

ISDE DIGITAL EARTH INITIATIVE FOR CLIMATE GOVERNANCE AND REGENERATIVE ECONOMICS

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This statement outlines how Digital Earth will help Parties implement the next generation of climate commitments (NDC 3.0), strengthen the integrity of climate finance, and manage systemic climate risks through transparent, ethical, and participatory decision-support systems. It affirms the International Society for Digital Earth (ISDE) as a trusted scientific partner to the United Nations Framework Convention on Climate Change (UNFCCC) and to governments, financial institutions, and research communities worldwide. It is aligned with COP30's priorities on ambition, transparency, and resilience in climate action.

PREAMBLE

Humanity faces a convergence of environmental, economic, and social risks that demand coordinated planetary action. To meet this challenge, ISDE advances Digital Earth as a planetary infrastructure for understanding, managing, and regenerating the Earth system. Digital Earth refers to a dynamic, multi-dimensional virtual model of our planet that integrates vast quantities of geospatial data and knowledge.

Originally envisioned by former U.S. Vice President Al Gore in 1998¹ as a “multi-resolution, three-dimensional representation of the planet” linking all manner of Earth data for universal access, the concept has evolved into a unifying scientific and policy paradigm. Today, Digital Earth is pursued as a federated, open ecosystem spanning disciplines and scales - connecting satellite observations, in-situ sensors, models, and global data archives in real time. It functions both as a technological platform and an institutional framework that transforms data into understanding and understanding into informed action.

Digital Earth is implemented through twelve interrelated Thematic Frameworks² that together form a “system of systems” for planetary stewardship. These frameworks are organised into three tiers, ensuring that core technical systems, enabling mechanisms, and human-centric applications work in concert to address global challenges:

- **Tier 1: Foundational Systems:** Defines the core digital infrastructure of Digital Earth - treating the planet as a complex adaptive system and a real-time cyber-physical continuum. This tier establishes the technical backbone (e.g. integrated Earth observation, sustainable computing,

¹ Gore, Al. “Digital Earth”. Speech, California Science Center, Los Angeles, January 31, 1998.

² Simpson, Richard. “Message from the President.” International Society for Digital Earth. Accessed <date>. <https://www.digitalearth-isde.org/list-152-1.html>

and a trust & compliance infrastructure) needed for planetary-scale data collection and processing.

- **Tier 2: Enabling Infrastructures:** Links data to value and governance. It provides the policy and economic mechanisms that turn information into action - for example, Digital Earth as a Value Exchange Infrastructure for climate finance (Framework 6), as an ethical data governance system (Framework 7), as a knowledge federation across disciplines (Framework 8), and as a meta-design space to simulate future scenarios (Framework 9). These enable transparent carbon accounting, incentive structures, and cross-border collaboration essential to COP30's goals.
- **Tier 3: Human-Centric Applications:** Delivers user-facing tools and environments. It encompasses capacity-building and decision-support applications - from Digital Earth as a global learning and empowerment platform (Framework 10), to a cultural memory and storytelling hub (Framework 11), and a strategic intelligence and decision theatre for informed policymaking (Framework 12). This tier ensures data and insights are accessible, inclusive, and actionable for all stakeholders.

This tiered framework approach provides a structured blueprint to realise the Digital Earth vision, aligning technological innovation, governance, and societal engagement in a comprehensive way.

This COP30 initiative builds upon ISDE's Digital Earth Initiative for the Sustainable Development Goals (SDGs)³, launched during the World Science and Technology Development Forum in Beijing on 28 October 2025. This statement positions Digital Earth as a foundational infrastructure for advancing the Sustainable Development Goals and for spatial knowledge federation at a planetary scale. Together, the SDG-focused declaration and this COP30 statement form a complementary pair, with the SDG statement setting out the long-term scientific and educational vision, and the COP30 statement translating that vision into an operational agenda for climate governance, regenerative economics, and transparent finance.

VISION

Contemporary climate change encompasses both quantifiable impacts and systemic risks across ecological and economic systems. The Social Cost of Carbon (SCC)⁴ represents the expected economic damage from each additional tonne of greenhouse gas emissions, while the Risk Cost of Carbon (RCC)⁵ reflects the probability of cascading or irreversible changes to Earth's systems from those emissions. Current market mechanisms and policies have struggled to internalise these costs, indicating that climate change is not only a market failure but a broader market-and-systems failure. It

³ International Society for Digital Earth. (2025, October 28). ISDE Digital Earth Initiative for the Sustainable Development Goals. International Society for Digital Earth. <https://www.digitalearth-isde.org/uploadfile/2025/1103/20251103060205259.pdf>

⁴ Asdourian, E. and Wessel, D. "What Is the Social Cost of Carbon?" Brookings Institution, 14 March 2023. <https://www.brookings.edu/articles/what-is-the-social-cost-of-carbon/>

⁵ Chen, Delton B., Joel van der Beek & Jonathan Cloud. 2017. "Climate Mitigation Policy as a System Solution: Addressing the Risk Cost of Carbon." *Journal of Sustainable Finance & Investment* 7 (3): 233-274, <https://doi.org/10.1080/20430795.2017.1314814>

demands new architectures that explicitly account for both SCC and RCC in decision-making, as proposed in emerging concepts like the *Carbon Reward Policy*⁶.

