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# NATURAL RESOURCES MANAGEMENT PROJECT

BAPPENAS – Ministry of Forestry
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# BIOLOGICAL CONSERVATION IN THE SUSTAINABLE MANAGEMENT OF PRODUCTION FOREST

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# Preface

This report is one of a number of reports produced under the Government of Indonesia's Natural Resources Management Project (NRM) that is assisted by the United States Agency for International Development (USAID).

The NRM Project, working with the Indonesian National Planning Board (BAPPENAS) and the Department of Forestry (Departemen Kehutanan), provides through a specially established project Policy Secretariat advice to BAPPENAS on natural resource issues relating to long term and short-term national planning. In addition, working with the Department of Forestry the NRM project carries out field activities in two pilot project areas one in West/Central Kalimantan and one in North Sulawesi including the preparation of management plans for the Bukit Baka - Bukit Raya National Park in Kalimantan and the Bunaken National Park in North Sulawesi. Each report addresses an aspect of the planned NRM project activities that are agreed on and laid out in an annual NRM Implementation Plan and each report aims at providing specific recommendations for future work in the area addressed.

Following recent ITTO guidelines on setting up conservation areas within production forest, APHI released a further set relating to Indonesian timber concessions. This report analyzes the instructions from APHI with particular reference to a case study, and goes on to provide input from a biological viewpoint to the Ministry of Forestry.

## Acknowledgements

My first thanks must go to Pak Adeline, Pak Erwin and Pak Budi of the timber concession SBK for providing insights into how they set up their germplasm conservation area. My thanks also to the numerous conservation scientists in Pontianak and Bogor who did much to form the ideas herein, to Pak Suhendar of KANWIL Kehutanan in West Kalimantan, and to the Department of Forestry and LIPI for providing fora for discussion.

## Executive summary

The Ministry of Forestry is developing guidelines for biodiversity conservation in production forest. This initiative follows recent ITTO guidelines. The purpose of this document is assist this process by providing comments from a biological standpoint.

The ITTO guidelines leave implementation details to individual tropical timber producing countries. Indonesia, under the auspices of APHI, has already responded by providing instructions on how to set up 300 ha conservation areas within HPHs. Several concessions following up these instructions have commented that further clarification of the guidelines are needed. Concerns have been expressed that skills have been called for in concessions which are not currently available. Further explanation is needed to specify what is to be conserved, and what benefits the conservation areas will bring to sustainable forest management.

A two tiered study was set up to provide biological input to the Ministry of Forestry's guidelines. Firstly, an APHI inspired 300 ha conservation area was examined to find out conceptual and implementation problems encountered in the process of setting up the area. The practical lessons learned during this exercise were applied in recommending the courses of action suggested herein.

Based on the data gathered from field study, discussion with staff from Ministry of Forestry, KANWIL in Kalimantan Barat, KSDA/ PHPA, concession personnel, APHI, LIPI and other biologists, a set of recommendations are given on how conservation areas might be set up in Indonesia. These are broken into three groups in this document:

- procedures for practical implementation of conservation areas within production forest, regardless of the objectives
- biological concerns with any conservation planning process.
- a suggested case example in which conservation areas are used as a supply of seeds and seedlings. These can be extracted in a non-destructive way. Their uses would be for planting indigenous pioneer and timber species for commercial interests, and for species of use to local populations. A mix of timber and non-timber species is suggested. Use of this system will require the HPH being the fundamental management unit in consultation with local communities. Coordination of management units will be required at both regional and national level.

## Background

ITTO guidelines on conservation areas (appendix 1) were recently prepared on setting up conservation areas in production forest. These guidelines consist of 14 principles and 20 recommended actions, which are intended to be baseline principles applicable to all forest types on a global basis. They are consequently vague and leave implementation details up to individual timber producing countries. The guidelines acknowledge that little detailed information is available on which to base conservation programs, and also that forest management systems cannot conserve all biodiversity, but can minimize loss. The involvement of many parties is suggested, ranging from the global community to local populations.

Following the release of subsequent guidelines (appendix 2) from the Asosiasi Pengusaha Hutanan Indonesia (APHI) to all timber concessions (HPHs), approximately 120 HPHs have already demarcated conservation areas. APHI called for these to be at least 300 ha in area and named them *kebun plasma nutfah* (germplasm gardens). APHI has released documentation on these (appendix 3), and summary data are presented in table 1.

**Table 1: Summary data of HPH conservation areas**

| Value | HPH area (ha) | Garden (ha) | %age[1] |
|---|---|---|---|
| Total | 17361935 | 37337 | 0.22 |
| Minimum | 30000 | 100 | 0.02 |
| Maximum | 1777000 | 1550 | 2.00 |
| Average | 168562 | 362 | 0.41[2] |

The three major points from table 1 are that:

- conservation areas represent a very small percentage of total concession area

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1 Percentages pertain to figures in initial document, not summary data in presented table

2 The true average is nearer 0.2%. This figure is heavily influenced by the unusual size of the largest conservation area

- percentage size of conservation area within concessions are not proportional to overall HPH size

- the area covered by all HPH conserved areas barely exceeds the size of the smallest concession

The documentation calls for inventory of plant and animal species and information on breeding populations. It does not state what sort of germplasm is targeted, whether representative of all variation in the concession or of specific groups. A special method of border marking is also given, which is different from that used by concessions to demarcate areas within production forest. An analysis of this document is presented in a further section.

## Biological concerns

The principle area of concern in providing biological input to construction of conservation areas is over definitions. Provision of guidelines will depend on obtaining clear answers to two questions:

- what is to be protected?
- why is protection needed?

Different resolutions of these points will affect the following issues:

- targets
  *what are the goals?*
- manpower resources
  *who is going to do the job?*
- area of protected zones
  *how big are they going to be?*
- selection of potential zones
  *which sites are possible areas of interest?*
- selection of actual zones
  *which sites should be finally selected?*
- number of protected zones
  *how many should there be?*
- long term maintenance
  *how are conservation areas going to be looked after?*
- long term monitoring
  *how are they going to be checked on the long term?*

## Analysis of APHI document

### Background

In summary, the APHI document calls for:

- a single 300 ha kebun plasma nutfah (KPN) per concession
- the KPN to be representative of the concession
- the KPN to be a single block with a minimum width of 1000 m, clearly demarcated along boundaries with specific instruction for the sort of boundary posts and markings to be made
- transects across the KPN at intervals, with trees marked along these transects
- inventory of plant and animal species, and for herbarium collections to be taken whenever confusion arises

The guidelines were discussed with the APHI office, KANWIL in West Kalimantan and the SBK timber concession.

The APHI office emphasized that its documentation was an initial attempt to meet ITTO guidelines and would require development after evaluation of field application.

A discussion was held between the KANWIL office of West Kalimantan, the operations manager of SBK and the forestry staff of Universitas Tanjungpura to discuss KANWIL's concern over implementation procedures of the APHI document. These major questions asked of the document were:

- What <u>is</u> a KPN?
- What is the purpose of a KPN?
- Why is 300 ha the selected size?
- How are sites to be selected?
- Would it not be wiser to make site selection a responsibility of a joint committee including staff from KANWIL, HPHs, PHPA and biologists? Such a procedure would allow broader scope planning.
- Can the KPN be used for enrichment planting?

- If the KPN cannot be used for seed stock, what can it be used for?

**Case study of a 300 ha kebun plasma nutfah**

Analysis of the APHI guidelines is presented below in the context of a case study made at HPH SBK in West Kalimantan. The KPN was set up under the BINHUT section of the concession. Time and financial budgets are presented in tables 2-5.

**Table 2: Actual cost to SBK (basic)**

| Article | Time | No. | Cost (Rp) |
|---|---|---|---|
| Senior management | 1 | 3 | |
| Forestry manager | 5 | 1 | |
| Daily laborers | 40 | 10 | 1,500,000 |
| Surveyors | 40 | 2 | 500,000 |
| Accommodation | 40 | | 2,500,000 |
| TOTAL | | | 4,500,000 |

**Table 3: Topography/ marking added**

| Article | Time | No. | Cost (Rp) |
|---|---|---|---|
| Carried from table 2 | | | 4,500,000 |
| Daily laborers | 30 | 10 | 1,200,000 |
| Surveyors | 30 | 2 | 400,000 |
| Accommodation | 30 | | 1,800,000 |
| TOTAL | | | 7,900,000 |

**Table 4: Fire break cost**

| Article | Time | No. | Cost (Rp) |
|---|---|---|---|
| Bulldozer | 30 | 1 | [3]36,000,000 |
| Other labor | 30 | 2 | 1,200,000 |
| TOTAL | | | 37,200,000 |

**Table 5: Timber losses**

| Value (Rp 30K $m^3$ timber) | Cubic meter | Cost |
|---|---|---|
| Minimum | 12,000 | 360,000,000 |
| Maximum | 30,000 | 900,000,000 |
| Normal | 18,000 | 540,000,000 |

The relevant points to come out of the study were that:

- Senior management understood the document to call for one three hundred hectare area to be delimited for the entire concession. The concept of *kebun plasma nutfah* was unclear. The concession understood the conservation area to be a directive that had to be followed. No relation between the conservation area and production operations, in either the short or long term, was realized.

- Following the spirit of the document, the site was selected as representative of the concession, however, the definition of "representative" was not well emphasized in the document. Within the concession, the entire area (>66,000 ha) has been timber cruised to the 2% level; about 60% of the total area has been cruised at the 20% level; only 40% of the total area has been cruised at the 100% level. The 100% level records the position of all trees > 50 cm dbh as well as topography. Importantly, identifications are generally made to timber classification names. Thus all species are reduced to approximately 12 names, and about 50% remain unidentified except as future "floaters" or "sinkers". There is no-one in the concession able to identify to species for inventory.

[3] Based on a value of US$ 75 per hour

This is liable to be the generalized case across Indonesia given that the primary concern of any timber concession is stocking volumes of timber groups.

- The conservation area was situated 200 m from the national park with the long edge running parallel. Thus much of the total edge was completely protected. Other edges abutted virgin forest or areas logged 10 years ago.

- 60 ha of the 300 ha conservation area was logged 10 years ago. This provided access for carrying manpower and materials. As this area is regenerating, it was reported as virgin forest.

- Signs were omitted marking the edge of each KPN as they would be very difficult to find again in the forest. Certainly it is highly unlikely that anyone would ever come across them.

- The proposed 10 m firebreak was ignored as it appeared to the concession that it would rather act as a fire enhancer and appeared to cause unnecessary destruction.

- Zinc tags were used instead of painted rings to mark trees, as is usual in concession areas when marking within cutting blocks. Furthermore, standard concession practices were used to mark boundaries, not those called for by APHI.

- Trees were identified by the production timber classification normally used. Animals were identified roughly, i.e. monkey, hornbill - not to species.

- No plans exist to use the garden, although seeds might later be taken if thought necessary.

## Conclusions

The APHI guidelines intend to conserve biodiversity of unspecified scope, however, the practical and theoretical guidelines laid out are vague. The goal of the exercise is at no time clearly stated. Until it is, the incentive for rigorous implementation of germplasm zones will be absent and varied interpretations of purpose and form will arise.

The guidelines do not take ecogeographic variation into account, even though this is the best indicator of potential germplasm diversity. The underlying assumption would appear to be that HPHs are ecologically homogenous. Furthermore, the insistence on a rectangular conservation block omits to take into account natural geographic boundaries, which may be more useful.

Recommended implementation practices ignore standard concession practices, which are those which should be employed as they are already known, used and demonstrated to work.

Inventory needs to be done at the species level, which is different from the stocking inventories currently undertaken by HPHs. Stocking inventory is based on timber group, and reduces all trees to less than twenty industrially based names, which are biologically meaningless. Within any country, even a biologically rich one such as Indonesia, staff who can undertake inventory are already overstretched and are not available in sufficient numbers to undertake detailed research in the > 500 HPHs within Indonesia. Inventory by HPHs will require training of their staff for a different task and recruitment of further expertise.

The recurrent theme of this document is that conservation guidelines for production forestry must clearly state what is to be conserved, and why the activities are being requested. Once these are in place, a conservation strategy can be better drawn up, implemented and monitored.

## Recommendations for setting up conservation zones

### Background

The recommendations are divided into three sections:

1. **Implementation** procedures, independent of the goals of the conservation zones

2. **Biological requirements**, which will be valid for any conservation area

3. **Case example**, linking implementation of conservation areas to forestry practices

### 1. Implementation

- **Do not clear fire protection boundaries.**

  Their drawbacks are that they will:

  - be expensive (see table 4)
  - destroy germplasm within the strip and areas surrounding it from treefall and associated sources of damage
  - restrict geneflow out from the conservation zone by being a physical barrier
  - form unnatural edges that will be the starting points for erosion
  - enhance the risk of fire

  Quite simply, there is no obvious reason that favors this practice.

- **Use standard concession practices to mark boundaries**

  Timber concessions have staff trained in demarcating areas through practices which are completely applicable to the setting up of conservation zones. Using these practices will:

  - be easier for the concession
  - save concessions the time of having to work out new marking practices and teaching these methods to their staff
  - save on expense

- **Use concession skills where appropriate**

  Skills not already present in concessions should not be called for on the short term as training, especially for tasks such as inventory of biologically defined groups, in the > 500 HPHs in Indonesia will take significant time to realize. For inventory, organizations such as LIPI, universities and foreign assistance in conjunction with those institutions have the capacity to start this task.

  Concession staff could usefully map topography and location of trees above 50 cm dbh (see table 3). This would provide baseline data for biologists and provide evidence to the Ministry of Forestry that proposed conservation areas are indeed representative of the concession area in terms of topography and stocking volumes. This documentation could be followed up by formal spot checks.

- **Coordinate the siting of conservation areas with other conservation zones such as *cagar alam, hutan lindung* and *taman nasional*. The shape of conservation zones should follow natural boundaries and not necessarily be rectangular.**

- **Discuss coordination of conservation areas.**

  The setting up of, and research within, these areas will require coordination between institutions with different resource bases and appropriate skills. This would allow conservation areas to be demarcated with common borders allowing large germplasm areas to be set up among HPHs. Coordination at the HPH level could possibly miss this opportunity. KANWILs could aid HPHs with required reporting. Local involvement will be important in this process. Areas rich in, for example, rattans, medicinal plants, fruit trees, should also be considered for conservation.

