1.2.2 Saltation

There is saltation problem in certain areas in Sakon Nakhon and Kalasin. Although the problem is limited to some areas compared to the situation at the southern part of the northeastern region, potential areas of saltation are widely distributed in the NBR, as shown in Figure 1.7. Important factors affecting the formation of salty farmland in the NBR are listed below:

(1) Climatic Factor

The climatic factor is both an exterior factor enhancing the accumulation of salts in soil and an important factor affecting the formation of salty soil. During the dry season, especially in the NBR region, evaporation is dozens, or even hundreds of times higher than precipitation, and the leaching effect is extremely weak, resulting in even more forcible accumulation of salts in soil, and leading to soil saltation.

(2) Hydrologic Factor

There exists a close correlation between the formation of salty soil and the level and mineralization of groundwater. In general, the higher the level of groundwater, and the stronger the evaporation, the more salts will accumulate in the soil. Under similar conditions of groundwater level and ionic composition, the accumulation of salt in farmland depends on the mineralization of groundwater. The higher the mineralization of groundwater, the more salt will accumulate in the soil through evaporation.

(3) Topographic Factor

This basin has a low and level terrain resulting in a poor drainage of rainwater during the rainy season. Water comes from the neighboring highlands around this region, containing large amounts of soluble salts. After coming to this basin, it cannot flowquickly into the river. While evaporation is the only means to lower water level, soluble salts may accumulate in soil or groundwater, thus enhancing the saltation of soil.

(4) Soil Factor

The soil factor mainly involves the mechanical composition of parent material of soil, which may affect the rate and quantity of salt accumulation. In the NBR region, loam

soil and silt loam soil possesses a strong capillarity. The proper size of capillaries makes it possible for capillary absorbed water to climb higher and quicker, resulting in the fast and excessive accumulation of salts in the soil.

(5) Human Factor

The soil saltation is called secondary saltation, which is caused by human factors, unreasonable production activities of humans. In the irrigated areas of the arid or semi-arid zones, improper irrigation and drainage, and extensive management of farming may incur the rise of groundwater and strong evaporation, and thus enhance the accumulation of salts in the soil.

