International Sustainability Science Symposium
"Transdisciplinarity and Human Well-Being: Putting SDGs into Reality"

Sustainability Science in Higher Education

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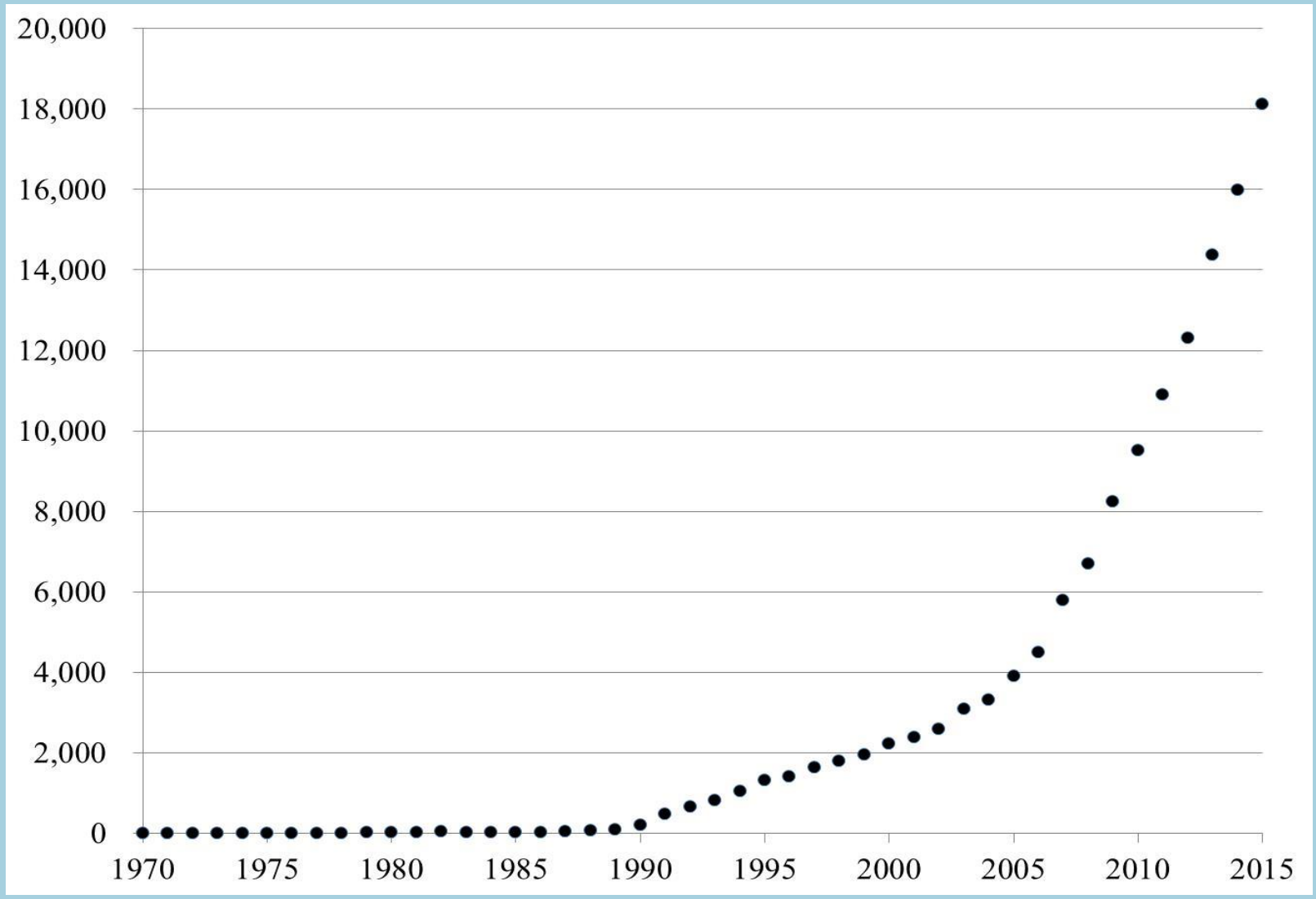
20 September 2016, Padjadjaran University

The Progress and Development of Sustainability Science

- Systems perspective: links natural and social systems
- From complex thinking to transformational change
- Transdisciplinary focus, solution-oriented transformative research
- Co-design and co-creation of knowledge, promotes partnerships and collaborative action
- Need for education and capacity development for global sustainability

