In Japan No. 9	**Regional circulation that combines biogas power generation with agriculture and livestock husbandry in Kyotango City, Kyoto Prefecture, Japan**

1. Regional Profile

Geographical Location	Country and Region	Kyotango City, Kyoto Prefecture, Japan, East Asia
	Longitude and Latitude	North Latitude 35° 37’ 25”, East Longitude 135° 3’ 40” (Kyotango City Hall)
	Geographical Conditions	• Agricultural and mountainous village area • Approximately 6 km from the nearest ocean • Approximately 450 km from Tokyo • Approximately 90 km from Kyoto City (prefectural capital)
Natural Environment	Topography and Altitude	• The most part of Kyotango City is mountainous or hilly. The lowest altitude is 0 m and the highest altitude is 697 m. • Flat areas are extremely limited, only existing along rivers and the coastline.
	Climate	• The annual average temperature is approximately 15°C and the annual precipitation is approximately 1850 mm. • Categorized as Cfa (humid subtropical climate) in accordance with the Koeppen climate classification.
	Vegetation and Soil	• The secondary forests of Japanese red pine (*Pinus densiflora*) and konara oak (*Quercus serrata*) cover the most part of the vegetation in this area. Weed community in rice paddies cover the most part of flatlands. • The soil type is the brown forest soil.
	Biodiversity and Ecosystem	• The most part of the natural environment in Kyotango City is either artificially created farmland or secondary forests. Proper management of these areas over many years has made the area inhabitable for a variety of flora and fauna. • The management of such areas containing the secondary natural environment has been abandoned in the recent years as the agricultural and forestry industries stagnated, the population outflow increased, and the population of society got older. The deteriorating quality of biodiversity and ecosystems as vegetation succession progresses has become a source of concern.
Social Background	Population and Changes in Population	• The population of Kyotango City was 80,160 people in 1960. It decreased to 62,723 people in 2005. • The ratio of the elderly citizens in the population (the ratio of people aged 65 and older in the population) of Kyotango City was 9.1% in 1960. It increased to 28% in 2005.
	History and Culture	• This area has been associated with active interaction with countries in the Eurasia for centuries. This area has many historic remains and ruins such as the tumuli of those in power constructed from the 3rd to 7th centuries. This area has been the stage of a variety of human activities since then.
	Regional Economy (Major Industries, Livelihood (including data and forecasts))	• The main industries of Kyotango City, including the target site, are agriculture, silk textile industry, machinery and metal manufacturing industry, and tourism. The change in the industry structure, population outflow, and aging society have been part of the reasons for the overall stagnation of the local economy. • The table below shows the number of employees by industry types in 2005.

Primary industry (agriculture, forestry, and fishery)	3,622	11.0%
Secondary industry (mining, manufacturing, and construction)	11,891	36.0%
Tertiary industry (commercial, tourism, and others)	17,473	53.0%
Total*	32,986	100.0%

**Note: As the percentages of workers in Primary Industry, Secondary Industry, and Tertiary Industry are rounded off to one decimal place, they may not add up to 100.0%.*

2. Use and Management of Natural Resources in the Region

(1) Use and Management of Natural Resources in the Past and Present

1) Land Use Related to the Use and Management of Natural Resources in the Past and Present

- The total area of Kyotango City is 501.84 km2, of which mountains and forests cover 377.15 km2 (75.2% of the total area) and agricultural lands cover 35.93 km2 (7.2% of the total area). Most of land within the city used to be the subject of use and management of natural resources (however, abandoned land has increased as described below).
- Rivers weave through the mountains and forests. Agricultural lands and small communities are located on the narrow flatlands along rivers.
- As shown in the figure below, use and management of natural resources with interaction among different land uses were practiced formerly. However, this kind of relationship has been reduced dramatically.

2) Objectives and Details of the Current Use and Management of Natural Resources

- Forestry: Forest products including timber, charcoal, and compost used to be produced in forests, but the amount of production has been significantly reduced in recent years.
- Agriculture: Agriculture is one of the main industries of Kyotango City and its produce was 7.3 billion yen in 2008. The largest outputs by produce type in descending order are rice, vegetables, fruits, and dairy cattle. In addition, silkworm raising to produce silk goods, cultivation of mulberry trees as food for silkworms, and cultivation of plants to produce dyes were conducted actively in this area, but the amount of production has been significantly reduced in the recent years.
- Fishery: Fishery for human consumption is conducted in the coastal area. Snow crab and flatfish from this area is nationally well known.

