FREEP-GHNP 06/23

Report of Monitoring and Evaluation Consultancy

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As always, I thank the people of the subcontinent for their charm and hospitality. I hope that together we can find the understanding and the strength of mind to protect what is ancient and beautiful here, while allowing everyone to prosper according to their ambitions.

CONTENTS

BACKGROUND

The Forest Research, Education and Extension Project, funded by the World Bank, includes a pioneer initiative aimed at fostering ecodevelopment in villages adjacent to two important protected areas: the Kalakad-Mudanthurai Tiger Reserve (KMTR), in Tamil Nadu, and the Great Himalayan National Park (GHNP), in Himachal Pradesh. In addition to diverting human pressures away from the biological resources of the Protected Areas, the project is intended to strengthen wildlife management within them, especially through improved understanding of the major ecosystems and ways that they are affected by the activities of local people.

Because ecodevelopment is a relatively new concept and its application on the scale envisaged by this project unprecedented in India, it was felt important to monitor carefully the impact of ecodevelopment, both on local people and communities, and on the flora and fauna of the Protected Areas. As no formal biological monitoring schemes were in place in either area, except for censuses of a few species of large mammals (Tiger, Musk Deer), it was necessary to develop such monitoring capacity. This consultancy was intended to provide advice on the best approach and design for such monitoring schemes.

The final choice of monitoring protocols will need to be determined by the parties actually undertaking the monitoring, whether this is the WII itself, or contracting organizations such as universities or local field clubs. In this report, I attempt to lay out a variety of options for monitoring, concentrating at two levels: (i) short term monitoring to be carried out before the termination of the FREE Project and concentrated mainly on indicators of human use, (ii) long-term monitoring to be carried out over at least a decade subsequent to the termination of the project, dealing mainly with important biological indicators, especially those relating to biodiversity (as opposed to charismatic large mammals). In some cases, I suggest detailed protocols, where I believe that my familiarity with the subject will allow. For other types of monitoring, I present broad concepts, the details of which will need to be designed by the investigators themselves.

The ideas and opinions expressed in the report have been developed on the basis of one-week field visits to each of the protected areas (timetable, Appendix 3), during which intensive discussions were held with the biologists involved, as well as discussions with the Principle and Co-Investigators. Because of difficulties with travel (it took up one out of the four weeks of the consultancy), this report has been prepared over a relatively short period. Hence, recommendations are necessarily preliminary and tentative. I suggest that they be read as guidelines, rather than firm prescriptions.

GREAT HIMALAYAN NATIONAL PARK

The progress of the overall ecodevelopment project in the Great Himalayan National Park has been different from KMTR: the biological studies are further ahead in GHNP, but the ecodevelopment planning and execution appears to have got off to a much slower start (Pabla 1996, Report of the Workshop on mid-term review proposals, FREEP-GHNP, March 1997). With only two years left for the project to run, it appears that some priorization is required if anything is to be achieved by 1999. Consequently, with the concurrence of B.M.S. Rathore, principal investigator, and those co-investigators with whom I was able to discuss the issue (Drs. S. Sathyakumar and G.S. Rawat, P.K. Mathur), I narrowed the focus of the consultancy to developing a priorization of biodiversity values within the GHNP, as a prelude to targeting specific areas and their customary users for accelerated negotiation and support under the ecodevelopment programme. Subsequent review of the information provided by the research team suggested that such a priorization was premature at present. Instead, I concentrated on developing a strategy for a monitoring programme linked to the ecodevelopment work.

DeCoursey (1997), in her consultancy report on the medicinal plant trade in GHNP, set out numerous recommendations for the management of this trade in GHNP. I have attempted to tailor my recommendations with hers, so that an integrated approach that recognizes the constraints and opportunities inherent in the current plant-collection situation can be adopted. Unluckily, I was unable to discuss these issues with the socioeconomics researcher, P. Chaudury, because our paths never crossed. However, I obtained substantial information on socioeconomic aspects from B. Mehra and S. Singh, as well as from M. DeCoursey's report and from discussions with her, and from the report of Dr R. Tucker ("The historical development of human impacts on the Great Himalayan National Park").

TIMING OF BIOLOGICAL MONITORING

Among the research team, K. Ramesh and B. Mehra do not plan to provide monitoring recommendations until they complete their projects. T.R. Vinod proposes to develop monitoring recommendations for mammals by September 1998, allowing a year for initiating monitoring and training Park staff. I endorse this approach. I think it is essential that at least one monitoring period include an overlap between WII project biologists and Park staff. I strongly recommend that final methods for all ongoing biological monitoring be defined by autumn 1998 so that training and fine tuning can be carried out.