- **Research the area required for desired germplasm capture.**

  Few data exist to support ideal sizes of conservation areas to optimize quantitative and qualitative germplasm capture in tropical forests. There remains the possibility that whatever area is selected might not be enough, or planned with insufficient understanding of field variations.

## 2. Biological requirements

- **Clear long term objectives must be provided on the role of the conservation areas in forestry interests and other interest.**

  Planning of conservation area sizes, and hence placement and shape, will depend upon the intended goal. Without clear objectives, implementation of conservation zones will vary among HPHs and possibly expose the governing regulations to outside criticism.

- **Protection should be accorded to *in situ* genepools through demarcating representative habitats within HPHs.**

  One goal of conservation is to maintain a sufficient genetic stocks to ensure the well-being of species over coming generations. Maintaining only a few representatives of species within a small conservation area may lead to severe inbreeding depression over time. A major drawback is the lack of knowledge on minimum sizes for breeding pools, not just for groups such as tropical trees, but also for many large mammals. Therefore, conservation areas should be made as large as possible to enhance the possibility that future generations are indeed protected.

  Many plant populations, including those of commercial tree groups, show variation among habitats. This ecogeographic variation means that genepool conservation is best achieved by safeguarding populations in as many different habitats as possible.

- **Inventory will have to be done by biologists from LIPI, universities and foreign personnel. Given the immense scope of this task it will have to involve training staff especially for this task.**

  Within Kalimantan alone it is estimated that as much as 30% of the flora is unknown, that many known species are described from as little as one specimen and that little is understood about variation within species. The task of inventorying requires trained staff and time, however, the numbers of trained and available personnel are limited. Within HPHs staff do not have the capacity to undertake this task. Inventory will require cooperation between forestry and biological institutions.

- **Conservation areas must be kept intact.**

  One of the first sources of damage to any area is along exposed edges. In forest, damage can be inflicted along edges by wind and soil erosion. If conservation areas are broken into smaller areas, the amount of exposed edge perimeter will rise dramatically in relation to the area contained within. Erosion will increase accordingly, too. Maintaining large integral areas, preferably without the artificial sharp edges of rectangles, will minimize deleterious edge effects.

- **In ecogeographically homogenous HPHs, individual conservation areas should be dispersed equally.**

  For example, if conservation areas are to be designated within each five year cutting plan conservation areas, in ecogeographically homogenous HPHs, should be dispersed across the concession in an attempt to randomly sample and capture available germplasm.

- **In ecogeographically heterogenous HPHs individual conservation zones should cover each type of ecosystem present.**

  Species compositions vary among habitats. Therefore, in contrast to the recommendation for homogenous HPHs, conservation areas within heterogenous HPHs should be allocated in such a way that the different habitats present are conserved.

- **Shape of conservation areas should follow natural boundaries whenever possible.**

  The temptation is always present to demarcate areas based on neat rectangles, which look tidy on a map and are relatively easy to survey, yet are biologically irrelevant and cause additional edge erosion. To mitigate this, wherever possible conservation area boundaries should follow natural borders such as streams and rivers (or at least the *hutan lindung* beside them) or hill ridges.

- **Protection of conservation area edges must always be considered - abutting against other protected areas or regenerating production petaks.**

  The primary area of erosion for a small conservation area will be the edge. Edge protection must always be considered, and attention to the above point will further mitigate unnecessary damage.

- **The Ministry of Forestry, HPHs and biological institutions should collaborate over preparation, delimitation and inventory of conservation areas. No single body contains the complete capacity to carry out this task, thus mutual assistance will ensure the best results.**

## 3. Case example

### Background

If conservation areas were constructed to enhance sustainable management of natural timber and non-timber resources, they would demonstrate a means through which conservation, commercial timber and local population interests could participate to mutual benefit. It is suggested here that such a program could be devised through which conservation areas would provide replanting stock for timber concessions and people using local resources such as rattan. Alternatives uses of conservation areas do exist, such as extending *hutan lindung* or making miniature *cagar alam*. If either of these were to be selected as the rationale for conservation areas in production forest, then current practices for their demarcation could be followed. Yet no tangible benefit from their allocation would arise for production forestry.

Two types of replanting take place in concessions:

- Fast growing species

  These species are planted in denuded areas, which are exposed, hot, dry, compacted and susceptible to erosion. Such areas are abandoned log ponds, camps, roads and skid trails. Exotic species are favored although some local species are sometimes used. The long term effect of bringing in exotic species, especially whether or not they will influence future regeneration negatively, has not been adequately researched. The question of whether they will foster local mycorhizae, essential to many ecosystems, is yet to be realistically addressed.

  Replanting denuded areas with local pioneer species should be encouraged. These species are the species that first emerge in naturally disturbed zones. They later die off, by which time seedlings of commercial species are ready to take over. Ecologically, it makes more sense to use such species. Sampling of natural gaps for seeds of natural pioneers from conservation areas would provide a seedling mix which could be planted in denuded areas.

- Commercial species

  A major failing in the replanting of commercial species is that no thought is given to the specific species being planted. This is especially the case for meranti's, Shorea species. Some Shorea species are ecological generalists, found in a range of habitats. Others do better in specialist habitats such as certain soil types, dry ridge tops or in lower and wetter areas. Yet because HPHs divide Shorea into timber classes for sale and not species groups, this commercial classification is also used for restocking. When meranti seeds are gathered, various species are sampled randomly, therefore most specialists are probably planted in inappropriate places. Furthermore, there has to date been no research on which species of meranti are preferred and if these the ones which are easiest to regenerate. Current practices might well be selecting against the species most valuable in the first cutting cycles.

  It would be preferable from a biodiversity standpoint if with each cutting plan conservation areas were allocated representing all habitat types within the proposed cutting block. During the first felling cycle, seed and seedling collections could be built up. Ridge top species would be replanted on ridges, wet area species in wet areas. Such a process would not require detailed species identification. Although this would be valuable, it is unlikely that sufficient training programs could be installed into HPHs in the short term. Nonetheless, it would be feasible to train staff and instill the idea that collections should be taken from areas that "look different", build up seed and seedling collections from each area and replant logged areas with seedling stocks from ecogeographically similar zones. The additional advantage of this would be that species compositions would be replanted, helping maintain the biodiversity of the area. Retaining intact ecosystems will also maximize conservation of planting stock and other resources used by indigenous peoples. Linkages need to be investigated between conservation zones and traditional forest areas.

**Objectives**

- To set up conservation zones within production forest. These zones will function to:

  - provide replanting stock for pioneer and commercial timber species
  - provide replanting stock for indigenous species, both those of direct value to local people and of potential agricultural of pharmaceutical value
  - maintain viable genetic stock for future generations

- maintain a self sufficient ecological balance to ensure that species associated with the well being of commercial species, such as soil mycorhizae, pollination and natural dispersal agents, are also protected

**Policy requirements**

- Forestry policy encouraging:
  - maintenance of sustainable forest practices through safeguarding functional ecosystems with HPHs
  - replanting with appropriate local species, and not promoting the introduction of exotic species
- Mechanisms to ensure that HPHs are advised on where to place their conservation areas, possibly through a multidisciplinary committee consisting of foresters, biologists and representatives from individual HPHs.
- Resources to ensure that conservation zones are being set up and looked after.
- Linking the interests of commercial timber and local population populations in the regeneration of logged forest.

**Methodology**

The methodology below rests upon the principles outlined in the last two sections, in addition to the policy requirements described above.

- Conservation zones should be a percentage of HPH size, yet remain above a prescribed minimum. Available data suggests that 10% of production area should be allocated to conservation zones, and that conservation of the genetic resources of large trees require a minimum size of 1000 ha. It should be noted that some highly dispersed trees are valuable furniture as well as timber species, an example being kerupok (Lophopetalum: Celastraceae). These deserve protection from a commercial standpoint.

  It is realized that the above figures are larger than those already proposed by the forestry related sector in Indonesia, and are based on a model of maximum germplasm capture. Reduction of area may not lead to the genetic erosion of most timber species, yet the smaller the area the greater the danger.

Each conservation area must have as small an edge to area ratio as possible to mitigate edge effect and related erosion. Each area must be kept intact.

Because the goal is to conserve local pockets of diversity, it is further recommended that conservation areas be set up within each five year cutting plan. A percentage size of cutting plan is still recommended herein leading toward a 10% conservation of production area.

- The conservation zone should represent all habitats with the cutting area. In ecologically diverse concessions, all possible habitats should be represented. Ecologically diverse concessions are liable to be those relatively large in size, again emphasizing the need for conservation areas to be measured as a percentage of HPH size, with a statutory minimum. Seemingly ecologically homogenous concessions should consider local microvariation. Hill tops and ridges will probably contain a different species composition to small gullies. All should be represented. Geographic microvariants such as small ridges may present better boundaries for conservation areas than rectangular designs, which should be avoided.

- Utilization of conservation zones should be based on regular seed and seedling collections of desired timber species. During this time, representative seedlings of important species for animals in terms of food or nectar should also be collected for planting in logged over area. This practice will help maintain native animal species, some of which are likely to be important in pollination and seed distribution. The goal here is to emphasize ecosystem maintenance to promote healthy forest regeneration, thus enhancing sustainable forest management.

  The opportunity for collection of seed material by, and for the use of, indigenous species of locally used species should be provided. Silvicultural investigation of their replanting in logged production forest should be encouraged. The concommitant development of timber and non-timber resources will provide additional value to production forest area, and will go toward providing incentives for conservation by all forest users within any particular area.

- Site selection must be monitored at a level above the individual HPH, although the HPH should be the basic management unit. This will promote better coordination of conservation zone allocation. It is recommended that a coordinating committee from the Ministry of Forestry central office, local KANWIL and local HPHs, and biologists from LIPI and local universities, be formed. Their skills should be

drawn on to maximize output through cooperation. The committee could draw on outside assistance whenever necessary.

- Further research into optimal size of conservation area in relation to forest regeneration is badly needed in Indonesia's forests. A research program addressing these points, incorporating ecological and genetic studies, should be implemented.

- Monitoring of conservation area allocation and maintenance will have started, possibly involving a combination of satellite and ground checking. Legal disincentives for not following the conservation zone regulation requirements should be in place.

**Benefits**

The recommendations given in this case study, should current and future forestry policy provide support, will be to conserve biodiversity in production forest more effectively than current practices allow. Utilizing of the resources within these areas will go toward sustaining species compositions of forestry and local resources, thus providing national and local economic benefits for the future.

The recommendations meet many of the ITTO recommendations, and a summary of how is provided in table 6.

**Table 6: ITTO recommended actions and how the recommendations of the case example go toward meeting them**

| # | ITTO RECOMMENDED ACTIONS | SUGGESTED ACTIVITIES |
|---|---|---|
| 1 | Provide a national agency, or reform and strengthen existing institutions to include biodiversity conservation in their mandate. | Such institutions exist within Indonesia and biodiversity conservation efforts are heavily emphasized. Recommended here is coordination of relevant institutions, perhaps under the auspices of the Ministry of Forestry. |
| 2 | Provide this agency with sufficient human and financial resources to effectively achieve integrated biodiversity conservation involving both the totally protected area and production forest systems. | The size of the task proposed by the ITTO recommendations exceeds available manpower available on a global basis in the short term. Training will have to be rapidly provided to future managers and scientists involved in these efforts. Training of concession staff in skills such as species level identification may also have to be considered to speed up species inventory programs. |
| 3 | Develop practical biodiversity appraisal systems to guide forest land use allocations at both the landscape level and within the management units of production forests. Where forest exploitation or changes in forest land use are occurring rapidly, give attention to the development of rapid appraisal systems that can provide guidance to forest planners in a relevant time period. | By coordinating conservation areas at both national and regional levels, prioritized areas for immediate conservation emphasis can be determined. It is recommended that biodiversity appraisal at ecosystem and species levels be done by relevant personnel called upon by a coordinating body such as discussed under #1. |

| | | |
|---|---|---|
| 4 | Develop and adapt practical techniques, such as environmental impact assessment for assessing the consequences of different forest management techniques on biodiversity. Incorporate biodiversity monitoring into on-going management programs for all forests. | The organizations under the coordinating body should pool their resources toward satisfying this recommendation. Such resources would include the use of GIS systems, botanical and zoological inventory. |
| 5 | Identify, survey and delineate the various categories of the Permanent Forest Estate and develop complementary management plans in consultation with forest dwellers and surrounding populations, taking into account their present and future needs for agricultural land and their customary use of forest. | Through discussion with local residents within or nearby HPHs, management planning for activities such as seedling restocking of both HPH and local timber trees, and locally used non-timber resources, will go toward meeting this ITTO specified goal. This activity should be integrated with traditional forest area zones wherever appropriate. |
| 6 | Within the constraints of prevailing social and economic circumstances, design totally protected areas to cover as large an area of natural forest as socially and economically feasible, with due attention to optimizing their shape. Surround these totally protected area cores with sympathetically managed near-natural production forests to minimize edge effects, and ensure the protection of ecological function. | Use of standard concession practices will facilitate this recommendation by using already known techniques in delimiting conservation areas.<br><br>Use of natural boundaries is recommended to minimize edge effect on conservation areas, and placement to integrate, wherever possible, with protected areas such as national parks, *hutan lindung* and *cagar alam*. |

| | | |
|---|---|---|
| 7 | Link totally protected area reserves by providing "corridors" of natural forest and ensuring that the habitat at known major nesting sites and the known ends of migration routes are retained. Locate production forests to maximize to maximize the connectivity between natural forest totally protected areas at the landscape level. | Data on biological phenomena such as local migration routes and nesting sites are few. Over extrapolation of available data will be inadvisable in Indonesia's large and diverse ecosystems. Advice will have to be obtained on the local level for this, possibly facilitated by outside help, under the coordination of regional planning boards.<br><br>Use of natural boundaries is recommended to minimize edge effect on conservation areas, and placement to integrate, wherever possible, with protected areas such as national parks, *hutan lindung* and *cagar alam*. |
| 8 | Particular care should be taken in applying silvicultural treatments to ensure that adequate populations of species which are important in food chains or in providing ecological functions (keystone species) are retained. | As above, advice will have to be obtained on the local level for this, possibly under the coordination of regional planning boards. |
| 9 | Trees with hollows, standing dead trees (snags) and decomposing fallen trees all have ecological importance for a range of species and not all should be removed from the forest in any silvicultural treatment to improve timber yields. | Assuming that conservation areas are to be undisturbed apart for extraction of planting material, this ITTO recommendation is met. Within production forest is further topic falling outside the remit of this document. |

