

Social Republic of Viet Nam

Ex-Post Evaluation of Japanese Technical Cooperation Project  
“Forest Fire Rehabilitation Project”

External Evaluator: Wataru Yamamoto, OPMAC Corporation

**0. Summary**

The “Forest Fire Rehabilitation Project” aimed to develop and disseminate techniques for the Melaleuca (*Melaleuca cajuputi*)<sup>1</sup> planting using embankment<sup>2</sup> with high economic returns on acidic sulphate soil<sup>3</sup> whose topsoil was consolidated after the damage caused by a large forest fire. The plantation technique<sup>4</sup> was developed by a former JICA technical cooperation project<sup>5</sup>. The project was in line with Vietnam’s development policy as well as development needs but it was evaluated that environmental consideration on the risk involving with acidic sulphate soil was not sufficient during the project formulation stage. Therefore, relevance is evaluated as fair.

The impact of trial implementation of Melaleuca processing technologies was limited but Melaleuca plantation on embankment has been disseminated and expanded covering the target area of the overall goal. Also, trial implementation in the field, livelihood support to the demonstration farms (hereinafter called demo farms), showed a large impact on their income and outputs on forest fire prevention activities are effectively being utilized; therefore effectiveness and impact of the project are evaluated as high.

The cooperation period of the project was three years as planned; however, the input of human resources was increased due to development and transfer of new technologies. The project input was increased because the equipment planned to be utilized was unable to be utilized. Therefore, efficiency of the project is evaluated as fair.

The Forest Fishery Enterprise (hereinafter called FFE), one of the implementing agencies was institutionally and financially strengthened with political support by the Department of Agriculture and Rural Development (hereinafter called DARD). FFE became a forest company (hereinafter called Forest Company) through merger and liberalization. However, because of a political issue on immigrant farmers who live in the lands managed by Forest Company as well as a technical issue on formation of acid water by installing embankment, sustainability is

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<sup>1</sup> Tree species belong to Melaleuca genus, Myrtaceae family; distributed in tropical and sub-tropical region and characterized by tolerant against acidity and inundation.

<sup>2</sup> Raising ground level on line. See Figure 1.

<sup>3</sup> Soil that has a layer of sulfate sediment called Pyrite which contains sedimentation at the bottom of shallow sea. Sulfate sediment is oxidized by exposing to air at soil surface, producing sulfuric acid resulting in strong acidity of soil. The area is corresponding to the soil with peat formation on which organic matters are accumulated without decomposition by influence of inundation. Large proportion of clay contents consolidated at soil surface by forest fire made direct tree planting difficult. It was needed to dig line to break hard soil layer.

<sup>4</sup> Plantation site preparation method to avoid inundation which disturbs tree growth. The method raises the level of plantation site by digging and making embankment on line one after the other. Please Figure 1.

<sup>5</sup> Technical cooperation project, the Afforestation Technology Development Project on Acid Sulfate Soil in the Mekong Delta. Implemented between March, 1997 and March 2002.

evaluated as fair.

Thus this project as a whole is evaluated as partially satisfactory.

## 1. Project Description



Project Location



Melaleuca plantation on embankment, eight years old

### 1.1 Background

In Ca Mau province located at the Southern part of Viet Nam, a large scale forest fire burned more than 4,000 hectares of forest and damaged peat soil<sup>6</sup> and agricultural lands at U Minh Ha area<sup>7</sup> in March 2002. Vietnamese government took the situation seriously and initiated a forest rehabilitation program in July 2002 towards the target year 2010 with a special public finance. The program was composed of tree planting for forest restoration, improvement of forest quality on burned-over forest and livelihood development of local residents. However, the large size of forest which needed restoration as well as the lack of knowledge to use reforestation methods with high effects on forest fire prevention, and the complicated social situation of local residents caused by poverty problems, the prompt dissemination of the program was impeded.

Therefore, Ca Mau province together with South Vietnam Office of Vietnam Forest Academy (hereafter called VAFS) utilized the technologies applicable for reforestation on acid sulfate soil developed by the technical cooperation of JICA, the Afforestation Technology Development project on Acid Sulfate Soils in the Mekong Delta (March 1997 – March 2000). However, due to lack of experience in handling the technical applications on the special soil condition after the forest fire which was different from normal acidic sulphate soil (clay soil

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<sup>6</sup> With the influence of strong acidity with high level of underwater level, undercomposed humus is accumulated creating a layer of peat soil.

<sup>7</sup> Lower part of U Minh District (near the sea) is called U Minh Ha region.

after burning peat soil) as well as lack of knowledge, techniques, and experience of FFE<sup>8</sup> and the farmers on reforestation, equipment needed for land preparation for plantation, the area reforested by the technologies was very limited.

Based on the background, the project was implemented for three years, from February 2004, with the purpose of developing and disseminating reforestation techniques required in the forest restoration program in U Minh Ha region. The main activities of the project included: 1) enhancement of technical applicability of reforestation in the target area; 2) enhancement of knowledge and technologies related to marketing and processing of Melaleuca timber; and 3) technical support on strengthening forest fire prevention system and livelihood development for local residents.

## 1.2 Project Outline<sup>9</sup>

|                   |          |   |
|-------------------|----------|---|
| Overall Goal      |          | Techniques developed under the project are utilized by people and Forest and Fishery Enterprises (FFE) in some areas of Mekong Delta.   |
| Project Objective |          | Necessary techniques for implementation of the rehabilitation and forest fire prevention program of U Minh Ha region are developed and disseminated.  |
| Output(s)         | Output 1 | Establishment and expansion of appropriate techniques of silviculture activities in U Minh Ha region.   |
|                   | Output 2 | Knowledge and techniques related to market research and the wider-use and processing of Melaleuca timber are improved among those engaged in silviculture activities.   |
|                   | Output 3 | a Fire prevention system is improved in the target area.<br>b Training on livelihood development for local farmers is implemented.  |
| Inputs            |          | Japanese Side:<br>1. Experts: 0 for Long-Term, 9 for Short-Term<br>2. Trainees received (10 for Counterpart Training Programs in Japan)<br>3. Third-Country Training Programs (0)<br>4. Equipment: 71.51 million yen (soil survey equipment, GPS, excavators <sup>10</sup> , bulldozers, tractors, etc.)<br>5. Local Cost: 56.9 million yen |
| Inputs            |          | Vietnamese Side:<br>1. 12 Counterparts (Project director, vice director, etc.)<br>2. Local cost share: 19.81 million yen in total, DARD (2.56 million yen), U Minh 1 Forest Fishery Enterprise (17.33 million yen)  |

<sup>8</sup> At project appraisal, five FFEs (U Minh 1, U Minh 2, Son Trem, Tran Van Thoi, and April 30) were involved in plantation activities in project implementation. These FFEs were merged as U Minh Ha Forest Company in November 2007.

<sup>9</sup> According to the information provided by JICA, Project PDM was produced in April 2004 and never changed since then.

<sup>10</sup> Excavators shovel with oil pressure.

|                                |  |
|--------------------------------|--|
|                                | 3. Land and Facilities, Project Office, Utilities (power and water)<br>Other Local Cost: Counterpart Salary, Cost for nursery establishment, etc.  |
| Total cost                     | 257 million yen  |
| Period of Cooperation          | February, 2004 – February, 2007  |
| Implementing Agency            | Ministry of Agriculture and Rural Development (MARD),<br>Ca Mau Province Department of Agriculture and Rural<br>Development (DARD), Vietnam Forest Academy South Vietnam<br>Office (VAFS), Ca Mau Provincial People’s Committee (PPC),<br>Forest Fishery Enterprises (FFE).  |
| Cooperation Agency in<br>Japan | Japan Overseas Forest Consultants Association (JOFCA),<br>Japan International Forestry Promotion Organization (JIFPRO).  |
| Related Projects               | <ul style="list-style-type: none"> <li>· Afforestation Technology Development Project on Acid Sulfate Soils in the Mekong Delta (Technical Cooperation).</li> <li>· Ca Mau Province Regional Development Advisor (Dispatch of Expert).</li> <li>· Forest Management, Ca Mau Province U Minh Ha Forest Company (Junior Overseas Cooperation Volunteer, JOCV)</li> <li>· The Project for Empowerment to the Community Damaged by Forest Fire in Ca Mau Province (Grant Aid)</li> <li>· Forest Protection Program (Grant Aid by Ministry of Foreign Affairs)</li> </ul> |

### 1.3 Outline of the Terminal Evaluation

#### 1.3.1 Achievement of Project Purpose at the Time of the Terminal Evaluation

According to the result of a questionnaire survey conducted at the Terminal evaluation, 100% of respondents (except for those who did not respond) are satisfied with the techniques developed by the project either at highly or certain level, and wish to disseminate the techniques. Therefore, the evaluation regarded that the project purpose was mostly achieved.