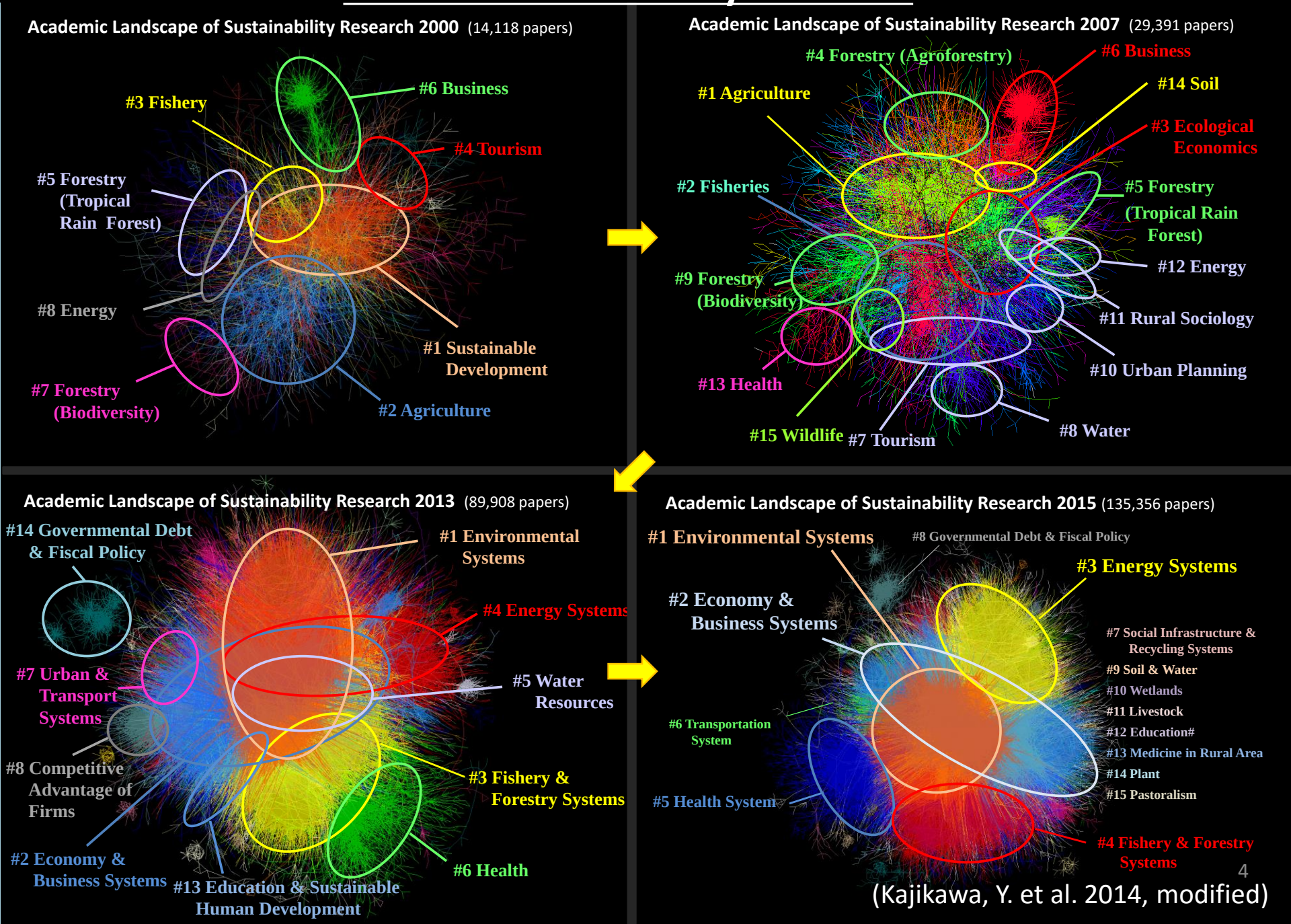
Sustainability Science Journal

Increasing Number of Academic Papers on Sustainability Science



(Kajikawa, Y. et al. 2014, modified)

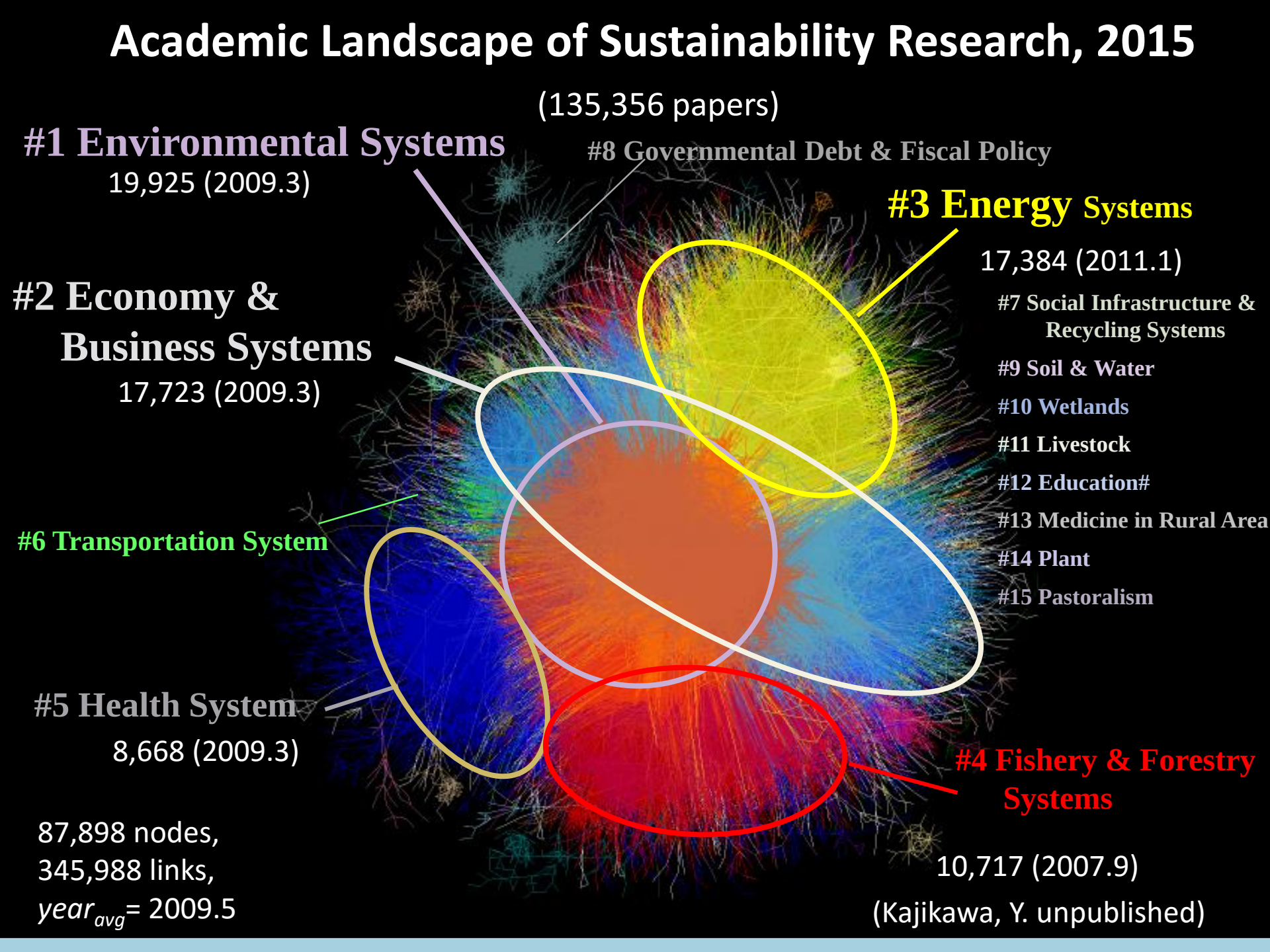
Trend of Sustainability Research



(Kajikawa, Y. et al. 2014, modified)