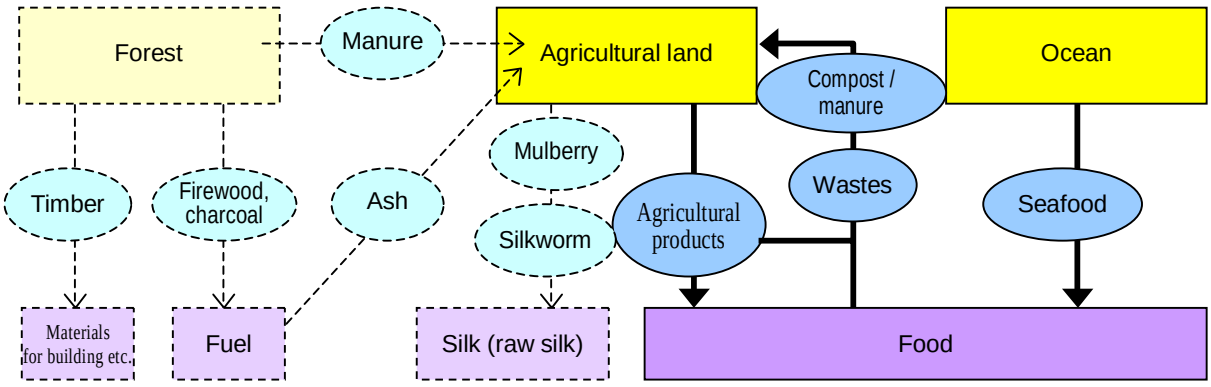


Figure: Schematic overview of natural resource uses
(Light colors and broken lines represent that the concerned uses are significantly lower today than before.)

(2) Problems Associated with the Use and Management of Natural Resources and their Impact on Biodiversity

- The decreased demand for firewood and charcoal due to the increased use of fossil fuels and the decreased demand for forest-based compost due to the increased use of chemical fertilizers have significantly lowered the forest use. Under such circumstances, the vegetation succession has advanced in secondary forests that had been maintained for a long time, which is resulting in the deterioration of habitats for wild animals and plants.
- Agricultural yield has increased due to the increased use of chemical fertilizers and agricultural chemicals. In the meantime, the use of chemicals has degraded habitats for wild animals and plants.
- The stagnation of industries including agriculture, forestry, and fishery caused a population outflow to large cities and the aging of society. The number of people involved in the use and management of natural resources has decreased which in turn increased the amount of abandoned fields and lowered forest management quality.
- Furthermore, the insufficient management increased the frequency at which agricultural lands are damaged by wild animals and further exacerbated the stagnation of agriculture, forestry, and fishery industries in a vicious cycle.

(3) Regional Plans and Other Measures toward a Resolution of the Above Problems

- In 2007, the local government of Kyotango City adopted the Biomass Town Vision. They are promoting the use of biomass in an effort to resolve the crisis and causes of problems described above.

● Outline of the Biomass Town Vision

[Local goals under the Biomass Town Vision]

- Promotion of industry based on the use of local biomass.
- Prevention of climate change.
- Conservation and restoration of the natural environment.
- Environmental education, eco-tourism, and environmental awareness-raising for the citizens.

[Proposed uses of local biomass]

1. Biogass power generation and conversion of organic products produced in the methane fermentation into the fertilizer
2. Conversion of the biomass into BDF (biodiesel fuel)
3. Conversion of the biomass into the compost
4. Conversion of the biomass into the biomass plastic, liquid, or resin
5. Others (utilization of industrial wastes from fishery)

3. Details

(1) Overview

Amita Corporation, a private company, is working for the establishment of a material recycling system that introduces new technologies such as biogas power generation and forest dairy farming as the core of the system in Funaki, Yasaka-cho, Kyotango City. The main purpose of this effort is to restore the devastated natural environment and to create a new industry in the agricultural mountain village.