#### 1.3.2 Achievement of Overall Goal at the Time of the Terminal Evaluation

At the time of the Terminal Evaluation, Ca Mau Province alone had an implantation plan to develop 3,000 hectares of Melaleuca plantation within four years from the completion of the project, and techniques developed by this project were planned to be utilized in most of the area. Also it was regarded that the techniques developed by the project had high potential to be utilized in other areas with similar soil, topography, climate and social conditions. The application of the technologies outside the demo farms had also been started showing some positive impacts. However, it was thought that in order to achieve the overall goal of the project, budgetary support by related governmental organizations and/or utilization of external funding were needed.

### 1.3.3 Recommendations at the Time of the Terminal Evaluation

The recommendations raised were as follows:

- 1) Utilization of the guideline for dissemination of the project outcomes and implementation of environmental impact assessment depending upon the size and type of the development area;
- 2) Implementation of feasibility study for processing of Melaleuca timber in order to promote its effective utilization for purposes other than construction materials;
- 3) Support by the governmental agencies for strengthening function and role of Agriculture Dissemination Club<sup>11</sup> and Agroforestry Activities Support Committee<sup>12</sup>; and
- 4) Positive approach for seeking external funding in order to disseminate the model developed by the project in the surrounding areas.

## **2. Outline of the Evaluation Study**

### 2.1 External Evaluator

Wataru Yamamoto, OPMAC Corporation

### 2.2 Duration of Evaluation Study

This ex-post evaluation was carried out as follow<sup>13</sup>:

Duration of the Study: October, 2013 – November, 2014

Duration of the Field Study: November 17, 2013 – December 22, 2013

February 23, 2014 – March 10, 2014.

### 2.3 Constraints during the Evaluation Study

The ex-post evaluation was implemented seven years after the termination of the project. The collection of information on project activities was restricted due to the change of FFE staff caused by the institutional reform. The study was carried out for the most part to the beneficiaries who are considered to be important<sup>14</sup> and the situation from the time of the terminal evaluation up to the completion of the project was judged based on the information obtained at the time of ex-post evaluation.

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<sup>11</sup> A farmers' group to connect trainings and technical information by Agriculture Dissemination Center with member farmers.

<sup>12</sup> A committee composed of leaders of farmers' groups, Agriculture Dissemination Center, FFEs, etc. The committee forms farmer groups and train them in agricultural activities.

<sup>13</sup> Ex-post evaluation on "the Project for Empowerment to the Community Damaged by Forest Fire in Ca Mau Province" was conducted at the same time.

<sup>14</sup> In the ex-post evaluation, interviews were carried out with training participants, 14 in totals: DARD (2), Sub department of Forestry (6), former FFEs (5), and Sub department of Forest Protection (1), and Demo farms (40 households, including 40 control farms who did not receive benefits from the project).

### 3. Results of the Evaluation (Overall Rating: C<sup>15</sup>)

#### 3.1 Relevance (Rating: ②<sup>16</sup>)

##### 3.1.1 Relevance to the Development Plan

At the time of project appraisal, the project was in line with the basic principles of Vietnam's forest policy, forest protection and restoration, as well as the objective of the National project, "The Five Million Hectare Reforestation Program (5MHRP)"<sup>17</sup>. After the large scale forest fire in 2002, the restoration of lost forest was an urgent issue of the nation. Also, it was a top priority of the forest policy in Ca Mau Province to stabilize livelihood of local residents by improving profitability by restoring Melaleuca forest. In addition, the Vietnamese government was aiming to enhance the forest quality for sustainable use in its "Five Year Forest Protection and Development Plan (2006-2010)" and "Forest Development Strategy (2006-2010)". These policies had not been changed at the time of project completion. Thus the project activities were in line with the national issues and provincial policies.

##### 3.1.2 Relevance to the Development Needs

The Soil in the target area of the project contains peat soil<sup>18</sup> which formed a hard layer at top soil after the forest fire; it was difficult to directly plant trees on such soil. Therefore, in land preparation for reforestation, it was needed to dig up the surface soil layer. Before the project started, DARD and FFEs studied and proposed the application of Melaleuca plantation on embankment in Ca Mau Province, the technique proved by Afforestation Technology Development Project on Acid Sulphate Soils in the Mekong Delta, a JICA's technical cooperation project.

The technologies introduced by the project (Melaleuca plantation on embankment) are characterized by: 1) effective for forest fire spread prevention by land preparation and plantation methods establishing water canals and agricultural lands between the plantation sites; and 2) relatively short rotation cycle of timber production producing straight timbers with high demand for construction materials, which are expected to have high marketability and income generation effects (Table 1). As direct beneficiaries, the farmers of U Min Ha region, who live in the poorest area in Ca Mau Province, face difficulty in agriculture due to acidic soil conditions, and are relying on the forest resources, which had been seriously damaged by the forest fire, were the main target of the project.

Hence, considering these conditions it is regarded that selecting a native species, Melaleuca

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<sup>15</sup> A: Highly satisfactory, B: Satisfactory, C: Partially satisfactory, D: Unsatisfactory

<sup>16</sup> ③: High, ② Fair, ① Low

<sup>17</sup> Reforestation Program formulated in 1998 by the Vietnamese government. The program contributed to environmental conservation for watershed protection, economic development by promotion of forest activities, and social development for poverty alleviation for the purpose to recover 5 million hectares of forest by 2010 through reforestation and forest restoration by assisting natural regeneration.

<sup>18</sup> Forest fire on peat soil is difficult to extinguish because of remaining fire in soil. Thus peat causes expansion of forest fire and caused the large forest fire in 2002.

which is tolerant against acidic soil and inundation, introducing continuously plantation on embankment highly profitable, with technical collaboration with FFEs and DARD and providing a model to directly support the poorest farmers who are victims of the forest fire, were continuously needed not only at the time of project appraisal but also at the time of the project completion. Therefore, it was judged the project is highly in line with development needs of the target area.

Table 1: Cost/benefit Comparison of Melaleuca Plantation by Existence of Embankment

| Plantation status  | Plantation cost in the first year (Million dong /ha) | Harvest year | Income* (Million dong/ha) |
|--------------------|--|--------------|---------------------------|
| With embankment    | 14.0   | 7-8          | 50                        |
| Without embankment | 7.5  | 13           | 30-40                     |

Source: U Minh Ha Forest Company, Purchase price of logging company in 2013

Remark: \*purchase price of local logger in 2013.

### 3.1.3 Relevance to Japan's ODA Policy

Japan's Country Assistance Program for Viet Nam<sup>19</sup> at the time of project planning was to support economic infrastructure development and strengthening competitiveness for growth promotion, poverty alleviation by agriculture and rural development, and enhancing quality of life and social aspects. In the Country Assistant Program, forest protection and restoration was one of the target areas of cooperation. Therefore, the project was in line with Japanese government's ODA policy for Viet Nam.

### 3.1.4 Appropriateness of Operation Plan and Project Approach

The project established embankment on acid sulphate soil (94 hectares of industrial plantation and 129 hectares of plantation at demo farms, 223 hectares in total). Acidic sulfate soil produces sulfuric acid by being exposed to oxygen in the air<sup>20</sup>; thus digging up soil has environmental risk.

“Environmental and Social Consideration Guidelines on Forest Development in 1994” by JICA suggests to produce “Table of Project Location on Environment”<sup>21</sup> and clarify the site-specific condition with regard to the environmental risk as a preliminary screening during project formulation (e.g. peat soil). If environmental conditions of the project location need special care, the guideline suggests conducting a survey to collect sufficient information in order to figure out the environmental impact. However, in the terminal evaluation it was pointed out

<sup>19</sup> The final plan was presented at 14<sup>th</sup> Meeting on ODA Integrated Strategy in October 2003.

<sup>20</sup> The following article suggests a negative impact of acidic sulphate soil on environment.: Naylor, S.D., Chapman, G.A., Atkinson, G., Murphy, C.L., Tulau, M.J., Flewin, T.C., Milford, H.B., Morand, D.T. 1998, Guidelines for the Use of Acid Sulfate Soil Risk Maps, 2nd ed., Department of Land and Water. Conservation, Sydney.

