

**Proposed Research Topics for IARU**  
**prepared by the Integrated Research System for Sustainability Science (IR3S)**  
**The University of Tokyo**

**Theme: Urban-Rural Sustainability**

**1. Background:**

Urban and rural areas are quite a contrast to each other in terms of their functions and typical problems related to sustainability. Taking an example of food, urban areas are on the consumption side, whereas rural areas are on the supply side. A typical problem concerning sustainability for urban areas is the megacity issue, whereas for rural areas it is the deterioration of the ecosystem.

The rapid growth of urban areas is being observed in many developing countries in the world. For example, the percentage of the urban population in China has increased from 17.4% in 1970 to 35.8% in 2000, and is expected to reach 59.5% in 2030. Many megacities have been emerging, especially in Asia, as represented by such cities as Dhaka, Mumbai and Delhi. Migration from rural areas to urban areas is the main reason behind such rapid urban growth.

This urban growth has had negative impact both on urban and rural areas--and especially on megacities. Urban areas, with poor physical and social infrastructures, suffer from excessive human activities. On the other hand, rural areas also suffer from the deterioration of their society due to migration to urban areas. Thus, the unbalanced growth of urban and rural areas may jeopardize social stability. Severe environmental problems such as water and air pollutions occur in urban areas, and deterioration of the ecosystem is often observed in the urban fringe areas. Rural areas also tend to experience the loss of stability in their ecosystems.

The issue of urban and rural areas is also important in the developed countries, which are facing the challenge of creating a society with a high standard of living while decreasing environmental impact of urban areas.

It is obvious that a harmonized development of both urban and rural areas is needed for sustainability. Changes in land use should be managed under a comprehensive strategy. Materials should be circulated between urban and rural areas in an environmentally sound manner to decrease environmental impact. But, the current reality is far from achieving such interactions.

Food and water are essential for supporting human life. Urban areas are where issues related to water and food become most critical. Tremendous demand for food and water in megacities create considerable friction. Rural areas surrounding a megacity are no longer capable of supporting high demand for food, and, what is even worse, agriculture now has to compete with urban areas over water demands.

Various aspects of water must be considered in securing human sustainability as water management is crucial in rapidly developing areas--especially under uncertain future climate changes. The food supply causes environmental burdens such as a huge amount of water consumption and emission of fertilizer and pesticides. Calculation of "virtual water" shows that food-importing countries are supported by a huge amount of water resources used in the food-producing countries. A huge amount of food waste is discharged without being eaten in many of the developed countries. Sustainable matching between production and consumption is needed in both water and food management.

**2. Structuring knowledge and need for collaborative research**

The urban-rural problems as a whole cannot be resolved by simply solving each individual problem one by one. Not only is a holistic and transdisciplinary approach necessary, but also structuring of the wide variety of knowledge in various academic fields is needed. On the other hand, building this kind of common academic base alone is not sufficient to solve the problems of individual cities. There is a need to introduce an important dimension, namely, social and cultural diversity, which is a heritage of humankind and something to be preserved for our progeny.

Urban development and management in a manner harmonized with rural areas are vital for the sustainability of mankind. Universities should contribute to providing solutions to these problems and carrying out capacity-building to enact those solutions. In following this process, along with structuring problems and knowledge, it is important to respect the social and cultural diversity of each region. It is also important to promote interdisciplinary activities within and across universities and cooperation with the outside world. The IARU, comprised of universities with diverse backgrounds, should be able to contribute in this regard.

### **3. The proposed research area and topics**

The University of Tokyo, herein, is proposing possible research topics for IARU collaboration research. Though urban and rural sustainability should be studied in a collaborative manner, the respective research topics are proposed separately below.

#### **A. Urban sustainability**

A huge amount of consumption of materials causes a significant environmental burden, including carbon dioxide emissions, depletion of natural resources as well as water and air pollution.

##### **1) Energy and mobility**

A huge amount of materials and energy is consumed in urban areas such as megacities. Reduction of such energy consumption is urgently required for mitigating global warming. An urban area, on the other hand, has a greater chance for introducing technologies to reduce energy consumption because of its high energy consumption. Mobility is closely related to urban energy consumption as motorization drastically increases energy consumption.

*Examples of specific topics: technological options for energy saving, life style changes related to energy consumption, interactive analysis of energy saving options.*

##### **2) Sustainable food consumption**

The current food consumption habits in urban areas especially in developed countries are not sustainable. A huge amount of food is directly wasted without even being eaten, which also causes solid waste problems. Urban areas tend to import a wide variety of foods from various other areas including foreign countries, and such imports impose an environmental burden on areas far from the consuming city. Thus, methods for recognition and reduction of such environmental burden should be studied.