Academic Landscape of Sustainability Research, 2015

(135,356 papers)

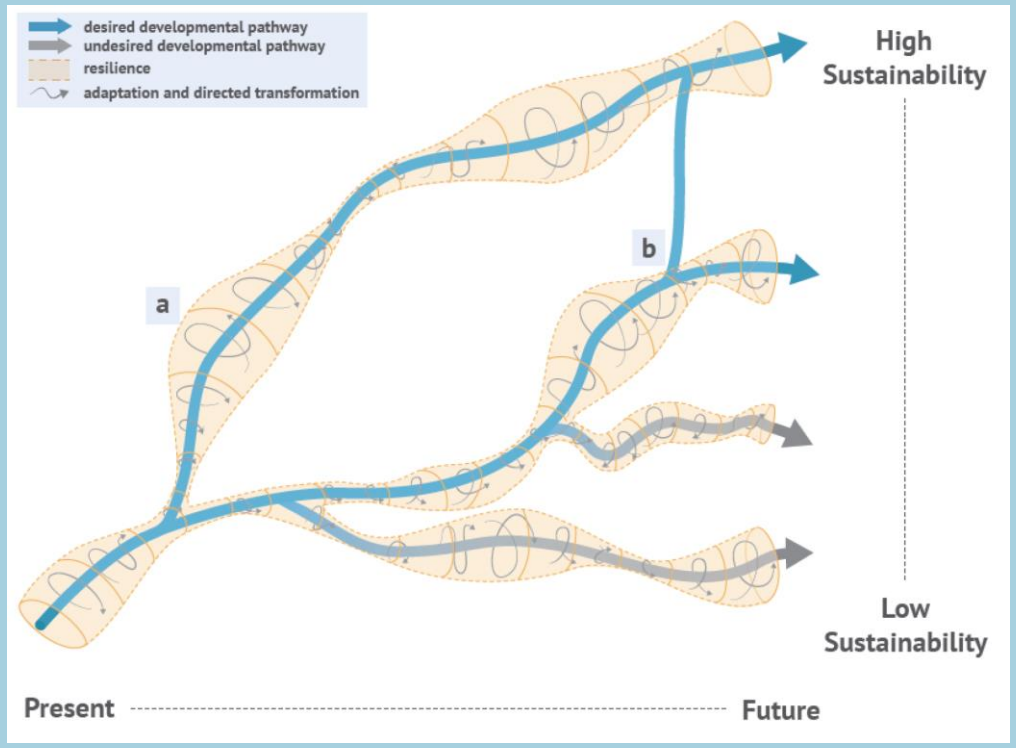


87,898 nodes,
345,988 links,
$year_{avg}$= 2009.5

(Kajikawa, Y. unpublished)

Sustainability and Resilience: Complementary Concepts

- Sustainability is a "normative goal", while resilience is the "capacity" of a system to absorb disturbances.
- The concept of resilience includes not only the capacity to recover from disturbances, but also the capacity to adapt to a new situation.
- As concepts, sustainability and resilience complement each other. Defining their relationship is important for beneficial societal progress.
- By considering the capacity of transformations, each of which have various optional interventions, resilience will be better linked with sustainability.



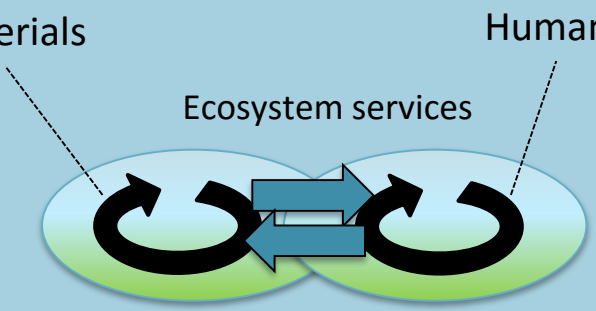
（Elmqvist，T. et al., submitted）

Changing Relationships between People and Nature

(Takeuchi et al., 2016)

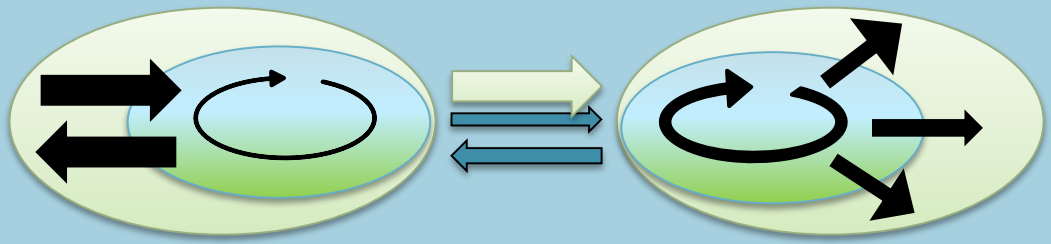
Past

Closed and coupled social-ecological system



Present

Open and decoupled systems

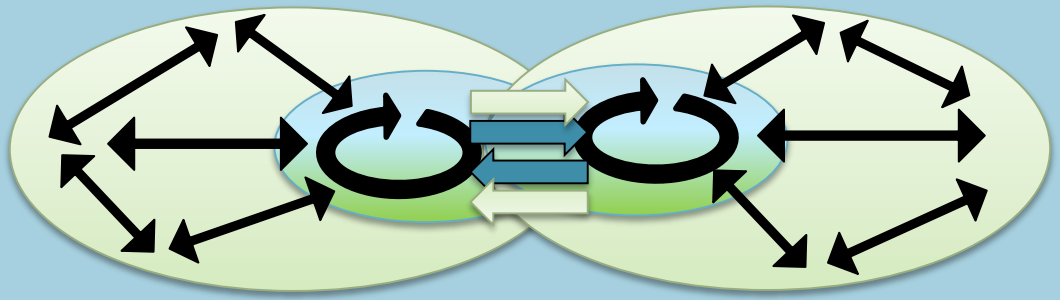


i.e., Intensification of monoculture

i.e., Migration to urban areas

Future

Toward multi-level governance: Cross-scale, connected and coupled social-ecological system