DEVELOPING A BIOLOGICAL MONITORING STRATEGY FOR GHNP

The strategy for monitoring was developed as follows:

1. Selection of species and communities for monitoring

Animals and plant associations to be monitored were identified on the following criteria:

a. Biodiversity value: importance of GHNP populations/ecosystems to Indian and World populations/ecosystems;

b. Feasibility: how easy will it be to carry out meaningful monitoring (i.e. availability of techniques that could yield reproduceable results and which could be performed by GHNP staff);

c. Vulnerability to human activities (grazing, plant collecting, etc..);

d. Ecodevelopment potential: likelihood that such activities may be affected by ecodevelopment initiatives.

2. Selection of monitoring areas

No final selection of areas is proposed here, pending further information (see below). Monitoring areas of two types are to be selected:

a. Those where the organisms of interest are likely to be affected by changes in human use patterns resulting from ecodevelopment initiatives;

b. Control sites where no impact is expected as a result of ecodevelopment.

3. Selection of monitoring methods

These were selected on the basis of simplicity and precision.

4. Selection of timing

Timing was defined on the basis of:

a. Accessibility at different seasons;

b. Suitability in relation to phenology;

c. Adjustments in relation to other monitoring activities, so that an annual timetable can be established without creating an unrealistic workload for the staff.

1. Animals and plant associations to be monitored

In this section I set out choices, based on the discussions held with the WII biologists, and on opinions derived from my own field experiences in GHNP and elsewhere in the Western Himalayas. A simplified format for decision-making on biological monitoring priorities is provided in Table 3. Explanations and discussion follow. The final selection rests with the project team, especially Dr V.P. Unniyal and the PIs. I expect that my suggestions will be modified as more information becomes available over the next year.

Numerical values for Table 3 assigned as follows:

Importance: 1 = common elsewhere in India; 2 = rare in India, common globally; 3 rare in India and elsewhere; 4 = rare, endemic to W Himalayas. **Feasibility**: 1 = difficult; 2 = possible; 3 = easy. **Vulnerability**: 1 = low; 2 = medium; 3 = high. **Ecodevelopment**: 1 = not likely to be affected; 2 = possibly affected in the long-term; 3 = possibly affected in the short-term. **Score**: sum of other four categories; higher score indicates higher priority for monitoring.

a: based on Collar et al. 1994; Singh et al. 1990; Gaston and Garson 1992

b: based on proportion of endemics, and rareness of ecosystem type

b: a composite ranking based on the following species: Lammergeyier, Golden Eagle, Black Eagle, Himalayan Griffon Vulture, Mountain Hawk-Eagle.

Notes on the decision format for biological monitoring

Alpine meadows (score, 11)

Highest total score for monitoring priority. They are ranked high for biodiversity value because of the large number of Himalayan endemics and medicinal herbs becoming rare because of over-harvesting (Tandon 1996, DeCoursey 1997). This ecosystem is heavily affected by grazing and plant collecting and has to be a primary target for ecodevelopment efforts. However, monitoring of botanical diversity will be difficult, as it requires some botanical expertise. The involvement of the G.B. Pant Institute, or similar organization, should be explored.

Subalpine scrub (10)

Similar to alpine meadows, but probably lower in endemic plants (S. Singh). Juniper is thought to be on the way to extirpation within the Park (Singh and Vinod 1997). Monitoring of rhodedendron and juniper cover can be monitored using long-distance photography (see methods). Plant species diversity will require specialist knowledge.

Table 3. Suggested decision format for biological monitoring in GHNP.

Taxon or association	Biodiversity value[a]	Feasibility	Vulnerability to human activities	Ecodevelopment potential	Score
Vegetation:					
Alpine meadow	4[b]	1	3	3	11
Subalpine scrub	3	1	3	3	10
Thach in forest	3	2	3	1	9
Temperate forest >2500 m	3	1	2	1	7
Temperate forest <2500 m	3	1	3	1	8
Animals					
Bharal	1	2	2	2	7
Tahr	3	2	3	2	10
Goral	1	3	1	1	6
Musk Deer	3	2	3	2	10
Brown Bear	2	2	2	2	8
Black Bear	3	2	2	2	9
Leopard	1	2	1	1	5
Monal	1	3	2	2	8
Koklass	1	3	1	1	6
Western Tragopan	4	2	2	2	10
Birds of prey	2[b]	3	1	1	7

Thach in forest (9)

The main question for these forest-zone meadows is whether they are expanding, stable, or contracting. There is general agreement that these forest openings enhance biodiversity by increasing ecotones, hence no ecodevelopment or other management iniatives that would eliminate grazing from these meadows altogether should be initiated without careful thought. Monitoring the extent of these meadows, both by long-distance photography, and by examining evidence of advance or retreat at the margins, is important for their future management. Because many herds pass through most of the significant thach in forest (e.g. Shilt, Nara, Kolipoi) en

route for the alpine zone, the elimination of a few grazing herds by settlement of rights will not eliminate grazing from any of these meadows.