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| 10 | The use of pesticides or other chemicals should be kept to a minimum in any silvicultural treatment, and the manufacturers instructions for the use of each product should be strictly observed. | Assuming that conservation areas are to be undisturbed apart for extraction of planting material, this ITTO recommendation is met. Within production forest is further topic falling outside the remit of this document. |
| 11 | In forest areas of recognized importance for biodiversity conservation incorporate consideration of the effects of rotation length, felling cycles, girth limits and size of the annual area cut-over in deciding the allocation of the annual allowable cuts. | Assuming that conservation areas are to be undisturbed apart for extraction of planting material, this ITTO recommendation is met. Within production forest is further topic falling outside the remit of this document. |
| 12 | When determining yield allocations and rotation lengths for particular management units, plan logging operations so that a mosaic or recently logged and old growth forests are maintained over time. | Assuming that conservation areas are to be undisturbed apart for extraction of planting material, this ITTO recommendation is met. Within production forest is further topic falling outside the remit of this document. |
| 13 | Within each major management area, a system of small virgin reserves should be designated on the management plan and maps The boundaries of these reserves should be marked in the field where feasible. | Given the relatively large amount of canopy removal undertaken in Dipterocarp forests it is recommended that conservation areas (virgin reserves) be kept large and intact, preferably with at least one per cutting plan.<br><br>It is further recommended that standard concession practices be used to delimit conservation areas, using available skills currently available. |

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| 14 | Management inventories should aim to locate key areas within all production forest units that are known to have higher biodiversity values ... | Data on local high biodiversity areas are few and scattered. Over extrapolation of available data will be inadvisable in Indonesia's large and diverse ecosystems. Advice will have to be obtained on the local level for this, possibly facilitated by outside help, under the coordination of regional planning boards. |
| 15 | Working plans should prescribe appropriate management measures in accordance with the specific biodiversity value of these key areas. Buffer strips of no intervention should be established along streams and around lakes and wetland areas. | Data on local high biodiversity areas are few and scattered. Over extrapolation of available data will be inadvisable in Indonesia's large and diverse ecosystems. Advice will have to be obtained on the local level for this, possibly facilitated by outside help, under the coordination of regional planning boards.<br><br>Buffer strips are already partly covered by the regulations in place for *hutan lindung*. |
| 16 | Reduce individual gap size as far as possible, unless specifically required for the regeneration of key species. Avoid creating very large gaps that equate to areas of local clear felling. | Assuming that conservation areas are to be undisturbed apart for extraction of planting material, this ITTO recommendation is met. Within production forest is further topic falling outside the remit of this document. |

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| 17 | Minimize machinery and felling damage to the residual stand, undergrowth and soil. | Assuming that conservation areas are to be undisturbed apart for extraction of planting material, this ITTO recommendation is met. Within production forest is further topic falling outside the remit of this document. |
| 18 | Utilize market mechanisms and economic incentives at the national and international level to encourage maintenance of biological services. Taking into account the options contained in Agenda 21 adopted by UNCED in Rio, members will encourage the transfer of technology on mutually agreed terms, taking into account the special needs of developing countries and the provision of new and additional financial resources ...(for global community to local populations)... where appropriate. | The recommendation of incorporation of HPH and local populations in the development of international, national, regional and local timber and non-timber resources in logged forest, and further development of marketing mechanisms for non-timber products go toward meeting this goal. |
| 19 | Efforts should be made to involve local people in the management of the forests, and to ensure that they obtain benefits, which will motivate the people themselves to use their traditional knowledge in support of the conservation of biodiversity. | The recommendation of incorporation of HPH and local populations in the development of international, national, regional and local timber and non-timber resources in logged forest, and further development of marketing mechanisms for non-timber products go toward meeting this goal. |

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| 20 | Investigate and adapt existing systems to develop locally specific, rapid, cost-effective and efficient biodiversity surveys and monitoring systems that could be carried out by, or in conjunction with, forest inventory teams during their survey activities.<br>Implement such systems as a part of the normal forest inventory processes. | Recommended here is coordination of relevant institutions with skills appropriate to the tasks called for in the ITTO guidelines, perhaps under the auspices of the Ministry of Forestry, and the pooling of their manpower and hardware resources.<br><br>As stated previously, training is urgently required to provide the future managers and scientists who will be involved in these efforts. Training of concession staff in skills such as species level identification may also have to be considered to speed up species inventory programs. |

# Appendix 1: ITTO GUidelines

INTERNATIONAL TROPICAL
TIMBER COUNCIL

ITTO

PERMANENT COMMITTEE ON
REFORESTATION AND FOREST MANAGEMENT

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FINAL VERSION

OF

# ITTO GUIDELINES ON THE CONSERVATION OF BIOLOGICAL DIVERSITY IN TROPICAL PRODUCTION FORESTS

- a supplement to ITTO Guidelines for the Sustainable Management of Natural Tropical Forests

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# ITTO GUIDELINE ON THE CONSERVATION OF BIOLOGICAL DIVERSITY IN TROPICAL PRODUCTION FORESTS

## A SUPPLEMENT TO ITTO GUIDELINES FOR THE SUSTAINABLE MANAGEMENT OF NATURAL TROPICAL FORESTS

## FOREWORD

These Guidelines are developed to be integrated in the ITTO Guidelines for the Sustainable Management of Natural Tropical Forests. With these principles and actions, biodiversity issues that are contained already implicitly in the existing ITTO Guidelines will be shown more explicitly.

Incorporation will require renumbering of the principles and consequent actions to allow for the additional 14 principles and 20 actions be put in the right place. Much of the introductory chapters 1 and 2 will then be presented as an annex to the integrated Guidelines.

For practical logistical reasons the factual integration will be coincided with the anticipated second edition of the ITTO Guidelines in a few years time. Until then these Guidelines on the Conservation of Biological Diversity will be published as a separate supplement to the existing ITTO Guidelines for the Sustainable Management of Natural Forests.

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## 1. INTRODUCTION

At its Eighth Session in Bali in Indonesia in May 1990, the International tropical Timber Council adopted Target 2000 through which its member countries set themselves the goal of ensuring that by the year 2000 all trade in tropical timber would come from forests that are managed sustainably. This goal was set in relation to objective 1(h) of the International Tropical Timber Agreement of 1983 which is: *"To encourage the development of national policies aimed at sustainable utilization and conservation of tropical forests and their genetic resources, and at maintaining the ecological balance in the regions concerned."*

Forests managed for timber and/or non-timber products do provide habitats for many, in some cases the majority, of the plant and animal species found in pristine, unmanaged forests. The number of species persisting is dependent on a variety of factors, predominantly on the degree of intervention and modification of the original ecosystem. In some cases of low-intensity utilization, forests may, at least in the short-term, have greater diversity than undisturbed ecosystems. Species composition will have changed, however, and some rare or specialized species may be lost.

Biological diversity is important both in its own right, and for the functional support it provides for the total forest ecosystem, and hence ultimately, for sustainable timber production. However, due to deforestation and forest degradation it is increasingly at risk. The principle objective of the ITTO Guidelines on the Conservation of Biological Diversity in Tropical Production Forests is therefore to optimize the contribution of these forests to the conservation of biological diversity that is consistent with their primary objective, namely the sustainable production of timber and other products.

These guidelines are based on the Report of an International Technical Working Group established in accordance with Decision 6(X) of the International Tropical Timber Council. The terms of reference for this Working Group required it to prepare guidelines for "The Conservation of Biodiversity in Tropical Production Forests" to complement the "ITTO Guidelines for the Sustainable management of Natural Tropical Forests" and the "ITTO Guidelines for the Establishment and Sustainable Management of Planted Tropical Forests".

In meeting these terms of reference, the Working Group's report was based in large part on a Pre-Project Report on "Realistic Strategies for the Conservation of Biological Diversity in Tropical Forests" which was prepared for ITTO by the International Union for the Conservation of Nature and Natural Resources - IUCN. This report summarized the outputs from a workshop conducted in conjunction with the General Assembly of the

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IUCN which was held in Perth Australia in December 1990. On the basis of the workshop discussions, a set of draft guidelines was prepared, revised by IUCN and sent for consideration by the Working Group when they met in Switzerland in October 1991 to formulate an amplification of the principles relating to the conservation of biodiversity implicit in the existing ITTO Guidelines on sustainable management in tropical forests. These constitute the international reference standard established by ITTO for the development of more specific national guidelines. The details of these national guidelines are matters for national decision by individual timber producing countries, in accordance with their national objectives and land use strategies.

## 2. KEY ISSUES IN BIODIVERSITY CONSERVATION IN PRODUCTION FORESTS

Before outlining a series of general principles and recommended actions for the various aspects of biodiversity conservation in tropical production forests, it is useful to examine the key issues associated with the conservation of biological diversity in these forests. These issues include the nature of biological diversity itself; the nature of the threats to biological diversity in tropical forests; the key role of forests set aside and totally protected for the purposes of species and ecosystem preservation; the role of production forests in the conservation of biological diversity; and the contribution of biodiversity conservation to the sustainable management of tropical forests.

### 2.1 What is Biological Diversity?

Biological Diversity or Biodiversity is not just the number of species in a particular area. Rather, it is the total variety of genetic strains, species and ecosystems that are found in nature. For practical purposes Biodiversity is normally subdivided into three major hierarchical categories - variation at the genetic level within a particular species; species diversity or the number and proportion of different species in a particular area; and ecosystem diversity that describes the variation in the assemblages of species and their habitats.

Tropical forests are extremely rich in plant and animal species. Biodiversity does not just refer to trees, birds and mammals but to all groups of organisms. Most of these are invertebrates and microorganisms and although less conspicuous, some of them may be essential to the functioning and sustainable production of the forest.

Another key feature of biodiversity is the fact that it is not a static entity. It is continually changing as evolution gives rise to new species and changing ecological conditions cause others to disappear. Tropical

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forests are also not static ecosystems maintaining a fixed climax species composition over time. All forests have been subject to modification in the past by climatic, geomorphological and human influences throughout their evolutionary history, and these modifications themselves have influenced current patterns of biodiversity. Modifications caused by inter alia timber harvesting, silvicultural operations or fire are important aspects of this dynamic development of the forests.

## 2.2 The Benefits of Biodiversity

The diversity of nature is the source of biological wealth and the foundation of the material wealth of human societies. It has been the basis for selective development of our food crops, a wide range of direct goods and services and much of the raw inputs and genetic materials for industry, agriculture and medicine. Collectively, these benefits are worth many billions of dollars each year. People spend additional billions of dollars each year to appreciate nature and its diversity through recreation and tourism.

All human societies - urban, rural, industrial and non-industrial - continue to depend on a wide array of ecosystems, species and genetic variants to meet their ever changing needs and the needs of the markets they supply. The diversity of nature is also a source of beauty, enjoyment, cultural and spiritual inspiration, understanding and knowledge and provides the foundation for much human creativity.

Through their evolution over millions of years, plants and animals have made the Earth a fit habitat for humanity and the other forms of life we know today. Plants and animals help maintain the chemical balance of the Earth, and stabilize climate. They also protect watersheds and renew the soil. Furthermore, we are only beginning to understand these roles and know too little about the relative importance of different ecosystems or the species which compose them.

## 2.3 Threats to Biodiversity

Any disturbance of a forest, whether by natural agents or caused by people, will alter it as a habitat for animal and plant species. Small-scale disturbances may in some instances enhance structural, floristic and faunistic diversity. However, large-scale disturbances tend to simplify the ecosystem and result in a loss of genetic diversity within a species, loss of species and reduced available habitat and as a consequence may result in an overall loss of biodiversity.

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In general, the management of a forest for timber production and many other purposes requires the modification of the natural ecosystem to provide access, to remove forest products and in some cases, to increase the yield of commercial species. Inevitably, some of the original forest species will then be at least locally lost. Total biodiversity may remain the same as other species colonize the modified forest environment. However, the colonists are often common and widespread while the displaced species are often old-growth specialists, many with restricted ranges. The net result therefore is often a qualitative change in diversity favoring generalists species at the expense of old-growth specialists.

Converting natural forests into other land uses has far more drastic impacts on biodiversity than sustainable management for timber production. A very large proportion of the world's forests are allocated for the production of timber and this situation is likely to persist. The future of much of the world's forest biological diversity depends upon the way in which these forests are managed.

## 2.4 The Key Role of Totally Protected Conservation Areas

In the light of the benefits of biodiversity and all of the above threats, prudence demands that people and human societies keep as much biodiversity as possible, while at the same time ensuring that the areas appropriate for the production of timber or other benefits are sustainably managed to meet their primary production objectives.
However, detailed information on the ecology of all forest species and their response to disturbance is frequently not available. Thus, there is often little information upon which to base conservation programs.

In this uncertain situation, the safest strategy for conserving biodiversity is to establish large undisturbed protected areas covering representative examples of all forest types and ecosystems. Totally Protected Areas (TPA's) such as Strict Nature Reserves, National Parks and other equivalent areas (See Appendix 1 for details) must therefore be seen as the corner stone of any systematic conservation programme. However, for a number of reasons TPA systems by themselves cannot be expected to conserve all biodiversity.

Few countries are able to allocate sufficient areas to total protection to guarantee the preservation of all animal and plant species and their intraspecific genetic variation. In most countries, totally protected areas do not exceed 4-8 percent of national territory and individual areas are generally small. When species exist in small isolated populations they are susceptible to extinction caused by random environmental events

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and genetic deterioration. If natural forests are only retained in small isolated protected areas then many species will inevitably be lost.

In many tropical countries, for practical purposes TPA's are usually identified on the basis of the distribution of mammals, birds and trees, or even broader environmental classification systems. The utility of these designation systems for conserving invertebrates and microorganisms and the full genetic diversity of the trees, birds and mammals is unknown.

