

# Earth Knowledge's System of Systems Approach: Achieving Success with Nature Positive Investments

ZHAW School of Management & Law  
Swiss Sustainable Finance

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The Challenge & Why Now

## **Transform Decision-Making to Mitigate Financial Risk & Harness Investment Opportunities**

**Global ESG assets are on track to exceed \$53T by 2025**, representing more than a third of total AUM. Yet there is a perceived lack of reliable, authoritative data upon which to make the best investment decisions.

**\$44 trillion of economic value generation** – over half the world's total GDP – is moderately or highly dependent on nature and its services.

**Nature loss is a planetary emergency.** Humanity has already wiped out 83% of wild mammals and half of all plants and severely altered three-quarters of ice-free land and two-thirds of marine environments.

**“Climate risk is investment risk.” (BlackRock)** Investors are demanding that corporations reveal their climate and environmental risks.

**ESG (Environmental, Social and Governance)** ratings have depended on what the companies say that they are doing rather than more accurate fully-objective methodology.

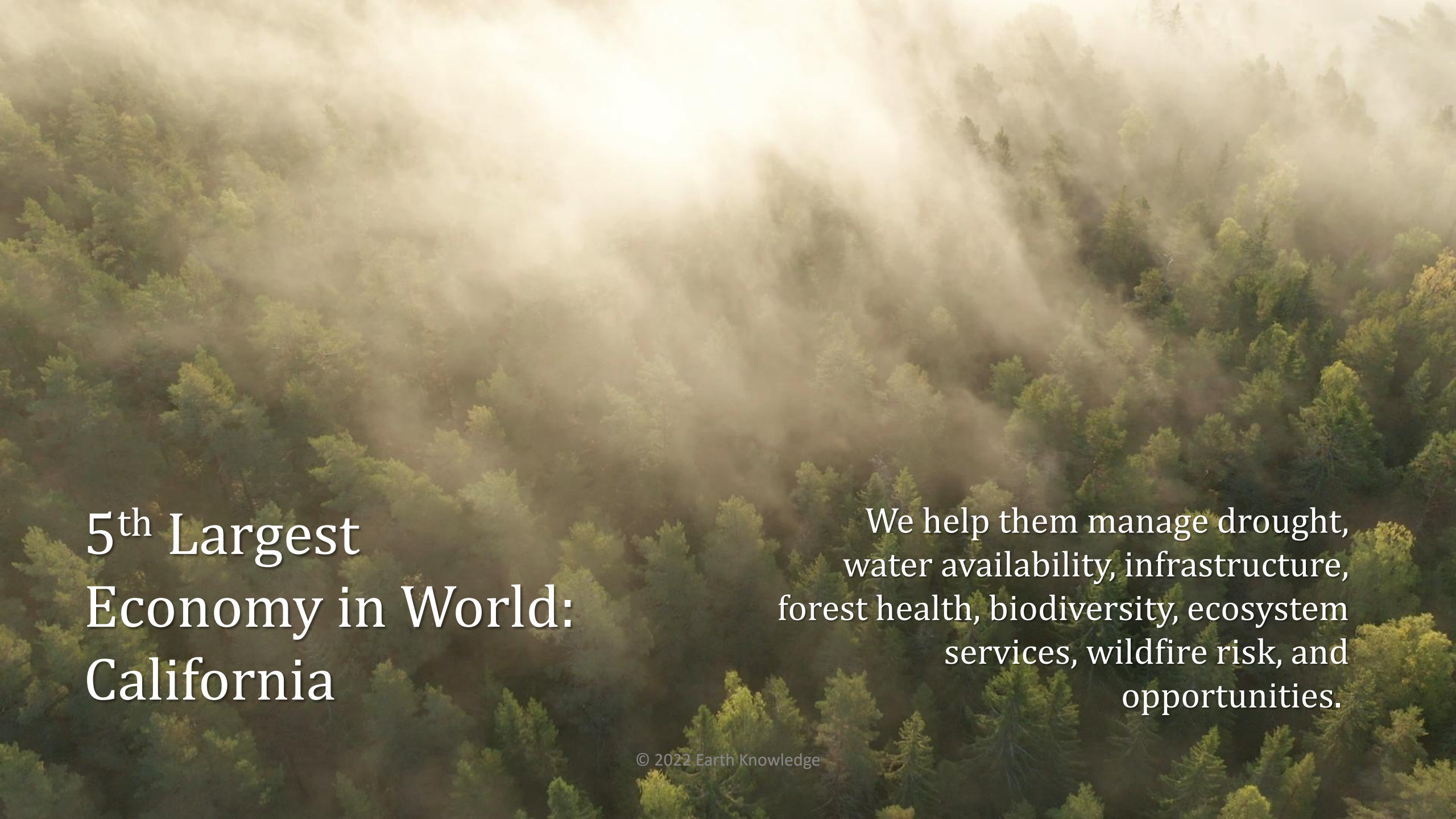
**Financial Regulations** for Climate Risk and Environment, Social and Governance (**ESG**) are going mainstream...and soon Nature-related Financial Risk Regulations.

# Earth Knowledge – Integrated Planetary Intelligence™ Platform

The Earth is a system of systems.

We have built a Digital Twin of the Earth,  
tracking global changes of these systems and the interaction of these systems  
from subsurface to atmosphere.

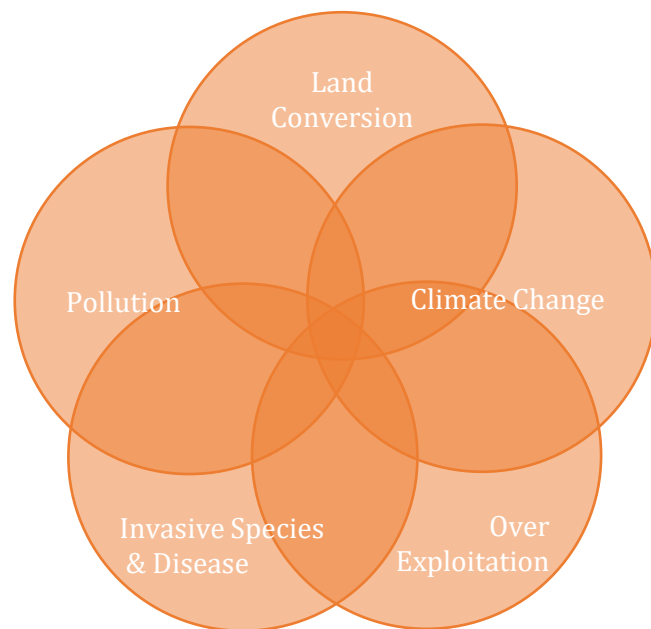
For any location on the globe, Earth Knowledge provides you the  
understanding of the earth systems and global change interactions  
for the best forward-thinking intelligence.



