



# Future Earth Research for Global Sustainability

## The Research Framework

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# **Some of the challenges we face**

- Feeding 9 billion people within sustainable planetary boundaries
- Valuing and protecting nature's services and biodiversity
- Adapting to a warmer and more urban world
- Transitioning to low carbon societies
- Providing income and innovation opportunities through transformations to global sustainability
- Reducing disaster risks
- Aligning governance with stewardship
- Global scientific capacity building

The challenges of global environmental change and sustainable development require some new approaches which are:

- *More international*
- *More integrated*
- *More collaborative*
- *Co-designed with users, funders...*
- *More responsive to society and grand challenges of sustainability*
- *Builds on the success of current international research programmes*



photos: www.dawide.com

# Future Earth

To provide the knowledge required for societies in the world to face risks posed by global environmental change and to seize opportunities in a transition to global sustainability

# Future Earth: can we answer ...

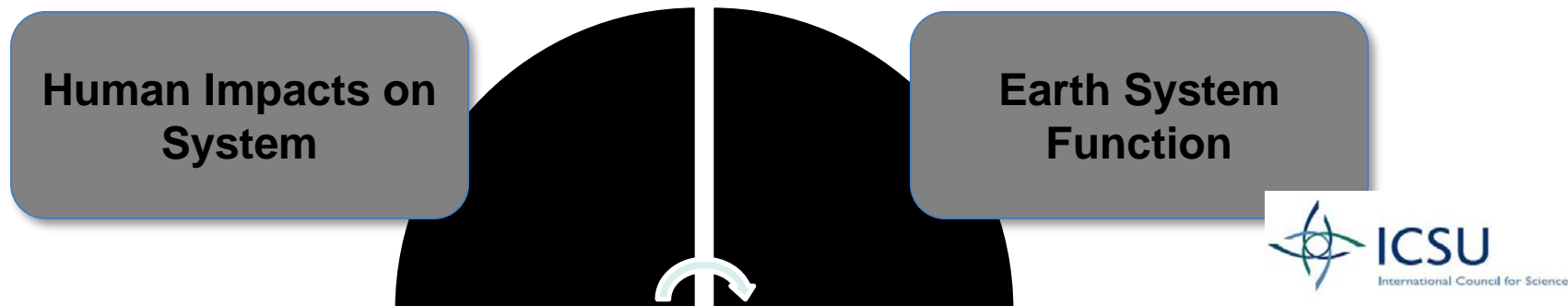
How and why the global environment is changing, what are likely future changes, what the implications are for human wellbeing and other species, what choices can be made to reduce harmful risks and vulnerabilities and enhance resilience, and how this knowledge can support decisions and sustainable development?



# Future Earth: A new International Initiative

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Mobilize international global change scientific community around an unprecedented decade of focused and intensive research