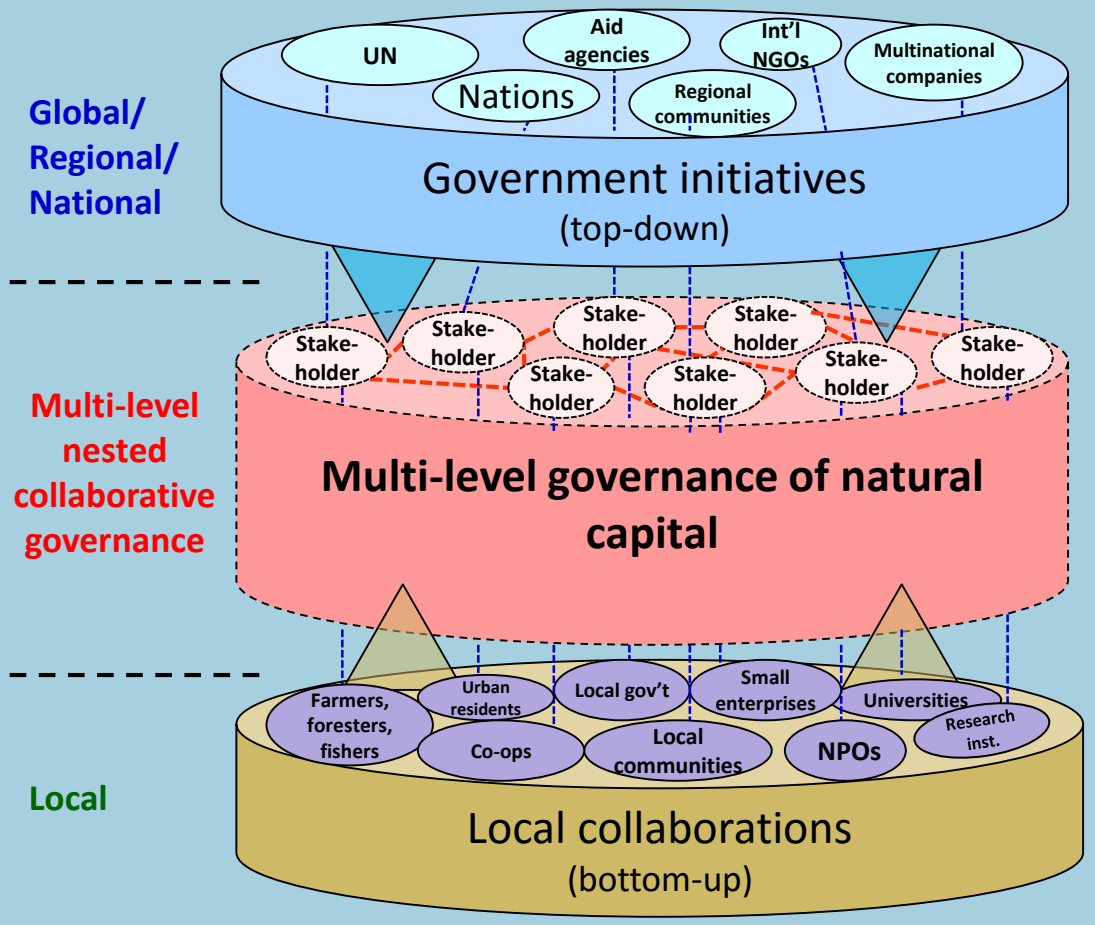


Ecological System

Social System

Multi-level Nested Governance of Natural Capital

- It is necessary to create mechanisms for collaborative management in order to avoid degradation of natural capital as stock, and to promote sustainable provision of ecosystem services.
- It is necessary to explore new governance structures, or "new commons" whereby various stakeholders engage in horizontal cooperation.
- It would be effective to build multi-level and nested governance structures that value bottom-up activities at the local level while connecting with global networks.



Mechanism for cooperative management of natural capital based on nested collaboration between different stakeholders

Traditional Home Garden Systems in Rural Asia

Common features and issues

[Features]

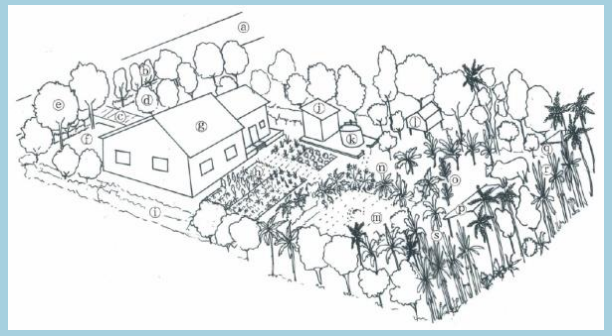
- Cultivate many varieties in small quantities
- Use of diverse ecosystem services
- High biodiversity
- Ensuring multiple options to respond to various shocks and disturbances
- Predominance of small farmers

[Issues (Variable factors)]

- Climate/ecosystem change
- Urbanization and population outflow
- Increase scale, commercialization, and monoculture of farming
- International market pressure
- Passing on traditional knowledge to next generation

Typical arrangement

VAC system in Vietnam



Pekarangan in Indonesia

Kandyan home garden in Sri Lanka

Options to enhance resilience

Addressing climate and ecosystem change

- Diversity of cultivation, from traditional varieties to varieties resistant to environmental change
- Improve material cycling within households and settlements, through mixed production systems combining agroforestry, aquaculture ponds, and livestock
- Improve soil erosion and rainwater catchment using community-pooled labor

Addressing socio-economic changes

- Sell high value-added products to the international market by acquiring international certification
- Offer incentives to small-scale farmers by paying for ecosystem services and introducing a system for purchasing local products

The above options make it possible to sustain the high resilience of traditional systems in any kind of home garden system, as well as to adapt to socio-economic changes, thereby improving overall resilience.

Mohri et al. (2013) *Ecosystem Services*, 5: 124-136.