5<sup>th</sup> Largest  
Economy in World:  
California

We help them manage drought,  
water availability, infrastructure,  
forest health, biodiversity, ecosystem  
services, wildfire risk, and  
opportunities.

**Living  
Scientific  
Network**



**Earth Knowledge  
Indicators**



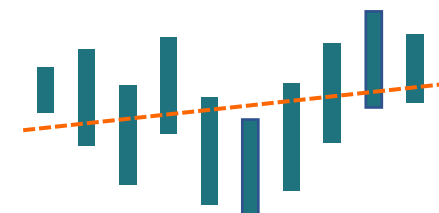
300 Global Change &  
Sustainability Indicators

Sustainability Risk

Operational Risk

Economic Risk

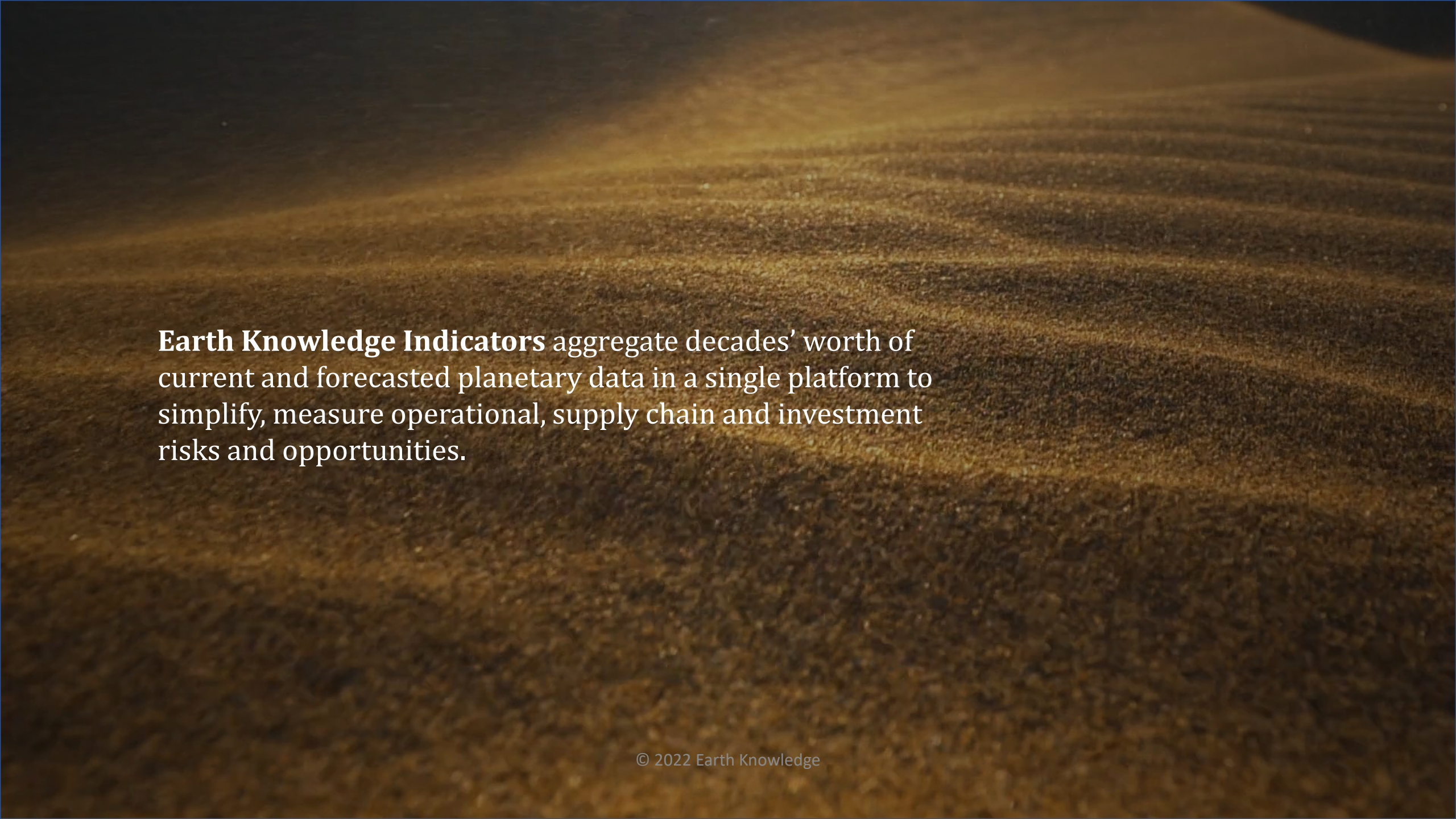
**Better  
Financial  
Performance**



**Step change in  
Risk forecasting  
& mitigation**

A wide-angle, high-altitude photograph capturing a massive herd of reindeer in a vast, flat, snow-covered landscape. The herd is densely packed in the foreground and middle ground, stretching towards the horizon. The sun is low on the horizon, creating a warm, golden glow that illuminates the scene and casts long, soft shadows. The sky is a pale, hazy blue, and the overall atmosphere is serene and majestic.

**Earth Knowledge's Digital Twin of the Earth** integrates the highest caliber of models and data of the Earth's Systems illuminating human-planet interactions and key global change current and forecasted data patterns.



**Earth Knowledge Indicators** aggregate decades' worth of current and forecasted planetary data in a single platform to simplify, measure operational, supply chain and investment risks and opportunities.