*Examples of specific topics: life cycle analysis on food consumption such as food miles, virtual water, the supply chain management of food.*

##### **3) Sustainable water management**

Urban areas depend on hinterland regions for their water resources to support the high density of population and activity. In addition to water saving, water reuse is another approach to create usable water resources in urban areas. Water is cheap because construction costs of infrastructure such as dams or potential costs of environmental damage are usually not reflected on the price of water. While reflection of the full costs on the water price could provide an economic incentive to save water, it would make the price of water unaffordable for poor people, making them unable to use safe water. A proper pricing system reflecting economic and social circumstances is necessary.

*Examples of specific topics: water reuse technology, water pricing, river-basin management, water and wastewater technologies.*

##### **4) Health risk management**

Water and food-borne disease control is one of the most important issues in the developing world, and is yet to be resolved even in the developed world. A water supply system, flood control and sanitation practices are essential for controlling this problem. The world-wide trade of food increases the risk of internationally transmitted diseases like BSE. A strategic approach is needed to avoid health risks.

*Examples of specific topics: the fate and control of viruses in the water environment, infrastructure for safe water supply, food safety, genetically modified food, international food traceability control.*

##### **5) Social problems in megacities**

Population migration to urban areas takes place because of social reasons such as the high income and living standards and better employment opportunities in such areas. However, the proliferation of poor homeless people is also a reality in urban areas. Solving social problems in megacities should be regarded as integral part of strategies for a more sustainable society.

*Examples of specific topics: the urban poor in fringe areas, an economic model for human settlement, social problems in human settlements, social stability in urban areas.*

#### **B. Rural sustainability**

##### **1) Deterioration of the ecosystem**

The ecosystems in rural areas and transient areas from rural to urban areas are facing deterioration

problems. Unplanned changes in land use and decline of agriculture and forestry activities can cause such problems. Poor management of land causes deforestation, soil erosion and the loss of biodiversity in rural areas. A landscape ecology approach is needed to analyze and relieve the ecosystem from such deterioration.

*Examples of specific topics: analysis of ecosystem deterioration in urban fringe areas, adaptive management of urban-rural transition zones, the mitigation of impact of human activity on the ecosystem.*

## **2) Sustainable food production**

Agriculture is supposed to be environmentally friendly as a primary production function, but it also causes deforestation in developing tropical countries, as well as water pollution due to excessive use of fertilizer and pesticides in developed countries. Mitigating the environmental impact is required for sustainable food production.

*Examples of specific topics: analysis of the environmental impact, the fate of fertilizers and pesticides in the environment, green food production, agro-forestry management.*

## **3) Impact of climate change on agriculture**

The largest potential damage of climate change could be on agriculture. Adaptation to climate change is the key factor to mitigating such an impact.

*Examples of specific topics: regional evaluations of impact of climate change on agriculture, adaptation strategies for agriculture under uncertainty.*

## **C. Symbiosis between urban and rural areas**

### **1) Harmonized growth of urban and rural areas**

The growth of an urban area directly influences the rural area where agricultural land is being converted for urban use and the society is changing from a traditional to a modernized one. Separate approaches to urban and rural management are not satisfactory for solving the problems. The interaction between urban and rural areas should be studied to realize the development of these two in a harmonized manner.

*Examples of specific topics: urban-rural migration planning, a national policy on urban and rural development.*

### **2) Material flow between urban and rural areas**

An urban area consumes a large amount of materials such as food and paper, whereas a rural area has a potential to provide them, and to utilize the wasted material from the urban area. The circulation of materials between urban and rural areas can decrease resource consumption.

*Examples of specific topics: analysis of the food flow and return flow of organic resources between urban and rural areas, life cycle assessments of material flow, biomass transformation technology.*

### **3) Social and economic conflict in and between urban and rural areas**

Income disparity is the driving force behind migration from rural areas to urban areas in developing countries. The gap in social service level between urban and rural areas has actually been expanding. These factors cause social instability.

*Examples of specific topics: an economic and social analysis of population migration, analysis of social problems in the community, institutional strategies for controlling urban poverty.*

### **4) Governance of urban and rural areas**

A comparison of urban and rural areas highlights the conflicts over land, money, food and water both in the developing and developed regions. There is dynamism behind such contrasts. Governance of urban and rural areas should be studied from a holistic standpoint and in a transdisciplinary manner.

*Examples of specific topics: Analysis of dynamism between urban and rural areas, a long-term policy for urban and rural development and maintenance, integrated evaluation of food and water problems, structuring of the social and environmental issues and their countermeasures.*

## **4. Contact persons**

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