Digital Earth represents a strategic journey toward an integrated, science-based decision environment for addressing the global climate challenge. It offers the opportunity to connect data, models, and governance processes into a coherent framework that enables real-time insight and informed action. Its federated modelling capacity supports both incentive-based and regulatory approaches, allowing policymakers to reward verified mitigation efforts and strengthen compliance within a transparent global framework.

This vision transforms climate governance from a reactive process into a continuous, adaptive cycle of observation, evaluation, and improvement. Through the emerging network of Digital Earth decision theatres and analytical dashboards, leaders and citizens can explore scenarios, assess progress, and refine strategies. The journey toward Digital Earth invites collaboration across governments, science, and civil society to build a shared foundation of trust, accountability, and foresight in global climate action.

In essence, the vision of Digital Earth offers a pathway toward a trusted, science-based data and analytical infrastructure for managing the risks associated with anthropogenic climate change⁷. It establishes the principles of data integrity, ethical governance, and interoperability that underpin transparency, participation, and accountability across all climate-finance mechanisms.

By aligning scientific evidence with financial and policy systems, Digital Earth enables coherence between emissions accounting, NDC tracking, and emerging incentive frameworks within a shared digital environment. Through this evolving architecture, it connects high-level commitments to measurable and verifiable outcomes on the ground, turning ambition into accountable progress.

OUR COMMITMENTS

To operationalise this vision, ISDE will pursue the following commitments in chronological sequence, each coordinated through dedicated ISDE Task Forces reporting annually to the ISDE Council:

1. **Convene the Framework 6 Value Exchange Forum (Q1 2026)** - led by an ISDE Framework 6 Task Force:
 - Bring together central banks, finance ministries/treasuries, multilateral development banks (MDBs), and standards bodies into dialogue.
 - Identify pilot pathways linking Digital Earth data infrastructures to climate-finance assurance, disclosure, and risk management processes.

⁶ Chen, D. B. (2025). Carbon Reward Policy: An Economic Framework for Responding to Climate Damages and Systemic Risks. Economics & Policy Working Paper No. 1. Global Carbon Reward / Inquiring Systems, Inc. <https://doi.org/10.5281/zenodo.17294364>

⁷ Crutzen, P. J. (2002). Geology of Mankind – The Anthropocene. Nature, 415, 23. <https://doi.org/10.1038/415023a>

2. **Strengthen Framework 5 (Trust and Compliance) through Regional Pilots (Q2-Q3 2026)** - led by the ISDE Trust and Data Integrity Task Force:
 - Release version 1.0 provenance profiles, consent templates, and verification toolkits aligned with FAIR and CARE data principles (for findability, accessibility, interoperability, reusability, and for collective benefit, authority, responsibility, ethics).
 - Scope and initiate two regional pilot projects demonstrating transparent Measurement, Reporting and Verification (MRV) of climate adaptation and mitigation outcomes, using Digital Earth's trust infrastructure.
3. **Publish the Framework 6 Reference Architecture (Q1 2027)** - jointly overseen by the ISDE Framework 6 Task Force and other relevant ISDE Task Forces:
 - Deliver a "data-to-value pathway" reference guide, co-authored with MDBs and international standards agencies, detailing how climate data streams can be converted into trusted climate finance value streams.
 - Define interfaces between Digital Earth registries, investment models, and carbon-accounting or climate crediting protocols to ensure interoperability and integrity in emerging climate markets.
4. **Explore the Digital Earth Carbon Incentive Protocol (DECIP) (Q4 2026)** - led by the ISDE Carbon Incentive Exploration Task Force (in collaboration with the Framework 6 Task Force and the Global Carbon Reward (GCR) project):
 - Undertake a joint scoping exercise with interested Parties, MDBs, and the GCR project to assess how a *Digital Earth Carbon Incentive Protocol* could link verified carbon performance (e.g. measured emissions reductions or removals) to new financial instruments such as a sovereign-backed carbon "reward."
 - Ensure that any elements overlapping with the GCR policy are developed in consultation with the GCR Project's management team and proceed only with agreed governance arrangements and resourcing.
 - Emphasise that this exploration is proof-of-concept only and *does not* constitute a new financial instrument at this stage, but rather lays the groundwork for future climate finance innovation if deemed viable.