<sup>21</sup> Attachment to project profile table of special considerations to grasp the impacts on environment including socio-economic conditions, natural environmental conditions, existence of local conditions which need special care, and examples of large impacts on environment.

that the project appraisal of the project was promptly conducted and mitigation of risk as well as removal of uncertainty was not sufficiently considered. In addition, according to the beneficiary survey carried out in the ex-post evaluation, 54% of the demo farms<sup>22</sup> claimed the problems of rice growth, death of fish at maximum for three years after establishing embankment<sup>23</sup>.

Thus in the project formulation, even though installing embankment on acidic sulphate soil had environmental risk to acidify water by exposing sulphate salt to oxygen, proper countermeasures were not undertaken. Conducting certain countermeasures such as preliminary screening on evaluation of environmental impact, elaboration of environmental risk through opinion hearing from experts, or incorporating implementation of environmental monitoring in an action plan was needed.

Hence, the project was in line with Vietnamese development plan, development needs and Japan's ODA policy. However, the consideration on the environmental risk of sulphate soil was not sufficient. Therefore, the relevance is judged as fair.

### 3.2 Effectiveness and Impact<sup>24</sup> (Rating:③)

#### 3.2.1 Effectiveness

##### 3.2.1.1 Project Output

1) Output 1: Appropriate silvicultural techniques at project site are established and expanded.

Indicator ①: Survival rate of planted trees at demo farms based on reforestation guidelines is higher than 85%.

The project developed embankment and planted Melaleuca as industrial plantation (94ha) at degraded lands after forest fire directly managed by U Minh 1 FFE and at an area managed by individual households (40 demo farms, 129 ha) (Figure 1)<sup>25</sup>. According to the Terminal Evaluation, inspection conducted by DARD together with FFE and farmers after completing tree plantation, entire survival rate was higher than 90%.

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<sup>22</sup> Considering dissemination effects on other farms the project established Melaleuca plantation on embankment and L shape water canal at neighbor farms (trench to control water in the farm).

<sup>23</sup> Beneficiary Survey targeting 40 demo farms.

<sup>24</sup> Sub-rating for Effectiveness is to be put with consideration of Impact.

<sup>25</sup> Please see Figure 2 for land development at demo farms.

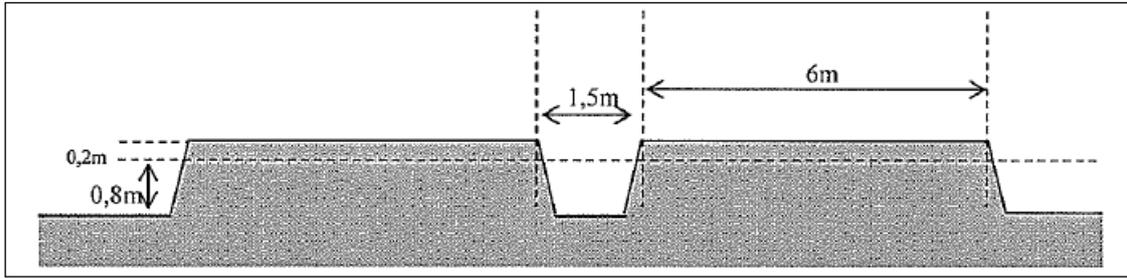


Figure1: Example of Cross Section of Embankment Installation  
 (The example of embankment: 0.2m higher than ground level with 6m wide,  
 0.8m digging with 1.5m wide)

Also, through the field site surveys conducted at the Ex-post Evaluation as those conducted at the Terminal Evaluation, good growth of Melaleuca were confirmed. In 2013 at ex-post evaluation, Melaleuca planted under the project were maintained at forests as a source of high quality seeds for seedling production (industrial plantation managed by Forest Company). Among those planted at the demo farms, Melaleuca was harvested and replanted at 11 farms<sup>26</sup>, the survival rate of the second rotation is higher than 90%.

Thus the indicator 1 was evaluated as achieved.

Indicator ②: Staff of VAFS and DARD, Ca Mau Province carries out 18 technical training courses on appropriate reforestation techniques in U Minh Ha region.

Indicator ③: Staff of VAFS and DARD, Ca Mau Province and farmers acquire the techniques of the reforestation manual.

The project<sup>27</sup> produced two technical manuals on Melaleuca plantation on embankment for technical staff and farmers and distributed them to relevant organizations. Technical trainings were held 22 times for technical staff of U Minh 1 FFE in the second year and for staff of other FFEs (U Minh 2, Son Trem, Tran Ban Thoi, and April 30) in the third year. Technical training on forest plantation for the demo farmers was held twice.

According to questionnaire survey at the Terminal Evaluation, 91% of counterparts<sup>28</sup> expressed their confidence in conducting a technical training on Melaleuca plantation for other people. Also at the Ex-post Evaluation, more than 80% of participants of training courses expressed that they understood almost all the contents of training and have enough confidence in teaching them to others (Table 2).

At the Ex-post Evaluation, 97% of demo farmers highly evaluated the training of

<sup>26</sup> Total area reforested in the 11 farms was 33 hectares.

<sup>27</sup> In this project, working groups were formed by each output: sub department of forestry for Melaleuca plantation on embankment and training for demonstration farms, Forest Company for construction of demo farms, sub department of forest protection for forest fire prevention, and DARD for timber processing.

<sup>28</sup> Based on interviews with seven staff nominated as counterparts who belong to DARD, Sub department of Forestry, U Minh 1 FFE, sub department of forest protection

Melaleuca plantation techniques. In the demo farms<sup>29</sup> in which harvested Melaleuca was harvested in 2013, farmers applied the techniques for replanting which were learnt at the training using the technical manual on replanting Melaleuca produced by the project<sup>30 31</sup> (Table 3).

Therefore, indicators 2 and 3 were evaluated as achieved.

Table 2: Evaluation of Melaleuca Plantation Training by Vietnamese Government and Forest Company

Unit: # of persons

| Contents of training                   | Participants | Highly Evaluated <sup>1)</sup> | With confidence <sup>2)</sup> | With confidence (%) |
|--|--------------|--------------------------------|-------------------------------|---------------------|
| Experience at Long An <sup>3)</sup>    | 12           | 12                             | 10                            | 83                  |
| Land preparation for tree planting     | 12           | 12                             | 12                            | 100                 |
| Characteristics of Melaleuca           | 14           | 14                             | 13                            | 93                  |
| Establishment and tendering of nursery | 14           | 14                             | 12                            | 86                  |
| Inspection and treatment of acid soil  | 10           | 10                             | 7                             | 70                  |
| Hoa An <sup>4)</sup> Field Trip        | 11           | 11                             | 11                            | 100                 |
| Utilization of heavy equipment         | 2            | 2                              | 2                             | 100                 |
| Geographic Information System (GIS)    | 6            | 6                              | 5                             | 83                  |

Source: Interview survey with 14 training participants (DARD (2), Sub-department of Forest Protection Sub-department of Forestry (6), former FFEs (5)) at ex-post evaluation

Note: 1) Participants were asked whether they highly evaluate the contents of training or not.

2) Participants were asked whether they can conduct training course or not.

3) Project sites of Afforestation Technology Development on Acid Sulfate Soils in the Mekong Delta.

4) Trial site of Melaleuca plantation on embankment.

Table 3: Evaluation of training by demo farms

| Theme                                  | No. of participants | Highly evaluated |    | Partially applied |    |
|--|---------------------|------------------|----|-------------------|----|
|  |                     | #                | %  | #                 | %  |
| Melaleuca and reforestation techniques | 37                  | 36               | 97 | 36                | 97 |
| Forest fire prevention                 | 37                  | 28               | 76 | 35                | 95 |
| Charcoal and wood vinegar production   | 35                  | 23               | 66 | 21                | 60 |
| Rice production technology             | 38                  | 33               | 87 | 35                | 92 |
| Vegetable/Fruit production             | 35                  | 24               | 69 | 31                | 89 |
| Livestock production/Pig raising       | 34                  | 22               | 65 | 26                | 76 |
| Soil enhancement technology            | 35                  | 32               | 91 | 34                | 97 |

Source: Interviews with 40 demo farmers at ex-post evaluation.

Thus, Melaleuca plantation on embankment had high survival rate. Appropriate techniques to the project site were developed and considered to be acquired by relevant parties. Therefore, output 1 was evaluated as achieved.

<sup>29</sup> Replanting was carried out at 11 farms in 40 demo farms. The remaining 29 farms also plan to harvest in 2014.