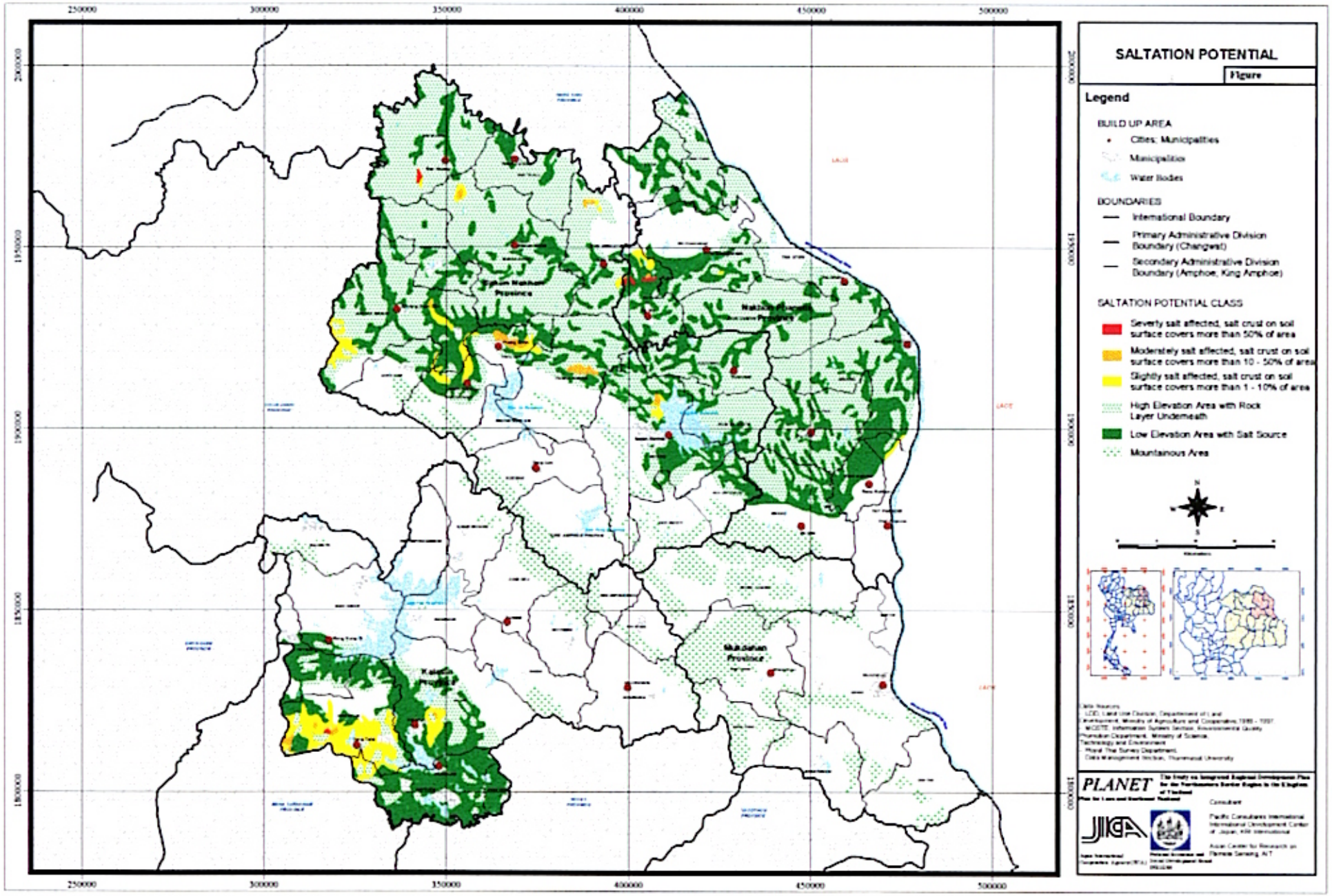

Figure 1.7 Potential Areas of Saltation in the NBR

1.2.3 Environmental Pollution by Urban Activities

Environmental burden may increase in accordance with population growth in urban areas and with industrial location.

(1) Water Quality

Areas along the Mekong River use river water as source of drinking water and for agricultural purpose. The water quality of the Mekong River has not changed even with the large volume of water flow.

Major reservoirs in the NBR are utilized as source of irrigation water and drinking water. Water quality of the reservoirs clears the standard level.

Water quality of Nong Han reservoir needs to be pied special attention. The reservoir is used as source of drinking water, irrigation water, and at the same time, wastewater is discharged into the reservoir.

(2) Solid Waste

Solid waste are collected daily by the municipalities and disposed of without intermediate treatment. Final disposal has recently been improved in the NBR by introducing a sanitary landfill site in Nakhon Phanom, Sakon Nakhon and Kalasin, and will be improved in Mukdahan. Sanitary landfill sites are ready to handle wastes from the other municipalities and Tambons.

(3) Pollution from Industries

Although there is not typical industrial pollution reported due to small agglomeration of factories, the problem of odor surrounding the cassava factory in Kalasin occasionally occurs.

1.3 Natural System and Functions of the NBR

NBR has been covered by forest for a long time; however, the forest has gradually decreased due to commercial logging and land exploitation for cultivation. Paddy field, upland crops like cassava and sugar cane occupies approximately 50% and forest occupies only approximately 17% of the total area of the NBR. The remaining forest cover and paddy field have a significant role in maintaining a sustainable cycle of the natural environment in the NBR.

The forest areas in Phu Phan Mountain have an important function of water retention and habitat for wildlife. The remaining forest cover in the hilly areas mitigates soil erosion caused by upland crop cultivation and maintains moisture in the soil. The forest supplies nourishment to the paddy field. The paddy field has a water retention function and avoids saltation by washing out organic salt contents from the paddy field.

The Mekong River and Nong Han Reservoir have a catabolic function in the area.

This environmental system maintains the environment of the NBR as a sustainable cycle.

