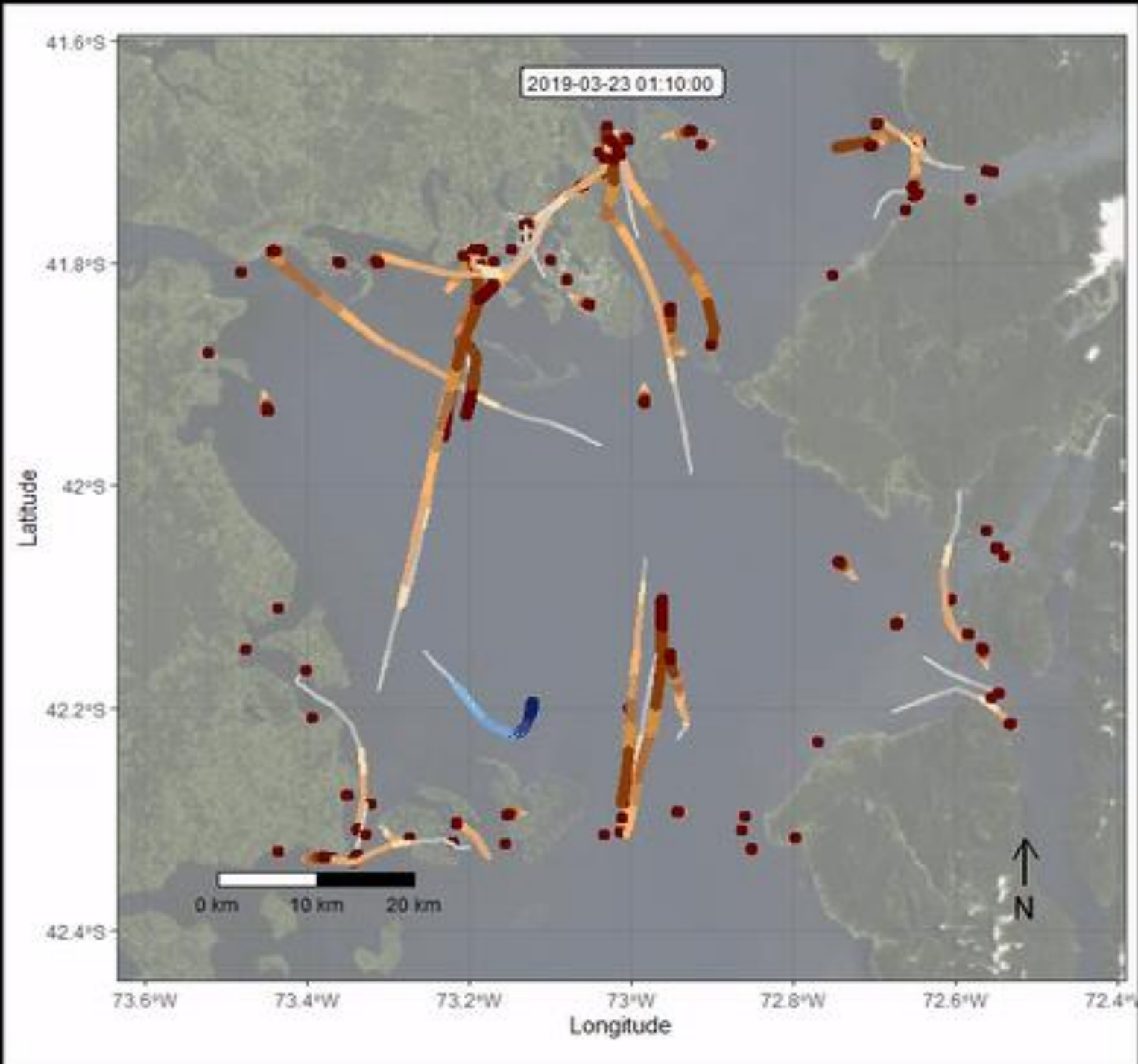
Disinformation about whale fatalities due to offshore wind threatens the industry. Many people are working to set the record straight.

7 apr 2023









## RESEARCH

### RESEARCH ARTICLE


#### MARINE CONSERVATION

# Ship collision risk threatens whales across the world's oceans

Anna C. Nisi<sup>1\*</sup>, Heather Welch<sup>2,3</sup>, Stephanie Brodie<sup>4</sup>, Callie Leiphardt<sup>5</sup>, Rachel Rhodes<sup>5</sup>, Elliott L. Hazen<sup>3</sup>, Jessica V. Redfern<sup>6</sup>, Trevor A. Branch<sup>7</sup>, Andre S. Barreto<sup>8</sup>, John Calambokidis<sup>9</sup>, Tyler Clavelle<sup>10</sup>, Lauren Dares<sup>11</sup>, Asha de Vos<sup>12</sup>, Shane Gero<sup>13</sup>, Jennifer A. Jackson<sup>14</sup>, Robert D. Kenney<sup>15</sup>, David Kroodsma<sup>10</sup>, Russell Leaper<sup>16</sup>, Douglas J. McCauley<sup>5</sup>, Sue E. Moore<sup>1</sup>, Ekaterina Ovsyanikova<sup>17</sup>, Simone Panigada<sup>18</sup>, Chloe V. Robinson<sup>11</sup>, Tim White<sup>10</sup>, Jono Wilson<sup>19</sup>, Briana Abrahms<sup>1</sup>