Temperate forests (upper,7; lower, 8)

Lower altitude forests tend to be less affected by grazing and plant collection than those at higher altitudes: otherwise the values are the same for the two altitude zones. Monitoring methods for these vegetation zones will need careful design. Sampling carried out so far has mainly been along recognized trails, which are used by grazing herds on migration (S. Singh). The difficulty of relocating any study plot not placed on such trails probably means that monitoring will have to be conducted at the same sites. We need to recognize that such sites may not be representative of the vegetation as a whole.

Bharal (7)

Bharal are not common in GHNP and a much larger population exists in the adjacent Pin Valley NP. Because of their very high altitude habitat the species is probably less disturbed by humans than the other ungulates, and as it lives in treeless areas, snares are unlikely to be effective. Hence, monitoring this species rates a lower priority than some other ungulates. However, scanning for flocks in the alpine zone in September is relatively easy and could be done in conjunction with monitoring Brown Bears.

Tahr (10)

The Himalayan Tahr is one of the most important large mammals in the Park, from a conservation perspective (Gaston 1986). As it stays partly in the temperate forest zone, where ecodevelopment initiatives look unlikely to have much impact, there is little chance that ecodevelopment will assist this species. However, it is a secondary target of poachers after Musk Deer and should be monitored to assess the impact of anti-poaching measures. It seems to be very susceptible to human disturbance, but can be monitored effectively with a minimum of disturbance by distant scanning from fixed points.

Goral (6)

A common species, widespread in nearly every forested area of Himachal Pradesh and apparently capable of co-existing with heavy human disturbance. Although it can be readily monitored using pellet counts, it probably rates low priority.

Musk Deer (10)

A threatened species, heavily hunted for its musk, although still found in many parts of the Western Himalayas in reduced numbers. Monitoring in GHNP has been carried out for several years using the “silent drive” method. This method probably provides an effective index of population size, although it is always a minimum estimate of the numbers present, because even on the best organized drive, some animals may slip back through the line of drivers. However, silent drives do cause substantial disturbance, and require the mobilization of large numbers of assistants. The method is very expensive to carry out in remote areas because of the logistics involved. We badly need an alternative method for monitoring this species.

Brown Bear (8)

Although very widespread, the Brown Bear has become rare in the Himalayas. It seems to be susceptible to disturbance, although individual bears may become accustomed to human activities. Elsewhere, Brown Bear require very large home ranges (no information for the Himalayas). Monitoring can be done by distant scanning, and combined with similar watches for Bharal.

Himalayan Black Bear (9)

Commoner than Brown Bear in Himachal Pradesh, but with a smaller distribution world-wide. Can be monitored by counts of signs and droppings along trails, along with leopard and goral.

Leopard (5)

Widespread throughout the Himalayan front-ranges, apparently easily habituated to people and difficult to monitor - low on the priority list.

Monal (8)

Listed as threatened by Singh et al. (1990), but rather common in limited areas of Himachal Pradesh and Uttar Pradesh. Very easily disturbed by people, although in the Khumbu area of Nepal, where they are protected by religious sentiment, they are very tame. Easily monitored by a variety of techniques. Gaston and Garson (1992) argued that Monal were a suitable indicator species to monitor disturbance in temperate Himalayan forests.

Koklass (6)

Common and widespread throughout Himachal Pradesh above 2000 m and the easiest of all pheasants to monitor, on the basis of call-counts (Gaston 1981). Low priority, but can be monitored in conjunction with Western Tragopan.

Western Tragopan (10)

Listed as threatened by Collar et al. 1994 and confined to the Western and North-western Himalayas. One of the major threats to it during breeding is the penetration of its habitat by *gucchi* collectors with their dogs. As this threat is unlikely to be reduced by any conceivable ecodevelopment initiatives, at least in the next few years, there is little likelihood that we shall see any changes in status through the intervention of the ecodevelopment project.