Activities presented below are as of March 31, 2010.

Location	Funaki, Yasaka-cho, Kyotango City, Kyoto Prefecture
Involved Parties	**[Implementing body of the use and management of the natural resources]** Amita Corporation **[Owner of the forest and agricultural land]** Farmer/forest owner **[Owner of the biogas power generation facility]** Kyotango City * *Amita Corporation is renting the land on a loan from farmers and forest owners. The company is also commissioned by Kyotango City to operate and manage a biogas power generation facility.*
Background and history	**[Amita Corporation was commissioned to operate and manage the biogas power generation facility]** • The national New Energy and Industrial Technology Development Organization (NEDO) started a microgrid experiment (Kyoto Eco Energy Project (KEEP)) in this area. • Amita Corporation was commissioned by NEDO to implement a KEEP in 2003 and started to plan, operate, and manage the biogas power generation facility, "Kyotango Recycle-based Material Production Plant", one of the components of the microgrid, as a company facility. Such was the beginning of the relationship between Amita Corporation and this area. • The operation of the biogas power generation facility started in August 2005. The facility was handed over from NEDO to Kyotango City; Amita Corporation continues to run the operation. **[Expansion of resource circulation efforts: Start of farming utilizing liquid fertilizer and forest dairy farming]** • Amita Corporation worked on the effective utilization of liquid fertilizer, which is the byproduct of the biogas power generation and started organic vegetable cultivation demonstration experiment in collaboration with local farmers in 2006 as a new initiative. In addition, it also started rice farming using no agricultural chemicals and limited chemical fertilizers in 2007. • In addition, in the end of December 2007, the company started the natural grazing by releasing milk cows to the degraded forests and started "forest dairy farming" in which a forest is properly managed in a long run while producing dairy products.
Purpose and Purpose and objectives	• Amita Corporation is a private company that engages in resource recycling, reduction of environmental risks, corporate social responsibility (CSR) activities, and consulting services on agriculture, forestry, and fishery business for the ultimate objective of achieving sustainable society. • This effort aims to: develop both environmentally and economically sustainable local communities, through the implementation of sustainable use and management of natural resources as well as the creation of new industries comprehensively.

Main contents	**[Main contents of the effort]** • Run and manage the Kyotango Recycle-based Material Production Plant (biogas power generation facility). • Organic farming using liquid fertilizer produced as the byproduct of the above facility and sales of agricultural crops. • Forest dairy farming and sales of livestock products. **[Characteristics of the effort]** • This effort uses new technologies such as biomass based power generation and forest dairy farming as the core for the creation of new connections of multiple types of land uses and natural resources that had been disconnected due to changes in socioeconomic situations and other factors. • This effort is based on the concept of resource circulation systems that achieve the balance between industry promotion and the natural environment conservation. It is a good practical example of holistic and sustainable land uses as well as natural resource use and management.
Main achievements	• The natural environment of agricultural lands was improved through (1) the recycling of regional organic wastes in the biogas power generation and (2) organic farming that utilized the liquid fertilizer produced as the byproduct of the biogas power generation. • The milk cows brought in for forest farming grazed on the undergrowth of the forest, which improved the quality of the natural environment of the secondary forest that had been degraded. • New added-value agricultural products and stock farming products of the region such as "*Shinrin no Okome* (rice from the forest)" cultivated without agricultural chemicals during the cultivation period and "*Shinrin no Gyunyu* (milk from the forest)," the high-quality natural pasturing milk started to be produced and sold. New industry for an agricultural mountain village was produced through this effort.

Picture: Paddy fields and biogus plant
(Photograph provided by Amita Corporation)

(2) Details of the Use and Management of Natural Resources from the "Five Perspectives" of the Satoyama Initiative

The table below shows the primary relevance of this case to the five perspectives.
Details are given below the table for the perspectives which have high relevance (items with the "◎" mark in the table).