Bio-Production Systems in Harmony with Biodiversity

Traditional bio-production

Example of Gunung Kidul, Indonesia

Modern bio-production

Pekarangan

Teak planting by residents, mainly in pekarangan (in woods around their homes)

High biodiversity features

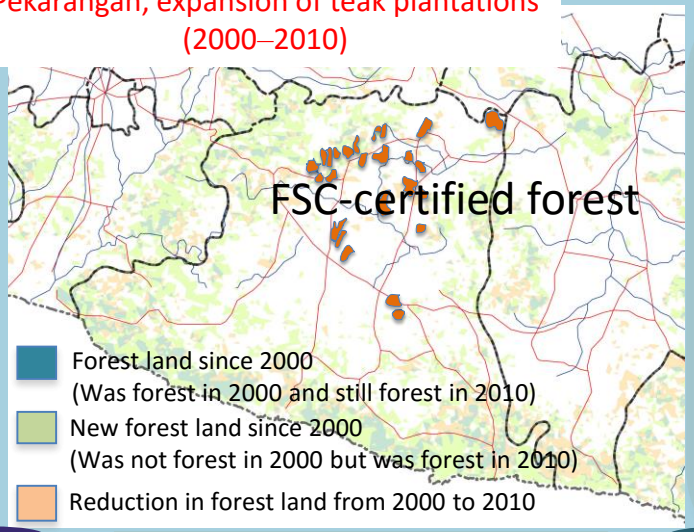
- Diversity of plants (49 types)
- Variety of biota (10 species of mammals, 30 species of birds, 15 species of amphibians)

Role of pekarangans

- Community use
- Trees can be cut to sell high-priced materials such as teak and mahogany when needed to cover expenses of healthcare, education, disaster recovery (saving function)

A huge tree said to be 300 years old

Pekarangan, expansion of teak plantations (2000–2010)



- Pekarangans are traditional home gardens that protect against various kinds of shock
- Pekarangans also protect against socio-economic changes
- Biodiversity conservation by means of agroforestry and forest certification, while enhancing protection against socio-economic changes by commercial reforestation (correction of excessive focus on efficiency and economics)
- Increasing resilience by combining the two

HTI (Hutan Tanaman Industry)
Commercial reforestation
Sengon (*Albizia chinensis*)
Kayu Putih (*Melaleuca leucadendron*)

Soil erosion/agrochemicals/excess fertilizer

Managed as shrubs to press oil from branches and leaves.
External output is high. Disease-pest damage.

Encourage farming between forests (agroforestry)

Forest Certification System (FSC)

Putting a premium on certified materials, expanding sales channels, regulating the use of agrochemicals on seedlings, protect forests of high conservation value, contribute to biodiversity conservation

Acquired group certification for a small teak forest in 2012
Certified area: 330.5 ha
Total of 96 groups of farmers in the alliance
Price of certified material: 30% higher

17 goals
169 associated targets
Indicators to be decided in 2016

Resilience in the SDGs

Goal1 End poverty in all its forms everywhere

target 1.5 by 2030 build the **resilience** of the poor and those in vulnerable situations, and reduce their exposure and vulnerability to climate-related extreme events and other economic, social and environmental shocks and disasters

Goal2 End hunger, achieve food security and improved nutrition and promote sustainable agriculture

2.4 by 2030 ensure sustainable food production systems and implement **resilient** agricultural practices that increase productivity and production, that help maintain ecosystems, that strengthen capacity for adaptation to climate change, extreme weather, drought, flooding and other disasters, and that progressively improve land and soil quality

Goal9 Build **resilient** infrastructure, promote inclusive and sustainable industrialization and foster innovation

9.1 develop quality, reliable, sustainable and **resilient** infrastructure, including regional and trans-border infrastructure, to support economic development and human well-being, with a focus on affordable and equitable access for all

9.a facilitate sustainable and **resilient** infrastructure development in developing countries through enhanced financial, technological and technical support to African countries, LDCs, LLDCs and SIDS

Goal11 Make cities and human settlements inclusive, safe, **resilient** and sustainable

11.b by 2020, substantially increase the number of cities and human settlements adopting and implementing integrated policies and plans towards inclusion, resource efficiency, mitigation and adaptation to climate change, **resilience** to disasters, develop and implement in line with the forthcoming Hyogo Framework holistic disaster risk management at all levels

11.c support least developed countries, including through financial and technical assistance, for sustainable and **resilient** buildings utilizing local materials

Goal13 Take urgent action to combat climate change and its impacts

13.1 strengthen **resilience** and adaptive capacity to climate related hazards and natural disasters in all countries

Goal14 Conserve and sustainably use the oceans, seas and marine resources for sustainable development

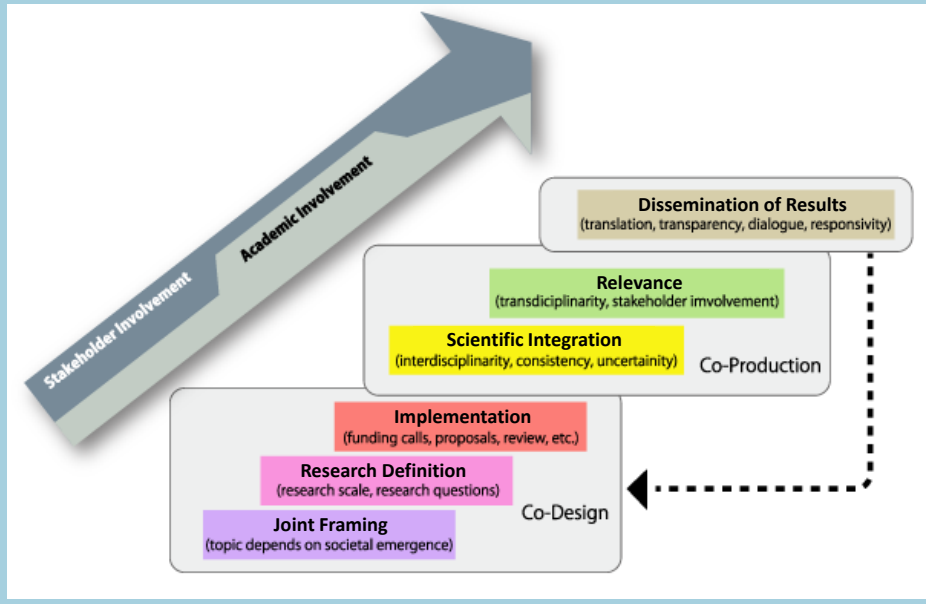
14.2 by 2020, sustainably manage and protect marine and coastal ecosystems to avoid significant adverse impacts, including by strengthening their **resilience**, and take action for their restoration, to achieve healthy and productive oceans