1.4 Socio-economic Changes Affecting the Environment

1.4.1 Agricultural Development

Land exploitation for agriculture has long decreased forest areas. If deforestation continues, the environmental system of the NBR will be damaged. In particular, more deforestation in Phu Phan Mountain will reduce water resource capacity as well as the habitat of wildlife, and more deforestation in the hilly area will have an impact on the over-utilization of farmland and on groundwater, resulting in increased possibility of saltation.

1.4.2 Urbanization

Urbanization will seriously affect the catabolic function of the NBR. In particular, Sakon Nakhon uses Nong Han reservoir as a water source and discharging place of wastewater. The discharged wastewater is naturally purified for a long time. If the urbanization is going to proceed in a disorderly manner in Sakon Nakhon, it will put undue burden on the environment possibly exceeding environmental capacity and result in the collapse of an already vulnerable environmental balance.

On the other hand, the Mekong River has also a catabolic function for the surrounding areas aside from its use as water source. Although the environmental capacity of Mekong River might be large, it would be necessary for its water quality to be well maintained for use in the downstream.

1.5 Issues on Environmental Management in the NBR

1.5.1 General

Deforestation and saltation problems occur in accordance with expansion of human activities. However, the natural environmental system of the NBR is still functioning well. But more environmental burdens due to increasing urbanization, more deforestation and excessive agricultural development and land use may harm the sustainable environmental system of the NBR. Since farming activities will continuously be one of major sources of income in the region, they are very important to maintain/rehabilitate the current environmental system as a basis of human activities.

In this sense, there are three focal issues as below:

- Forest Conservation;
- Prevention from Soil Erosion and Saltation; and
- Water Quality Conservation.

1.5.2 Environmental Issues

(1) Forest Conservation

Deforestation of the Phu Phan Mountain directly reduces its water retention capacity, thereby increasing the possibility of flooding in the region. It is accordingly important to maintain forest areas in the Phu Phan Mountain. This also contributes to maintain a good living space for wildlife and wild plants.

(2) Prevention from Soil Erosion and Saltation

Forest areas and paddy fields in the NBR restrain soil erosion, while in some upland crop areas, especially to cassava, soil erosion occurs. Forests and paddy fields need to be maintained well to sustain its agricultural use.

Currently, saltation problem occurs at limited areas in Sakon Nakhon and Kalasin, but potential saltation points cover a large area of the NBR. These areas are currently used as farm areas with forests. More deforestation or more utilization of groundwater will increase the saltation potential more. It is necessary to restrain over- utilization of land and groundwater. In particular, hilly areas, with farmland and forest, need sustainable land use to restrain over-utilization of land and groundwater.

(3) Water Quality Conservation

1) Water Quality Management in the Main Water Bodies

In NBR, the Nong Ham Reservoir, the Lam Pao Reservoir, and the Songkhram River occupy an important position. Sakon Nakhon depends on the Nong Han Reservoir in terms of urban metabolism. Sakon Nakhon takes drinking water as well as irrigation water from Nong Han Reservoir, while all wastewater discharges into the reservoir. Accordingly, the first sewage treatment plant in the NBR, which was initiated by the King, is located in Sakon Nakhon.

The areas along the Mekong River are densely utilized with relatively large population in particular, Nakhon Phanom and Mukdahan. There are also many human activities in the Laos side, too. These areas generate heavier environmental burdens into the Mekong River such as wastewater and solid waste. It is therefore necessary to intensively conserve water quality of Mekong River.

The other important water bodies in the NBR such as Lam Pao Reservoir and Songkhram River are similar position as Nong Han Reservoir and Mekong River, respectively. They also need to be paid special attention for conservation as well.

Consequently, it is of great necessity to adequately control urbanization, industrialization and even agricultural activities in relation to the conservation of water quality of Nong Han Reservoir, the Lam Pao Reservoir, and the Songkhram River

2) Wastewater Treatment

Wastewater discharges into the water bodies without any treatment in the NBR in general, expect for a part of Sakon Nakhon Minicipality. It is necessary to introduce wastewater treatment facilities to maintain the water quality of water bodies like the Mekong River.

3) Solid Waste Management

Municipal garbage is collected and disposed of in the final disposal site near the city by the local governments. Collection and transport of garbage are well managed by the municipalities; however, some municipalities have open dumping sites. It is necessary to introduce a sanitary landfill to restrain any negative impacts to the surrounding areas.

