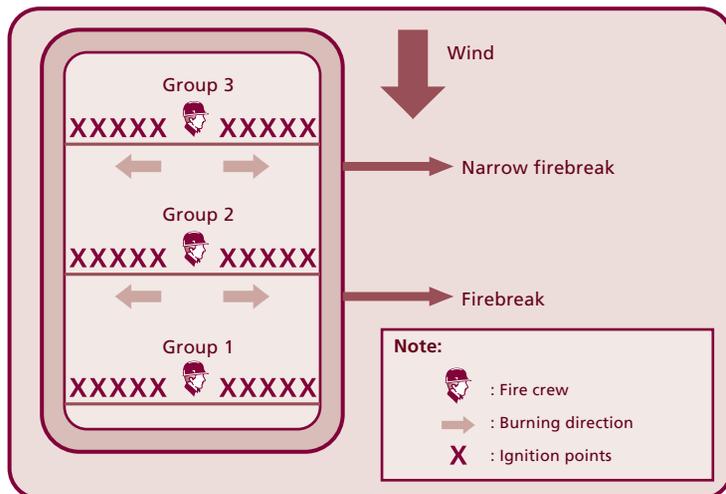


**c. Burning technique**

There are 3 types of burning techniques used by the local communities:

**(1) Modification of spot fire**

This technique was used by 9 out of 20 sampled farmers (45%). Firebreak of 4 - 6 m wide is constructed around the selected area. The area is divided into 3 sections. Each section is separated by a narrow firebreak of 0.5 - 1 m wide. This burning technique requires 6 torch people (apart from the fire guards) to ignite the fires. These 6 people are grouped into three groups of 2 people as shown in Figure 17. One group is positioned in the middle of firebreak no. 1, one group in the middle of firebreak no. 2, and the third group at the side opposite to the wind direction. Ignition is conducted simultaneously by the three groups, with burning direction opposite to each other. Ignition points are made along the narrow firebreaks and at the upwind line with a distance of about 1 m. After igniting the fires, the fire crew joins the fire guards to monitor the fires. For an area of 1 - 1.5 ha, it takes 1 - 2 hours to complete the burning.



**Figure 17. Burning technique against the wind (Rohasan, 1998)**

## (2) Combination of back firing technique and ring firing technique

This technique was used by 5 out of 20 sampled farmers (25%). This technique requires 4 fire crew who then are grouped into two groups of 2 people (apart from the fire guards) (Figure 18). One group (Group 2) is positioned at the side of the area where the wind is blowing and the other group is at the side opposite to the wind direction (Group 1). Ignition starts from the side opposite to the wind direction. Ignition points are made with a distance of around 1 m in opposite direction. If one sixth of the area has been burned, Group 2 starts to burn the ignition points at the downwind line and along the sides that are opposite to one another until finally the sides are surrounded (circled) by fires. It takes about 1 hour for 1 - 1.5 ha-land area to complete the burning.

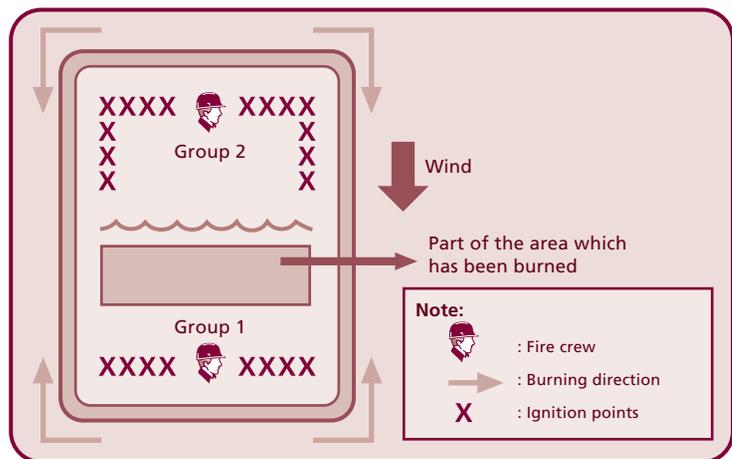
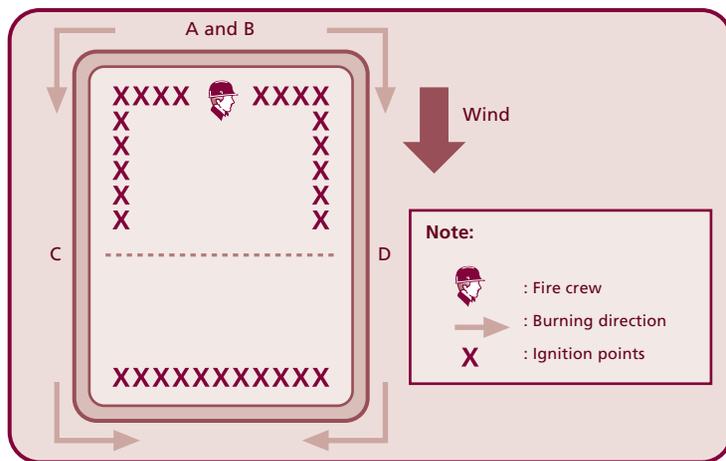