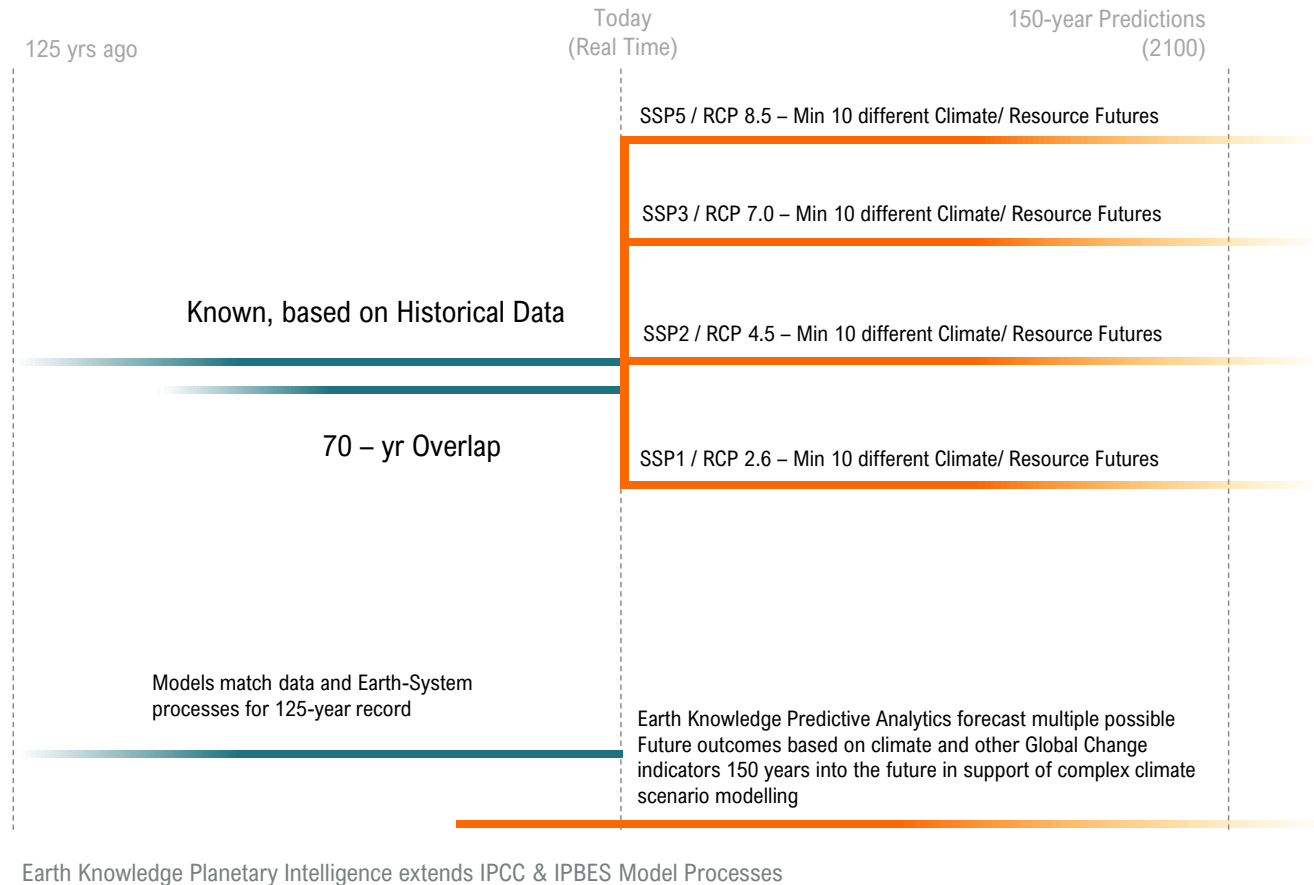
An aerial photograph of a skyscraper, likely the Willis Tower in Chicago, during sunset. The building's top section is illuminated with a bright green light. Two tall communication towers are visible on the roof. The city below is lit up, and a body of water is visible to the right.

**Achieving Success:** This accelerates your investments and operations to become more nature positive, climate resilient and sustainable - profitably.

# Trusted, Authoritative Data Analytics and Modeling Processes

All data, models, and indicators are linked to geographic location and time

- Deployed using MS Azure and Esri Cloud GIS
- Consistent, normalized, seamless, updated
- Global to Local (100km to 10 m) scales
- Biophysical processes are calculated at each model cell
- Outputs included 1000's of variables
- Digital Twin containing Petabytes to Exabytes of authoritative data, analytics, and simulation



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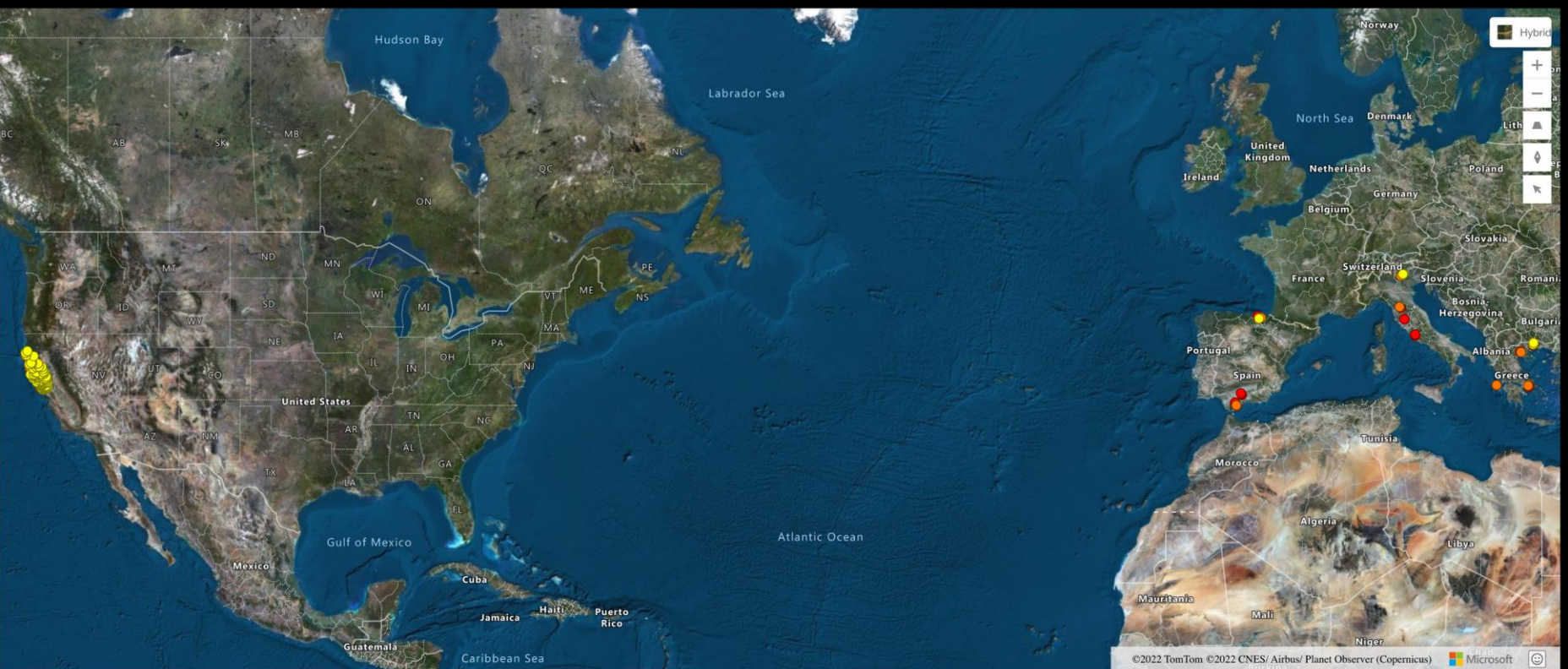
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Indicator Scores