On a regional basis there is movement and migrations of many organisms between forest areas. Many of these, such as fruit eating birds and many insects, are functionally important to the forest ecosystem as a whole because of their role as pollinators and dispersers. Their movements are often not fully known and, again, it is unlikely a TPA network itself would be able to incorporate all these movements. Loss of natural or near-natural habitat outside the TPA network that support these migrants or nomads will result in the reduction of their populations and effect the overall functioning of the forests throughout the region. This is particularly important for keystone species which play a role in the life cycle of others, such as the major timber trees.

## 2.5 The Value of Sustainably Managed Production Forests in Biodiversity Conservation

There is a broad consensus that it is possible to manage tropical forests for production of timber and other products while still maintaining considerable biodiversity values. Thus, while tropical forest lands may be extremely fragile when people attempt to convert them to other uses, the forests themselves are often reasonably robust in their ability to recover from localized and periodic disturbance.

Such disturbances in the past have been caused by agents such as tree falls, storm damage, earthquakes, fire and low intensity forms of shifting cultivation, and they have contributed to the present patterns of diversity of the forests. Selective harvesting of timber trees and subsequent protection of the forests constitutes a form of disturbance which might therefore be expected to be compatible with the conservation of much of the biodiversity of the forests.

Theoretically, sustainably managed production forests represent the best compromise between the desirability of conserving species and the need to use land to generate wealth and employment. Production forests often represent a more tangible economic asset to societies in poorer countries than do TPAs, and are therefore more likely to be respected. In view of the worldwide decline in total forest area, even modified forests will

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have an important part to play in preserving habitat, species and sub-specific diversity. It is not possible to design forest management systems which would conserve all biodiversity, but we can apply known principles to minimize loss.

However, the contribution of production forests to the conservation of biodiversity can only be fully realized within an integrated national land use strategy, which assigns appropriate attention to biodiversity conservation in specific areas of forest, in accordance with their composition and location, taking account of the TPA system.

### 2.6 The Functional Role of Biodiversity in Production Forests

One of the major values of retaining biodiversity is to maintain important ecosystem functions such as mineral cycling, pollination and maintaining a balance of organisms such that the likelihood of major outbreaks of pest species is reduced. Even small, apparently insignificant organisms can play a major role, and conservation of high overall levels of diversity is a prudent for achieving sustainable forest production with low levels of risk.

## 3. POLICY AND LEGISLATION

The success or failure of forest resource management is greatly affected both by the laws and policies that relate to the forest sector, and by the structures and staffing of the agencies that have been established to secure their implementation. This may require action to strengthen attention to biodiversity conservation in national education and training programs. In order to promote the conservation of biodiversity in production forests, it is essential that biodiversity issues are given appropriate recognition in policy and legislation by the application of the following principles and recommended actions.

<u>Principle 1</u>
National forest policy and legislation should recognize biodiversity conservation as an important goal of forest management. Programs must be developed to assess the importance of biodiversity in all forest areas, including those utilized for timber and other non-wood forest products, and to determine the degree of priority to be assigned to biodiversity conservation in each specific area.

<u>Recommended Action 1</u>
Provide a national agency, or reform and strengthen existing institutions to include biodiversity conservation in their mandate.

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Principle 2

The national agency responsible for forests should have both the mandate and the capability to ensure that forests are managed for all values including biodiversity in an integrated system, with allocation of priority to production and conservation objectives as appropriate to the particular forest area. It should also assist in the integrated management of private and customarily held forests, according to the objectives laid down in the national forest policy.

Recommended Action 2

Provide this agency with sufficient human and financial resources to effectively achieve integrated biodiversity conservation involving both the TPA and production forest systems.

Principle 3

Inventories need to be undertaken to describe, quantify and monitor biodiversity in all production forests which are assessed as sufficiently high priority in national conservation strategies to warrant such action. Where possible and feasible, these inventories should be incorporated within existing timber management inventories.

Recommended Action 3

Develop practical biodiversity appraisal systems to guide forest land use allocations at both the landscape level and within the management units of production forests. Where forest exploitation or changes in forest land use are occurring rapidly, give attention to the development of rapid appraisal systems that can provide guidance to forest planners in a relevant time period.

Recommended Action 4

Develop and adapt practical techniques, such as environmental impact assessment for assessing the consequences of different forest management techniques on biodiversity. Incorporate biodiversity monitoring into on-going management programs for all forests.

## 4. PROMOTING THE ROLE OF SUSTAINABLY MANAGED PRODUCTION FORESTS IN CONSERVING BIODIVERSITY AT THE LANDSCAPE LEVEL

Because some key elements of a nation's biodiversity are expressed at an ecosystem level, the conservation of overall biodiversity ultimately requires management at the broad landscape level to cover all major ecosystem types. In addition, the effects of land-use activities in a particular area can have a significant effect on the biota of other areas.

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Careful land-use planning can, however, be used to both promote the retention of biodiversity at the ecosystem level and to minimize the external impacts of particular land-use activities on biodiversity values in other areas. However, to do this, forests and other key components of the landscape need to be managed as a single inter-related system. This, in turn, is best achieved through an integrated system of protected areas, production forests and sympathetically managed agricultural and urban lands.

The following principles and recommended actions outline some of the key considerations needed to establish such an integrated approach to biodiversity conservation and land-use planning and management.

Principle 4

The different categories of land that need to be kept under permanent forest cover include lands for nature conservation and ecosystem preservation (TPAs), fragile lands requiring protection forests, natural production forests and planted production forests - see Appendix 1 in both the ITTO Guidelines on the Sustainable Management of Natural Tropical Forests and the ITTO Guidelines on the Establishment and Sustainable Management of Planted Tropical Forests.

Recommended Action 5

Identify, survey and delineate the various categories of the Permanent Forest Estate and develop complementary management plans in consultation with forest dwellers and surrounding populations, taking into account their present and future needs for agricultural land and their customary use of the forest.

Principle 5

Research in conservation biology has indicated that there is a direct relationship between the size of a protected area and the number of species it will conserve in the long-term. Such studies have also indicated that increasing the perimeter to area ratio of a TPA will reduce its effectiveness as a conservation unit. This is due to "edge effects" which favor generalists species rather than species with more specialist habitat requirements.

Recommended Action 6

Within the constraints of prevailing social and economic circumstances, design TPA's to cover as large an area of natural forest as socially and economically feasible, with due attention to optimizing their shape. Surround these TPA cores with sympathetically managed near-natural production forests to

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minimize edge effects, and ensure the protection of ecological function.

Principle 6

Where forest clearing or disturbance becomes necessary, maintaining the connectivity between undisturbed forests will help to minimize erosion of biodiversity. In designing such connecting areas, a fundamental principle is to facilitate the movement of seeds, pollen and animals between the various forest areas and other habitats.

Recommended Action 7

Link TPA reserves by providing "corridors" of natural forest and ensuring that the habitat at known major resting sites and the known ends of migration routes are retained. Locate production forests to maximize the connectivity between natural forest TPA's at the landscape level.

## 5. CONSIDERATIONS FOR THE CONSERVATION OF BIODIVERSITY AT THE MANAGEMENT UNIT LEVEL IN PRODUCTION FORESTS.

With careful land use planning that gives particular attention to the complementary location of all retained forest areas, production forests can potentially play a key role in the conservation of biological diversity at all levels. However, whether or not this potential is realized in practice will depend in very large part on how particular production forests are managed at the operational level. The following principles and recommendations for operational management will help to maximize the contribution of production forest to the conservation of biodiversity.

### 5.1 Planning

#### 5.1.1 Choice of silvicultural concept

Principle 7

Silvicultural systems that aim to change species composition or selectively remove certain structural or floristic components of the forest can have a negative effect on biodiversity conservation. Forest areas of recognized importance for biodiversity conservation should be the subject of special action as recommended below.

Recommended Action 8

Particular care should be taken in applying silvicultural treatments to ensure that adequate populations of species which are important in

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food chains or in providing ecological functions (keystone species) are retained.

In the case of plantations, the use of indigenous species should be encouraged.

Recommended Action 9
Trees with hollows, standing dead trees (snags) and decomposing fallen trees all have ecological importance for a range of species and not all should be removed from the forest in any silvicultural treatment to improve timber yields.

Recommended Action 10
The use of pesticides or other chemicals should be kept to a minimum in any silvicultural treatment, and the manufacturers instructions for the use of each product should be strictly observed.

### 5.1.2 Yield Regulation, Annual allowable Cut and Rotation time

Principle 8
The presence of some larger and older trees in the forest, and longer intervals between the disturbances caused by harvesting operations, generally favor biodiversity conservation.

Recommended Action 11
In forest areas of recognized importance for biodiversity conservation incorporate consideration of the effects of rotation length, felling cycles, girth limits and size of the annual area cut-over in deciding the allocation of the AAC.

Principle 9
In general, a mosaic of old-growth forests in close proximity to logged forests will help to maintain biodiversity.

Recommended Action 12
When determining yield allocations and rotation lengths for particular management units, plan logging operations so that a mosaic of recently logged and old growth forests are maintained over time.

### 5.1.3 Management Inventory and Mapping

Principle 10

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A system of small (approximately 100 ha) undisturbed forest reserves within the management area can have profound positive effects on biodiversity conservation that are disproportionate to their size. A system of such reserves, carefully distributed throughout the management area, can act as temporary refuges for fauna moving away from the active logging areas and also as sources for rapid re-colonization.

Recommended Action 13

Within each major management area, a system of small virgin reserves should be designated on the management plan and maps. The boundaries of these reserves should be marked in the field where feasible.

Principle 11

Not all areas of a production forest will have equal importance for biodiversity conservation. Sites of particular importance for biodiversity conservation (key areas) will include:

* areas adjacent to TPA reserves;
* areas with populations of rare or endangered species or with high concentrations of endemic species, or with exceptional species richness;
* areas with unusual land-forms, geology or other physical features not adequately represented in TPA's;
* rivers, streams and wetland areas;
* areas with forest types not represented in TPA's;
* areas that contain biological diversity of social or cultural value, or of medicinal, agricultural or other economic value;
* areas that contain habitats frequented by migrating species.

Recommended Action 14

Management inventories should aim to locate key areas within all production forest units that are known to have higher biodiversity values as outlined in Principle 12.

Recommended Action 15

Working plans should prescribe appropriate management measures in accordance with the specific biodiversity value of these key areas. Buffer strips of no intervention should be established along streams and around lakes and wetland areas.

5.2.2. Extraction

Principle 12

Biodiversity conservation is strongly affected by degree of canopy disruption, extent of damage to the standing vegetation and severity

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of erosion.

Recommended Action 16
Reduce individual gap size as far as possible, unless specifically required for the regeneration of key species. Avoid creating very large gaps that equate to areas of local clearfelling.

Recommended Action 17
Minimize machinery and felling damage to the residual stand, undergrowth and soil.

6. Implementation

Principle 13
Biodiversity conservation can provide many benefits to the global community, to national economies and local populations. Management for biodiversity conservation may add extra costs to management of production forests but may also yield extra economic and social benefits.

Recommended Action 18
Utilize market mechanisms and economic incentives at the national and international level to encourage maintenance of biodiversity services. Taking into account the options contained in Agenda 21 adopted by UNCED in Rio, members will encourage the transfer of technology on mutually agreed terms, taking into account the special needs of developing countries and the provision of new and additional financial resources, bearing in mind principle 13 above; where appropriate.

Recommended Action 19
Efforts should be made to involve local people in the management of the forests, and to ensure that they obtain benefits, which will motivate the people themselves to use their traditional knowledge in support of the conservation of biodiversity.

7. RESEARCH AND MONITORING

Principle 14

The value of production forests to biodiversity and the effects of various management systems are inadequately understood. Additional information on the status of biodiversity in production forests and the efficacy of the management measures instituted to minimize its erosion is needed.

Recommended Action 20

Investigate and adapt existing systems to develop locally specific, rapid, cost-effective and efficient biodiversity surveys and monitoring systems that could be carried out by, or in conjunction with, forest inventory teams during their survey activities. Implement such systems as a part of normal forest inventory processes.

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## APPENDIX 1

## CATEGORIES AND MANAGEMENT OBJECTIVES OF PROTECTED AREAS

I. **Strict Nature Reserve.** To protect nature and maintain natural processes in an undisturbed state in order to have ecologically representative examples of the natural environment available for scientific study, environmental monitoring, education, and for the maintenance of genetic resources in a dynamic and evolutionary state.

II. **National Park.** To protect outstanding natural and scenic areas of national or international significance for scientific, educational, and recreational use. These are relatively large natural areas not materially altered by human activity where extractive resource uses are not allowed.

III. **Natural Monument/Natural Landmark.** To protect and preserve nationally significant natural features because of their special interest or unique characteristics. These are relatively small areas focused on protection of specific features.

IV. **Managed Nature Reserve/Wildlife Sanctuary.** To assure the natural conditions necessary to protect nationally significant species, groups of species, biotic communities, or physical features of the environment where these may require specific human manipulation for their perpetuation. Controlled harvesting of some resources can be permitted.

V. **Protected Landscapes and Seascapes.** To maintain nationally significant natural landscapes which are characteristic of the harmonious interaction of man and land while providing opportunities for public enjoyment through recreation and tourism within the normal life style and economic activity of these areas. These are mixed cultural/natural landscapes of high scenic value where traditional land uses are maintained.

VI. **Resource Reserve.** To protect the natural resources of the area for future use and prevent or contain development activities that could affect the resource pending the establishment of objectives which are based upon appropriate knowledge and planning. This is a 'holding' category used until a permanent classification can be determined.

VII. **Anthropological Reserve/Natural Biotic Area.** To allow the way of life of societies living in harmony with the environments to continue undisturbed by modern technology. This category is appropriate where resource extraction by indigenous people is conducted in a traditional manner.

VIII. **Multiple Use Management Area/Managed Resource Area.** To provide for the sustained production of water, timber, wildlife, pasture and tourism, with the conservation of nature primarily oriented to the support of the economic activities (although specific zones may also be designated within these areas to achieve specific conservation objectives).

Two additional categories are international labels which overlay protected areas in the above eight categories:

IX. **Biosphere Reserve.** To conserve for present and future use the diversity and integrity of biotic communities of plants and animals within natural ecosystems, and to safeguard the genetic diversity of species on which their continuing evolution depends. These are internationally designated sites managed for research, education and training.