After the near-complete cessation of commercial whaling, ship collisions have emerged as a primary threat to large whales, but knowledge of collision risk is lacking across most of the world's oceans. We compiled a dataset of 435,000 whale locations to generate global distribution models for four globally ranging species. We then combined >35 billion positions from 176,000 ships to produce a global estimate of whale-ship collision risk. Shipping occurs across 92% of whale ranges, and <7% of risk hotspots contain management strategies to reduce collisions. Full coverage of hotspots could be achieved by expanding management over only 2.6% of the ocean's surface. These inferences support the continued recovery of large whales against the backdrop of a rapidly growing shipping industry.





## New maps show high-risk zones for whale-ship collisions – vessel speed limits and rerouting can reduce the toll

Published: November 21, 2024 8.09pm CET Updated: November 21, 2024 9.17pm CET



**SHARROW MARINE**  
THE FUTURE OF PROPULSION



[Home](#)

[Performance Reports](#)

[Videos](#)

[Testimonials](#)

[Store](#)

[Our Story](#)

[News](#)

[Partners](#) 

[Contact Us](#)

# Spend more time on the water

Get there faster, with less fuel

[ORDER NOW](#)



HACK DATA FOR A LIVABLE PLANET

# BIODIVERSITY HACKATHON



# Zoohackathon

<Coding to End Wildlife Trafficking>



# Prometheus and his flame

- Controlling and reductionist approach towards nature, primarily to benefit humans
- Dominant paradigm in science



## Orpheus and his lyre

- Respectful, ecological-sensitive and reciprocal attitude towards nature
- Is found in old civilizations and Indigenous peoples

***Orpheus thus penetrates the secrets of nature not through violence but through melody, rhythm, and harmony. Whereas the Promethean attitude is inspired by audacity, boundless curiosity, the will to power, and the search for utility, the Orphic attitude, by contrast, is inspired by respect in the face of mystery and disinterestedness.***

Hadot (2006, p. 96) in *The Veil of Isis: An Essay on the History of the Idea of Nature*.







# The Role of Whales in Carbon Storage

## The Whale Conveyor Belt

Whales migrate from nutrient-rich feeding grounds to nutrient-poor breeding grounds to mate and give birth. They bring nutrients in their feces and urine to these areas that stimulate carbon-capturing phytoplankton blooms.

## Biomass Storage

Whales are some of the largest, longest-living animals on Earth. They are efficient at storing carbon in their bodies, like trees in a rainforest storing carbon in their trunks.

## Whale Falls

When whales die, their carbon-rich carcasses often sink to the seafloor where that carbon is stored in sediment. The animal decomposes and is consumed by deep-sea animals, which prevents the carbon from returning to the atmosphere as carbon dioxide.

## The Whale Pump

Whales cycle between breathing at the surface and feeding in the waters below. When at the surface, they expel nutrient-rich feces and urine that stimulate carbon-capturing phytoplankton blooms.

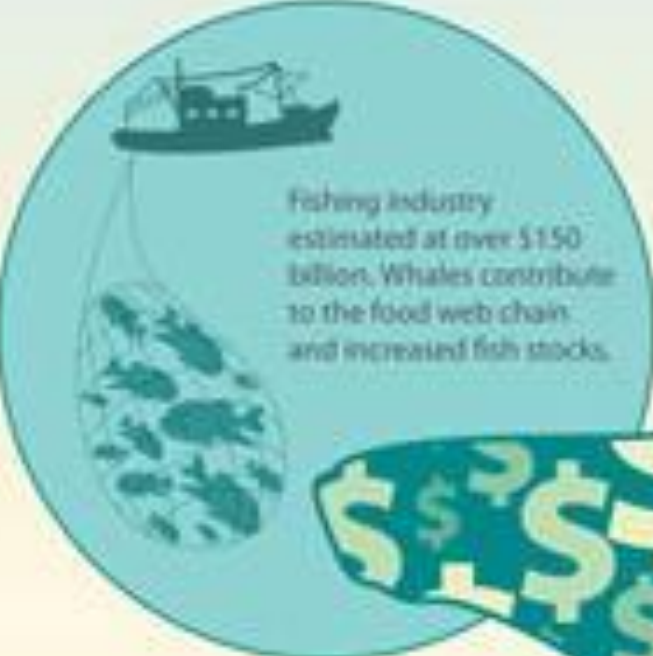
## Photosynthesis

Like plants on land, phytoplankton capture sunlight, carbon dioxide, and water through photosynthesis. This helps reduce atmospheric carbon dioxide levels.