Figure 18. Combination between back firing and ring firing techniques (Rohasan, 1998)

## (3) Combination between head firing and ring firing

This technique was used by 6 out of 20 sampled farmers (30%). This technique requires 4 torch people to ignite the fires. Two people (A and B) are positioned at the side when the wind is blowing. The other 2 are positioned at the sides in the same direction as the wind (C and D). A and B start to burn from their

side by burning the ignition points at the opposite direction. A is igniting fires and moving towards C, while B is igniting fires and moving towards D. When A is moving closer to C and B is moving closer to D, C and D will start to burn the ignition points along the perimeter until finally they meet at one point. This burning technique is shown in Figure 19. This technique takes less than 1 hour in 1 - 1.5 ha-land area. Burning is usually scheduled at 15:00 - 17:00.



**Figure 19. Technique combining head firing with ring firing (Rohasan, 1998)**

**4.2.4. Burning technique in Subanjeriji, South Sumatera (Saharjo et.al., 1998)**

**a. Site selection**

There following were two burn areas selected for the study:

- Potential cultivated area with the size of 20 ha owned by 13 cultivators.
- Potential cultivated area with the size of 4 ha owned by one cultivator.

**b. Fuel preparation**

All bushes and undergrowth were slashed, while trees with large and small diameter were felled with chain saw. Trees with a diameter of more than 50 cm were removed from the selected area to be

further processed into sawn timber. Trees with a diameter of  $\leq 40$  cm, bushes and undergrowth which had been slashed were left on the selected area to be used as fuels. Drying of fuels took 2 - 3 weeks before burning.

c. Burning technique

The technique used was allowing fire head to move to the centre of the selected area. The flame fronts originated from ignition points around the borders were allowed to converge at the centre. With this technique, the possibility of fire to escape could be reduced to minimum (Saharjo et.al., 1998). When applying this technique, the fire crew should examine and calculate the wind speed and direction, and land topography (slope).

(1) Burning of 20 ha-land area

Before burning, fire break of 2 - 3 m wide was constructed around the area. Fuel energy was 15 tons per ha. Fuels were dominated by tree stems with a diameter of 10 - 20 cm. The rest of the fuels were twigs, branches, shrubs, bushes, litter and alang-alang (coarse grass). Fuel depth was 0.5 m, with moisture content of 5.2 - 25.2%.

Ignition started from the edge. Fire crew consisted of 3 people (A, B, and C) positioned at different places as shown in Figure 20. Distance between each torch person was approximately equal. Ignition started simultaneously under one command. While moving in semi running speed, each person ignited the fuels with an interval of 1 m, in the same moving direction i.e. clockwise. This burning technique took only 56 minutes, starting from first ignition up to the moment when the fire was completely extinguished. Maximum temperature of the fire was 760°C with an average flame height of 2.75 m (maximum of 8 m) and fire intensity of 2,568 kW/m.

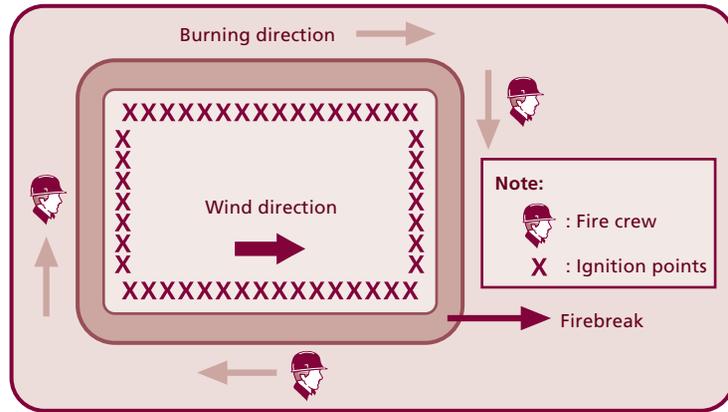


Figure 20. Technique of ring firing on 20 ha-land area with a slope level of < 8% (Saharjo et.al., 1998)

(2) Burning of 4 ha-land area

Fuel energy in this case was 40.3 tons per ha, comprising tree stems with a diameter of 20 - 30 cm. The rest were twigs, branches, slash from shrubs, and alang-alang. Fuel depth was 0.6 m with moisture content of 7.1 - 35.3%. Burning technique was the same as the burning technique conducted on the 20 ha-land area. It was slightly modified because there were some slopes with a slope level up to 30% (Figure 21).