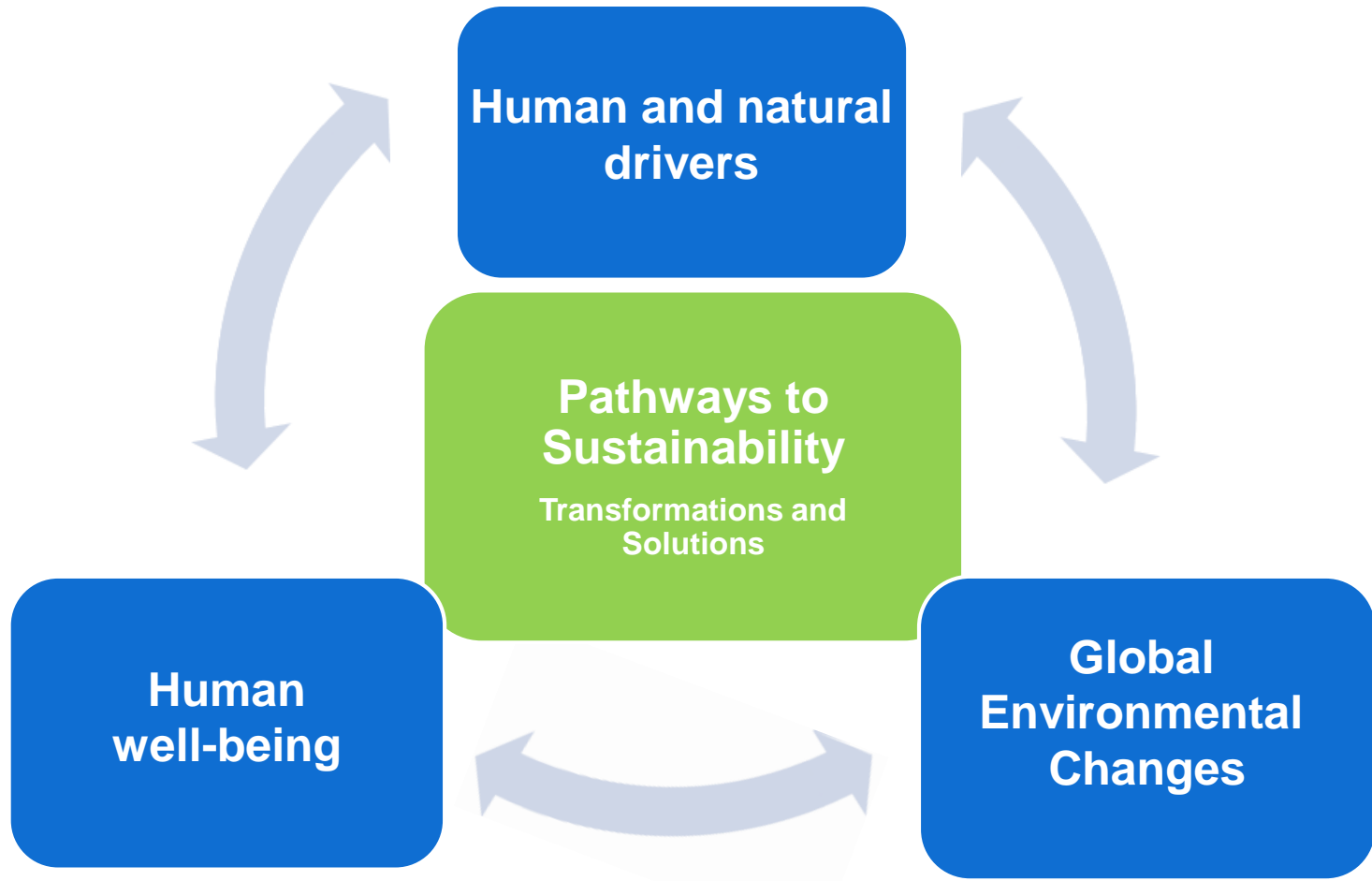


# Organizing Future Earth research

A conceptual framework that leads to three integrated research themes:

- broad areas in which research will be carried out
- characterized by a range of key research questions
- populated by existing and new co-designed projects

# Future Earth conceptual framework

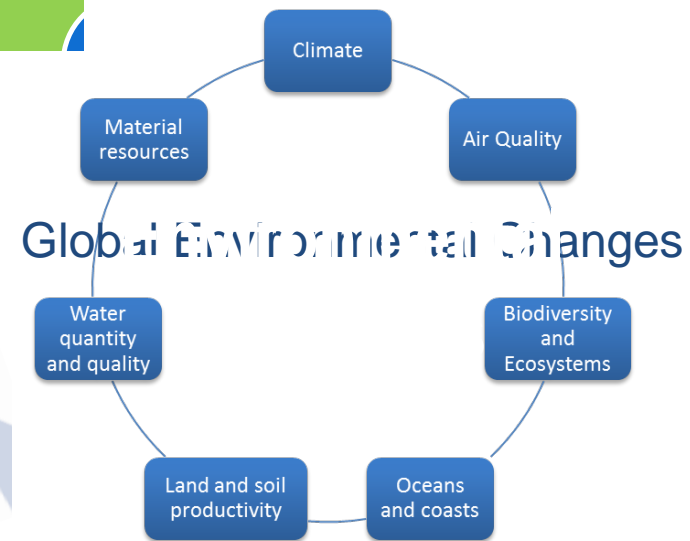




**Human and natural  
drivers**

**Pathways to  
Sustainability**  
Transformations and  
Solutions

**Human  
well-being**



# Criteria for Future Earth Research

- From fundamental to actionable Earth system research for global sustainability
- Answer complex questions that require international collaboration
- Co-design and co-production of knowledge
- Integrates natural, economic, engineering, arts, humanities and social sciences
- Regional to global scale



# Future Earth Design

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- *Scientific excellence: a commitment to support science of the highest quality.*
- *International scope: a focus on areas where international research co-ordination is needed for successful analysis and solutions.*
- *Environmental sustainability: an emphasis on global environmental change and its intersection with human wellbeing and sustainable development.*
- *Integration: draws on expertise in natural and social science, as well as engineering, humanities, sustainability science, and professions such as planning, law, and business. This must be complemented by strong disciplinary excellence that contributes insights to integrated projects.*