| Theme                | Score |
|----------------------|-------|
| ⊕ Biodiversity       | 48.6  |
| ⊕ Temperature        | 26.2  |
| ⊕ Precipitation      | 25.0  |
| ⊕ Flood              | 10.8  |
| ⊕ Water Availability | 8.6   |
| ⊕ Sea-Level Rise     | 1.4   |
| Total                | 28.1  |



| Company                           | Score | Symbol / Asset Type | Industry / Asset Status                   | Value (mm) | Broad Biome   | Conservation Status                | Biodiversity Hotspot |
|-----------------------------------|-------|---------------------|-------------------------------------------|------------|---------------|------------------------------------|----------------------|
| ⊖ Acme Commercial Real Properties | 33.2  | ACME                | 53112 - Lessors of Nonresidential Buil... | \$28.1     |               |                                    |                      |
| Executive Building 1              | 35.9  | Office Building     | Current                                   | \$12.3     | Boreal/Alpine | Nature could reach Half Protect... | No                   |
| Office Park 1                     | 34.4  | Office Park         | Current                                   | \$7.3      | Boreal/Alpine | Nature could reach Half Protect... | No                   |
| Warehouse 1                       | 29.4  | Warehouse           | Current                                   | \$8.6      | Boreal/Alpine | Nature could reach Half Protect... | No                   |
| ⊖ Allied Facilities               | 31.4  | ALLF                | 53112 - Lessors of Nonresidential Buil... | \$31.0     |               |                                    |                      |
| Executive Building 2              | 31.6  | Office Building     | Current                                   | \$11.1     | Boreal/Alpine | Nature could reach Half Protect... | No                   |
| Office Park 2                     | 31.2  | Office Park         | Current                                   | \$9.0      | Boreal/Alpine | Nature could reach Half Protect... | No                   |
| Warehouse 2                       | 31.2  | Warehouse           | Proposed                                  | \$10.8     | Boreal/Alpine | Nature could reach Half Protect... | No                   |
| ⊖ Alto Facilities                 | 76.1  | ALTO                | 53112 - Lessors of Nonresidential Buil... | \$32.0     |               |                                    |                      |
| Executive Building 2              | 74.7  | Office Building     | Current                                   | \$12.7     | Boreal/Alpine | Nature could reach Half Protect... | No                   |
| Total                             | 28.1  |                     |                                           | \$756.2    |               |                                    |                      |

Locations

Themes

Heatmap

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Locations

Themes

Heatmap

| Theme                                 | Biodiversity |       | Flood |       | Precipitation |       | Sea-Level Rise |       | Temperature |       | Water Availability |       | Total |       |
|---------------------------------------|--------------|-------|-------|-------|---------------|-------|----------------|-------|-------------|-------|--------------------|-------|-------|-------|
| Company                               | Score        | Trend | Score | Trend | Score         | Trend | Score          | Trend | Score       | Trend | Score              | Trend | Score | Trend |
| Acme Commercial Real Properties       | 58.3         |       | 14.7  |       | 17.6          |       | 0.5            |       | 42.1        |       | 1.8                |       | 33.2  |       |
| Allied Facilities                     | 54.9         |       | 9.0   |       | 20.3          |       | 4.1            |       | 36.5        |       | 2.0                |       | 31.4  |       |
| Alto Facilities                       | 81.4         |       | 0.3   |       | 92.9          |       | 0.4            |       | 81.1        |       | 31.7               |       | 76.1  |       |
| Amalgamated Offices                   | 56.2         |       | 6.8   |       | 11.7          |       | 1.4            |       | 36.8        |       | 0.3                |       | 28.8  |       |
| Andalusia Real Properties             | 40.6         |       | 0.5   |       | 68.7          |       | 0.0            |       | 74.1        |       | 65.5               |       | 58.5  |       |
| Athens Renewables                     | 77.0         |       | 0.0   |       | 53.4          |       | 0.1            |       | 40.0        |       | 28.2               |       | 48.1  |       |
| CAL Cell                              | 48.7         |       | 20.1  |       | 22.2          |       | 0.2            |       | 16.8        |       | 0.9                |       | 23.9  |       |
| California Main Energy                | 58.6         |       | 4.0   |       | 18.4          |       | 0.8            |       | 30.2        |       | 0.3                |       | 28.9  |       |
| Castelveccio                          | 59.5         |       | 0.0   |       | 60.1          |       | 0.0            |       | 53.4        |       | 22.8               |       | 51.0  |       |
| Costa del Sol Coastal Energy          | 30.3         |       | 0.0   |       | 55.3          |       | 0.1            |       | 29.3        |       | 67.2               |       | 36.5  |       |
| CP Cellular                           | 45.3         |       | 19.9  |       | 20.6          |       | 0.0            |       | 15.4        |       | 0.4                |       | 22.1  |       |
| Espana Estates                        | 40.3         |       | 0.0   |       | 68.9          |       | 0.0            |       | 55.0        |       | 63.7               |       | 51.8  |       |
| ETG Mobile                            | 48.3         |       | 10.9  |       | 17.0          |       | 4.0            |       | 21.3        |       | 2.2                |       | 23.7  |       |
| Gemelli Wine Company                  | 46.3         |       | 19.0  |       | 35.5          |       | 0.6            |       | 22.4        |       | 1.5                |       | 29.6  |       |
| Geppetto Wood Products                | 36.8         |       | 0.7   |       | 33.6          |       | 0.0            |       | 15.8        |       | 11.7               |       | 24.3  |       |
| Greco Wine Company                    | 67.5         |       | 0.0   |       | 32.4          |       | 0.2            |       | 25.5        |       | 47.7               |       | 35.1  |       |
| Half Moon Sustainable Forest Products | 46.6         |       | 23.0  |       | 34.4          |       | 0.0            |       | 14.2        |       | 0.0                |       | 26.5  |       |
| Hauser Wood Products                  | 40.4         |       | 8.5   |       | 14.3          |       | 0.0            |       | 14.9        |       | 0.0                |       | 18.5  |       |
| Iera Sustainable Forest Products      | 42.6         |       | 0.0   |       | 37.0          |       | 0.0            |       | 33.3        |       | 29.0               |       | 33.4  |       |
| Total                                 | 48.6         |       | 10.8  |       | 25.0          |       | 1.4            |       | 26.2        |       | 8.6                |       | 28.1  |       |