Fire crew consisted of 3 people. Two people were positioned at the same point, but they moved in opposite direction (A and B). C was positioned at the oblique angle and started to burn downward. Burning took place in 25 minutes, maximum fire temperature was 1,000°C, average flame height was 3.13 m with maximum of 12 m, and fire intensity was 3,962 kW/m. Burning was scheduled at 15:00 - 17:00.

The above burning technique can be categorised as ring firing or circle firing technique.

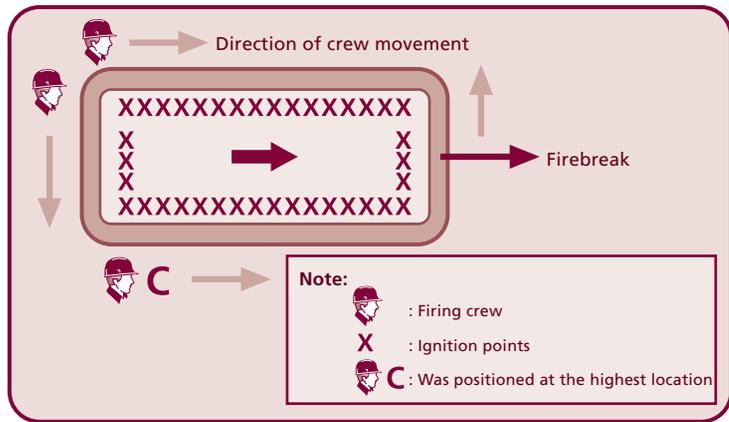


Figure 21. Burning technique of 4 ha-land area with a slope level of 7 - 30 % (Saharjo et al., 1998)

#### 4.2.5. Burning method in Rejang Lebong district, Bengkulu province

##### a. Site selection

Clearing of potential cultivated area in Pal VIII village, Rejang Lebong is conducted in protected forest, secondary forest, and bush. Size of the selected area is between 1 - 2 hectares.

##### b. Fuel preparation

Slashing of the undergrowth and bushes by using machete is done at the height of 15 cm above the ground so this process can be completed quickly. For 1 ha-land area, the process takes about 30 days. Farmers usually work individually. The next stage is tree felling using machete or axe. Trees are cut 1 - 1.5 m above the ground. There are cases when trees are cut at the body height. Trees that are too tall (more than 30 m) or buttressed are felled at the height of more than 5 m. Time interval between slashing and tree felling is around 4 weeks. It is then continued with trimming or cutting branches and twigs. Fuels produced from slashing and tree felling are dried under the sun for 30 - 60 days.

c. Burning technique

Before burning, a strip of  $\pm 2$  m wide is made around the area to ensure that fire will not escape. This technique is called *kekas*. Burning in Dusun Talang Kedurang is conducted around 12:00 - 13:00, coinciding with the time when the sun is in its full intensity and the wind starts to blow so burning can be done faster. Wind direction can be determined by observing the movement of tree foliage. Torch is made of dry coconut fibre and kerosene is used as the fuel. There are two burning techniques used in the village of Pal VIII, particularly in Dusun Talang Kedurang, i.e. ring firing technique and pile burning technique.

(1) Ring firing technique

This technique is the first and most commonly used technique by farmers in Talang Kedurang (80%) because it is simple. Fire crew consists of two people who are positioned at the corners. Ignition starts from the edge or side of the land area. Ignition starts simultaneously at these two different points under one command. Each torch person moves in the same direction. Fires are allowed to converge at the centre. This will ensure that fires will not escape. This ring firing technique is described in Figure 22.



Figure 22. Ring firing technique used in Dusun Talang Kedurang, village of Pal VIII

## (2) Pile burning technique

Pile burning or stack burning technique is shown in Figure 23. Before burning, dried fuels are collected in one or several piles at the centre of the potential cultivated area. After the fuels are collected, the piles are burned. Burning is confined only at the centre, and therefore the fires will not escape. This type of burning is relatively safe and effective, although the burning period takes longer than the other techniques and more people are required to collect the scattered fuels.