<sup>30</sup> In case of forest plantation by farmer's investment, farmers will receive 95% of profit excluding the cost such as harvest planning and harvest itself. In case Forest Company invests, farmers will receive 80% of the profit.

<sup>31</sup> Based on interviews with 40 demo farms

2) Output 2: Knowledge and techniques related to market research, utilization and processing of Melaleuca timber are improved among those who engaged in rehabilitation activities

Indicator: Staff of VAFS, DARD, and FFE holds extension training courses on market research and utilization/processing of Melaleuca timber three times.

Trainings on wood processing were carried out nine times (study tours six times, training lectures twice and workshop once) for staff of VAFS, DARD and FFE during the project period. In the second year JICA expert lead a market survey providing instructions to the counterparts. In the 3<sup>rd</sup> and 4<sup>th</sup> years, the counterparts themselves conducted survey of wood processing factories four times in Ho Chi Minh and Hanoi cities. As a result, the counterparts realized the importance of chip boards and block boards to expand the use of Melaleuca and proposed extension of the project for technical instruction in order to obtain the technologies to make them at FFE (the proposal was not accepted). Also at the village of demo farms, enhanced oven (10 ovens) for charcoal making with Melaleuca was experimentally manufactured and trainings on charcoal making and wood vinegar<sup>32</sup> were conducted. At the Terminal Evaluation, 67% and 89% of the counterparts who participated in the activities reported that they understood the contents of training on marketing research (to certain extent) and the charcoal/wood vinegar making, respectively. 78% of the participants evaluated highly the project achievement.

#### Utilization of Melaleuca processing technologies

At the time of ex-post evaluation, 90% of participants were confident in the contents training on research and development, feature, processing technologies, and future potential of Melaleuca, visit for processing companies with advanced processing technologies, and international marketing study, and they were confident to hold trainings themselves. However, only one third of participants are confident in charcoal and wood vinegar production (Table 4). Regarding the processing technologies, training on market research and wood processing factories surveys are offered, and through the training, the participants understood the importance of chip boards and block boards as possible ways to utilize Melaleuca. However, it is not practical to utilize Melaleuca as chip boards or block boards due to competition with other species (e.g. Acacia), and that thick bark reduces the part to be utilized as wood to only 10%. It is possibly one of the reasons why the processing technologies of Melaleuca had discontinued at the time of ex-post evaluation. According to the interview of demo farmers, training on charcoal and wood vinegar production using Melaleuca was conducted but it was difficult to use the techniques in practice due to high technical requirement with high cost. Thus, regarding output 2, trainings related to marketing study and utilization and processing of Melaleuca were

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<sup>32</sup> The clear layer of fluid of dry distillation liquid produced as by-product during the process of charcoal making. The fluid has an effect of natural pesticide.

conducted and the level of knowledge and techniques was enhanced; however, continued utilization of the knowledge and techniques was not observed at the time of the ex-post evaluation.

Table 4: Evaluation of Training for Melaleuca Processing

Unit: # of persons

| Contents of training   | Participants | Highly evaluated | With confidence* | With confidence (%) |
|--|--------------|------------------|------------------|---------------------|
| Charcoal and wood vinegar production                               | 9            | 9                | 3                | 33                  |
| Wood processing technology   | 3            | 2                | 1                | 33                  |
| Research and development   | 1            | 1                | 1                | 100                 |
| Feature, processing technologies and future potential of Melaleuca | 10           | 10               | 9                | 90                  |
| Market development   | 8            | 8                | 8                | 100                 |
| Visit for companies with advanced processing technologies          | 2            | 2                | 2                | 100                 |
| International marketing analysis                                   | 1            | 1                | 1                | 100                 |

Source: Based on interviews with 14 training participants at ex-post evaluation

Note: \*Questioned if they are confident to hold a training program of the subject.

### 3) Output 3a Fire prevention system is improved in the target area

Indicator: DARD Ca Mau staff is capable to operate forest fire prevention training system.

The project produced a manual on fire prevention and conducted forest fire prevention training with focus on strengthening public relations activities (one session for three days, ten times in total) in order to strengthen forest fire prevention for staff of Sub-department of Forest Protection, FFE, local farmers and primary school students. The activities included: a basic training on forest fire prevention, a slogan contest on forest fire prevention, an exercise to make firefighting stick, fire extinguishing exercises, and forest fire prevention poster contests for primary school students. Based on these activities, in the third and fourth years of the project, DARD Sub-department of Forest Protection initiated original activities such as competition of fire extinguishing by commune<sup>33</sup> representatives through Youth Union<sup>34</sup> with their own budget.

At the Terminal Evaluation, among seven counterparts, all of them found that Forest Fire Prevention Manual was effective, five found that the forest fire prevention model was effective (two did not respond) and four marked the excellence and goodness of the achievement of the project<sup>35</sup> (three did not respond).

At the ex-post evaluation, 100% of the training participants from DARD and FFE evaluated highly the training contents on forest fire prevention and showed confidence in

<sup>33</sup> The smallest political unit in Viet Nam.

<sup>34</sup> National organization of youth organized by community party.

<sup>35</sup> Evaluation was based on four levels: Excellent, Good, Satisfactory, Un-satisfactory, and No response.

knowledge acquisition (Table 5). 95% of demo farmers (38 out of 40 farmers) responded that they had applied the techniques taught in training in their practices (Table 7).

Table 5: Evaluation for the Training on Forest Fire Prevention

| Contents of training  | Participants | Unit: # of persons |                 |                     |
|---|--------------|--------------------|-----------------|---------------------|
|   |              | Highly evaluated   | With confidence | With confidence (%) |
| Basics of forest fire prevention, fire extinguishing, slogan making | 10           | 10                 | 10              | 100                 |

Source: Based on interviews with 14 training participants at ex-post evaluation.

Implementation of forest fire prevention measures and actual status of forest fire occurrence

At the time of ex-post evaluation, based on the supervision of DARD Sub-department of Forest Protection, U Minh Ha Forest Company annually carried out forest fire prevention training for local farmers once a year in each village based on this experience using the technical manual developed by the project. Farmers are organized into three groups per village (20 people in one group), as a unit of fire extinguishing activities when a fire occurs. Also at least two persons of each household are obliged to stay in the house during the forest fire season (from January to May). Fire warning is alerted on extremely dry days by sign and radio (Photo 1).



Photo 1: Alert sign board to show the risk of forest fire by level of dryness

As seen in the record of forest fire occurrence and damaged area from the time of project implementation to 2013, with exception of the driest years, 2010 and 2013, damaged area by forest fire tends to be reduced (Table 6).

Thus at the time of ex-post evaluation, under the supervision of DARD Sub-department Forest Protection, U Minh Ha Forest Company carries out fire prevention training for local farmers by using the manual produced by the project and organizes farmers to participate in forest fire extinguishing practices. It confirms forest fire prevention and firefighting system

Table 6: Damaged Area by Forest Fire and Number of Incidence in Ca Mau Province

| Year | Damaged area (ha) | # of forest fire |
|------|-------------------|------------------|
| 2006 | 0.3               | 3                |
| 2007 | 17                | 19               |
| 2008 | 15                | 22               |
| 2009 | 4                 | 3                |
| 2010 | 235               | 23               |
| 2011 | 1                 | 3                |
| 2012 | 3                 | 12               |
| 2013 | 43                | 27               |

Source: DARD.

Remarks: In the boundary of Forest Company, forest fires damaged 1 ha (2 occurrences) in 2011, 680m<sup>2</sup> (2 occurrences) in 2012, and 15.9 ha (6 occurrences) in 2013.

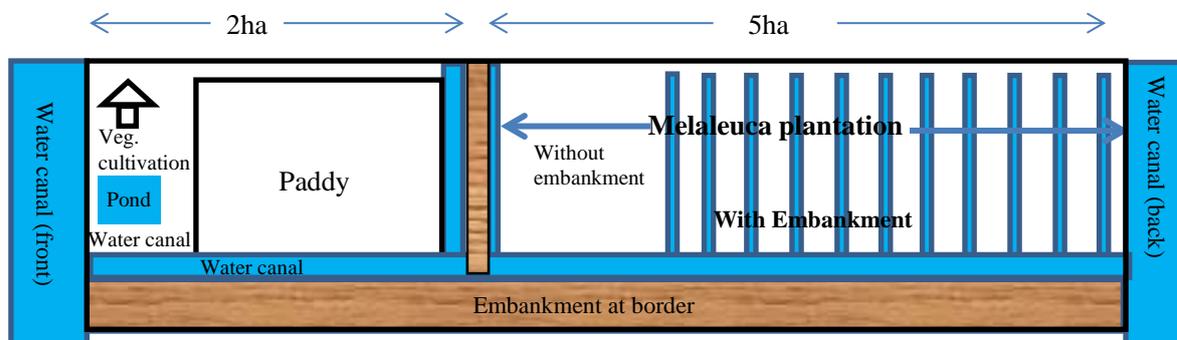
were strengthened based on the experience of the project. In addition, even though it is hard to clarify the direct impact of the project, fire occurrence and damaged area are likely to be reduced except for the driest years, 2010 and 2013. Hence, output 3a is judged as achieved.

