# 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.

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 examines life support mechanisms and self-sufficient modes of production among Arab peoples who have survived in dryland environments for more than a millennium. It examines low energy-intensity life-support mechanisms and modes of production, such as hunting, gathering, fishing, herding, farming, and forestry. In doing so the study 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 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 (Fig. 1).

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 their dependence on 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
4) Local ecosystems comparative studies group (Fig. 2).

## Assessing the environmental effects of development in coastal arid tropical zones

Local peoples in coastal arid tropical ecosystems have historically depended on sea products (fish, shellfish, dugong, dolphin, and sea turtles), and harvesting from mangrove forests (dominant species: *Avicennia marina*) and coral reefs, two complex and interrelated ecosystems. Such coastal zones present a large—but fragile—frontier for development. Development can lead to environmental degradation through destruction of mangrove forests, coral reefs, and seagrass beds and the release of highly concentrated saline water into the sea (Fig. 3). Meanwhile,


**Figure 1** Field survey areas

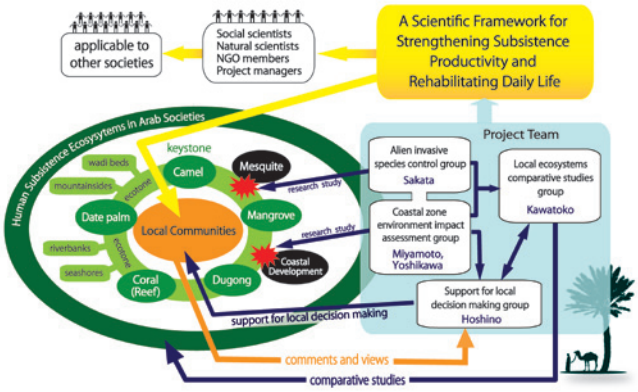


**Figure 2** Research methods, approaches, and organization

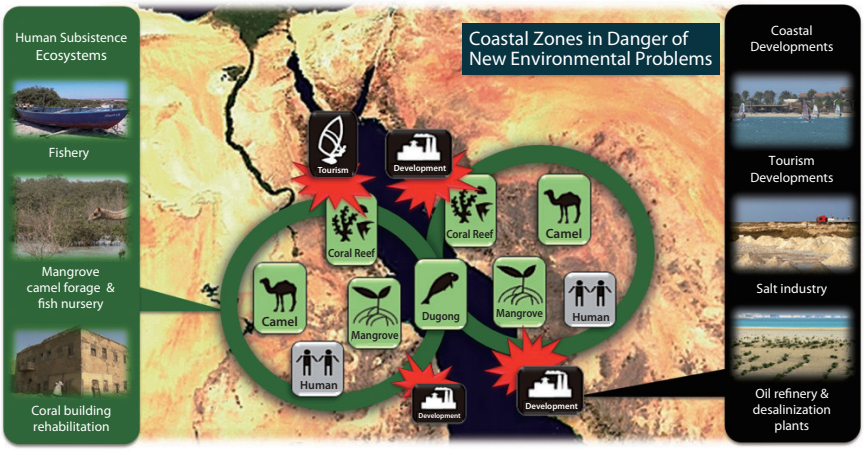


**Figure 3 Coastal zones in danger of new environmental problems**

**Figure 4 Mangrove leaf sampling area**

mangrove afforestation projects can provide fodder for domesticated animals such as camels while also serving as nurseries for nearby reef fish. In order to suggest frameworks for a new environmental assessment with community participation for prevention of environmental problems, we have conducted multi-principal studies focusing on coastal mangroves in Sudan, Egypt, and Saudi Arabia.

Based on studies on forest structure, morphological adaptation to environmental stresses, and isotope analysis of *Avicennia marina* water-use characteristics, we found significant impacts of soil salinity on tree height, leaf dry weight, internode length, and shoot length. We also found in some forests that appropriate camel feeding might promote the growth of *A. marina* leaves and shoots. Having begun DNA analysis of 3100 leaf samples collected along the Red Sea Coast (13 forests in Egypt; 25 forests in Sudan; 24 forests in Saudi Arabia) (Fig. 4) which will allow a regional-scale analysis of genetic diversity, mangrove forest dynamics and processes of change.

Since concluding a MOU with the Red Sea University, a principal institution of marine science in Sudan, several full-scale field surveys are now underway. These include a behavioral study using biologging of dugongs in seagrass beds, a GPS-based monitoring of camel grazing area and browsing pressure in *A. marina* forests, and continuing anthropological study on fishing villages.

## Future activities

In the next year, we will synthesize our findings in order to propose a scientific framework to strengthen subsistence productivity and combat livelihood degradation in local Arab communities in preparation for the post-oil era. Several books are also in preparation, including *How Do We Live Without Oil?* (RIHN book series, in Japanese) and *Human Subsistence Ecosystems in Arab Societies* (9 volumes, in Japanese).

**Photo 1 Mangrove leaf sampling (Saudi Arabia)**

**Photo 2 Camels eat mangrove leaves and branches (Sudan)**

**Photo 3 Japanese and Sudanese researchers discuss a mangrove plantation (Sudan)**

**Photo 4 Morphological study on *A. marina* (Sudan)**


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