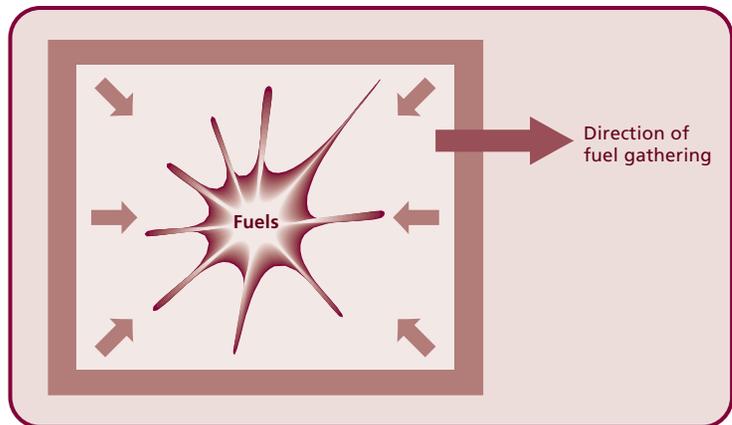


Figure 23. Pile burning technique

One day after the first burning, a second burning or a repeated burning (*manduk*) is conducted by collecting remaining fuels after the first burning. These remaining fuels are collected into piles and subsequently burned. In one hectare area, there are 100 piles of fuels. Intensity of repeated burning is relatively low because the remaining fuel is around 35% of the total fuels. Time schedule of land cultivation in Pal VIII village, Rejang Lebong, Bengkulu is shown in Table 1.

**Table 1. Time schedule of land cultivation in Pal VIII village, Rejang Lebong, Bengkulu.**

No.	Activities	J	F	M	A	M	J	J	A	S	O	N	D
1.	Site selection			X									
2.	Slashing				X								
3.	Tree felling					X							
4.	Fuel drying						X	X					
5.	Burning								X				
6.	Repeated burning (manduk)								X				
7.	Dibbling for main crop (coffee)									X			
8.	Planting (coffee)										X		
9.	Planting secondary crops: groundnuts, corn, soybeans, vegetables, crop rice (gogo), yams and cassava											X	



*(a) Drying process*



*(b) Land preparation*



*(c) Burn area*



*(d) Coffee farming in hilly dry land area in Bengkulu, Sumatera*

**Figure 24.**

## **5. Guidelines for the Implementation of Controlled Burning Practices**

### **5.1. General provisions for controlled burning**

#### **5.1.1. Preparation of crew and equipment**

Before burning, each group of farmers should prepare fire crew within the group and the necessary equipment. The crew consists of fire crew who will conduct the burning, and fire guards who will monitor and extinguish the fires. Equipment should consist of tools to ignite fires, such as torches, and the following simple tools to extinguish fires, which can be made or provided by the local communities themselves (see Figure 25):

- a. Water sprayer
- b. Machete
- c. Axe
- d. Shovel rake hoe
- e. Fire rake
- f. Bucket
- g. Hoe
- h. Shovel
- i. Flapper
- j. Fire broom
- k. Backpack pump
- l. Chain saw or hand saw
- m. Portable water pump
- n. Water drum

#### **5.1.2. Fire management**

- a. Maximum area allowed to be burned

The maximum size of area to be burned for crop cultivation should be not more than 2 hectares on every tract or family land in every growing season to avoid high fire intensity and large amount of smoke.



Figure 25. Samples of traditional fire extinguishing equipment of indigenous people in East Kalimantan

Source:

- Aspiannur, U. Bato, H. Abberger. 1997. *Metoda Tradisional Pembersihan Lahan pada Salah Satu Suku Dayak di Kalimantan Timur*. IFFM. Samarinda.
- Dove, M.R. 1998. *Sistem Perladangan di Indonesia; Suatu Studi Kasus dari Kalimantan Barat*. Gajah Mada University Press, Yogyakarta.
- *Prosiding Lokakarya Teknologi Tradisional Pengendalian Api, Kerjasama Bioma- AusAID dan WWF Indonesia Sundaland Bioregional*.

b. Distribution of burn areas (scattered or concentrated)

In one day, burning should not be concentrated in the same area or same tract of land to avoid smoke accumulation in the surrounding areas. Burning can be done in turn (rotation burning), conducted together with and monitored by the other community members.

c. Schedule of burning

Burning is usually conducted at noon (at 14:00 - 16:00) and at the end of dry season prior to the beginning of rainy season. In Indonesia, the end of August will be the best time to burn since fuels are dry enough and it is also the right period for planting. Burning during dry period that may result in transboundary haze pollution should not be allowed. The critical period is June and July to the middle of August. Decision on the burning schedule varies, depending on weather, fuel dryness, air quality and smoke intensity in the surrounding areas. Burning is best conducted when the fuel is dry enough and the wind is not so strong, so that fuel will be burned easily and fire spread can be controlled.