4) Output 3b Trainings on livelihood development for local farmers are implemented

Indicator: Not specified since this output was mixed with Output3a.

For the 40 demo farms households, along with the embankment for Melaleuca plantation, L shape water canals<sup>36</sup> and embankment along the canal were also introduced as basic facilities in order to prevent acidic water inflow from plantation area to agricultural lands next to each other (Figure 2). Trainings on livelihood development techniques (rice production techniques, vegetable/fruit production, and livestock production/pig raising and soil improvement techniques) were conducted 28 times (lectures (23) and study tours (2) and workshops (3)).

In order to arrange the support system for demo farms, “Technical Support Committee on Agroforestry Activities<sup>37</sup>” composed of demo farmers, counterparts, DARD, dissemination centers of agriculture/fishery/livestock production, Agriculture Sub-department at district level and U Minh 1 FFE was established. “Agriculture Dissemination Club” was formed among demo farms led by advanced farmers as a system to receive technical support by DARD.



Remark: Diagram seen from the sky: the things supported by the project (embankment installment at the boundary, L shape water canal (surrounding two sides of paddy and residential area), and embankment and water canal for plantation).

Figure 2: Typical Land Use Model at a Demo Farm

<sup>36</sup> The land allocated to farmer in FFE is divided into forest and agricultural land (demo farmers live in the land based on forest protection contract for 5ha forest and 2 ha agricultural land). This project constructed L shape water canal and embankment to enclose the agricultural land in order to drain the strong acidic water which is generated at the beginning of rainy season.

<sup>37</sup> An organization composed of advanced farmers, FFE, Extension centers, DARD, etc. Established in order to sustainably support farmer activities and widely disseminate impact of project.

At the terminal evaluation, 87% of demo farmers believed that the outcome of the project would continue to produce benefits and 75% was motivated for the continuation and 94% viewed the project achievement as excellent or good based on the four level scale assessment. At ex-post evaluation, more than 90% of demo farmers suggested that they applied the contents of training in their practices (Melaleuca planting, forest fire prevention, rice production, vegetable/fruit production, soil enhancement techniques) except for charcoal and wood vinegar production/livestock production and pig raising (Table 7).

Table 7: Evaluation on Technical Training by Demo Farms

| Theme                                | No. of participants | Highly evaluated |    | Partially applied |    |
|--------------------------------------|---------------------|------------------|----|-------------------|----|
|                                      |                     | No               | %  | No                | %  |
| Melaleuca reforestation techniques   | 37                  | 36               | 97 | 36                | 97 |
| Forest fire prevention               | 37                  | 28               | 76 | 35                | 95 |
| Charcoal and wood vinegar production | 35                  | 23               | 66 | 21                | 60 |
| Rice production techniques           | 38                  | 33               | 87 | 35                | 92 |
| Vegetable and fruit production       | 35                  | 24               | 69 | 31                | 89 |
| Livestock production and pig raising | 34                  | 22               | 65 | 26                | 76 |
| Soil enhancement techniques          | 35                  | 32               | 91 | 34                | 97 |

Remark) Based on interviews with 37 demo farmers at ex-post evaluation.

Although it was not setup as an indicator, 11 demo farms which harvested Melaleuca in 2013 had 1.2 million Dong of income on average, equivalent to approximately 30% of their annual income (14.9 million Dong). Demo Farmers are enabled to increase production of rice, fruit and fish having 2.4 times more income than neighbor farms (ref. supplementary analysis). This is largely the result of the introduction of water level control by means of L shape water canals for rice production, and fruit production on embankment (Photo 2).

Agriculture Dissemination Club of demo farms has 37 member households. They have monthly meetings, provide support information from DARD dissemination centers and share the fund to provide credit with no interest to members who need financial support.

Moreover, “Technical Support Committee on Agroforestry Activities” was not sustained after the completion of the project. The reasons for the discontinuation are: 1) the committee was established specifically for demo farms, thus lacking general-purpose to support farmers, 2)



Photo 2: Paddy field (near) and banana on embankment (further) at demo farms by level of dryness

since technical dissemination is carried out by dissemination centers, additional multi-sector organization was not easy to be accepted.

Although some activities related to output 3b was not continued, installation of L shape water canal and embankment was highly evaluated by farmers and generated actual livelihood development impacts with the techniques introduced. Therefore, output 3b was evaluated as achieved.

#### **Supplementary analysis: Impact of livelihood development on demo farms**

The project activities for local farmers including Melaleuca plantation on embankment, constructing L shape water canal and embankment along the canal, and technical trainings showed significant impacts on livelihood development. The impact of livelihood development was more noticeable on the farms under medium and wealthy income levels than poor farms, and higher on farms which have access to road.

The project carried out technical trainings and establishment of Melaleuca plantation on embankment (tree planting in 2005, total area 129 ha, seedlings and installing embankment are provided by the project and planting activities was conducted by farmers). L shape water canal and embankment along the canal was installed as basic infrastructure for agricultural production. Trainings on rice production technologies, vegetable and fruit production, livestock production/pig raising, and soil improvement techniques using water canal and embankment were conducted.

Followings are the comparison between 40 demo farms and 40 farms in the vicinity. Melaleuca planted by the project was harvested at 11 demo farms in 2013 producing 119.6 million Dong (standard error + 8.9 million Dong, mean 112 million Dong, 8 years rotation, 14.9 Million Dong /year). This income is significant as 2.4 times of their annual income from agriculture (30% for annual income on average of eight years). On the other hand, at other farms in the vicinity, the Melaleuca harvest without embankment was conducted at four farms in 2013 generating 12 million Dong on average (standard error+2.4 million Dong, mean 12 million Dong) (10.3 years to harvest, annual average income, 1.2 million Dong). It suggests that Melaleuca plantation on embankment generated 12.4 times larger income per household in 2013 (=14.9 million Dong /1.2 Million Dong) than those from non-embankment.

Regarding comparison between rice and fruit production between 2003 (before the project) and 2013 (ex-post evaluation), there was a 50% increase in demo farms for rice production but 29% decrease in non-demo farms were found, as well as 2700% increase in demo farm and only 16% increase in non-demo for fruit production. Agricultural production based on the value of 2013 has increased by 106% in demo farms but only by 4% in non-demo farms.

However, according to the income level comparison among demo farms<sup>38</sup>, poor farms did increase their fruit production, but decreased in total due to the decrease of rice, pig and charcoal production. Medium level farms increased fruit, rice and honey, thus total agricultural production was increased by 154%. Rich farms increased fruit, rice as well as pig raising, resulting in 113% increase in total production. The increase in income from agriculture is 61 times larger in rich farms than poor farms and 27 times in medium farms than poor farms.

Moreover, most of demo farms were connected to District center by a paved road in 2008. The comparison between farms connected and not connected to the road showed that both farms doubled their agricultural production but income is 1.9 times larger in farms with road than farms without road.

<sup>38</sup> Poor households, annual income less than 25 million Dong, Medium households 25-100 million Dong, Rich households more than 100 million Dong.

### 3.2.1.2 Achievement of Project Purpose

Project Purpose: Necessary techniques for implementation of the rehabilitation and forest fire prevention program of U Minh Ha region are developed and disseminated.

- 1) Indicator ①: 100 percent of staff of VAFS and DARD, FFE agreed with techniques developed by the project and will implement the extensions of the techniques

At the terminal evaluation, both VAFS and DARD staff intended to disseminate Melaleuca plantation by using the technique developed by the project. All the counterparts' responses to the questionnaires were positive for the dissemination of the technique. The material provided by JICA suggested that the participants of plantation techniques from FFEs other than U Minh 1 are intended to use the knowledge obtained in the training in their job.

The questionnaire survey to training participants at the ex-post evaluation suggested that more than 80% of participants are confident to teach the contents of all the trainings except for inspection and treatment of acidic soil inspection.