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I. **World Heritage Site.** To protect the natural features for which the area is considered to be of outstanding universal significance. This is a select list of the world's unique natural and cultural sites nominated by countries that are Party to the World Heritage

Source: IUCN/UNEP/WWF, 1991, Caring for the Earth, Gland, Switzerland, pp 192-193.

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## APPENDIX 2

The following paragraphs may be considered for inclusion in the Introduction of the combined Guidelines:

The loss and fragmentation of tropical moist forests are among the greatest threats to the world's current biological diversity. Conversely, under sustainable management these forests have a unique potential to contribute to biodiversity conservation.

Converting natural forests into other land uses has far more drastic impacts on biodiversity than sustainable management for timber production. A very large proportion of the world's forests are allocated for the production of timber and this situation is likely to persist. The future of much of the world's forest biological diversity depends upon the way in which these forests are managed.

Theoretically, managed production forests represent the best compromise between the desirability of conserving species and the need to use land to generate wealth and employment. Production forests often represent a more tangible economic asset to societies in poorer countries than do TPAs, and are therefore more likely to be respected. In view of the worldwide decline in total forest area, even modified forests will have an important part to play in preserving habitat, species and sub-specific diversity. It is not possible to design forest management systems which would conserve all biodiversity, but we can apply known principles to minimize loss.

However, the contribution of production forests to the conservation of biodiversity can only be fully realized within an integrated national land use strategy, which assigns appropriate attention to biodiversity conservation in specific areas of forest, in accordance with their composition and location, taking account of the TPA system.

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## APPENDIX III

## ITTO PRE-PROJECT
## THE DEVELOPMENT OF GUIDELINES FOR THE PROTECTION OF TROPICAL FORESTS AGAINST FIRE

### I. Introduction

The destruction of tropical forests caused by fires has been well documented, particularly in countries such as Indonesia and Brazil, where large areas of forests are devastated each year. The causes and effects of fire vary considerably, however, tropical timber producing countries suffer from lost economic opportunities and environmental degradation. Experts generally agree that the detrimental effects can be significantly reduced through an integrated fire prevention and control program.

In January/February 1992, ITTO sponsored a consultative visit to Indonesia to explore possible actions to minimize the destructive effects of tropical forest fire. The major findings and recommendations of this visit is documented in the *Report on the Consultative Visit to Indonesia with Regard to ITTO Activity on the Protection of Tropical Forests Against Fire*, PCF(X)/6 dated 31 March 1992, which was presented to the Committee during its Tenth Session in Yaoundé, Cameroon. As part of their recommendations, the specialists drafted a Terms of Reference for creating a Panel of Experts to develop ITTO guidelines for the protection of tropical forests against fires (See Appendix I). It is envisioned that these Guidelines would be incorporated in ITTO's set of principles to assist member countries to develop national policies and strategies for the prevention and control of fire in tropical forests. The Guidelines would be published in ITTO's Policy Development Series and be distributed to interested members and others dealing with forest fire management.

### II. Objective

The objective of this Pre-Project is to develop principles and a set of possible actions to prevent and manage tropical forest fires, which would be published as ITTO Guidelines for the Protection of Tropical Forests Against Fire. These Guidelines will complement ITTO's Guidelines for: 1) Sustainable Management of Tropical Forests, 2) Planted Tropical Forests and 3) Biodiversity Conservation, which when taken together, will provide a comprehensive set of reference standards for the development of more specific guidelines at the national level.

### III. Activities

The steps required for the development of the fire guidelines include:

1. Presentation, approval and funding of this Pre-Project.
2. Formation of an Expert Panel, with the participation of four consumer and four producer countries, on fire prevention and management as outlined in Appendix I.
3. The commission of a consultancy report to be used as a discussion paper by the Expert Panel (See Appendix II for the Terms of Reference for the Consultants).
4. A meeting of the Expert Panel for four days to review the consultancy report and develop a draft set of Guidelines, to be translated and sent to all ITTO member countries as a PCF document.
5. Discussion and comment on the draft Guidelines by the Committee during its November 1993 Session in Yokohama, to provide guidance and recommendation needed for adoption.
6. Adoption by the Council of the finalized version of the Guidelines in May 1994.
7. Publication and distribution of the Guidelines as part of ITTO Policy Development Series.

# Appendix 2: APHI Guidelines

# PEDOMAN PEMBUATAN KEBUN PLASMA NUTFAH

ASOSIASI PENGUSAHA HUTAN INDONESIA
JAKARTA - 1992

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# PEDOMAN PEMBUATAN KEBUN PLASMA N UTFAH

## PENDAHULUAN

Keberadaan hutan tropis di Indonesia merupakan anugerah sekaligus menambah tanggung jawab kita terhadap kelestariannya. Kekhawatiran akan kerusakan hutan tropis pada saat ini semakin meningkat mengingat semakin tingginya pengetahuan masyarakat akan kelestarian hutan pada khususnya dan alam pada umumnya, selain itu semakin banyak negara yang menaruh perhatian akan kelangsungan hidup hutan tropika.

*Plasma nutfah* adalah sumber daya genetik yang memiliki oleh suatu kawasan baik yang tergolong flora maupun fauna.

Tujuan pembuatan *Kebun Plasma Nutfah* secara umum adalah untuk menyelamatkan plasma nutfah yang ada di bumi dari kepunahan. Sedangkan tujuan khususnya adalah untuk melindungi keberadaan plasma nutfah yang ada di areal HPH tersebut dari kepunahan dan sebagai tempat penelitian.

Keberadaan plasma nutfah sangat penting bagi kehidupan manusia dalam rangka pembangunan yang berkelanjutan, utamanya sebagai sumberdaya genetik baik untuk industri, pertanian maupun farmasi. Dalam upaya meningkatkan plasma nutfah di hutan alam produksi, bersama ini dicanangkan areal hutan seluas 300 Hektar sebagai Kebun Plasma Nutfah. Kebun plasma nutfah merupakan wilayah yang mutlak dilindungi keberadaannya (Totally Protected Area) dalam kawasan hutan produksi. Usaha ini merupakan kesadaran HPH dalam rangka pelestarian plasma nutfah. Adapun kriteria penetapannya adalah sebagai berikut: :

## I. PEMILIHAN LAHAN

### A. LUAS

Seperti yang telah disebutkan diatas, luas kebun plasma nutfah ditetapkan 300 (duaratus) hektar dan mempunyai lebar minimum 1000 (seribu) meter. Sedapat ungkin kedua sisi lebar memiliki tinggi dari permukaan laut (dpl) yang sama.

### B. PENENTUAN TEMPAT

1. Letak Kebun Plasma Nutfah

   Pemilihan kebun plasma nutfah harus memperhatikan komposisi sekitarnya. kebun plasma nutfah harus berjauhan dengan kegiatan manusia (pemukiman penduduk dan jalan). Hal ini untuk menghindari gangguan manusia/kegiatan manusia yang dapat merusak vegetasi hutan. Selain itu areal tersebut juga harus aman dari bahaya kebakaran

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2. Kondisi Tanah
   Kondisi tanah yang diinginkan adalah kondisi tanah yang dapat mewakili kondisi tanah rata-rata dari HPH setempat.

3. Ketinggian
   Areal yang meemenuhi syarat untuk dijadikan kebun plasma nutfah diharapkan yang mampu mewakili selang keragaman ketinggian di lokasi HPH oleh karena nya sedapat ungkin panjang areal mengarah ke atas lereng. Diharapkan dari ketinggian yang mewakili ini dapat diperoleh koleksi yang lebih lengkap sehingga mampu mewakili vegetasi yang ada pada setiap kelas ketinggian.

4. Kondisi vegetasi
   Hutan yang akan dijadikan kebun plasma nutfah sebaiknya masih berupa hutan virgin atau hutan yang mempunyai kerusakan sesedikit mungkin, baik itu karena pembalakan ataupun karena kebakaran.
   Keragaman vegetasi diusahakan dapat mewakili keragaman tegakan di hutan konsesi yang ada disekelilingnya. Jenis-jenis vegetasi dapat dirujuk kembali dari hasil inventarisasi tegakan saat pelaksanaan pembuatan RKPH, sehingga kebun plasma nutfah dapat mewakili hutan di areal HPH tersebut.

5. Kondisi satwa liar
   Selain keragaman vegetasi yang perlu diperhatikan, maka dalam pemilihan areal tsb. juga perlu dilihat adanya keanekaragaman hayati lain, khususnya bagi satwa liar, yang khas, endemik dan utamanya yang terancam punah. Hal ini dapat dilihat pula dari adanya sarang/rumah, kotoran binatang serta petunjuk lain yang memberikan ciri khusus.

## II. SARANA DAN PRASARANA

### A. TATA BATAS

Setelah penetapan lokasi dilakukan, dilanjutkan dengan pembuatan batas-batas kawasan. Pal batas dibuat dari beton bertulang berbentuk bulat. Tinggi pal secara keseluruhan adalah *150 cm* dan bagian yang tertanam di dalam tanah adalah *50 cm* (*Lampiran 1*). *50 cm* bagian atas pal dicat warna orange agar mudah dikenali . sisanya berwarna hitam. Jarak antara pal batas yang satu dengan yang lainnya adalah 100 m.
Disekeliling kebun plasma nutfah dibuat penyekat bakar berupa lahan kosong selebar 10 m dan mintakat penyangga selebar 40 m (*Lampiran 2*) untuk melindungi hutan dari kebakaran dan gangguan lain yang mungkin terjadi.

### B. PEMBUATAN DAN PEMASANGAN PAPAN NAMA

Setelah ditemukan lokasi yang cocok, di luar kebun plasma nutfah dipasang papan nama permanen berukuran 1 m x 1 m di pinggir hutan seperti terlihat

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pada Lampiran 3. Papan nama dibuat dari kayu yang mempunyai kelas awet yang tinggi (contoh: damar laut) agar tahan terhadap cuaca.

## III. PERLAKUAN

### A. PERLAKUAN AWAL

1. Inventarisasi Pertama

   Inventarisasi pertama ini bertujuan untuk melihat kelayakan kawasan ditinjau dari syarat-syarat yang diperlukan untuk dijadikan kebun plasma nutfah.

   Jalur inventarisasi dibuat melebar (*Lampiran 4*), dengan jarak antar jalur sebesar 1/6 sisi panjang. Lebar jalur inventrisasi adalah 20 m. Sepanjang jalur inventarisasi dalam rentang 1 m pada sisi kanan dan kiri, tegakan yang cukup besar ditandai dengan cat putih. Penandaaan dilakukan pada sekeliling pohon pada ketinggian setinggi dada, agar pada kegiatan inventarisasi berikutnya jalur inventarisasi mudah diketemukan kembali (*Lampiran 5*).

   Nama yang dipakai dalam inventarisasi adalah nama lokal dan nama latinnya bila memungkinkan, dan untuk pohon yang tidak dikenal dibuatkan herbariumnya, untuk identifikasi lebih lanjut.

   Untuk satwa liar yang terdapat dalam lokasi perlu dicatat jenis, besar populasinya, distribusi dan perilakunya.

2. Inventarisasi Kedua

   Inventarisasi kedua dilakukan dengan lebih intensif. Tujuan inventarisasi kedua ini adalah untuk menginventarisasi lebih lengkap kondisi biota/habitat satwa liar yang ada di kebun plasma nutfah. Jalur yang digunakan adalah jalur yang dipakai pada inventarisasi pertama.

### B. PEMELIHARAAN

Sistem pemeliharaan yang dilakukan hanya menjaga lingkungan luar kawasan dari gangguan manusia, seperti pencurian kayu, perambahan hutan dan kebakaran hutan.

Sedangkan untuk vegetasinya tidak diberikan perlakukan tetapi dibiarkan sesuai aslinya. Untuk satwa liar, pemeliharaan yang perlu dilakukan adalah pada tempat-tempat khusus: tempat untuk makan, bersarang, berlindung. Setiap kerusakan hutan yang cukup berarti/berpengaruh besar terhadap keberadaan kebun plasma nutfah, harus dicatat dan dilaporkan.

## IV. SISTEM PELAPORAN

### A. LAPORAN PENDAHULUAN

Laporan diberikan kepada APHI setelah penetapan kawasan. laporan yang diberikan meliputi luas aktual, letak lokasi, jenis vegetasi dan satwa liar yang ada dan kondisi kebun plasma nutfah serta keadaan umum dan hambatan-

hambatan yang ada serta kemungkinan gangguan yang dapat berpengaruh terhadap kelangsungan kebun plasma nutfah.
Daftar isian yang digunakan di lapangan dapat dilihat pada Lampiran 6. Sedangkan pembuatan laporan inventarisasi dilakukan seperti yang terlihat pada *Lampiran 7.*

B. LAPORAN RUTIN

Inventarisasi lanjutan dilakukan setiap 5 tahun sekali untuk mengetahui perkembangan, perubahan dan kerusakan vegetasi serta satwa liar yang terjadi. Laporan inventarisasi lanjtan memiliki format yang sama dengan laporan pendahuluan dan diserahkan bersamaan dengan pengajuan RKL ke Departemen Kehutanan. Jalur inspeksi yang dipakai adalah jalur yang telah dibuat sebelumnya pada saat penentuan/penetapan kawasan. Pada saat inventarisasi lanjutan ini tanda-tanda jalur sebaiknya diperbaharui lagi untuk menjaga penampakannya. Dari hasil inventarisasi dibuat laporan ke APHI untuk mengetahui perkembangan Kebun Plasma Nutfah.