Future Earth
Strategic Research Agenda 2014

A Dynamic Planet
a1 Observing and attributing change
a2 Understanding processes, interactions, risks and thresholds
a3 Exploring and predicting futures

B Global Sustainable Development
b1 Meeting basic needs and overcoming inequalities
b2 Governing sustainable development
b3 Managing growth, synergies and trade-offs

C Transformations towards Sustainability
c1 Understanding and evaluating transformations
c2 Identifying and promoting sustainable behaviours
c3 Transforming development pathways



Future Earth. 2014. Future Earth Strategic Research Agenda 2014. Paris: International Council for Science (ICSU).

Transdisciplinarity is Key to Scientific Contribution

Disciplinarity
- Within one academic discipline
- Disciplinary goal setting
- No cooperation with other disciplines
- Development of new disciplinary knowledge and theory

Multidisciplinarity
- Multiple disciplines
- Multiple disciplinary goal setting under one thematic umbrella
- Loose cooperation of disciplines for exchange of knowledge
- Disciplinary theory development

Interdisciplinarity
- Crosses disciplinary boundaries
- Common goal setting
- Integration of disciplines
- Development of integrated knowledge and theory

Transdisciplinarity
- Crosses disciplinary and scientific/academic boundaries
- Common goal-setting
- Integration of disciplines and non-academic participants
- Development of integrated knowledge and theory among science and society

- discipline
- non-academic participants
- goal of a research project
- movement towards goal
- cooperation
- integration
- thematic umbrella
- academic knowledge body
- non-academic knowledge body