# Future Earth Design

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- *Co-design and co-production: expects that the research agenda and programmes will be co-designed, and where appropriate co-produced, by researchers in collaboration with various stakeholders— in governments, industry and business, and civil society.*
- *‘Bottom-up’ inspiration: depends on ideas and innovative approaches generated by the research community.*
- *Solution-oriented: by listening to the needs of decision makers, providing foresight of changes and risks, testing the effectiveness of responses and providing a knowledge base for innovations, Future Earth will seek solutions to the grand challenges of environmental change and development.*

# Future Earth Design

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- *Inclusion and enhancement: embraces and enhances the existing international Global Environmental Change (GEC) projects and related national activities, connects them to the global environmental change and sustainability programmes of allied organizations, and provides new opportunities for international collaboration and research initiatives.*

*Regional engagement, geographic and gender balance, capacity building, supporting new generations of researchers and networking are priorities.*

## Drivers

Economic, demographic, Socio-Political, technical and cultural



Land use, resource management, ecosystems diversity and energy



Natural forcing factors  
(sun, volcanoes etc.)

## Pathways to Sustainability

### Transformations and Solutions

Policy, Market, Behavioural, Technological, and Informational choices

## Human well-being

Opportunities

Security

Empowerment

Livelihoods

Health

Values

Wealth

food, water and energy

air, materials and human  
security

## Global Environmental Changes

Climate

Material  
resources

Air Quality

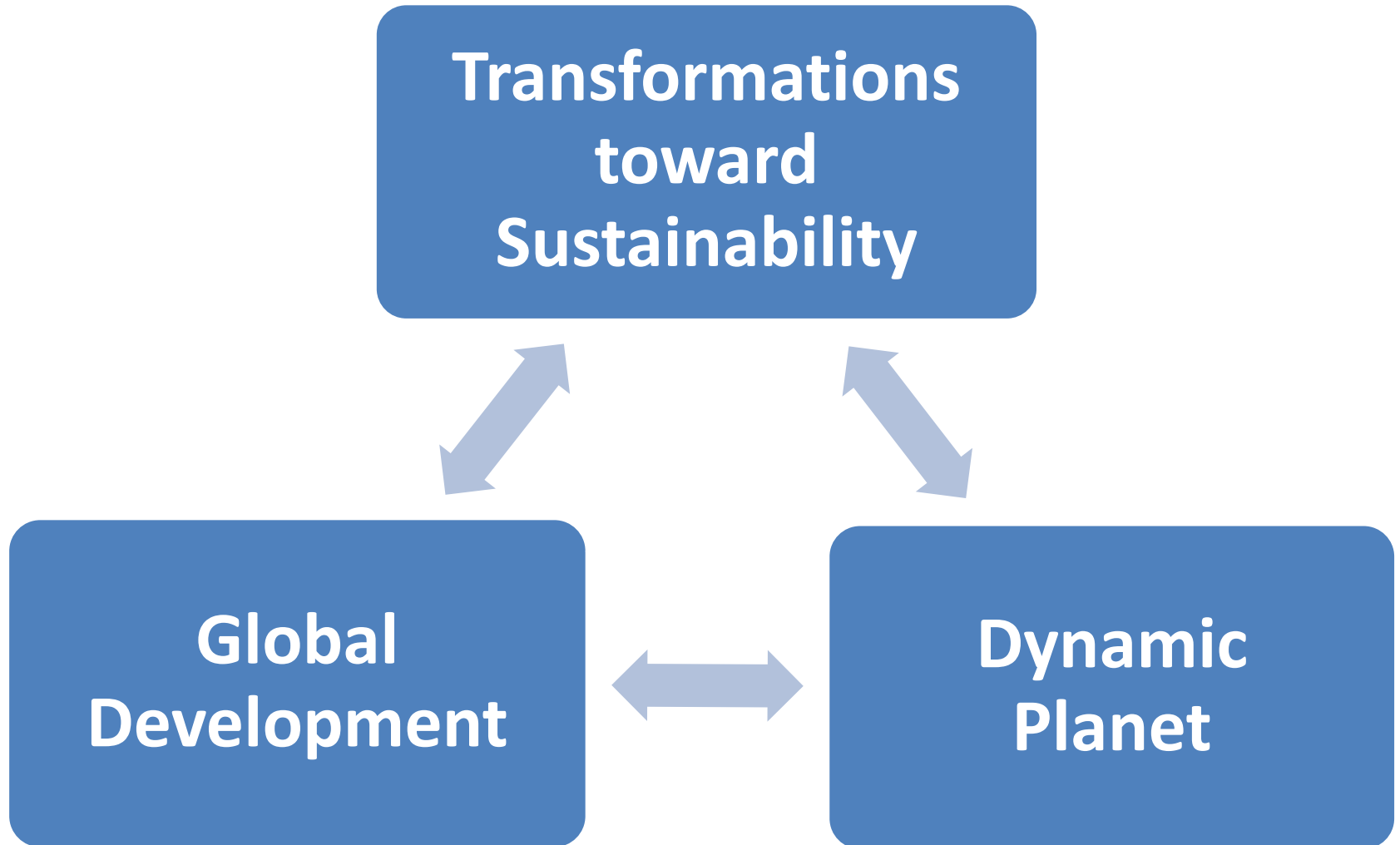
Water  
quantity  
and quality

Biodiversity  
and  
Ecosystems

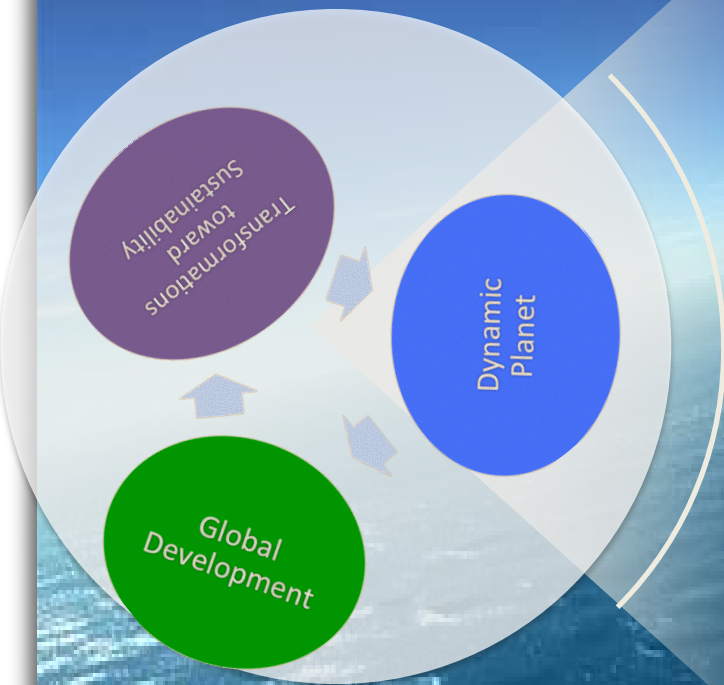
Land and soil  
productivity

Oceans  
and coasts

# Future Earth Research Themes



# Dynamic Planet



projecting environment

- **Approaches and Models**

drivers

societal system

observing

- **States and Trends**

explaining

thresholds

understanding

- **Critical Zones**

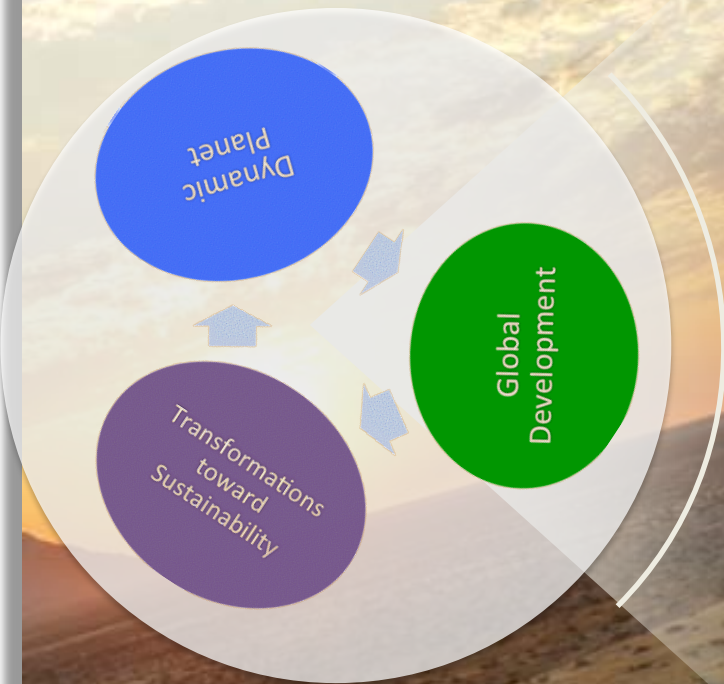
coasts

tropical forests

Polar regions



# Global Development



- **stewardship of resources**
  - clean air
  - mining
  - materials
  - biodiversity
- **ecosystem services**
  - Trade-offs
  - climate change
  - fisheries
- **equitable access**
  - food security
  - water availability
  - healthy environment