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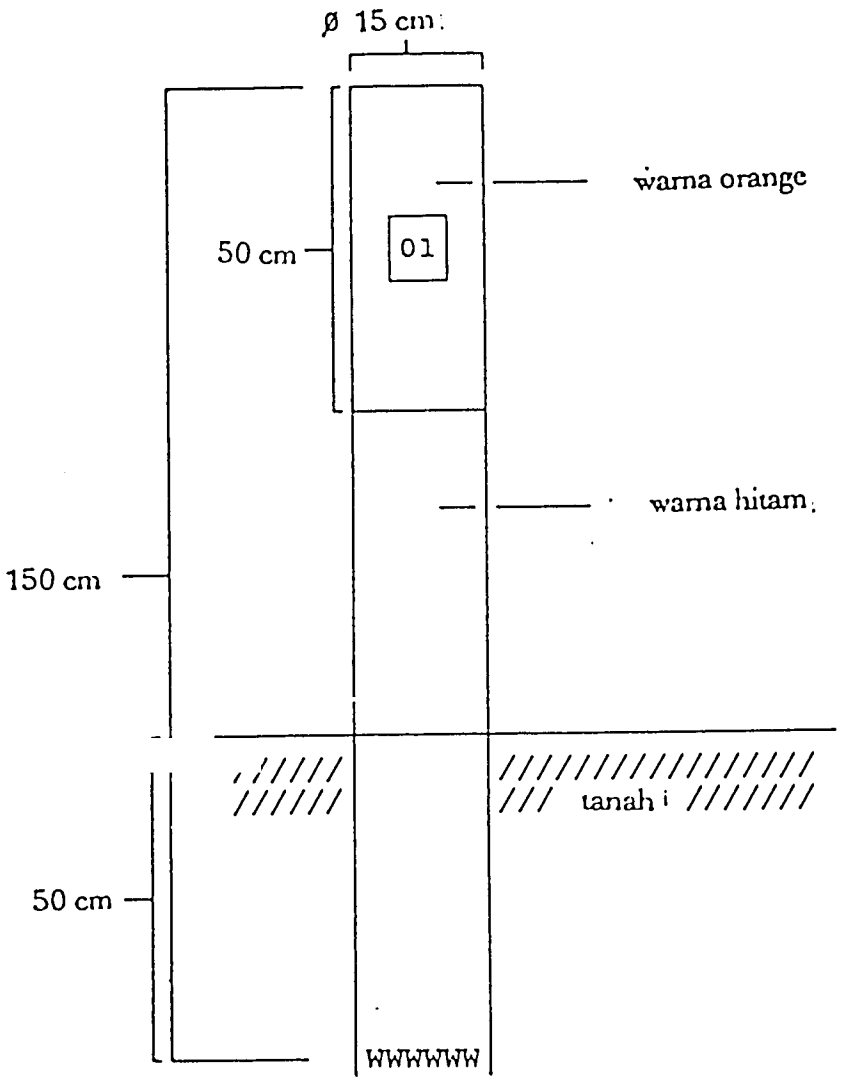
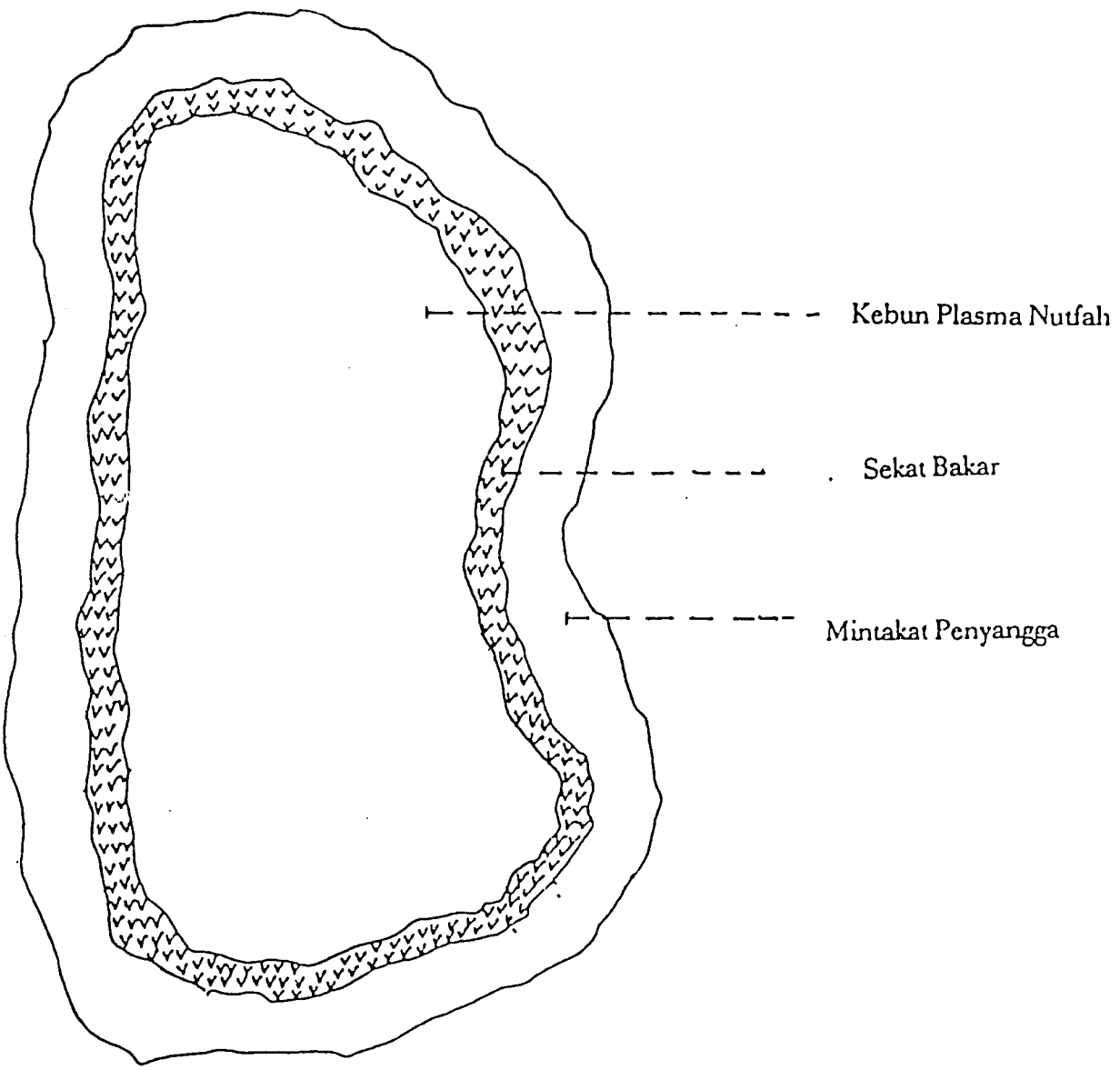
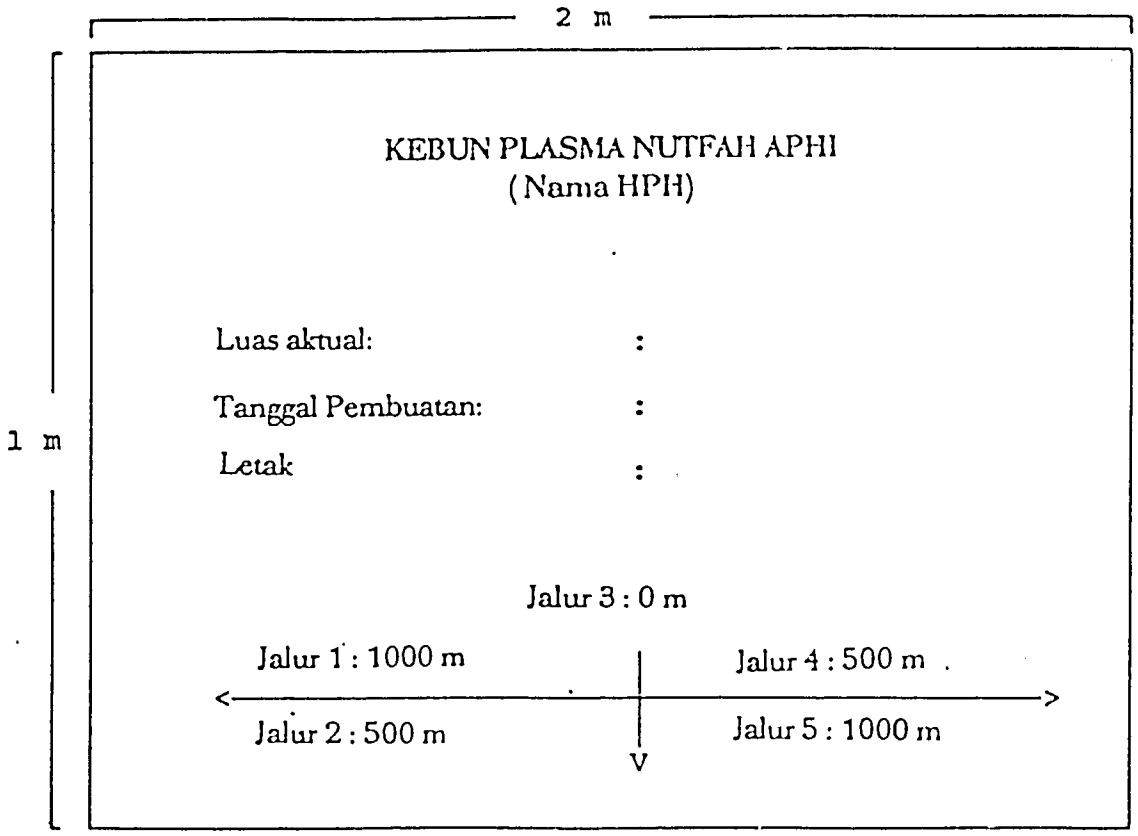
Lampiran 1. Contoh Bentuk pal batas.



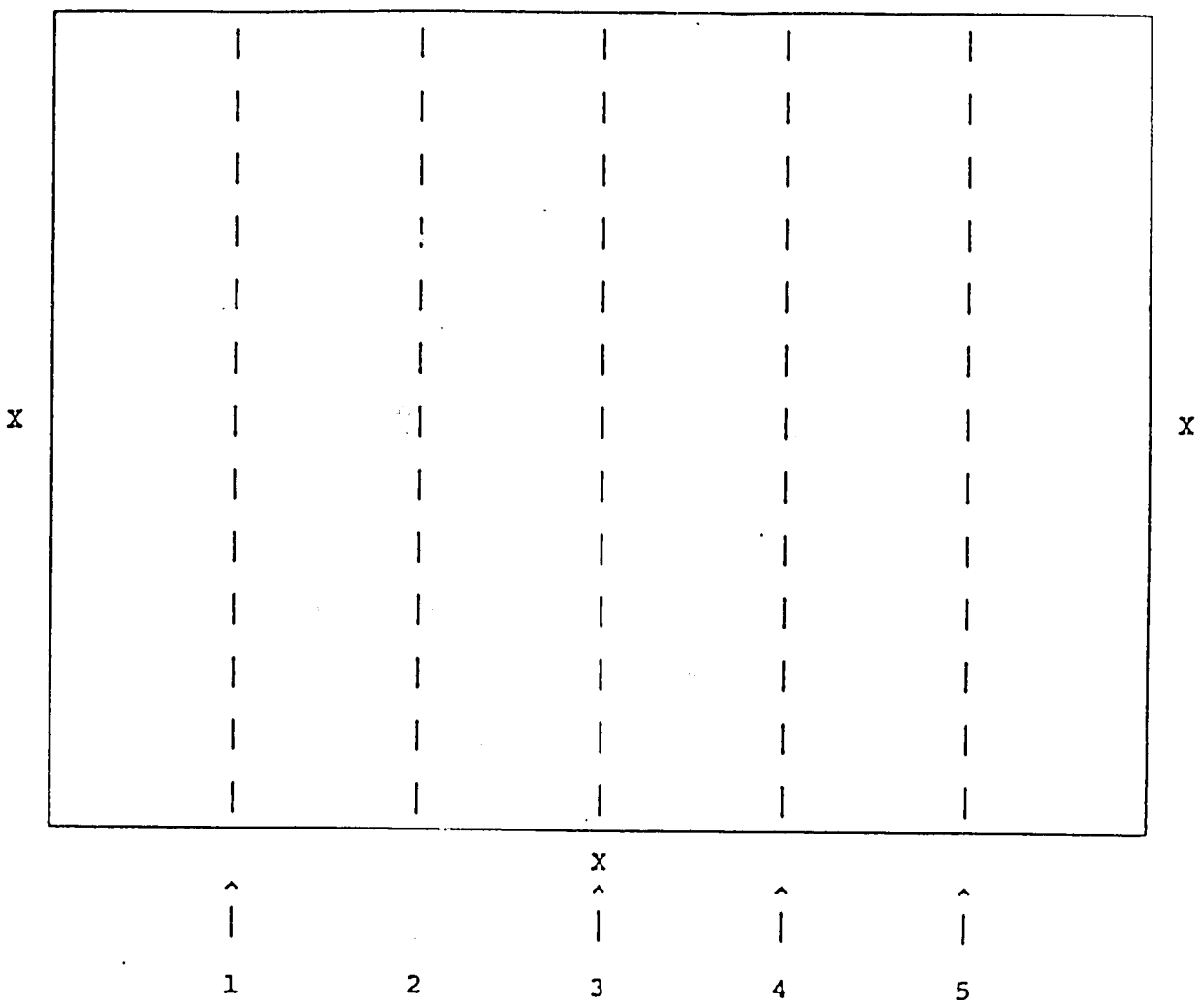
Lampiran 2. Contoh Bentuk Sekat Bakar dan Mintakat Penyangga.