Birds of prey (7)

Several species of birds of prey are listed by Singh et al. (1990) as threatened, among them Golden Eagle and Lammergeyier. Both species are widespread in Asia and Europe, but occur at very low densities (Newton 1980). The Black Eagle is rare in the Western Himalayas, but is common in the Central Himalayas and Western Ghats (Ali 1968, Inskipp and Inskipp 1988). Although low on the monitoring priority score, watches for soaring birds of prey could be combined with distant scans for ungulates, especially Tahr.

SELECTION OF MONITORING AREAS

Most of the research so far has been concentrated in Tirthan and areas around Dela Thach in Sainj. It is believed that the best populations of pheasants and large mammals are in Tirthan (K. Ramesh, T.R. Vinod), as well as the best preserved vegetation (S. Singh). Consequently, it seems sensible to concentrate monitoring activity in that area. In addition, because some of the forest staff are elderly or otherwise unable to cope with arduous work in remote areas, it would enable the Director to concentrate his younger, fitter staff in this area so that those best able to conduct monitoring would be concentrated in one area.

Alpine meadows

Rather than recommending specific areas now, I suggest the following strategy:

1) In conjunction with Park staff, conduct interviews and workshops with graziers to explore possible incentives that would allow a settlement with one or two right-holders.

2) If this can be achieved, announce immediate closure of the customary alpine grazing meadows used by those accepting a settlement (those meadows where they camp permanently during the summer, not those used en route).

3) Identify vegetation monitoring sites on the closed meadows, and on adjacent meadows still being grazed (control sites), matched as closely as possible for altitude, slope and aspect.

4) For the first few years, at least, the Park staff should patrol the closed areas as often as possible, to ensure that no one camps on them (some encroachment by remaining herds cannot be prevented, probably).

5) Examine information on the villages using different alpine meadows for medicinal plant collection (S. Singh has this information for many meadows), and identify meadows where only a small number of villages are involved (target meadows).

6) Initiate accelerated village level workshops (stakeholder workshops of DeCoursey) to create joint managment of those target meadows, involving limitations on collections (either amount or size/age class) and rotational closures.

7) As for grazing, select appropriate control meadows.

SELECTION OF MONITORING METHODS

These are likely to be refined as the biological work proceeds. My recommendations are based on the idea that only limited time will be available to Park staff for monitoring and on the priorizations recognized in Table 3.

Encouter rate estimates along prescribed routes and counts of droppings

These methods are being used at present for pheasants and ungulates.They can be combined in a single set of surveys if two people work together, the first recording sightings, and the second (staying always a little behind) recording droppings. This technique is best used in the forest zone and will yield monitoring data for Monal (sightings), Goral, Himalayan Tahr, Leopard and Black Bear (droppings). Routes and methods have already been selected by the research team (K. Ramesh, T.R. Vinod). These methods can be applied at any time of year when trails are negotiable.

Call counts

Counting of calling pheasants in spring is the standard technique for monitoring Koklass and Western Tragopan and is being practiced by K. Ramesh at present, using fixed listening points. The main constraint on this method is the need to get observers into place before dawn, so it

is best carried out adjacent to camping sites, or where good trails that can be safely negotiated in the dark are available. April and May are the best months for this method, but if snow conditions permit, March is also good.

Scanning from a fixed point

This method is being used by T.R. Vinod to monitor Himalayan Tahr, using selected watching points. It has the great advantage that it causes minimal disturbance to wildlife, but it is very dependent on observer acuity and motivation. Observers should work in pairs to reduce "wishful thinking" observations. Substantial training of Park staff by WII researchers is probably required if this technique is to be used effectively.

It is important that scans are made from exactly the same point each time, as even a few metres shift can obscure parts of the area to be scanned, while bringing others into view. Season and time of day should also be standardized. Watching points should be clearly marked with rock pillars, and the area to be scanned marked on a photo-enlargement. All animals observed should be recorded, but whether inside or outside the count area should be noted. The distance from watching point to count area will vary, but ranges up to 500 m are acceptable if binoculars are used. Longer distances may be possible using a spotting 'scope. A protocol for scanning should include fixed rest periods, as observer fatigue sets in after some time. A series of 10-minute watches, separated by 5-minute rest periods has proved suitable under certain conditions. The method is useable at any season, provided watch points are accessible, but may be of limited value during the rains, owing to mist obscuring visibility.