#### Current situation of Melaleuca plantation on embankment

Since 2002, PPC and DARD have been supporting U Minh Ha Forest Company for Melaleuca plantation on embankment. The Forest Company received a loan of commercial bank for Melaleuca plantation on embankment from 2004 to 2007 and provided refinancing to farmers with the loan. With the political and financial support, Melaleuca plantation on embankment expanded to 2,422 hectares in 2007 and 4,229 hectares in 2013.

Hence, more than 80% of VAFS and DARD staff who participated in training is confident to teach others on the content of the training. The technique developed by the project has been utilized with political and financial support by counterparts with consistent dissemination activities. It is considered that the counterpart agencies had clear intention to disseminate Melaleuca plantation on embankment. Therefore, the project purpose is evaluated as having been achieved.

## 3.2.2 Impact

### 3.2.2.1 Achievement of Overall Goal

Overall goal: Techniques developed by the project are utilized by people and Forest and Fishery Enterprises in some areas of Mekong Delta<sup>39</sup>.

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<sup>39</sup> Mekong Delta extends to 12 provinces and Ho Chi Minh city in Viet Nam. Outcomes of the project is applicable only with similar soil conditions. Therefore the Mekong Delta in this context was considered to indicate the Melaleuca area in Ca Mau province (Project target area).

Indicator: Forest plantation area established by the technique developed by the project reaches 2,000 hectares.

As mentioned above, the plantation area of Melaleuca on embankment had reached 2,422 hectares in 2007, reaching the figure targeted by the overall goal. In 2013, the area of Melaleuca plantation by embankment reached 4,229 hectares in total in U Minh Ha Forest Company (composed of Five FFEs) (Table 8) and the area is still expanding.

Table 8: Melaleuca plantation area by embankment

Unit: ha

| Year | Directly management by Forest Company | Contract with other company | Contract with farmers | Total |
|------|---------------------------------------|-----------------------------|-----------------------|-------|
| 2007 | 727*                                  | 0                           | 1,695*                | 2,422 |
| 2013 | 1,648.                                | 847                         | 1,734                 | 4,229 |

Source: U Minh Ha Forest Company

Note: \*Estimated values.

#### Contribution of Outputs and Project Purpose for achievement of Overall Goal

Although some project activities including charcoal making trial as well as wood vinegar production (Output 2) was not realized, technical development by FFE (Output 1), strengthening forest fire prevention in collaboration with local farmers (Output 3a) and implementation of plantation model combined with agricultural activities (Output 3b) were realized and dissemination activities were carried out by the Forest Company (merged with former FFEs) and other implementation agencies (the project purpose). Techniques of Melaleuca plantation on embankment established by the project were expanded and contributed to the achievement of the overall goal.

It was considered that the following factors had contributed for the achievement of the overall goal: 1) PPC policy to introduce Melaleuca on embankment in 2002; 2) utilization of bank loan by FFE between 2004 and 2007 (FFE provided loan of 50 million Dongs to farmers); and 3) larger potential of reinvestment from Melaleuca harvest (re-planting) produced in the shortened rotation<sup>40</sup>.

#### Contributing factors for expansion of Melaleuca plantation on embankment from 2007 to the recent years (2013)

Melaleuca plantation on embankment was further expanded by the project “Empowerment to the Community Damaged by Forest Fire in Ca Mau Province” (Plantation area 500ha) by JICA, investment of private company (847ha) and the Forest Protection

<sup>40</sup> Based on an interview with the Forest Company.

Program<sup>41</sup> (360ha) by Japan’s Ministry of Foreign Affairs in 2012. Eight excavators provided by “the Project for Empowerment to the Community Damaged by Forest Fire in Ca Mau Province”, made the expansion of Melaleuca plantation on embankment easier. The Forest Company implemented 733 hectares of Melaleuca plantation on embankment in 2013. Moreover, as an external factor, the upward trend of the price of Melaleuca pole since 2012 contributed to the expansion of Melaleuca plantation on embankment reflecting the high demand of construction materials (Table 9, Photo 3 & 4).

Table 9: Market price of Melaleuca pole (5m in length and 4.2-4.9cm in diameter)

|       | 2009    | 2010    | 2011    | 2012    | 2013    |
|-------|---------|---------|---------|---------|---------|
| Price | 549,000 | 549,000 | 549,000 | 610,000 | 732,000 |

Unit: Dong/m<sup>3</sup>

Source: U Minh Ha Forest Company

Thus the area of Melaleuca plantation on embankment not only reached the area targeted by the overall goal but also is steadily expanding even after the global economic crises in 2008, after being supported by Japanese aid as well as the private sector investment. Therefore, overall goal is evaluated as achieved.



Photo 3: Melaleuca shipping yard (shipped as round wood)



Photo 4: Melaleuca pole to sustain a concrete building

### 3.2.2.2 Other Impacts

#### Increased employment by introducing Melaleuca plantation on embankment

Melaleuca plantation is sold by auction as standing tees (approximately 1,200 hectares of plantation was sold in 2013) to logging companies. According to a logging company which harvested 150 hectares in 2013, the company hires 110 workers and 70% of their harvest comes from Melaleuca plantation on embankment. Assuming the company is an average company which is engaged in Melaleuca harvest, it is roughly estimated that entire Melaleuca plantation

<sup>41</sup> A grant aid targeting Mekong Delta region implemented in order to rehabilitate forest in the region by supporting forest fire prevention and endemic tree planting on the area and shifting cultivation had been conducted.

on embankment creates job for approximately 600 workers (=110 workers x (1200 hectares x 70%)/150 hectares).

Impact on natural environment

According to the Forest Company, in order to prevent the exposure of pyrite<sup>42</sup> in the soil, digging operation was contrived as follow: 1) shallow digging in order not to touch pyrite in the area where pyrite is present in shallow place; and 2) digging deeper than the soil layer of pyrite where pyrite is present in deeper soil and covering the pyrite with soil dug under the pyrite. When developing embankment, excavator operations were conducted twice and pyrites were covered for the second time (the first time was to dig the soil). While digging, presence of acidic water was treated with caution. In case of presence of acidic water, the amount of required lime was previously studied. Training to farmers for treatment of acidity (introduction of a variety tolerant against acidity, drainage method, fertilization and utilization of lime) and preparation of guidelines were conducted.

However, according to a beneficiary survey to demo farms, 54% of farmers (22 farmers) stated that the negative influence of embankment on their farm production (bad growth of rice and death of fish, in particular) lasted for three years at longest (Table 10).

Table 10: Damage by acidic water at demo farms

| Category                  | # of farms | %   |
|---------------------------|------------|-----|
| Damage by acidic water    | 19         | 54  |
| No damage by acidic water | 14         | 40  |
| I do not know             | 2          | 6   |
| Total                     | 35         | 100 |

Remark) Based on interviews with 40 demo farmers at the ex-post evaluation

A farmer who experienced negative impact described their damage after developing embankment as follows: the first year serious damage (100% damage on agricultural crops), the second year (70%), the third year (30%) and then they recovered normal production. It is considered as a reason why the project could not prevent the damage, that the project could not sufficiently monitor digging operations and excavators dug deeper than the limited depth (1.2m), which was a limit set to prevent the exposure of pyrite, resulting in stronger acidity of water. The other reason is that the support for farmers was limited to group training, and support for individual farmers was not provided. In the field survey, no damage on humans was observed; however, in order to maintain the damage at minimum, not only the countermeasures to the situation mentioned above but also sufficient consideration on countermeasures including environmental risk assessment as well as planning and execution of environmental monitoring and consideration of taking necessary measures in case damages occur was needed.

<sup>42</sup> Substance in the soil layer to be acidified by exposing to the air producing sulfuric acid which causes strong acidification of soil. In order to prevent it, pyrite needs to be covered not to touch the air.

In summary, the following two negative factors are present in the project impact, but they are considered to be either trivial or positively treated by beneficiaries.

- 1) Impact of enhancement of Melaleuca processing techniques is limited but considered to be merely trial implementation; and,
- 2) Acidic water had negative impact on agricultural production but recovered in a few years and farmers accepted it.

Effectiveness/impact of the project is judged as high considering the following factors: 1) areas of Melaleuca on embankment have enhanced soil conditions and transformed land use to be highly profitable with sustainable use, and reached the target of the overall goal and are expanding steadily; 2) livelihood development of demo farms had a large positive impact; and 3) forest fire prevention shows effective impact.