OUR CALL FOR ACTION

To accelerate delivery, ISDE calls upon governments, international organisations, financial institutions, and scientific partners to collaborate in this initiative. We invite stakeholders to participate through newly established Digital Earth Task Forces, each with a specific mandate:

- **Framework 6 Task Force** - convene the Global Value Exchange Forum and guide alignment of Digital Earth with multilateral climate finance systems.

- **Trust and Data Integrity Task Force** - implement data provenance, consent, and transparency pilots across regions, demonstrating trustworthy climate data ecosystems.
- **Framework 12 Task Force** - develop open ontologies, shared strategic dashboards, and “Decision Theatre” toolkits for climate risk analysis and policy simulation.
- **Carbon Incentive Exploration Task Force** - co-design the DECIP scoping exercise with the Global Carbon Reward project and interested stakeholders, laying the foundation for future carbon reward pilot programs.

PATHWAYS FOR ENGAGEMENT

Stakeholders can support and engage with the Digital Earth Initiative through multiple pathways:

- **Collaborate:** Form ISDE chapter-led partnerships with national statistical offices, environment ministries, treasuries, and space agencies to pilot Digital Earth-based MRV systems and climate risk dashboards during 2026. (For example, a country could partner with ISDE to integrate satellite-derived data and Digital Earth models into its national emissions tracking and climate risk assessment platforms.)
- **Integrate:** Adopt open indicator frameworks, regulatory “digital twins,” and participatory scenario exercises (Decision Theatre sessions) to test and refine NDC 3.0 and 2035 climate pathways under uncertainty. By using Digital Earth’s simulation environments, countries can explore the impacts of various policy choices and economic scenarios before finalizing their climate strategies.
- **Join:** Nominate representatives to ISDE Task Forces via the ISDE Secretariat. Joining a task force will grant access to shared data sets, analytic tools, and pilot project opportunities - enabling members to contribute expertise and directly shape the development of Digital Earth solutions.
- **Embed:** Reference and embed Digital Earth principles of data ethics, trust, and inclusive participation within UNFCCC programs and multilateral development bank initiatives. This includes aligning with global standards (such as UN-GGIM guidelines and the evolving SDG Data Commons) to ensure interoperability and to accelerate the flow of high-integrity climate finance across borders.

A SHARED FUTURE

Digital Earth Framework 6, the Value Exchange Infrastructure, links climate data with financial value and opens a direct dialogue between the scientific community and the financial system. It connects ISDE’s Digital Earth architecture with ministries of finance, central banks, treasuries, monetary authorities, and institutional investors, embedding Digital Earth within the evolving framework of sustainable finance and climate-risk management.

In shaping this bridge between environmental action and monetary policy, we draw on pioneering insights from Paul Crutzen’s work on atmospheric chemistry and planetary boundaries⁸, William Nordhaus’s integration of climate costs into economics⁹, and Elinor Ostrom’s principles for governing shared resources¹⁰. By transforming verified environmental performance into transparent, measurable financial assets, Digital Earth links geospatial intelligence with global monetary and policy systems, ensuring that climate action is recognised and rewarded within economic decision-making.

ISDE will remain instrument-agnostic in this effort, positioning Digital Earth as a neutral and trusted digital infrastructure to support any lawful climate-finance mechanism adopted by Parties. Whether enhancing carbon markets, developing a global carbon reward currency, or strengthening climate-risk disclosures, the same foundations of open data, rigorous science, and ethical governance will guide its operation. Through this role, ISDE reaffirms its commitment to the UNFCCC process, helping nations and institutions turn high-level climate pledges into coordinated, evidence-based actions on the ground.

CONCLUDING STATEMENT

In summary, the Digital Earth frameworks establish the conceptual, technical, and ethical foundations for a new era of climate governance. They unite currently fragmented efforts into a coherent planetary architecture, allowing the global community to progress from measurement to understanding, and from reactive management to regenerative action. Moreover, the tangible outputs of this initiative are the Digital Earth Enablers (DEEs)¹¹, such as new standards, tools, and pilot programs developed by the task forces, which will bridge across the frameworks and translate this high-level architecture into practical solutions. These enablers ensure that Digital Earth’s vision is not just theoretical, but a lived reality of better data, better decisions, and better outcomes for our planet.

Through this statement, ISDE underscores its commitment to work alongside COP30 and future UNFCCC processes as a trusted scientific ally. Our shared purpose is to realise Digital Earth as the institutional backbone of risk-aware climate governance and regenerative economics, ensuring that the outcomes of COP30 and beyond are measurable, transparent, and just. Digital Earth is not merely a platform, but a *living infrastructure of understanding* - one that transforms data into shared meaning, knowledge into equitable value, and vision into action. By linking credible science with innovative policy and finance, we can move together from rhetoric to results, and from a climate of fear to a climate of hope.