Lampiran 3. Contoh Bentuk Papan Nama

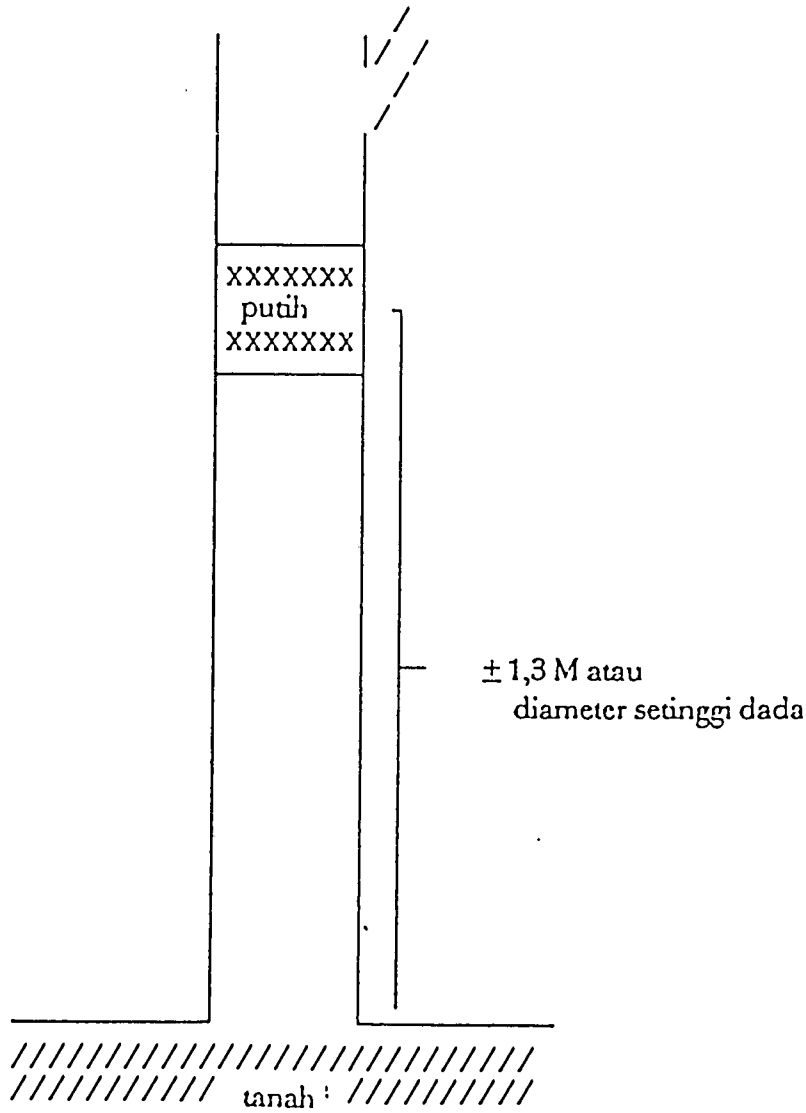


Lampiran 4. Gambar Jalur Inventarisasi




Keterangan: 1,2,3,4,5 = Nomor Jalur
X = Posisi Papan Nama
Jarak antar jalur adalah 1/6 sisi panjang

Lampiran 5. Cara penandaan Pohon Sepanjang Jalur Inventarisasi



Lampiran 6. Contoh Daftar Isian Inventarisasi di Lapangan

Tanggal :

Ulangan ke :

Nomor jalur : 1 2 3 4 5

| No. | Nama Daerah | Nama Latin | Diameter | Tinggi | Keterangan |
|---|---|---|---|---|---|

Lampiran 6a. Contoh Daftar Isian Inventarisasi di Lapangan (Satwa liar)

Tanggal :

Ulangan ke :

Nomor Jalur : 1 2 3 4 5

| No. | Jenis Satwa | Nama Latin | Populasi | Distribusi | Keterangan |
|---|---|---|---|---|---|

Lampiran 7. Contoh Pembuatan Laporan Untuk APHI

LAPORAN PENDAHULUAN/RUTIN
KEBUN PLASMA NUTFAH APHI/(Nama HPH)

Luas Aktual :
Letak :

TABEL INVENTARISASI

Tanggal :
No. Jalur :
Ulangan ke :

| No. | Nama Daerah | Nama Latin | Selang Diameter | Selang Tinggi | Jumlah |
|---|---|---|---|---|---|

Lanjutan Lampiran 7

Pandangan umum Kebun Plasma Nutfah

Kerusakan yang terjadi

Hambatan-hambatan yang ada

Lampiran 7a. Contoh Pembuatan Laporan Untuk APHI (Satwa Liar)

Tanggal :

Ulangan ke :

Nomor jalur : 1 2 3 4 5

| No. | Jenis satwa | Nama latin | Populasi | Distribusi | Keterangan |
|---|---|---|---|---|---|

Lanjutan Lampiran 7 a.

Pandangan umum Kebun Plasma Nutfah

Kerusakan yang terjadi

Hambatan-hambatan yang ada

## Appendix 3: HPH Reporting to APHI

# LAPORAN KEMAJUAN
# PELAKSANAAN KEBUN PLASMA NUTFAH
# PEMEGANG HPH ANGGOTA APHI
# S/D APRIL 1993

SEBAGAI RESPON TERHADAP SURAT APHI :

1. NOMOR 020/APHI/PUSAT/0191 TANGGAL 18 JANUARI 1991
2. NOMOR 515/APHI/PUSAT/0892 TANGGAL 27 AGUSTUS 1992
3. NOMOR 615/APHI/PUSAT/0992 TANGGAL 26 SEPTEMBER 1992
4. NOMOR 652/APHI/PUSAT/1092 TANGGAL 08 OKTOBER 1992
5. NOMOR 053/APHI/PUSAT/0193 TANGGAL 22 JANUARI 1993

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ASOSIASI PENGUSAHA HUTAN INDONESIA
1993

LAPORAN KEMAJUAN
PELAKSANAAN KEBUN PLASMA MUTIAH
ASOSIASI PENGUSAHA HUTAN INDONESIA

| NO. | PROPINSI NAMA PERUSAHAAN HPH | LUAS AREAL SK HPH (HA) | LUAS KEBUN PLASMA MUTIAH (HA) | KEADAAN UMUM | | KETERANGAN |
|---|---|---|---|---|---|---|
| | | | | TOPOGRAFI | KONDISI HUTAN | |
| I. | DI. ACEH | | | | | |
| | 1. PT ALAS HELAU | 133.000 | 930 | DATAR-LANDAI | VIRGIN FOREST KERAPATAN SEDANG | PETA TERLAMPIR |
| | 2. PT ACEH INTI TBK | 115.000 | 300 | BERGELOMBANG | VIRGIN FOREST KERAPATAN SEDANG | PETA TERLAMPIR |
| | 3. PT ACEH PRIMA PLY.IND | 66.000 | 300 | DATAR-BERGELOMBANG | VIRGIN FOREST KERAPATAN SEDANG | PETA BELUM LAPORAN PENDAHULUAN SUDAH |
| II. | SUMATERA BARAT | | | | | |
| | 1. PT CARYA PHARMIN PULAU SIBERUT | 110.000 | 400 | BERGELOMBANG | VIRGIN FOREST KERAPATAN SEDANG | PETA TERLAMPIR |
| III. | RIAU | | | | | |
| | 1. PT BRATA JAYA UTAMA | 100.000 | 400 | DATAR | VIRGIN FOREST KERAPATAN SEDANG | PETA TERLAMPIR |
| | 2. PT MANDAU ABADI | 100.000 | 1.400 | DATAR - RAWA KERING | VIRGIN FOREST KERAPATAN SEDANG | PETA BELUM |
| | 3. PT MANJAK MAKMUR | 91.000 | 1.550 | DATAR-BERGELOMBANG | VIRGIN FOREST KERAPATAN SEDANG | PETA BELUM |
| | 4. PT ROKAN PERMAI TBR | 161.000 | 300 | BERGELOMBANG | VIRGIN FOREST KERAPATAN BAIK | PETA BELUM LAPORAN PENDAHULUAN SUDAH |
| | 5. PT TERAS KAYU HARAPAN | 75.000 | 200 | LANDAI | VIRGIN FOREST KERAPATAN SEDANG | PETA TERLAMPIR |
| | 6. PT UBBI MEKAR | 65.000 | 100 | DATAR | VIRGIN FOREST KERAPATAN SEDANG | PETA TERLAMPIR |
| | 7. PT WANA RIAU SENTOSA | 65.000 | 1.300 | BERGELOMBANG | VIRGIN FOREST KERAPATAN SEDANG | PETA TERLAMPIR |
| IV. | JAMBI | | | | | |
| | 1. PT HEECHING IMB IND. | 120.000 | 300 | BERGELOMBANG | VIRGIN FOREST KERAPATAN SEDANG | PETA TERLAMPIR |
| | 2. PT MUGI TRIMAN INTER. | 165.000 | 300 | BERBUKIT-CURAM | VIRGIN FOREST KERAPATAN SEDANG | PETA TERLAMPIR |

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| NO. | PROPINSI NAMA PERUSAHAAN HPH | LUAS AREAL SK HPH (HA) | LUAS KEBUN PLASMA HUTAN (HA) | KEADAAN UMUM | | KETERANGAN |
|---|---|---|---|---|---|---|
| | | | | TOPOGRAFI | KONDISI HUTAN | |
| V. | SUMATERA SELATAN | | | | | |
| | 1. PT BUMI RAYA UTAMA INO | 130.000 | 300 | DATAR-BERAWA BASAH | VIRGIN FOREST KERA-PATAN JARANG | PETA TERLAMPIR |
| | 2. KURNIA MUSI PLY. INO. | 130.000 | 300 | DATAR-BERAWA KERING | VIRGIN FOREST KERA-PATAN JARANG | PETA TERLAMPIR |
| | 3. PT RINAYAT MUSI | 85.000 | 300 | DATAR-BERAWA BASAH | VIRGIN FOREST KERA-PATAN JARANG | PETA BELUM LAPORAN PENDAHULUAN SUDAH |
| VI. | KALIMANTAN TENGAH | | | | | |
| | 1. PT AJI UBAYA | 65.000 | 400 | DATAR-BERGE-LOMBANG | VIRGIN FOREST KERA-PATAN SEDANG | PETA TERLAMPIR |
| | 2. PT AUSTRAL BYNA | 370.000 | 300 | BERGELOMBANG | VIRGIN YOREST KERA-PATAN SEDANG | PETA TERLAMPIR |
| | 3. PT BARITO P'SIFIK LUM. | 65.000 | 300 | BERGELOMBANG | VIRGIN FOREST KERA-PATAN SEDANG | PETA BELUM |
| | 4. PT BUMI INDAH RAYA | 92.000 | 300 | BERBUKIT KERING | VIRGIN FOREST KERA-PATAN JARANG | PETA TERLAMPIR |
| | 5. PT DAYA SAKTI IBR.CORP | 272.000 | 500 | DATAR-BERGE-LOMBANG | VIRGIN FOREST KERA-PATAN SEDANG | PETA TERLAMPIR |
| | 6. PT DAYA SAKTI KRIDA UNGGUL | 65.000 | 150 | BERGELOMBANG | VIRGIN FOREST KERA-PATAN SEDANG | PETA BELUM |
| | 7. PT DWIMA JAYA UTAMA | 159.000 | 300 | BERGELOMBANG | LOGGED OVER AREA KERAPATAN SEDANG | PETA TERLAMPIR |
| | 8. PT FASS FOREST DEY. | 54.000 | 300 | BERGELOMBANG | VIRGIN FOREST KERA-PATAN SEDANG | PETA TERLAMPIR |
| | 9. PT GENPITA KALTENG | 110.000 | 300 | DATAR | VIRGIN FOREST KERA-PATAN SEDANG | PETA TERLAMPIR |
| | 10. PT GAJAH SENO SAKTI | 53.000 | 150 | DATAR | VIRGIN FOREST KERA-PATAN SEDANG | PETA TERLAMPIR |
| | 11. PT GIAT TKA ANEKA IBR | 81.000 | 300 | DATAR-BERGE-LOMBANG | VIRGIN YORESTS | PETA TERLAMPIR |
| | 12. PT HUTAN DOMAS RAYA | 249.000 | 100 | BERGELOMBANG | LOGGED OVER AREA KERAPATAN SEDANG | PETA TERLAMPIR |
| | 13. PT INDEXIM UTAMA CORP. | 73.000 | 300 | LANDAI-BERBU-KIT | VIRGIN FOREST KERA-PATAN SEDANG | PETA TERLAMPIR [illegible] |

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| NO. | PROPINSI NAMA PERUSAHAAN HPH | LUAS AREAL SK HPH (HA) | LUAS KEBUN PLASMA MUTFAH (HA) | KEADAAN UMUM | | KETERANGAN |
|---|---|---|---|---|---|---|
| | | | | TOPOGRAFI | KONDISI HUTAN | |
| | 14. PT INHUTANI III | 725.000 | 300 | DATAR-BERGE-LOMBANG | VIRGIN FOREST KERA-PATAN SEDANG | PETA BELUM |
| | 15. PT JAYA BINANGUN BUANA | 54.000 | 400 | DATAR | VIRGIN FOREST KERA-PATAN SEDANG | PETA TERLAMPIR |
| | 16. PT KAMAYAN LUMBER | 150.000 | 400 | DATAR-BERAWA BENCAH | VIRGIN FOREST KERA-PATAN SEDANG | PETA TERLAMPIR |
| | 17. PT KARUNIA WANA IKA WOOD INDUSTRIAL | 54.000 | 300 | DATAR-BERGE-LOMBANG | VIRGIN FOREST | PETA TERLAMPIR |
| | 18. PT KARUWAI TIMBER | 65.000 | 300 | BERGELOMBANG | VIRGIN FOREST KERA-PATAN SEDANG | PETA BELUM |
| | 19. PT KEMTAYA KALANG | 40.000 | 300 | DATAR | VIRGIN FOREST KERA-PATAN SEDANG | PETA TERLAMPIR |
| | 20. PT KULUNG BAS SIDI | 98.000 | 600 | BERGELOMBANG | VIRGIN FOREST KERA-PATAN SEDANG POTENSI: 213 PH/HA | PETA TERLAMPIR |
| | 21. PT PALANGKA NUSANTARA | 100.000 | 100 | BERBUKIT | VIRGIN FOREST KERA-PATAN SEDANG-RAWA | PETA TERLAMPIR |
| | 22. PT RATU KIRI | 42.000 | 300 | BERGELOMBANG | VIRGIN FOREST | PETA TERLAMPIR |
| | 23. PT SEBANGAU BESAR | 80.000 | 300 | DATAR | LOGGED OVER AREA KERAPATAN SEDANG | PETA BELUM |
| | 24. PT SETIA ALAM JAYA | 45.000 | 400 | DATAR | VIRGIN FOREST KERA-PATAN SEDANG | PETA TERLAMPIR |
| | 25. PT SINAR BARITO INDAH | 54.000 | 300 | BERGELOMBANG | VIRGIN FOREST KERA-PATAN SEDANG | PETA BELUM |
| | 26. PT SINOO LUMBER | 98.000 | 300 | DATAR-BERGE-LOMBANG | VIRGIN FOREST KERA-PATAN SEDANG | PETA TERLAMPIR |
| | 27. PT SUKA BUDI MULYA | 60.000 | 200 | DATAR-BERGE-LOMBANG | VIRGIN FOREST KERA-PATAN SEDANG | PETA TERLAMPIR |
| | 28. PT TUNGGAL PANENANG | 123.000 | 400 | DATAR-BERBUKIT | VIRGIN FOREST KERA-PATAN SEDANG | PETA TERLAMPIR |
| | 29. PT WIRA SARAYA TAMA | 52.500 | 300 | BERGELOMBANG | VIRGIN FOREST KERA-PATAN JARANG | PETA BELUM |