### 3.3 Efficiency (Rating: ②)

#### 3.3.1 Inputs

| <b>Inputs</b>                       | <b>Plan</b>   | <b>Actual (Terminal Evaluation)</b>   |
|-------------------------------------|---|---|
| (1) Experts                         | Short-Term 5 Experts, 19 Man Months (original plan for consultants)<br>Participatory forest management, forest soil/planning analysis, timber utilization development, forest fire prevention, agroforestry/agriculture, other as needed. | Short-Term 9 Experts, 33 Man Months (Based on the revised contract)<br>Participatory forest management, forest soil/planning analysis, marketing, timber utilization development, forest fire prevention, agroforestry/agriculture, project coordinator |
| (2) Trainees received               | Field(s) of training: not described   | Field(s) of training: plantation planning, operation management, technology, timber utilization and processing technology   |
| (3) Third-Country Training Programs | Field(s) of training: None  | Field(s) of training: None  |
| (4) Equipment                       | Main equipment provided<br>Equipment for reforestation, agroforestry, forest fire prevention, and timber processing   | Main equipment provided<br>Equipment for soil survey, GPS, Satellite images data, excavator, speed boats, tractor, bulldozers, etc.<br>71.51 million yen in total   |
| Local Cost                          | Not described   | Seedling production, a part of demo farms construction, etc. 56.90 million yen in total   |
| Total Project Cost                  | 200 million yen   | 257 million yen   |
| Total Local Cost                    | Unknown   | DARD 2.56 million yen, U Minh 1 FFE 17.33 million yen <sup>43</sup><br>19.89 million yen in total   |

Source: JICA.

<sup>43</sup> The 68% of the budget total (17.33 million yen) is paid by U Minh 1 FFE to construct demo farms which includes cost for seedling production and amount paid by farmers.

#### 3.3.1.1 Elements of Inputs

Dispatch of experts and provision of equipment were carried out as planned. The trainings were carried out in the fields of plantation planning, operation management, technology, timber utilization and processing technology; all were evaluated as appropriate.

#### 3.3.1.2 Project Cost

The project cost was 257 million yen, which was higher than the amount planned (129% of the planned amount). Due to the different soil condition from the project site of the previous technical cooperation, new technology development was needed; thus human resource input, as well as the period of expert dispatch, was increased from 19 Man Months to 33 Man Months. For the same reason, since the equipment utilized by the former technical cooperation<sup>44</sup> could not be utilized, new equipment was purchased. Therefore the increase of the actual project cost (30% higher than the amount planned) was judged as reasonable.

#### 3.3.1.3 Period of Cooperation

The period of cooperation was three years as planned. The inputs of expert dispatches were increased and adjusted without extending the project period by increasing the assignment period per year (input density). Equipment arrived late and the training for equipment utilization was delayed, resulting in the delay of tree planting from 2004 to 2005. However the delay of tree planting did not affect the entire plan of the project.

Although the project period was within the plan, the project cost exceeded the plan. Therefore, efficiency of the project is fair.

### 3.4 Sustainability (Rating: ②)

#### 3.4.1 Related Policy towards the Project

“Ca Mau Provincial Forest Protection and Development Plan”<sup>45</sup> aims to reach 56,000 hectares of industrial forest plantation by 2020. DARD plans to plant Melaleuca and Acacia half-by-half in the plantation area. Acacia is weaker against inundation and acidic water; therefore, it needs larger investment compared to Melaleuca due to the requirement of deeper ditches to make higher embankment. Therefore, the possibility to replace existing Melaleuca with Acacia plantation is considered to be limited. Also, according to the Annual Operation Plan 2013, approximately 50% of entire plantation area planned for 2013 by U Minh Ha Forest Company is Melaleuca plantation, suggesting that the recognition of importance of Melaleuca plantation was maintained at the time of ex-post evaluation.

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<sup>44</sup> The Afforestation Technology Development Project on Acid Sulfate Soil in the Mekong Delta.

<sup>45</sup> PPC Decision No. 1200, 2012.

Ca Mau Provincial People's Committee (PPC)<sup>46</sup> approved "Resettlement Plan of Citizen and Production in Melaleuca area"<sup>47</sup> and approved the land use plan in the scale of 1/2,000<sup>48</sup>. According to the plan, targeted farmers (950 households) will obtain place of residence, houses, and agricultural lands and access to roads, schools and health centers and drainages. If this plan is realized, plantation on embankment and L shape canal for agriculture are separated at the targeted farms; thus the model developed by the project at demo farms (operating both agriculture and forestry at one farm) may not be applicable. On the other hand, the other non-targeted farms (approximately 2,000 households) maintain both forest and agricultural lands since they do not move to the new area, the agro-forestry combined model developed by the project will be applicable.

The 15 year forest protection contract made by FFE with the demo farms who immigrated in early 1990s, with the warranty of Commune People's Committee (CPC), already expired in 2005 but not yet renewed. The outcome of the project is maintained only by automatic renewal of the contract<sup>49</sup>.

Therefore, due to the limitation in dissemination of agroforestry model combined in one farm unit, as well as unclear treatment of forest protection contract which sustains the model, the project sustainability is judged as having some policy issues to be considered.

#### 3.4.2 Institutional Aspects of the Implementing Agency

U Minh Ha Forest Company is an implementation agency of Melaleuca plantation on embankment, tendering of trees and taking care of forest fire prevention. The farmers who live in the lands of the Forest Company receive some support for their livelihood directly or indirectly from the Forest Company. U Minh Ha Forest Company was a group of FFEs at the project start, and was changed to a national company in 2007 by merging five FFEs, then became a one member limited<sup>50</sup> in 2010 in the process of institutional reform. The number of the Forest Company employees was reduced from 143 in 2010 to 79 in 2013 by 55%; thus management rationalization is in progress. According to MARD, it is expected that the Forest Company will be strengthened by transforming to a joint stock company<sup>51</sup> which is able to receive investment from the private sector. In this case, PPC would own 70% of stock and 30% would be allocated to the private sector; then the Forest Company will be strengthened by financial support, technologies and markets of private companies while maintaining policy

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<sup>46</sup> The highest administrative organ of the government appointed by People's Council which is selected by citizen.

<sup>47</sup> PPC Decision No. 227, 2009.

<sup>48</sup> PPC Decision No. 475, 2013.

<sup>49</sup> The automatic extension of forest protection contract with proper operation of forest protection is described in Forest Protection Contract.

<sup>50</sup> One member limited liability company is owned by a company or an individual alone. In case of U Minh Ha Forest Company is owned by PPC Ca Mau. PPC Ca Mau is responsible for all the debt and other liability up to the limit of capital described in the article of association.

<sup>51</sup> Form of company owned by stockholders. It enables co-ownership by both government and private companies.

support of PPC. At the time of ex-post evaluation, the profit of the Forest Company had been doubled in the recent years and Melaleuca plantation has been expanding by investment by private companies. Some private companies showed interests in investing Melaleuca plantation with high profitability. Thus, it is expected that the investment of private companies on Melaleuca plantation as well as on the Forest Company is expected to increase.

Agriculture and Fishery Dissemination Centers under DARD have dissemination activities in DPC of U Minh district (3 staff) and CPC (one staff each in eight communes).

VAFS is a public institute and special budget is not provided for supporting the maintenance of the project. VAFS has an office in Ca Mau and has a capacity to provide a technical service continuously when requested.

Thus U Minh Ha Forest Company started plantation on embankment with strong political support of PPC and would be strengthened in terms of finance, technologies and market by private sector investment in the near future. Also, other implementing agencies have sufficient capacity to maintain the project outputs. Therefore, there are no issues related to institutional sustainability in implementing agencies.

#### 3.4.3 Technical Aspects of the Implementing Agency

U Minh Ha Forest Company has sufficient techniques for installing embankment for Melaleuca plantations; thus it can expand the embankment by itself. Also Forest Company uses the manuals and techniques developed by the project and carries out forest fire prevention. Furthermore, Agricultural and Fishery Extension Centers use the manuals of agroforestry model provided by the project.

However, the treatment for acidic water produced by the embankment was not monitored though irrigation facilities were constructed to promote drainage of acidic water to the sea and water level is monitored by the department of irrigation<sup>52</sup>.

Therefore, technical sustainability has some issues in acidic water monitoring and its treatment partly as an issue.

#### 3.4.4 Financial Aspects of the Implementing Agency

Financial aspects of sustainability depend on the financial base of U Minh Ha Forest Company. The Forest Company became financially independent in 2007 and does not receive any subsidy from the government.