1.5.3 Overall Environmental Issues Map

The specific areas having environmental issues described above are identified in the PLANET-GIS as shown in Figure 1.8.

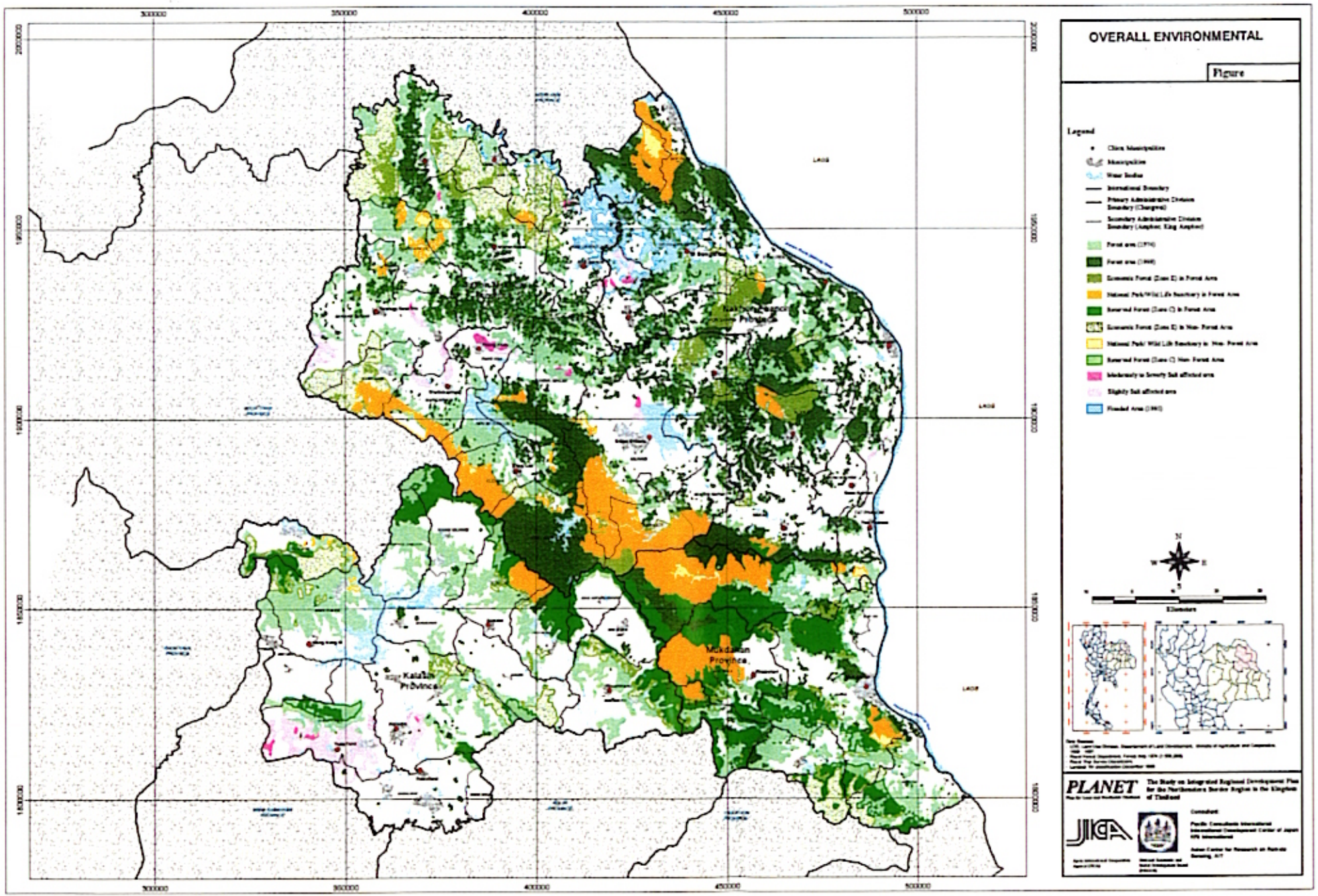

Figure 1.8 Overall Environmental Issues In the NBR