When the ASEAN region is experiencing transboundary haze pollution or when the air quality reaches unhealthy level or when the number of hotspots detected in the region has shown significant increase, all burning activities should be stopped immediately.

d. Fire monitoring

When doing burning for the potential cultivated area, farmers normally do not wish to have fires spread to areas outside the intended area because forest around the cultivated area may provide source of income for the farmers, farmers are afraid of penalties given to them if they break the customary laws, and the smoke arising from the fires will affect their health causing respiratory problems and other haze-related ailments. To ensure that fires do not escape, farmers should do the following before, during, and after burning:

- i. Constructing firebreak around the selected area.
- ii. Monitor the area when burning is conducted.

- iii. Extinguish smouldering material after the fire is put out.
- iv. Cutting down the stems, twigs and branches into small pieces.
- v. Burn the selected area in turn, particularly when the cultivated areas are located close to each other.

Fire spreading outside the selected area may happen because of the following:

- i. Burning is conducted at noon, when the temperature is high, the humidity is low, and the wind blow is strong.
- ii. The burning technique is not appropriate to the local conditions.
- iii. Occurrence of spot fire causing fires in other areas.
- iv. Firebreak is not constructed around the area to be burned.
- v. Burning is left unattended.

### **5.1.3. Burning Arrangements**

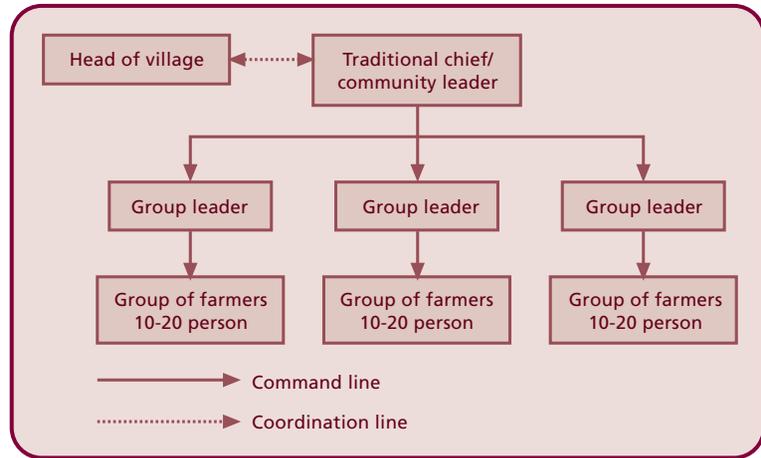
#### **a. Organisational arrangements**

- 1) Burning should be conducted by a farmer together with the other community members.
- 2) The local or indigenous communities are expected to form a group of 10 - 20 families, headed by a group leader.
- 3) Prior to burning, the group leader should provide burning plans to the tribal chief/community leader.
- 4) The tribal chief/community leader should regulate the burning, including giving sanctions to those breaking the rules in accordance to the customary law.
- 5) The head of the village will help facilitate the process and respond to the needs of the group through the tribal chief/community leader.
- 6) The head of the local government (Head of Regency and District) should conduct general monitoring and supervision.

The organisational chart for controlled burning is shown in Figure 26.

**b. Reporting and evaluating**

All controlled burning activities conducted by community members should be reported to the tribal chief/community leader. The tribal chief/community leader should make a periodic presentation at the meetings held among tribal chiefs/community leaders. The report should, at the minimum, include information regarding the date, time, location, size of burn areas, number of community members/farmers involved, group leader, and burning condition. The format of the report is shown in Table 2.



**Figure 26. Organisational structure for controlled burning**

**Table 2. Form for reporting controlled burning**

Date	Time	Location	Total burn area	No. of farmers involved	Group leader	Burning condition*)

\*)Burning condition:

- Complete (if all fuels are burned)
- Incomplete (if only some parts of the fuels are burned)
- Controlled fire
- Fire spread to other areas