

# A Study of Human Subsistence Ecosystems in Arab Societies: To Combat Livelihood Degradation for the Post-oil Era

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Hiroshi NAWATA received his Ph.D. in Human and Environmental Studies (Cultural Anthropology) at Kyoto University (2003). He was assistant professor at the Division of Comprehensive Measures to Combat Desertification, Arid Land Research Center, Tottori University (2004-2007). His major fields of interests are camel pastoral systems, Muslim trading networks, and indigenous (traditional) knowledge for rural development in the Middle East and Africa.



This project examines life support mechanisms and self-sufficient modes of production among Arab peoples who have survived in dryland environments for more than a millennium. Using the research results, we will propose a scientific framework to strengthen subsistence productivity and combat livelihood degradation in local Arab communities in preparation for the post-oil era.

## Background and Objectives

Japan and the oil-rich countries of the Middle East have put excessive pressures on the earth's energy, water, and food resources. In prioritizing economic prosperity, these countries have exploited irreplaceable resources, such as fossil fuel and fossil water. Schemes to plant alien species have also placed stress on local ecosystems. This pattern of development has increased social and economic differences within the Middle East just as the region faces a turning point in modern oil-based industrial development. Fossil fuel-based interdependencies must now be transformed into new relations that can support viable future societies.

This project focuses on human subsistence ecosystems of the region: low energy-intensity life-support mechanisms and modes of production, such as hunting, gathering, fishing, herding, farming, and forestry. In doing so it also reflects on the role of advanced technologies in economic development, and measures adopted thus far to combat desertification. Field research investigates keystone species, ecotones, and traditional knowledge and examines the sustainability of subsistence economies under site-specific conditions.

## Research Methods and Organization

Field surveys are conducted in semi-arid lands between the Nile River and the Red Sea in Sudan, with the Red Sea



Figure 1 Field survey areas and research themes

coast, Butana area, and Nile River areas as the main survey areas. Additional surveys will be conducted at the Sinai Peninsula in Egypt, the Red Sea coast in Saudi Arabia, and a Saharan oasis in Algeria. We will compare keystone species, ecotones, and traditional knowledge and examine differences in the sustainability of subsistence economies under site-specific conditions (Fig. 1).

We will develop and implement our study of human subsistence ecosystems around three main areas: 1) comprehensive measures to control the alien invasive species mesquite; 2) assessment of the environmental effects of development programs in coastal zones of the arid tropics to prevent the emergence of new environmental problems; and 3) sharing of research results to support local decision making.

Our research method combines two main approaches: (1) analysis of subsistence ecosystems, focusing on keystone species such as camels, date palm, dugong, mangrove, and coral reefs; and (2) examination of the sustainability and fragility of Arab societies, focusing on the ecotones such as wadi beds, riverbanks, mountainsides, and seashores.

The members of this project include social and natural scientists, members of local NGOs and project managers, who are divided into four study groups: 1) Alien invasive species control group, 2) Coastal zone environmental impact assessment group, 3) Support for local decision making group, and 4) Local ecosystems comparative studies group (Fig. 2).

## Major Achievements

### Suggestions for resource management in Marine Protected Areas (MPAs) through studies on fishing culture and behavioral characteristics of dugongs

The local people have historically depended on sea products (fish, shellfish, dugong, dolphin, and sea turtles) for their diet in unique coastal ecosystem of the arid tropics: coexistence of mangrove forests (dominant species: *Avicennia marina*) and coral reefs and complex relationship of the both. On the other hand, the coastal zones presents a large development frontier, therefore, it may also lead to environmental degradation such as destruction of mangrove forests, coral reefs, and seagrass beds and releasing highly concentrated saline water into the sea. In order to suggest frameworks for a new environmental assessment with community participating for prevention of global environmental problems, we have conducted multi-principal studies focusing on mangroves, coral reef, camels, dugongs, and fishing culture in the coastal areas of Sudan,