# ***Transformations toward Sustainability***



- **transformation process**

economy

mega-cities

development options

- **Innovation and ideas**

trade-offs

emerging technology

assessment of policies

- **global and regional governance**

International law

incentives

regional enforcement

***Dynamic Planet*** – observing, explaining, understanding, projecting Earth, environmental and societal system trends, drivers and processes and their interactions; anticipating global thresholds and risks.

**Example research questions include:**

What are the states and trends of key environmental components such as biodiversity, climate, soils, cryosphere, biogeochemistry, air quality, hydrology, and oceans, and in the social foundations of sustainable development such as wellbeing, equality, health, education, human security?

*How and why do these vary across time, space, and social context?*

What approaches, theories, and models allow us to explain the functioning of Earth and socio-ecological systems, understand the interactions between them, make projections for the future, and anticipate critical thresholds?

*What can be understood and anticipated about the condition and future for critical zones and biomes such as coasts, tropical forests, or polar regions?*



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***Global Development*** – provide the knowledge for sustainable, secure and fair stewardship of biodiversity, food, water, health, energy, materials and other ecosystem services.

**Example research questions include:**

What are the patterns, trade-offs and options for equitable and sustainable use of resources, and how can we ensure sustainable access to food, water, land, clean air, energy and materials for current and future populations?

*What are the implications of climate change for food, water, health, human settlements, and ecosystems? How can climate services and disaster risk reduction reduce these impacts and facilitate adaptation?*

What are the links between biodiversity, ecosystems, human wellbeing and sustainable development?

*What options are available to provide energy for all with reduced environmental impacts, and what are the social implications of these energy choices?*

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***Transformations toward Sustainability*** – understanding transformation processes and options, assessing how these relate to human values, emerging technologies and economic ideas, and evaluating strategies for governing and managing the global environment across sectors and scales.

**Example research questions include:**

How can governance and decision-making be aligned across different levels, issues, and places to manage global environmental change and promote sustainable development?

*How can technology and infrastructure choices be combined with changes in institutions and behaviors to achieve low carbon transitions, food security and safe water?*

How do values, beliefs and worldviews influence individual and collective behaviour to more sustainable lifestyles, patterns of trade, production and consumption?

*What facilitates deliberate transformations at the individual, organizational, and systems levels; what socio-political and ecological risks does it entail?*

