# 7. Other studies

In addition to the surveys and the observations described above for the construction of the subsurface dam and the evaluation of its effectiveness for water storage, the following studies were undertaken in this project.

(1) Experimental installation of water-supply facilities operated by solar energy
Water-supply facilities operated by solar energy were set up as follows to study the effective use of the reserved water by the subsurface dam (see Photographs at the end of this chapter):

- Water-pumping wells: 3 dug wells installed in the reservoir area of the subsurface dam (with about a 20-m depth)
- A solar power station: 3 solar panels generating 1.76 kwp of electricity
- Water supply facilities: A water tower whose volume is10 $m^3$, a water-supply station for domestic use (communal water taps), a water trough for livestock animals, and irrigation facilities for agricultural pilot studies

Namely, water was pumped up to the water tower from the 3 pumping wells by underwater motors operated by solar energy, and was distributed to the water-supply facilities installed in Kombangbedo Village for domestic and other uses.

Water provided by these facilities reached more than 30 $m^3$/day at maximum just after the start of the water supply. Thereafter, it fell to about 2,700 $m^3$ in 2002, i.e., 7.4 $m^3$/day on average, after the installation of hand pumps in the village and the voluntary restriction of water supply for livestock animals by the villagers themselves.

(2) Agricultural pilot studies
To study the effective use of groundwater for agriculture, a pilot farm was set up, and agricultural pilot studies were carried out there with the water provided by the water-supply facilities operated by solar energy mentioned above. The cultivation of cereals (millet and sorghum) and vegetables (tomato, onion, etc.) by drip irrigation, negative pressure irrigation and manual irrigation were tested, changing the water volume conditions.

The results of these studies showed that irrigation with appropriate water supply ensured harvest even in "a year of extraordinary drought". However, to use the reserved water by the subsurface dam for agriculture operationally, it is necessary to develop methods of irrigating large areas of land effectively and economically.

(3) Installation of a small-scale surface dam with water gates
To facilitate the recharge of groundwater, and support the development of agriculture and inland water fishing, a “small-scale surface dam with water gates” was installed on the Kolongo River 1.5 km upstream of the subsurface dam (see Photograph at the end of this chapter).

This “small-scale surface dam with water gates” was set up using the existing embankment of the main road as a dam body, attached with 23 water gates. The length of the dam body was 33 m, and the maximum water level of the reservoir was 1.2 m.

The gates were opened and closed by the inhabitants who grew rice on the flood plain. This surface dam increased largely the field area for rice crops on the flood plain, and the fishing

catch from the reservoir of this surface dam also appeared to be increasing.

(4) Vegetation research for environmental impact assessment

To assess the impact of the change in groundwater state caused by the subsurface dam on the environment, the following vegetation research, mainly on trees, was carried out:

1) Follow-up research of vegetation change around the reservoir area of the subsurface dam: This research was carried out between 1998 and 1999. In the reservoir area of the subsurface dam and its vicinity, whose total area was about15 $km^2$, 29 observation points at about 500-m intervals were selected, and species, height and diameter of the trees, etc. were observed. Furthermore, vegetation change thereafter at the same points was also researched between 2001 and 2002.

2) Life historical research on tree growth upstream and downstream of the subsurface dam: This research was carried out between November 2000 and December 2002 in research zone 50 to 100 m upstream and downstream of the subsurface dam, to compare the difference of the tree growth between the upstream side and the downstream side.

The target species of this research were *Acacia seyal*, *Mitragyna inermis* and *Piliostigma reticulatum*. In this life historical research, the vigorousness and shape of the trees, the state of the leaves (budding and defoliating seasons, color and volume of leaves, etc.), the state of the flowers (flowering season, volume of flowers), and the state of the fruit (fructification season, volume of fruit, etc.) were mainly observed. The research interval was once or twice a month.

In addition to this research, an inventory of the species was made before water storage by the subsurface dam, and examination for quantitative methods of environmental impact assessment was carried out.

The follow-up research mentioned above in 1) did not show any vegetation change in the reservoir area and its vicinity, except for the obviously artificial vegetation. On the other hand, the life historical research mentioned above in 2) showed that the defoliation season clearly tended to be earlier in the area downstream area than in the area upstream of the dam, which suggests a difference in the soil moisture content between the upstream side and the downstream side. However, dead trees were not found upstream or downstream.

Thus, the difference in the vegetation state between the upstream side and the downstream side of the subsurface dam was only “environmental change” observed since the construction of the subsurface dam until the end of 2002. This difference might also be attributed to the difference in the presence of surface water, and it was not clear whether the difference was affected by the construction of the subsurface dam or not.

(5) Research on awareness of this project by inhabitants

In January and February 2002, awareness of this project by inhabitants was researched in the form of an interview in Nare and nearby villages.

The results show that the inhabitants had a positive feeling toward this project in general.

It should be noted that the following facilities were set up during the model project but independently of it. Some staffs of the model project participated in the running of some of

these facilities:

- 3 mill stations, by "Grant Assistance for Grassroots Projects" from Japan
- 4 hand pumps, by Grant Aid from JICA (Japan International Cooperation Agency)
- 1 vegetable garden equipped with 4 large-diameter wells for the women of Nare Village, by the government of Burkina Faso
- 4 vegetable gardens, by a Japanese NGO (GEO-Action)

Photo 7.1: Solar power station for pumping

Photo 7.2: Pumping well installed in the reservoir area of the subsurface dam
(The well is surrounded by concrete walls for protection from river floods.)

Photo 7.3: Water-supply station for domestic use, installed in Kombangbedo Village


Photo 7.4: Pilot farm in this project
(The reserved water by the subsurface dam, pumped by solar power station, was used for irrigation.)

Photo 7.5: Small-scale surface dam with water gates, installed in this project