NOAA  
FISHERY


## How much is one whale worth?



Fishing industry estimated at over \$150 billion. Whales contribute to the food web chain and increased fish stocks.



Whale watching industry estimated at over \$2 billion globally.



Each whale  
CO<sub>2</sub> on a  
links to



On the illusions of  
green capitalism

Adrienne Buller

# The value of a whale



“We always have these constraints that insects don't have, and insects have different constraints that we don't have as engineers,” says Matěj Karásek of the Delft University of Technology, whose own flying robot can bank and dive like a fruit fly. “Even if we are trained to take inspiration from nature, the solutions we come up with are slightly different.”

While RoboBee X-Wing is nowhere near matching the capabilities of a real insect, one day it could exceed them. Better actuators will make the robot faster and more nimble, and better solar cells will theoretically let the robot operate indefinitely. That would make it ideal for environmental monitoring or for flying in sensitive settings. After all, at just two inches long, it wouldn't do too much damage if it crashed.



Our technology mimics the buzz of the bumblebee, blueberries' natural pollinator, by using mechanical arms mounted on an electric vehicle that vibrate the stems to release pollen grains on the flower's stigma. Years of research and testing have been conducted to calibrate the speed and strength of the vibration for optimal efficiency.

**Bloom**   
Formerly Bumblebee AI

Discussing the feasibility of using drone-bees in large scale pollination, David Goulson, professor of biology at the University of Sussex and founder of the Bumblebee Conservation Trust in the United Kingdom, wrote a [blog post](#) last year. His back-of-the-envelope calculation revealed that if it cost just a single penny to build a single drone-bee (which is a ridiculously impossible assumption), it would cost £32 billion (\$45 billion) to replace every honey bee in the world. He [wrote](#):



## *Eremocene: Age of Loneliness*

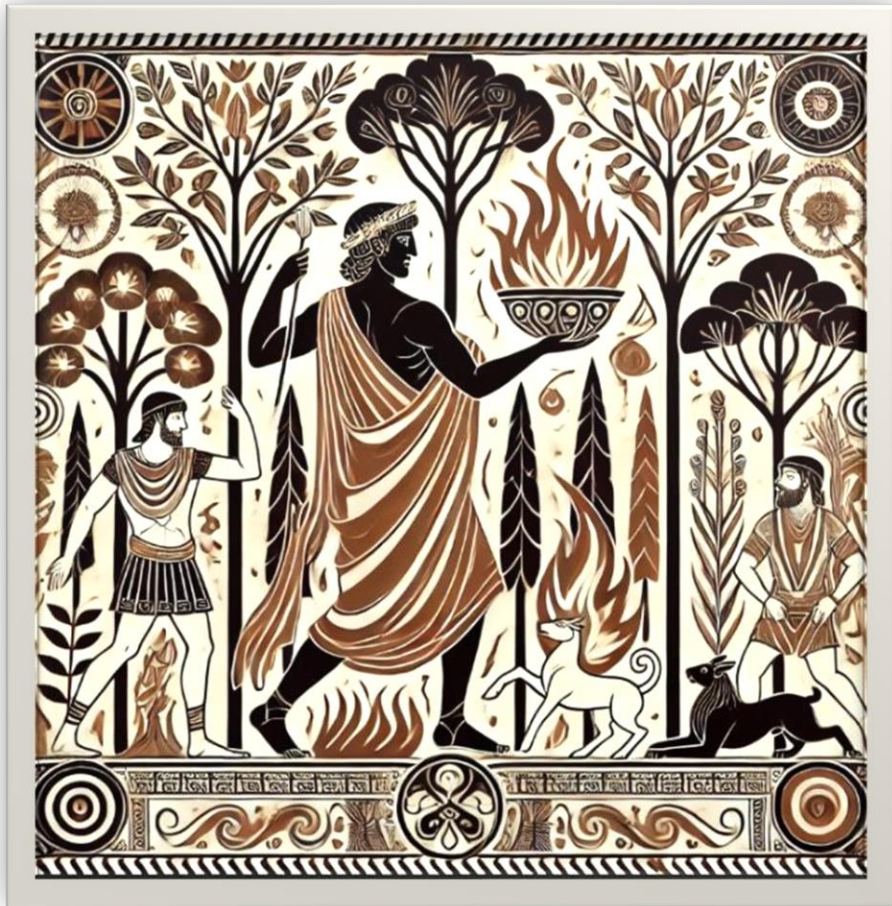
EO Wilson used this term to refer to a future where human society is devoid of biodiversity, making for a desolate, monotonous, life- and colourless world.





# Take-aways

Reachable at [b.e.kreiken@tudelft.nl](mailto:b.e.kreiken@tudelft.nl)



- 1. Go more frequently into nature to inspire yourself and your students**
- 2. Keep biodiversity at the top of your mind when you design new tech**
- 3. Reflect on the human-nature-technology relationship it promotes**