Show Any Score in Range

0.0

100.0

Show Indicators with Total Score in Range

1.4

67.3

Show Assets with Total Score in Range

11.5

78.1

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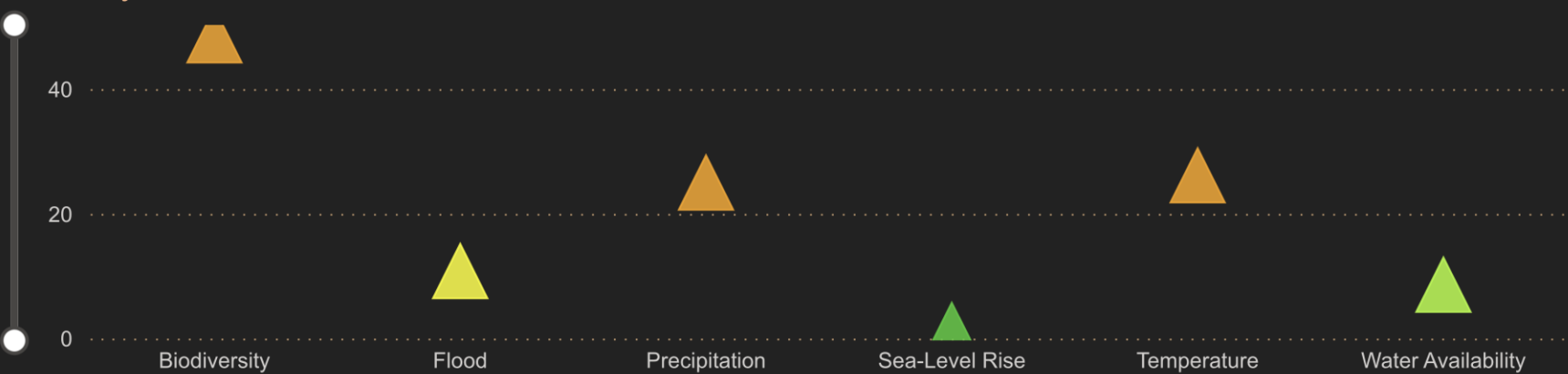