⁸ Müller, Rolf; Pöschl, Ulrich; Koop, Thomas; Peter, Thomas; Carslaw, Ken. 2023. “Paul J. Crutzen – a pioneer in Earth system science and a founding member of the journal Atmospheric Chemistry and Physics.” *Atmospheric Chemistry and Physics* 23, 15445-15453. <https://doi.org/10.5194/acp-23-15445-2023>

⁹ Nordhaus, William D. (2019). “Climate Change: The Ultimate Challenge for Economics.” *American Economic Review*, 109(6), 1991-2014. <https://doi.org/10.1257/aer.109.6.1991>

¹⁰ Ostrom, Elinor (1990). *Governing the Commons: The Evolution of Institutions for Collective Action*. Cambridge, UK: Cambridge University Press.

¹¹ Simpson, R., Finn, K., Trent, J., & Crawford, K. (2025, April). *The International Society of Digital Earth – A Strategic Vision*. Board paper presented at the 21st ISDE Council Meeting, 14th International Symposium on Digital Earth, Chongqing, China. International Society for Digital Earth.

NEXT STEPS AND REPORTING

- i. **Task Force Initiation:** The new ISDE Task Forces described above will be formally constituted by January 2026, with membership, charters, and work plans established. The Taskforce will convene a forum in Q1 2026.
 - ii. **Progress Milestones:** Initial progress reports from each Task Force will be presented to the 24th ISDE Council Meeting in February 2026, and interim outcomes will be shared publicly at the Digital Earth Summit 2026 being held 24 to 26 November in Melbourne, Australia. These forums will allow the global community to review advancements and provide feedback.
 - iii. **Pilot Projects (2026-2027):** Throughout 2026 and 2027, ISDE will work with selected pilot countries and multilateral partners to implement demonstration projects. These pilots will range from enhanced national MRV systems to prototype carbon reward transactions , and will openly publish their data and findings, fostering transparency and collective learning.
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FURTHER INFORMATION

For further information or to engage with the ISDE Digital Earth Initiative, please contact:

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Key references and scientific foundations:

- Guo, H., Goodchild, M. F., & Annoni, A. (Eds.). (2020). *Manual of Digital Earth*. Springer Nature.
<https://doi.org/10.1007/978-981-32-9915-3>
This open-access volume presents a comprehensive survey of the Digital Earth concept, tracing its evolution over two decades, detailing key technologies (such as remote sensing, big Earth data, AI, and cloud computing), exploring multi-domain applications (including climate change, sustainable development, urban digital twins), and reviewing regional and national implementations
- Goodchild, M. F., Guo, H., Annoni, A., Bian, L., de Bie, K., Campbell, F., Craglia, M., Ehlers, M., van Genderen, J., Skidmore, A. K., Woodgate, P., & others. (2012). Next-generation Digital Earth. *Proceedings of the National Academy of Sciences of the United States of America*, 109(28), 11088–11094. <https://doi.org/10.1073/pnas.1202383109>
A position paper arguing for a reconceptualisation of Digital Earth in light of big data, citizen science and new sensors.
- Annoni, A., Nativi, S., Çöltekin, A., Desha, C., Eremchenko, E., Gevaert, C. M., Giuliani, G., Chen, M., Perez-Mora, L., Strobl, J., & Tumampos, S. (2023). *Digital Earth: Yesterday, today and tomorrow*. *International Journal of Digital Earth*, 16(1), 1022–1072.
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A retrospective and forward-looking overview of how the Digital Earth concept has evolved and where it may head.
- Craglia, M., de Bie, K., Jackson, D., Pesaresi, M., Remetey-Fülöpp, G., Wang, C., Annoni, A., Bian, L., Campbell, F., Ehlers, M., van Genderen, J. L., Goodchild, M., Guo, H., Lewis, A., Simpson, R., Skidmore, A., Woodgate, P. (2012). Digital Earth 2020: Towards the vision for the next decade. *International Journal of Digital Earth*, 5(1), 4–21.
<https://doi.org/10.1080/17538947.2011.638500>
A multisectoral vision-setting paper developing a roadmap for Digital Earth through 2020, reflecting on policy drivers, science and technology.
- Craglia, M., Pogorzelska, K. (2020). The economic value of Digital Earth. In H. Guo, M. F. Goodchild & A. Annoni (Eds.), *Manual of Digital Earth* (pp. 623–643). Springer Nature.
https://doi.org/10.1007/978-981-32-9915-3_19
A chapter exploring how Digital Earth infrastructures generate economic value, focusing on Earth-observation data, infrastructure investment and policy.