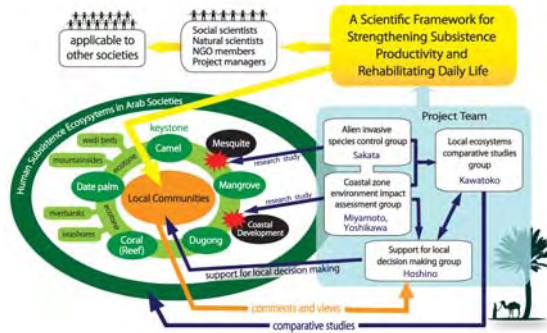


Figure 2 Research methods, approaches, and organization

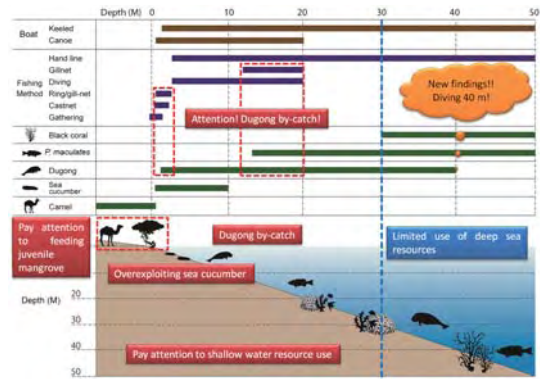


Figure 3 Actual situation of coastal resource use in Dugonab Bay in Sudan

Egypt, and Saudi Arabia, surrounding the Red Sea.

We have conducted surveys on fishing culture in Dugonab Bay in one of the MPAs in Sudan and have found that the local fishermen were catching fishes based on accurate recognition of their subsistence space and detailed understanding of ecology of the target fish. The fishermen find 77 fishing grounds accurately by using both maps and marine charts. Besides, it was suggested that fishing restriction due to harsh environmental conditions such as strong winds for half a year and hot temperature in summer may control over harvesting of the marine resources. On the other hand, there is a growing concern about over fishing of sea cucumbers which are coastal stationary species that inhabit shallow waters, because they are easily taken and traded at high price. It is also concerned that mangrove trees are used for processing the sea cucumbers.

Biologging studies of dugongs revealed behavioral characteristics of their space use. Dugongs stayed in the shallow waters less than 4 m for more than 96 % of their time, sometimes showing rapid dives down to 40 m. Strong site fidelity was also suggested because the animal repeatedly visited a specific feeding ground. Vocal communication is expected to be revealed by further analysis.

Most of the fishing grounds and the dugong habitats in Dugonab Bay did not overlap. It was shown that by catch of the dugongs in gill nets can be avoided by time-spatial segregation of fishermen and dugongs (Fig. 3).

We clarified precautions for development and resource management prior to waves of public projects and development. Accumulation of academic data by this project contributes to concrete input of framework and contents of

management of MPA, and at the same time, it can be used as reference for assessment of environmental impact in the whole area of Red Sea and also coastal areas of arid tropics.

### Future Activities

Challenges for the last year of this project is to present a persuasive contention by connecting the particular factual data and integrate the result of analysis for “Human subsistence ecosystems in Arab societies”. We will reveal human subsistence ecosystems in the seaside such as relationship between mangrove, coral reef, camels, dugongs, and fishing culture through our previous studies, and by comparing trees (wild species: *A. marina*, cultivated species: date palm, and alien invasive species: *Prosopis*), we will reevaluate them as new resources for energy and food. These research results will be exhibited as “Surviving in the desert (tentative)” at National Museum of Nature and Science. Last year, we have compiled a book “Human resource development and manufacturing in the post-oil era: Pursuit for a future vision of Japan and oil-producing countries” (RIHN book series, Showado) and volume 1 and 2 of multilingual books (in Arabic, English, French, and Swahili) as Arab Subsistence Monograph Series (Shoukadoh). We will also compile a series of books in Japanese “Human subsistence in Arab” (10 volumes, Rinsen Book Co.), and a book “Knowledge for sharing water in the desert (tentative)” (National Museum of Nature and Science, Tokai University Press) to conclude the study results and pass them on to the local society.



Photo1 Interview surveys with local fishermen (Sudan)



Photo2 Sea cucumbers are collected and dried in the sun (Sudan)



Photo3 A local fisherman and a dugong with biologging equipments (Sudan)

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