Natural Science

Social Science

Engineering

Practice
stakeholders

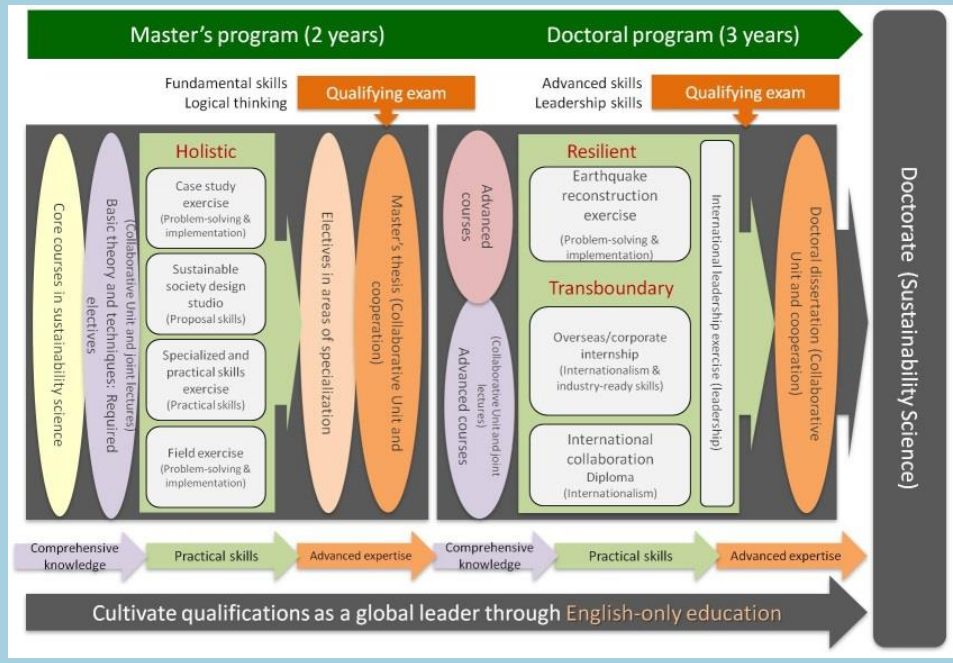
Transdisciplinarity

Tress *et al*. 2005 *Landscape Ecology* **20**: 479-493

futureearth
research for global sustainability

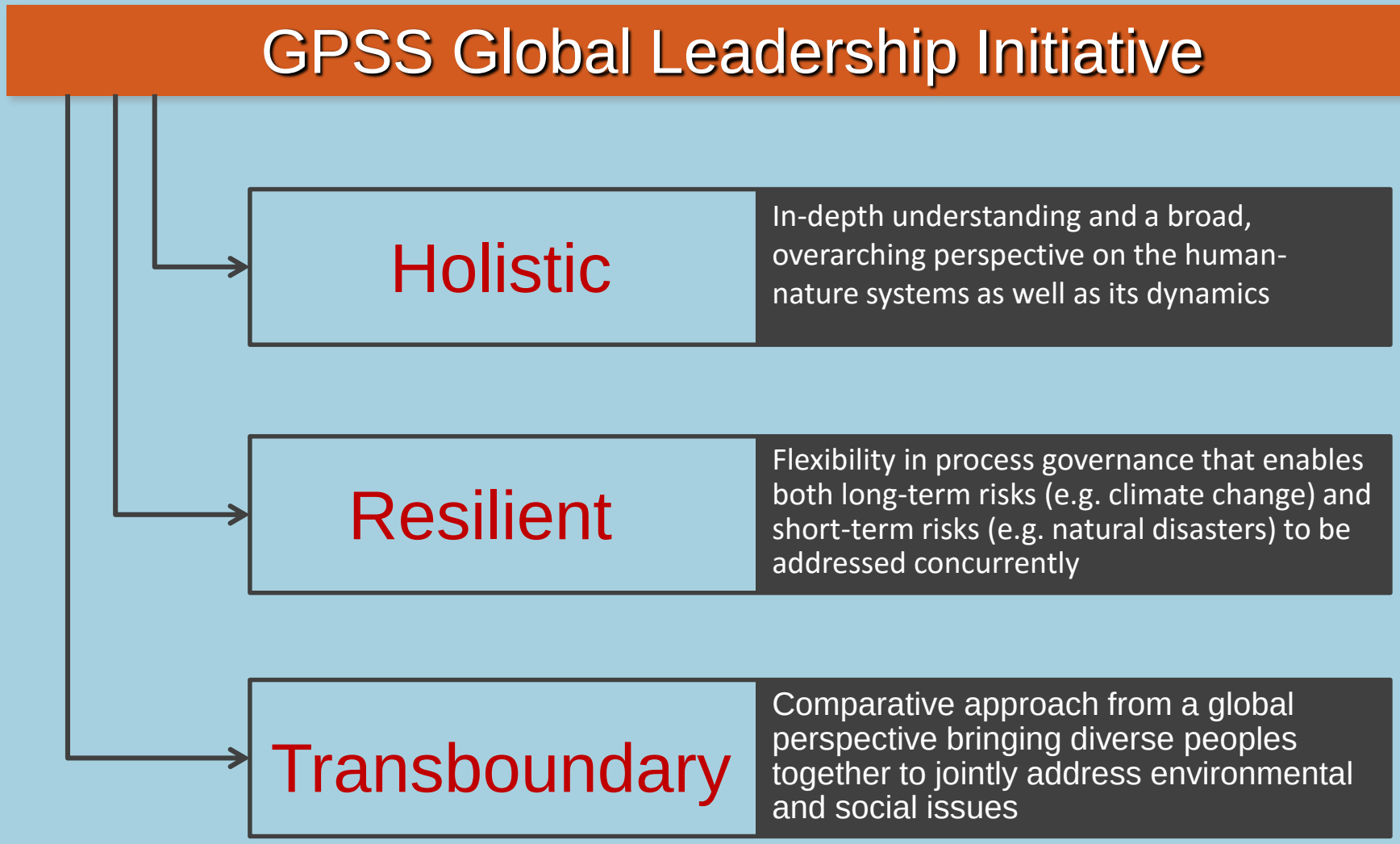
Graduate Program in Sustainability Science (GPSS)

- Postgraduate programmes in Sustainability Science, master's and doctoral degrees, have been launched mainly by universities in Europe, North America and Asia
- After the establishment of IR3S, teaching of Sustainability Science in Japan has been led by IR3S's partner universities
- GPSS was established in the Graduate School of Frontier Sciences of The University of Tokyo in 2007
- GPSS developed into the Graduate Program in Sustainability Science Global Leadership Initiative (GPSS-GLI) in 2011
- A Joint Diploma Program with the United Nations University Institute for the Advanced Study of Sustainability (UNU-IAS) was launched in 2013