Locations

Themes

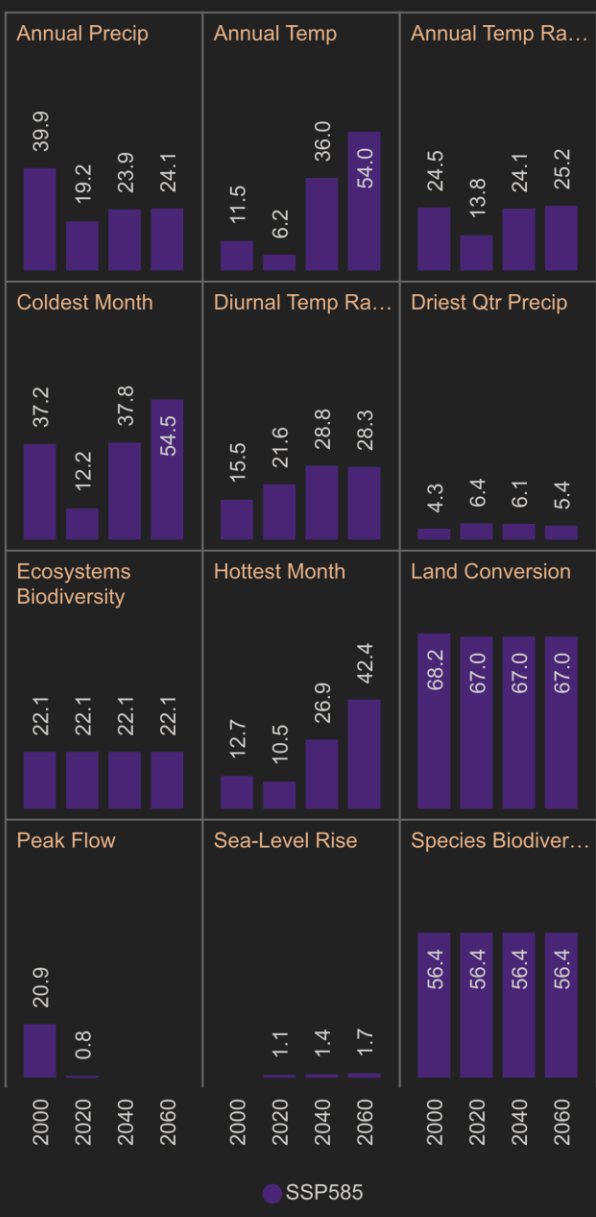
Heatmap

Score by Theme



| Company                               | Score | Symbol / Asset Type | Industry / Asset Status     | Value (mm) | Broad Biome | Conservation |
|---------------------------------------|-------|---------------------|-----------------------------|------------|-------------|--------------|
| Acme Commercial Real Properties       | 33.2  | ACME                | 53112 - Lessors of Non...   | \$28.1     |             |              |
| Allied Facilities                     | 31.4  | ALLF                | 53112 - Lessors of Non...   | \$31.0     |             |              |
| Alto Facilities                       | 76.1  | ALTO                | 53112 - Lessors of Non...   | \$32.0     |             |              |
| Amalgamated Offices                   | 28.8  | AMAL                | 53112 - Lessors of Non...   | \$28.2     |             |              |
| Andalusia Real Properties             | 58.5  | ARPR                | 53112 - Lessors of Non...   | \$21.8     |             |              |
| Athens Renewables                     | 48.1  | ATRE                | 22112 - Electric Power ...  | \$20.7     |             |              |
| CAL Cell                              | 23.9  | CALC                | 51731 - Wired and Wir...    | \$34.3     |             |              |
| California Main Energy                | 28.9  | CALM                | 22112 - Electric Power ...  | \$11.6     |             |              |
| Castelvecchio                         | 51.0  | CAST                | 31213 - Wineries            | \$19.4     |             |              |
| Costa del Sol Coastal Energy          | 36.5  | CDS                 | 22112 - Electric Power ...  | \$26.0     |             |              |
| CP Cellular                           | 22.1  | CPC                 | 51731 - Wired and Wir...    | \$19.7     |             |              |
| Espana Estates                        | 51.8  | EES                 | 31213 - Wineries            | \$28.0     |             |              |
| ETG Mobile                            | 23.7  | ETGM                | 51731 - Wired and Wir...    | \$113.1    |             |              |
| Gemelli Wine Company                  | 29.6  | GWI                 | 31213 - Wineries            | \$27.5     |             |              |
| Geppetto Wood Products                | 24.3  | GEPP                | 11531 - Support Activiti... | \$29.5     |             |              |
| Greco Wine Company                    | 35.1  | GRWI                | 31213 - Wineries            | \$11.1     |             |              |
| Half Moon Sustainable Forest Products | 26.5  | HALF                | 11531 - Support Activiti... | \$10.5     |             |              |
| Hauser Wood Products                  | 18.5  | HWP                 | 11531 - Support Activiti... | \$17.3     |             |              |
| Iera Sustainable Forest Products      | 33.4  | IERA                | 11531 - Support Activiti... | \$22.9     |             |              |
| Total                                 | 28.1  |                     |                             | \$756.2    |             |              |

Score over Time



# Earth Knowledge Natural Capital Indicators (Partial List)

## Naturally Functioning Ecosystems

### Biodiversity

- Ecosystems (Communities, Food Web, Structure)
- Species (Habitat, Composition, Population)

### Atmosphere

- Atmospheric Conditions / Composition
- Extreme Weather (Storms, Heat Waves, Cold Fronts)
- Climate Change (Droughts, Floods, Wildfire)

### Water

- Oceans (Acidification, Sea Levels, Environments, Coastal Hazards)
- Snow & Ice (Snow, Glaciers, Permafrost, Ice [sheets, shelves, sea])
- Groundwater (Movement, Availability, Quality)
- Surface Water (Streams, Rivers, Lakes, Wetlands, Reservoirs Quantity/Quality)

### Earth Resources

- Earth Materials (Mineral, Rock and Soil Resources)
- Plate Tectonics (Earthquakes, Volcanoes, Tectonics)
- Earth Processes (Weathering, Landslides, Sedimentation, Metamorphism)

## Land-use / Land Conversion

### Land Conversion

- **Developed Land** (Cities, Villages, Croplands, Rangelands)
- **Shared / Used Land**
- **Wild Land** (Woodlands/Grassland)

### Ecological Land-Use

- **Productive Rural Areas** (Forestry, Agriculture, Fisheries, Ecotourism)
- **Towns and Cities** (Neighborhoods, Green Building, Mass Transit, Eco-Infrastructure, Urban Growth Boundaries)
- **Connected Wildlands** (Core Reserves, Buffer Zones, Corridors)