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| NO. | PROPINSI NAMA PERUSAHAAN HPH | LUAS AREAL SK HPH (HA) | LUAS KEBUN PLASMA MUTFAK (HA) | KEADAAN UMUM | | KETERANGAN |
|---|---|---|---|---|---|---|
| | | | | TOPOGRAFI | KONDISI HUTAN | |
| VII. | KALIMANTAN BARAT | | | | | |
| | 1. PT BATASAN | 143.000 | 300 | BERGELOMBANG | VIRGIN FOREST KERAPATAN SEDANG | -PETA TERLAMPIR -LAPORAN PENDAHULUAN |
| | 2. PT BENUA INDAH | 195.000 | 300 | BERBUKIT | VIRGIN FOREST KERAPATAN SEDANG | PETA TERLAMPIR |
| | 3. PT BUMI RAYA UTAMA W.I | 236.000 | 300 | BERBUKIT | VIRGIN FOREST KERAPATAN BAIK | PETA TERLAMPIR |
| | 4. PT CARUS INDONESIA | 98.000 | 300 | BERGELOMBANG | LOGGED OVER AREA KERAPATAN SEDANG | PETA TERLAMPIR |
| | 5. PT HARJOHN TBR LIMITED | 161.000 | 300 | BERGELOMBANG | VIRGIN FOREST KERAPATAN BAIK | PETA TERLAMPIR |
| | 6. PT. HUTAN MULYA | 80.000 | 300 | BERGELOMBANG | LOGGED OVER AREA KERAPATAN JARANG | PETA TERLAMPIR |
| | 7. PT KARTIKA KAPUAS SARI | 131.000 | 300 | BERBUKIT | VIRGIN FOREST KERAPATAN SEDANG | PETA TERLAMPIR |
| | 8. PT KAWEDAR MUKTI TBR. | 68.400 | 400 | DATAR-BERGELOMBANG | VIRGIN FOREST KERAPATAN SEDANG | PETA TERLAMPIR |
| | 9. PT KAYU PAPA ENTERPRISES | 40.000 | 300 | DATAR | VIRGIN FOREST KERAPATAN BAIK | PETA TERLAMPIR |
| | 10. PT KAYU WAJA | 80.000 | 300 | BERGELOMBANG | LOGGED OVER AREA KERAPATAN SEDANG | PETA TERLAMPIR |
| | 11. PT KAYU PESAGUAN | 182.000 | 300 | LANDAI-BERGELOMBANG | VIRGIN FOREST KERAPATAN SEDANG | PETA TERLAMPIR |
| | 12. PT KURNIA KAPUAS PLY | 75.000 | 300 | BERBUKIT | VIRGIN FOREST KERAPATAN BAIK | PETA TERLAMPIR |
| | 13. PT KUSUMA PERKASA IND. | 80.000 | 300 | BERGELOMBANG | VIRGIN FOREST KERAPATAN SEDANG | -PETA TERLAMPIR -LAPORAN PENDAHULUAN |
| | 14. PT LANJAK DERAS RAYA | 60.000 | 300 | DATAR | VIRGIN FOREST KERAPATAN SEDANG | PETA TERLAMPIR |
| | 15. PT PESADAKAWI ITC | 107.000 | 300 | BERBUKIT | VIRGIN FOREST KERAPATAN BAIK | PETA TERLAMPIR |
| | 16. PT RIMBA RAMIN PONTIANAK | 84.000 | 300 | DATAR | LOGGED OVER AREA HUTAN RAWA KERAPATAN SEDANG | PETA TERLAMPIR |

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| NO. | PROPINSI NAMA PERUSAHAAN HPH | LUAS AREAL SK HPH (HA) | LUAS KEBUN PLASMA NUTFAH (HA) | KEADAAN UMUM | | KETERANGAN |
|---|---|---|---|---|---|---|
| | | | | TOPOGRAFI | KONDISI HUTAN | |
| | 17. PT RIMBA ADIJAYA NUSANTARA | 115.000 | 300 | BERGELOMBANG | VIRGIN FOREST KERAPATAN SEDANG | -PETA TERLAMPIR -LAPORAN PENDAHULUAN |
| | 18. PT SARI BUMI KUSUMA | 66.000 | 300 | BERGELOMBANG | VIRGIN FOREST KERAPATAN BAIK | PETA TERLAMPIR |
| | 19. PT SUKA JAYA MAKMUR | 294.000 | 300 | BERGELOMBANG | LOGGED OVER AREA KERAPATAN SEDANG | PETA TERLAMPIR |
| | 20. PT TAWANG KERANTI | 137.000 | 300 | BERBUKIT | VIRGIN FOREST KERAPATAN SEDANG | PETA TERLAMPIR |
| | 21. PT TRI IKA SARI | 60.000 | 300 | BERBUKIT | VIRGIN FOREST KERAPATAN BAIK | PETA TERLAMPIR |
| VIII. | KALIMANTAN TIMUR | | | | | |
| | 1. PT BELAYAN RIVER TBR | 30.000 | 300 | BERGELOMBANG | LOGGED OVER AREA KERAPATAN SEDANG | PETA TERLAMPIR |
| | 2. PT BULIM TRADING LIMITED | 60.000 | 300 | BERGELOMBANG | VIRGIN FOREST KERAPATAN SEDANG | PETA TERLAMPIR |
| | 3. PT CINTA SATYA PERSADA | 50.000 | 300 | BERGELOMBANG | LOGGED OVER AREA KERAPATAN SEDANG | PETA TERLAMPIR |
| | 4. PT DAISY TIMBER | 67.500 | 300 | BERGELOMBANG | VIRGIN FOREST KERAPATAN SEDANG POTENSI: 213 PH/HA | PETA BELUM |
| | 5. PT DHARMA SATYA NUSANTARA | 100.000 | 300 | BERGELOMBANG | SEDANG DILAKSANAKAN PENATAAN BATAS LOKASI, ANALISIS, DLL. | PETA BELUM |
| | 6. PT GUNUNG GAJAH ABADI | 81.000 | 300 | BERBUKIT-BERGUNUNG | VIRGIN FOREST KERAPATAN SEDANG | PETA TERLAMPIR LAPORAN PENDAHULUAN SUDAH |
| | 7. PT GUNUNG RAYA UTAMA/ KAYU KALIMANTAN | 142.000 | 300 | DATAR | VIRGIN FOREST KERAPATAN SEDANG | PETA TERLAMPIR |
| | 8. PT INHUTANI I HUTAN ALAM BATU AMPAR | 1.777.000 | 1.000 | DATAR-BERBUKIT | LOGGED OVER AREA KERAPATAN SEDANG | PETA BELUM |
| | 9. PT INHUTANI I HUTAN ALAM TANGAP | 500 | 700 | DATAR | VIRGIN FOREST KERAPATAN SEDANG | PETA BELUM |
| | 10. PT INHUTANI I HUTAN ALAM TARAKAN | 500 | 300 | DATAR-BERGELOMBANG | LOGGED OVER AREA KERAPATAN SEDANG | PETA TERLAMPIR |
| | 11. PT JAYA TIMBER TRAD. | 42.000 | 500 | DATAR-BERGELOMBANG | VIRGIN FOREST KERAPATAN SEDANG | PETA TERLAMPIR |

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| | PROPINSI NAMA PERUSAHAAN HPH | LUAS AREAL SK HPH (HA) | LUAS KEBUN PLASMA NUTFAH (HA) | KEADAAN UMUM | | KETERANGAN |
|---|---|---|---|---|---|---|
| | | | | TOPOGRAFI | KONDISI HUTAN | |
| | 12. PT KIANI LESTARI/ GEORGIA PACIFIC | 350.000 | 300 | DATAR-BERGE-LOMBANG | VIRGIN FOREST | PETA TERLAMPIR |
| | 13. PT KUGITRIMAN INTER. | 209.000 | 300 | DATAR-BERGE-LOMBANG | LOGGED OVER AREA KERAPATAN SEDANG | PETA TERLAMPIR |
| | 14. PT MARKATA RIMBA | 68.000 | 300 | BERBUKIT | VIRGIN FOREST KERA-PATAN SEDANG | PETA TERLAMPIR |
| | 15. PT PORODISA | 200.000 | 300 | LANDAI-BERON-BAK | VIRGIN FOREST KERA-PATAN SEDANG | PETA TERLAMPIR |
| | 16. PT SANID TIMBER II | 77.000 | 300 | BERGELOMBANG | LOGGED OVER AREA KERAPATAN SEDANG | PETA TERLAMPIR |
| | 17. PT SUMALINDO LESTARI JAYA IV | 100.000 | 300 | BERGELOMBANG | SEDANG DILAKSANAKAN PENATAAN BATAS LOKA-SI, INVENTARISASI | PETA BELUM |
| | 18. PT SUMALINDO LESTARI JAYA II | 272.000 | 300 | DATAR-BERGE-LOMBANG | SEDANG DILAKSANAKAN PENATAAN BATAS LOKA-SI, INVENTARISASI | PETA BELUM |
| | 19. PT SUMALINDO LESTARI JAYA I | 150.000 | 300 | DATAR-BERGE-LOBANG | SEDANG DILAKSANAKAN PENATAAN BATAS LOKA-SI, INVENTARISASI | |
| | 20. PT TANJUNG ARU ALPINO | 420.000 | 300 | BERGELOMBANG | LOGGED OVER AREA PATAN BAIK | PETA TERLAMPIR |
| | 21. PT TRIWIRAASTA BHARATA | 60.000 | 300 | DATAR-BERGE-LOMBANG | VIRGIN FOREST KERA-PATAN SEDANG | PETA TERLAMPIR |
| | 22. PT MARJOHN TBR LIMITED | 161.000 | 300 | BERGELOMBANG | VIRGIN FOREST KERA-PATAN BAIK | PETA TERLAMPIR |
| IX. | KALIMANTAN SELATAN | | | | | |
| | 1. PT AYA TIMBER | 36.500 | 300 | BERGELOMBANG | LOGGED OVER AREA KERAPATAN SEDANG | PETA BELUM |
| | 2. PT YAYANG INDONESIA | 85.000 | 300 | BERGELOMBANG | LOGGED OVER AREA KERAPATAN SEDANG | PETA BELUM |
| X. | SULAWESI SELATAN | | | | | |
| | 1. PT INTAN PERMATA | 47.000 | 400 | DATAR-BERGE-LOMBANG | VIRGIN FOREST KERA-PATAN SEDANG | PETA TERLAMPIR |

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| NO. | PROPINSI<br>NAMA PERUSAHAAN HPH | LUAS AREAL SK HPH (HA) | LUAS KEBUN PLASMA MUTFAK (HA) | KEADAAN UMUM | | KETERANGAN |
|---|---|---|---|---|---|---|
| | | | | TOPOGRAFI | KONDISI HUTAN | |
| | 2. PT PALAPI TIMBER | 64.000 | 300 | LANDAI-BERGE-LOMBANG | VIRGIN FORESI KERA-PATAN SEDANG | PETA TERLAMPIR |
| | 3. PT SULWOOD | 44.535 | 400 | DATAR-BERGE-LOMBANG | VIRGIN FORESI KERA-PATAN SEDANG | PETA TERLAMPIR |
| XI. | SULAWESI TENGAH | | | | | |
| | 1. PT KEBUN SARI | 300.000 | 300 | BERGELOMBANG | VIRGIN FORESI KERA-PATAN SEDANG | PETA TERLAMPIR |
| XII. | SULAWESI TENGGARA | | | | | |
| | 1. PT BINA MAHAWANA VISE-SA | 120.500 | 300 | BERBUKIT | VIRGIN VORESI KERA-PATAN SEDANG | PETA TERLAMPIR |
| XIII. | SULAWESI UTARA | | | | | |
| | 1. PT SANDI JAYA SATRIA | 50.000 | 300 | BERGELOMBANG | VIRGIN FORESI KERA-PATAN SEDANG | PETA TERLAMPIR<br>LAPORAN PENDAHULUAN SUDAH |
| | 2. PT TEMBARU BUDIPRATAMA | 43.000 | 300 | AGAK CURAM | VIRGIN FORESI KERA-PATAN SEDANG | PETA TERLAMPIR |
| | 3. TUNGGAL AGATHIS I.W. | 55.000 | 300 | CURAM | VIRGIN FORESI | -PETA TERLAMPIR<br>-LAPORAN PENDAHULUAN |
| XIV. | MALUKU | | | | | |
| | 1. PT AGATHIS INDAH WOOD | 125.000 | 300 | BERGELOMBANG | LOGGED OVER AREA PATAN SEDANG | PETA TERLAMPIR |
| | 2. PT BINA LESTARI SAMAK-THA | 62.000 | 300 | BERGELOMBANG - BERBUKIT | VIRGIN FORESI KERA-PATAN SEDANG | PETA TERLAMPIR |
| | 3. PT BRATA JAYA UTAMA | 60.000 | 400 | DATAR-BERGE-LOMBANG | VIRGIN FORESI KERA-PATAN SEDANG | PETA TERLAMPIR |
| | 4. PT GEMA SAKUBARI | 367.000 | 357 | BERBUKIT | VIRGIN FORESI KERA-PATAN SEDANG | PETA TERLAMPIR |
| | 5. PT GREEN DELTA | 124.000 | 300 | BERBUKIT | VIRGIN FORESI KERA-PATAN SEDANG | PETA TERLAMPIR<br>LAPORAN PENDAHULUAN SUDAH |
| XV. | IRIAN JAYA | | | | | |
| | 1. PT BINTUNI UTAMA MURNI WOOD INDUSTRIES | 135.000 | 9.050 | BERBUKIT | MERUPAKAN HUTAN BA-KAU. UNTUK PENGAMAN PANTAI DAN PELINDUNG SUNGAI | PETA BELUM |

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## Appendix 4: References

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