Five Perspectives	Relevance to this Case	
	Degree of relevance	Summary of Relevance
1) Resource use within the carrying capacity and resilience of the environment	◎	• Because the use of a natural resource was insufficient for a natural resilience, the forest and the farmland had been deteriorating. However, the use that harmonizes with a natural resilience is achieved by having introduced the biogas power generation, the forest dairy farming, and organic farming, and the quality of ecosystem has recovered. ** Details to follow.*
2) Cyclic use of natural resources	◎	• A new matter cycle is formed with the biogas power generation, the forest dairy farming, and low-input farming. • It contributes to making of the matter cycle in the region proper by effectively using the organic refuse exhausted from the Kansai region as a raw material of the biogas power generation. ** Details to follow.*
3) Recognition of the value and importance of local traditions and cultures	○	• Through the collaboration with local farmers and foresters, their indigenous knowledge and techniques they possess are utilized partially.
4) Natural resource management by various participating and cooperating entities	○	• Amita Corporation is carrying out the effort with cooperation with the local farmer and the Kyotango City.
5) Contributions to local socio-economics	◎	• The local populace's employment was created by industry's that newly produced farm products and the livestock product with high added value having been created. • The biogas power generation facilities, the forest, and the farmland have been used as a place for environmental education that cooperates with the school in the region. ** Details to follow.*

1) Resource use within the carrying capacity and resilience of the environment

- In Kyotango City, as the socioeconomic situation changed, agriculture, forestry, and fishery have declined and population outflow and aging have also occurred. As a result, devastation of forests and farmland is a major problem in the area.
- This effort attempts to create new industries and achieve sustainable use and the management by succeeding the traditional land use that harmonizes with a natural condition in the region and also by constructing the matter cycle with a core of a new practice such as the biogas power generation, the

forest dairy farming, and low-input farming.

- In the construction of the mechanism of the matter cycle, the stock of a natural resource and the management of flow are done as follows so that the biogas power generation, the forest dairy farming, and low-input farming should not produce excessive waste beyond the environmental carrying capacity or cause excessive use beyond the natural resilience.

  - The materials used for biogas power generation include the wastes generated by residents and industries in Kyotango City. Excessive uses of the natural environment will not occur in the utilization of these materials.
  - Gas emission and wastewater discharge from the biogas power generation facility are properly treated to meet the environmental carrying capacity.
  - The amount of liquid fertilizer, the by-product of the biogas power generation, applied to agricultural lands is set within the range that will not cause such problems as nitrogen overload.
  - The density of milk cow raising in the forest dairy farming is set within the range that would not cause overgrazing based on the knowledge of existing examples. The forest dairy farming is not likely to impede the resilience of the forest.

- As a result of these efforts, use and management of forests and farmland in harmony with the natural resilience of the environment is now carried out. And thus these efforts is also contributing to improve biodiversity.


Degraded forest before opening the farm


Present forest with forest dairy farming

Pictures: Transformation of the secondary forest environment before and after the start of forest dairy farming
(Photographs provided by Amita Corporation)

3) Circulative use of natural resources

- New material flow systems have been established in the area and different land uses are now connected by the activities of biogas power generation, forest dairy farming, and organic farming as shown in a figure below.
- Cyclical use of natural resources, with ecosystem function and human activity in harmony, has been achieved by this material flow being executed within the range of an environmental capacity and a natural resilience.
- Moreover, the organic refuses that are the raw materials of the biogas power generation are collected all over Kyotango City, and this contributes to making proper regional matter cycle.