## Ecosystem Services

### Provisioning Services

- Energy, Food, Materials, Medicine

### Regulating Services

- Air and Water Quality, Climate, Pollination, Habitat Maintenance

### Non-Material Services

- Cultural, Indigenous, Educational Experiences

# Comprehensive Digital Twin of the Earth

## Now

5km Global – Decades

1km Continental – Decades

- Natural Capital - Pillars, Themes, Indicators
- ~20 Indicators

## This Year

5km Global – Decades/Years

1km Continental – Years/Months

- Natural Capital - Pillars, Themes, Indicators
- Additional ~40 Indicators

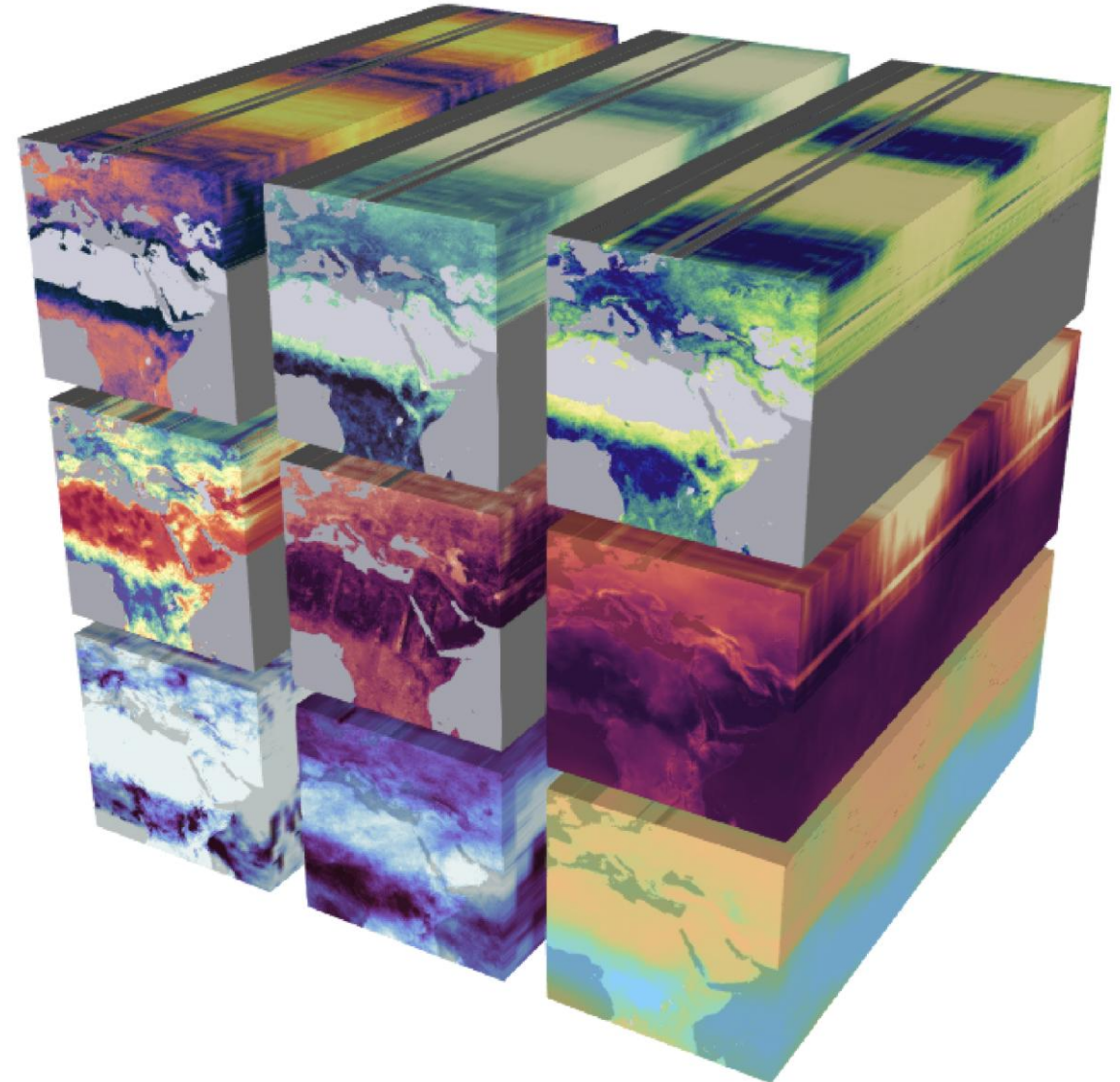
## Future / Custom

250 m Regional – Years/Months

50m Landscape – Months (for Select Megaregions)