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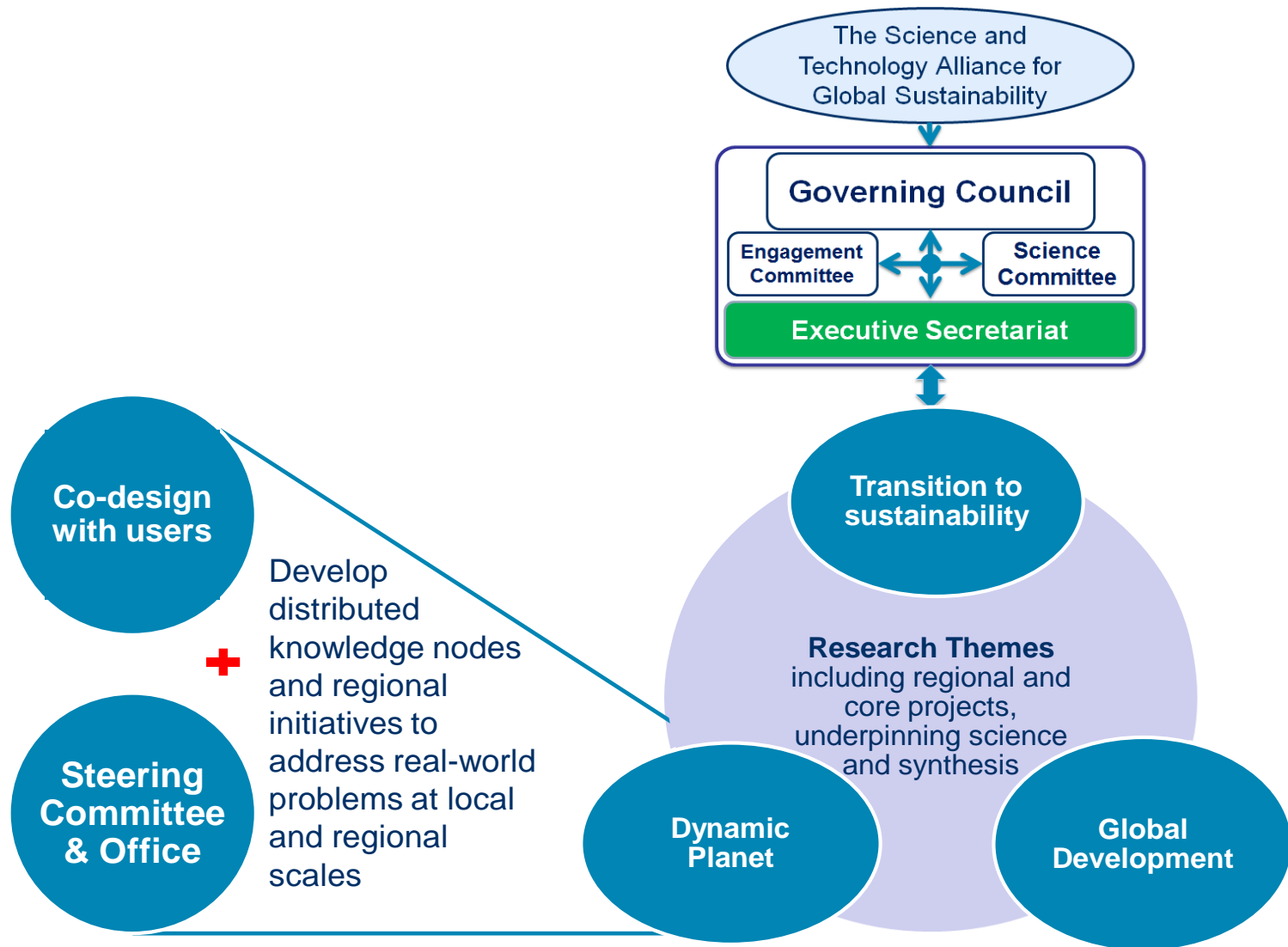


# Future Earth Cross Cutting Capabilities

- Science will be supported by a set of cross-cutting capabilities ... and will often be provided through partnerships with initiatives outside Future Earth.

	Activity	Partners
C1	Observing Systems	GCOS, GEOSS, ...
C2	Data Systems	World Data Systems, ...
C3	Earth System Modeling	Modeling Centers
C4	Theory Development	
C5	Synthesis and Assessments	IPCC, IPBES, AoA, ...
C6	Capacity Development and Education	START, ...
C7	Communication	
C8	Science-Policy Interface and interactions	

# Proposed governance structure for Future Earth



# Regional and National Engagement

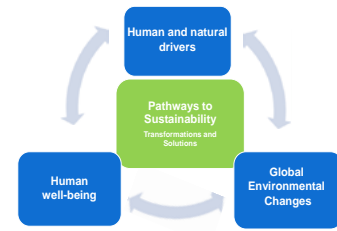
*Regional - building from existing regional networks*

- to implement the vision of Future Earth and adapt it to regional specificities
- to shape global priorities
- to define how to carry out and fund Future Earth activities in the regions

*National – benefiting from national committees*

- to link to national communities and planning
- to support integration

# Future Earth Research Themes



- **Dynamic Planet:**

What are the states, variability and trends in biodiversity, climate, soils, cryosphere, biogeochemistry, hydrology, and oceans?

What is happening to the human and geophysical driving forces of change such as consumption, population, technology, greenhouse gases, and evolution and how do they interact?

What are the scenarios for the future including natural variability, the risks of tipping points and catastrophic change?

**What are your research questions?**

- **Global Development:**

What are the patterns, trade offs and sustainable options for land use?

How can we ensure secure and sustainable food, water, air, energy and materials for 9 billion people?

How is global environmental change affecting human health, food, energy and ecosystem services?

What energy options are available to provide energy for all with reduced environmental impacts?

**What are your concerns?**

- **Transformations toward Sustainability:**

How can we align governance to manage global environmental change and sustainable development?

What are the options for innovative green technology and economics to promote, for example, lower carbon futures and more rewarding work?

How do information, values and policies influence individual and corporate behavior to more sustainable patterns of production, trade and consumption?

What triggers system transformations and what leverage points can be used to promote deliberate and equitable change towards sustainability?

**What is your vision?**