The sales of the Forest Company in 2013 are approximately 66.8 billion Dong. The sales of Melaleuca on embankment have high profitability accounting for 90% of the sales. The sales and profit for the three years between 2011 and 2013 have been doubled, indicating the financial stability (Table 11). The Forest Company has terminated paying back its debt that was taken

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<sup>52</sup> This project attempted to form monitoring committee for prevention of acidity by embankment installment among the stakeholders but the continuity of the activities is not observed.

over from former FFEs in 2007. As of ex-post evaluation, Forest Company allocated budget of 14 billion Dong for Melaleuca plantation and 2.5 billion Dong for forest fire prevention. Furthermore, it is planned to transform into a joint stock company which can receive investment from private companies. Since there is an increase in the investment on Melaleuca plantation on embankment by private companies, it is expected that U Minh Ha Forest Company will receive investment from private companies and will be financially strengthened.

No issue is observed in financial sustainability based on the following facts: high profitability of Melaleuca plantation on embankment: U Minh Ha Forest Company paid back its debt, having increased both sales and profit, and financially strengthened by having investment from private companies.

Table 11: Financial status of U Minh Ha Forest Company

|         | Unit: million Dong |        |        |
|---------|--------------------|--------|--------|
|         | 2011               | 2012   | 2013   |
| Sales   | 32,072             | 51,669 | 66,820 |
| Cost    | 28,937             | 48,994 | 60,851 |
| Profits | 3,135              | 2,675  | 5,969  |

Source: U Minh Ha Forest Company

Thus, although U Minh Ha Forest Company has been strengthened through merger and liberalization and transformed to have limited liability, the political issues on change on united agroforestry development in one farm, non-renewal of forest protection contracts of resident farmers, and the technical issue of acidic water by installing embankment are existent. Therefore, sustainability of the project effect is fair.

#### 4. Conclusion, Lessons Learned and Recommendations

##### 4.1 Conclusion

The “Forest Fire Rehabilitation Project” aimed to develop and disseminate techniques for the Melaleuca (*Melaleuca cajuputi*) planting using embankment with high economic returns on acidic sulphate soil whose topsoil was consolidated after the damage caused by a large forest fire. The plantation technique was developed by former JICA technical cooperation project. The project was in line with Vietnam’s development policy as well as development needs but it was evaluated that environmental consideration on the risk involving with acidic sulphate soil was not sufficient during the project formulation stage. Therefore, relevance is evaluated as fair.

The impact of trial implementation of Melaleuca processing technologies was limited but Melaleuca plantation on embankment has been disseminated and expanded covering the target area of the overall goal. Also, trial implementation in the field, livelihood support to demo farms, showed a large impact on their income and outputs on forest fire prevention activities are effectively being utilized; therefore effectiveness and impact of the project are evaluated as

high.

The cooperation period of the project was three years as planned; however, the input of human resources was increased due to development and transfer of new technologies. The project input was increased because the equipment planned to be utilized was unable to be utilized. Therefore, efficiency of the project is evaluated as fair.

FFE, one of counterpart agencies was institutionally and financially strengthened with political support by the DARD. FFE became a forest company (Forest Company) through merger and liberalization. However, because of a political issue on immigrant farmers who live in the lands managed by the Forest Company as well as a technical issue on formation of acid water by installing embankment, sustainability is evaluated as fair.

In light of the above, this project is evaluated to be satisfactory.

## 4.2 Recommendations

### 4.2.1 Recommendations to the Implementing Agency

- (1) Reduction of producing acidic water by installing embankment and continuous water quality monitoring<sup>53</sup>

After the introduction of the new plantation technologies by the project, establishing embankment and L shape water canal on acidic sulfate soil, exposure of sulfate was observed and pointed out as negative impacts on agriculture production. It is difficult to say that sufficient treatment is being carried out. Embankment establishment by the Forest Company has reached 4,229 hectares; it is difficult to deny all the negative impact on agriculture and eco-system in the area. DARD is expected to take the following measures in order to minimize the negative impact of acidic water.

- Institutionalization of the guideline for embankment installment which reduces the exposure of pyrite and enforcement of its compliance by the Forest Company;
- Enforcement to the Forest Company of preparing embankment installment plan including soil data (depth of dredging and layer of acidic sulphate soil), and current data and its monitoring plan of water quality;
- Setting up the maximum size for embankment installment at one location in order to control negative impact by acidic water; and,
- Establishment of a water quality monitoring coordination committee among stakeholders<sup>54</sup> for implementation of water inspection, circling and publication of technical information, and coordination to take necessary measures when problems occur.

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<sup>53</sup> Based on the result of the Workshop on Environmental Monitoring held on May 24-26, 2006 and recommendations by JICA experts.

<sup>54</sup> PPC, DPC, Department of Natural Resource and Environment (DONRE), Department of Science and Technologies(DOST), etc.

(2) Extension of the forest protection contract with the resident farmers who live in the territory of U Minh Ha Forest Company

Demo farmers who live in the territory of the Forest Company are immigrants who migrated to the area in the early 1990s with the forest protection contract with former FFEs. They are obliged to maintain 70% of the land as forest and are allowed to use the remaining 30% for agriculture. However, the contract terminated in 2005 and no renewal of the contract has been completed, although automatically the contract is supposed to be extended in case no problem is observed. The sustainability of the model developed by the project is at risk due to the instability of land use right. In order to maintain the demo farms as well as technologies developed by the project, the contract is expected to be renewed.

(3) Utilization of the forest-agriculture model proved by demo farms

At demo farms supported by the project, Melaleuca plantation on embankment and L shape water canal were established, trainings on rice production by water canal and embankment, vegetable/fruit production, livestock production including pig raising, soil improvement technologies were carried out. A large impact on livelihood development was recognized. These technologies can be widely applied to other part of Melaleuca area under poverty. It is expected that forest and agricultural areas will be more divided by the “Resettlement Plan of Citizen and Production in Melaleuca area”. However, considering the density of acidic water produced, concentration of Melaleuca plantation on embankment in limited areas may cause negative impact on environment. Hence, DARD is expected to conduct transfer of technologies developed by the project to other farms, applying agriculture-forestry model which minimizes production of acidic water by using dissemination centers.

(4) L shape water canal construction for acidic water control in the farms in the territory of the Forest Company

The project proved that by installing L shape water canal, agricultural production can be increased with proper control of acidic water even for the farms in acidic sulphate soil conditions. However, many farmers who live in the vicinity of demo farms do not have L shape water canal due to the lack of finance and they are suffering from low agricultural production. For the expansion of the project impact, DARD and the Forest Company are expected to provide financial support to the farmers who live inside the territory of the Forest Company and those who immigrate by the resettlement plan.

#### 4.2.2 Recommendations to JICA

The technical knowledge and experience including drainage and irrigation in acidic sulphate soil conditions, irrigation and ground water control, fertilizing and soil improvement considering acidic conditions have been accumulated in advanced farmers among demo farmers.

Agricultural Dissemination Club established among demo farmers provided information for technical support by dissemination centers and loans between members from wealthy farmers to poor farmers who need financial support as self-help activities are in practice. These project outcomes were what the farmers in the area desired; however, the on-going dissemination activities are limited to voluntary activities in a small scale.

JICA is expected to study the technical and institutional conditions of these technologies as well as organizing activities to be materialized, support dissemination through “farmers to farmers” approach and apply them to other areas.

#### 4.3 Lessons Learned

##### (1) Utilization of “Guidelines on Environmental Consideration for Forest Project Formulation” for forest project formulation

Even though installing embankment on acidic sulphate soil has environmental risk by exposing sulphate to oxygen which produces sulfuric acid, appropriate countermeasures including environmental impact examination by preliminary screening, examination of environmental risk, and environmental monitoring in activity plan, were not incorporated during the project formulation.

The guideline developed in 1994 by JICA, “Guidelines on Environmental Consideration for Forest Project Formulation” demonstrates the methods in detail on environmental consideration and evaluation through developing project profile, the table for environmental conditions of the project location, preliminary screening and scoping with examples. It is expected to review the guideline and further examine a way to complementarily utilize the contents (e.g. screening during forest project formulation) together with the up-dated JICA’s Guideline for environmental and social consideration.

##### (2) Confirmation on land use right of farmers at project formulation

The project produces a large impact on income generation by combining land development with training for farmers; however due to the unclear land use rights in terms of the access to farmland by farmers, the sustainability in relation to policy background is uncertain. In case the project activities include income generation activities for specific farms by demonstrating land development in their farmlands, land use rights of the farms should be confirmed. If the land use right was not ensured, in order to have higher sustainability it is recommended that the activities to ensure it be included in the project activities.