Local Scale – for Select Megaregions

Site Scale – for Select Megaregions



# A Digital Twin that Is...

Seamless

Harmonized

Queryable

Updatable

Interoperable

Multidimensional

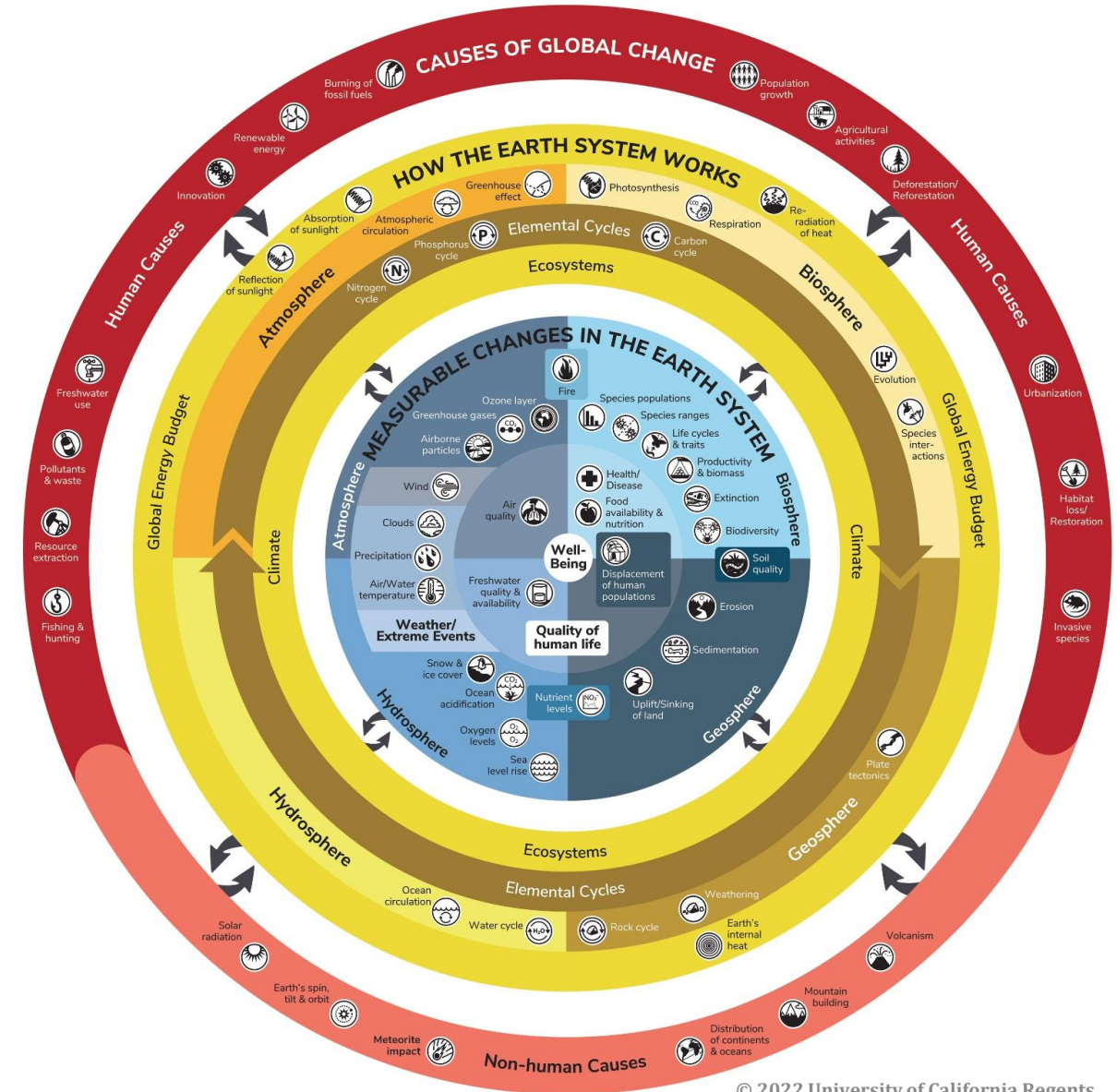
- space, time, indicators

Dynamic

Varying Resolutions

Multiple Likely Future Outcomes

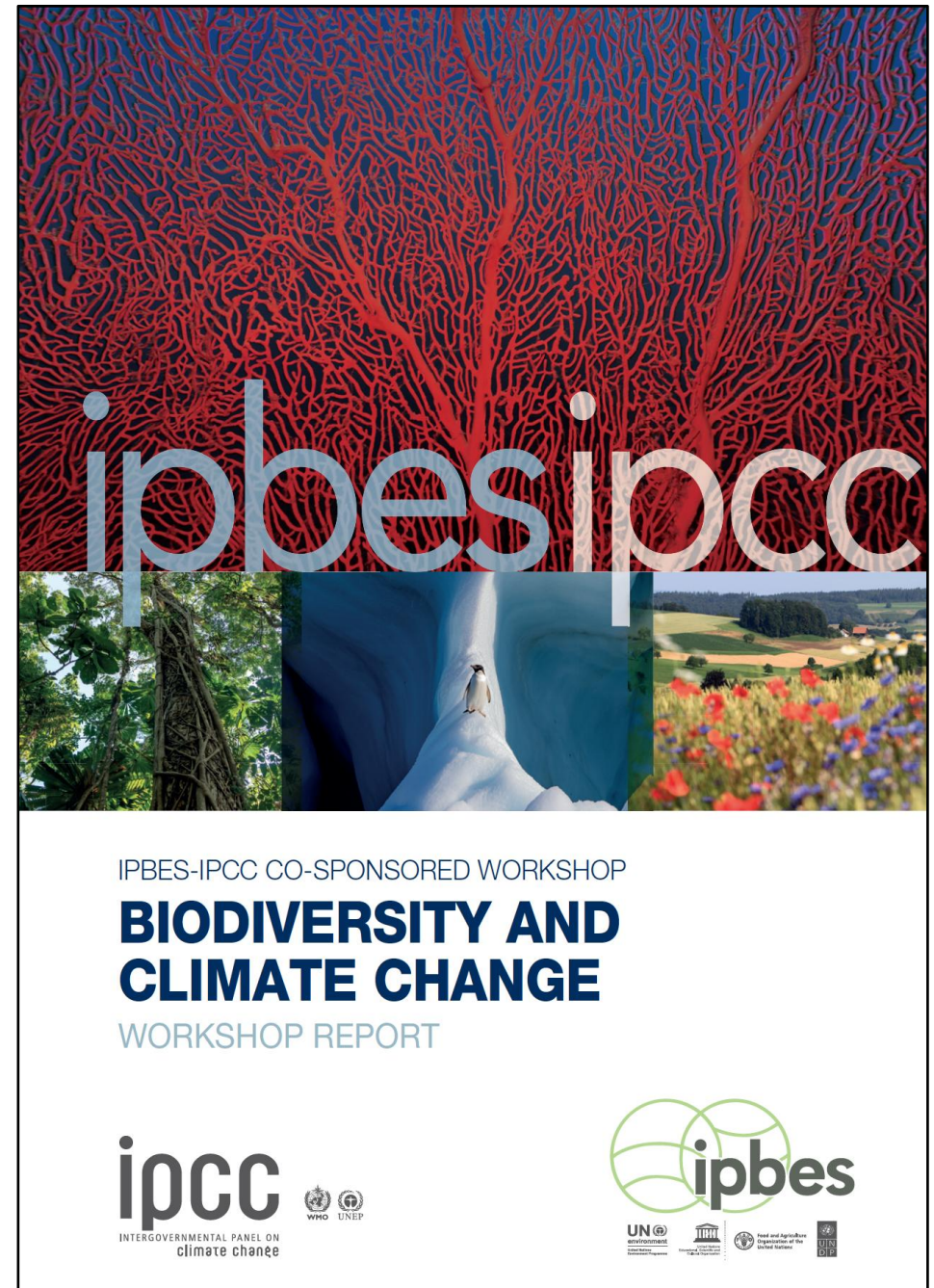
Uncertainty Indicated



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# IPBES – IPCC Workshop Findings

- Limiting global warming to ensure a habitable climate and protecting biodiversity are ***mutually supporting goals***, and their achievement is essential for sustainably and equitably providing benefits to people.
- Land- and ocean-based actions to protect, sustainably manage and restore ecosystems have ***co-benefits for climate mitigation, climate adaptation and biodiversity objectives***.
- Measures narrowly focused on climate mitigation and adaptation ***can have direct and indirect negative impacts on nature and nature's contributions to people***.
- Measures narrowly focusing on protection and restoration of biodiversity have generally important cascading benefits for climate change mitigation, but those ***benefits may be sub-optimal compared to measures that account for both biodiversity and climate***.
- ***Treating climate, biodiversity and human society as coupled systems is key to successful outcomes*** from policy interventions.
- ***Transformative change*** in governance of socio-ecological systems can help create climate and biodiversity resilient development pathways.



The background of the slide is a photograph of the interior of Antelope Canyon. The walls are made of smooth, undulating sandstone that has been eroded into flowing, wave-like patterns. The lighting is dramatic, with bright orange and yellow light coming from an opening at the top, creating a strong contrast with the deep shadows in the crevices. The overall color palette is dominated by warm tones of orange, red, and brown.

**Thank you.**

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