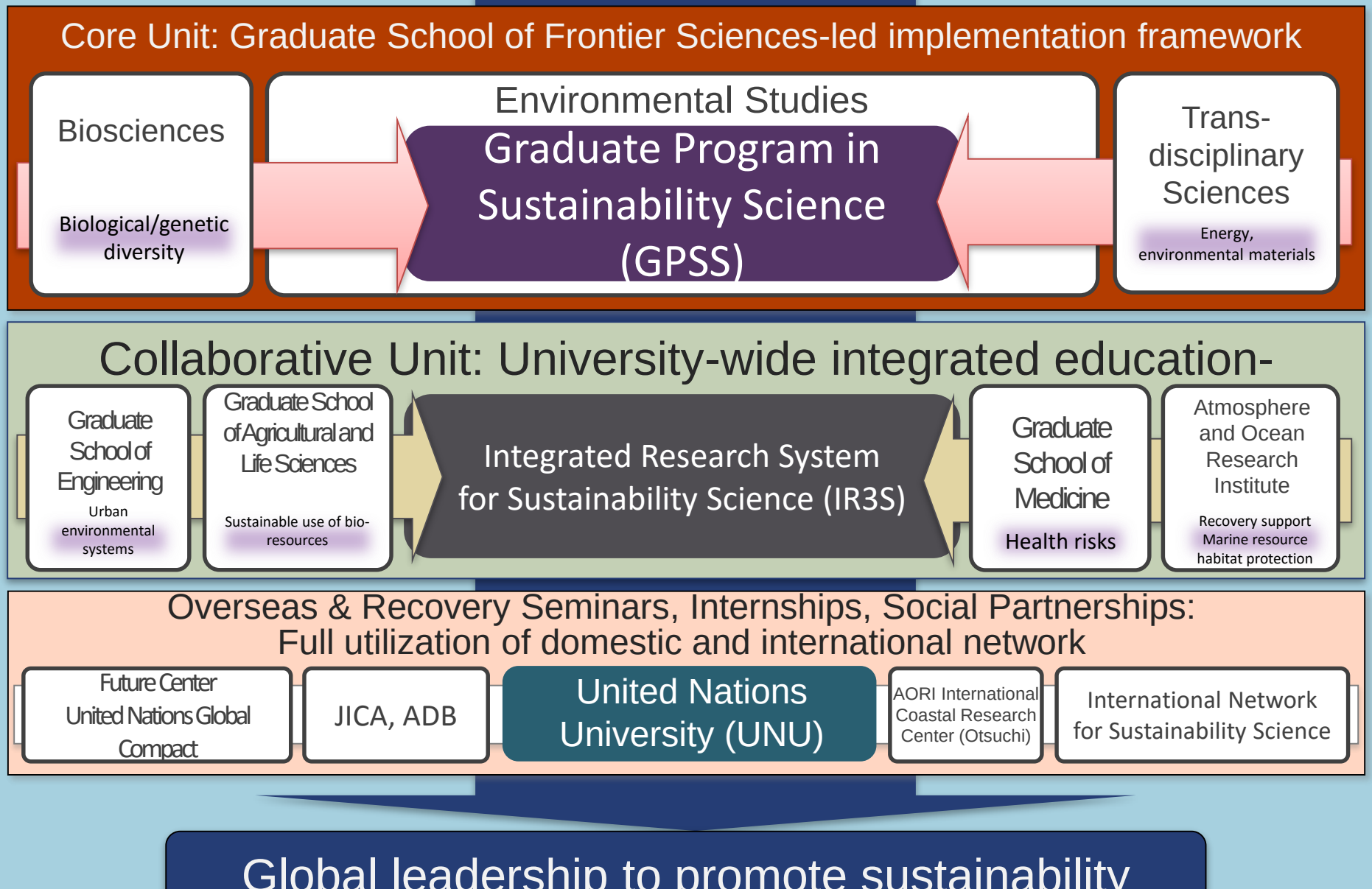


GPSS-GLI Curriculum

Threefold Approaches to Sustainability Science



Integrated Organizational Framework



UNITED NATIONS UNIVERSITY
UNU-IAS
Institute for the Advanced Study of Sustainability

United Nations University Institute for the Advanced Study of Sustainability (UNU-IAS)

UNU-IAS is a leading research and teaching institute based in Tokyo, Japan. Its mission is to advance efforts towards a more sustainable future, through policy-oriented research and capacity development focused on sustainability and its social, economic and environmental dimension. UNU-IAS serves international community through innovative contributions to high-level policymaking and debates, addressing priority issues for the UN System.

Three Thematic Areas of Research Activities

- Sustainable Societies
- Natural Capital & Biodiversity
- Global Change & Resilience

UNITED NATIONS UNIVERSITY

UNU-IAS
Institute for the Advanced Study of Sustainability

Postgraduate Degree Programmes

Through postgraduate teaching UNU-IAS develops international leaders with the interdisciplinary understanding and technical skills needed to advance creative solutions to problems of sustainability


Postgraduate Degree Programme


GLTP

Master of Science in Sustainability

Duration: 2 years

Credit Requirement: Minimum 30 credits

PhD in Sustainability Science

Duration: 3 years

Credit Requirement: Minimum 14 credits

Courses

A. Intensive Core Courses
4 week of intensive courses that provide board knowledge on sustainability
B. Research Seminars and competency courses
Provide necessary skills to conduct research and develop thesis of high quality
C. Elective Courses
Specialization of the knowledge

UNITED NATIONS UNIVERSITY

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Postgraduate Degree Programmes Details

Advantages

- All lectures are in English.
- A diverse faculty comprises both UNU-IAS academic staff and guest lecturers from other leading academic institutions and international organizations.
- UNU-IAS offers the unique learning environment of a global university within the UN system, with access to leading scholars and practitioners, as well as international events.
- Collaboration with leading universities in Japan
- Students are encouraged to take a joint diploma offered by UNU-IAS and the University of Tokyo's Graduate School of Frontier Sciences.
- Credits of some courses are transferable with partner universities in Japan.

Academic Calendar

2016 Autumn Semester	1 Sept. 2016	–	10 March 2017
Winter Break	23 Dec. 2016	–	3 Jan. 2017
Spring Break	11 March 2017	–	2 April 2017
2017 Spring Semester	3 April 2017	–	14 July 2017

What is Global Leadership in Sustainability Science Education?

- A clear view of the complexity and severity of global issues, while having a positive outlook for the future
- A comprehensive perspective on the complex relationships between humans and nature as a social ecological system
- The ability to integrate the findings of specialized research to formulate solutions to complex problems
- The ability to coordinate and integrate the opinions of different stakeholders
- Strong leadership in prompting transformations towards sustainable societies in the international community

Class at Kashiwa campus, The University of Tokyo

Class at UNU

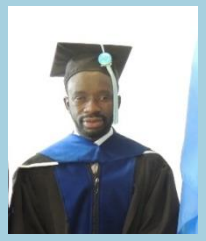
Master and PhD Students involved in Ghana Project

United Nations University & The University of Tokyo

Name: John Boakye Danquah
Country: Ghana
Degree: MSc Sustainability and Peace
Research: Farm Management Practices and Agricultural Land Use on Soil Organic Carbon Storage Potential
Year of Completion: 2013

Name: Ruby MENSAH
Country: Ghana
Degree: MSc Sustainability
Research: Land Use Change Effect on Plant Biodiversity
Year of Completion: 2015

Name: Priscilla Toloo APRONTI
Country: Ghana
Degree: MSc Sustainability
Research: Education for Disaster Risk Reduction (DRR
Year of Completion: 2015



Name: Yaw Agyeman BOAFO
Country: Ghana
Degree: PhD Sustainability Science
Research : Community-based ecosystem services assessment
Year of Completion: 2015

Name: Serah Yaba TRAORE
Country: Burkina Faso
Degree: MSc Sustainability
Research: Food waste potential for composting
Year of Completion: 2016

Name: Godfred Seidu JASAW
Country: Ghana
Degree: PhD Sustainability Science
Research: Sustainability of material flows in shea production
Year of Completion: 2016

Name: Yasuko KUSAKARI
Country: Japan
Degree: PhD Sustainability Science
Research: Community-based capacity assessment in Ghana and Malawi
Expected Year of Completion: 2017

Name: Nsioh Macnight NGWESE
Country: Cameroon
Research: Traditional practices/knowledge for coping with disasters
Expected Year of Completion: 2017

Education for Sustainable Development in Africa (ESDA)

- Postgraduate education programmes have been developed in partnership with UNU and other universities in Japan and Africa
- The University of Ghana and the University of Ibadan (Nigeria) are leading development of a programme on "Sustainable Integrated Rural Development (SIRD) "
- The University of Nairobi and Kenyatta University (Kenya) are leading development of a programme on "Sustainable Urban Development (SUD)"
- The University of Cape Town (South Africa) and the University of Zambia are leading development of a programme on "Management of Mineral Resources (MMR)"
- UNU is the focal point to promote global personnel exchange, as the ESDA consortium secretariat

ESDA meeting (Cape Town)

Work placements focused on reducing urban poverty

Thank you for your attention!