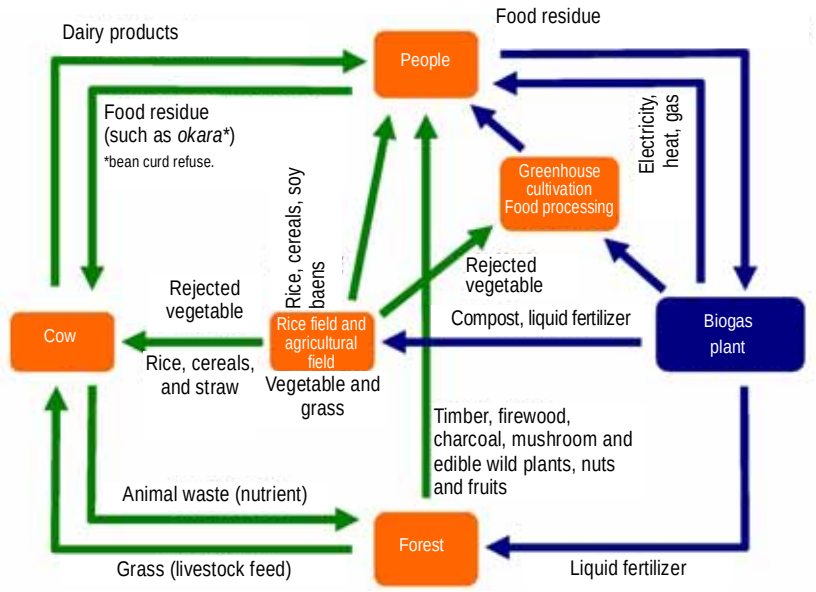
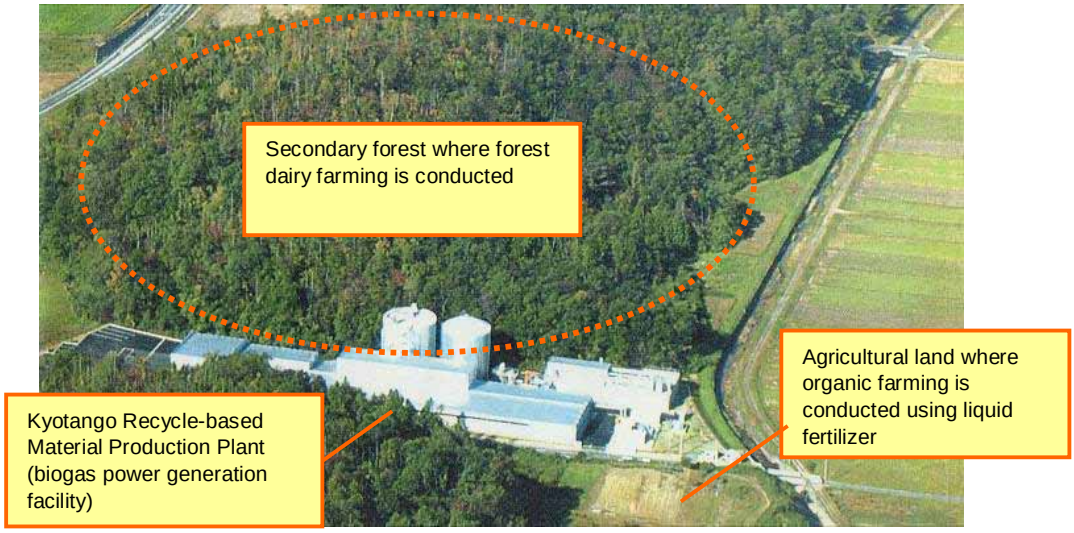


Figure: Conceptual diagram of material circulation in the target site (Figure: Amita Corporation)
(Figure provided by Amita Corporation)



Picture: Land use at the target site
(Photograph provided by Amita Corporation)

5) Contributions to local socio-economics

- High-value farm and livestock products in the region, such as "Forest Rice" with no agricultural chemical and chemical fertilizers being used during the cultivation period and "Milk of the Forest", high quality milk, by natural pasturing are produced and sold, and new industry in rural regions was produced.
- Amita corporation's business is not yet profitable. However, the accumulation and improvement of knowhow and the development of the market are advancing steadily, and it is aimed to make the business profitable in several years.
- Amita Corporation is a private company that has its head office outside the region, however, it values the harmony among nature, society, and economy in the region. As a direct contribution to the region, ten local people are employed by the company and it also works on environmental education that cooperates with a school in the region.
- As Amita Corporation is not a local enterprise, it was not easy to obtain support from land owners and other local residences when this project started. Therefore, the corporation has been carrying out

persistent work: such as intermittently disseminating information on the meaning and the effect of the project; as well as inviting people to enjoyable events to promote understanding of Amita's work.

- As a result of these efforts, the number of local people who understand and support the activity is now increasing steadily.

Picture: Products being produced and sold (Left: "Forest rice" Right: "Milk of the forest")
(Photographs provided by Amita Corporation)

Picture: Environmental education in elementary school in local
(Photograph provided by Amita Corporation)

End