Scanning may also be useful for Bharal and Brown Bears on alpine meadows, and for eagles and vultures at all altitudes. The scanning area for birds of prey will be different from that used for mammals. Alternating periods of mammal and bird-of-prey scans are possible. Alternatively, a period of scanning for mammals, best seen early in the day (e.g first 2 hours after dawn), can be followed by a period scanning for birds of prey (2-3 hours after dawn), which become most active only after the sun begins to create thermals for soaring.

Timing of monitoring

Snow lies deeply above 3000 m from November to April, making most of the subalpine and alpine areas inaccessible during that period. In addition, travel to remote parts of the Park during the rainy season is hazardous (WII team). Consequently, most monitoring of the subalpine and alpine zones must necesarily be conducted during May and June, or in September and October. As many plants do not flower until the rains, botanical work in the remoter parts of the Park will need to be mainly carried out in September.

Areas below 3000 m may be accessible in November, and from March onwards, depending on aspect (South faces clear rapidly) and the weather conditions that year. Some monitoring of the temperate forest zone is certainly possible from March to November. Bad weather, low temperatures and short days make the December and January unsuitable for any kind of monitoring in the Park. Table 5 sets out a tentative timetable for biological monitoring in GHNP, including the medicinal plant monitoring suggested by DeCoursey (1997).

Monitoring activity	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Forest zone												
Encounter rate and dropping transects			10		5	10					10	
Scanning for Himalayan Tahr, birds of prey			5		10	5					10	
Pheasant call counts			6	10	6							
Vegetation monitoring						6			6			
Gucchi *monitoring*					10	10						
Subalpine and alpine zones												
Silent drives for Musk Deer					8				4	4		
Scanning for Bharal, Brown Bear and birds of prey									8	6		
Vegetation monitoring									12			
Medicinal plant monitoring									10			

OTHER BIOLOGICAL MONITORING THAT COULD BE CONSIDERED

Collection-per-unit-effort statistics for medicinal plants and *gucchi*

Harvest-per-unit-effort is widely used in tracking the status of harvested populations, especially fish stocks. The theory is that, if harvest has a linear relationship with effort, then the amount harvested in a given time should be a function of the density of the resource. This model probably fits the situation for harvesting *gucchi* and some medicinal herbs fairly well, as the collection is based on random searching of suitable habitat. It would also give the harvesters a role in monitoring the resource that they depend on.

Monitoring harvest-per-unit-effort will require the cooperation of villagers, and could be built into any cooperative joint management scheme that is developed. The basic requirement is for each collector (it does not need to be all collectors, but should not be too biassed with

respect to age/experience) to record the amount of time spent in collecting (number of hours in suitable habitat would be best, number of days would be adequate), and the amount of plant material collected (number of individual morels or plants would be best, for-sale weight would be adequate).

These data could possibly be collected by interviews after the event, but to involve the villagers more closely, issuing them with callenders on which they record hours in the field each day and amounts collected might be useful. Note that this does not involve enquiring where they did their collection. The assumption is that each collector will always seek to maximize their rate of collection, and hence try the best patches they know. It is important not to ask for information on where the morels were collected, as this may scare people away by asking them to reveal their own special localities.

Birds other than birds of prey and pheasants

The GHNP supports populations of several birds that are rare, or at the limits of their range (Large-billed Mountain Thrush, Hodgson's Shortwing, Little Pied Flycatcher) and ongoing monitoring of bird communities could be valuable. However, identification of small birds requires skill and experience. The involvement of outside agencies (amateur naturalist groups, etc..) would probably be necessary. As many visitors to the Park are likely to be keen birdwatchers (especially foreigners), the staff may be able to obtain some ongoing information on the bird populations by requesting information at the time that permits are issued. Visitors agreeing to collaborate could be asked to record details of dates and localities for all rare species encountered.

The production of a check list of known and possible bird species in GHNP and adjacent areas would be a very useful tool for enhancing information on smaller birds and would provide a format for standardized recording. If tourist groups were provided with two lists they could be asked to hand in one at the relevent guard post on leaving the Park. A tentative format is given in Table 3.

This type of monitoring is crude, but has the advantage that it does not involve the staff in any field work and it makes use of the birdwatching skills that many visitors are likely to possess. The Canadian Wildlife service uses a similar scheme to keep track of birds in the enormous areas of Northwest territories, where the resident population of about 100,000 people is spread over an area larger than India. Tourists often visit areas where no one else goes and provide information that would otherwise be expensive to collect.

Using tourists to collect biological data could also be extended to large mammal sightings, especially where corroborated by local guides. The opportunities need to be explored within

the framework of a general policy for ecotourism in the Park.

Table 4 : Check-list format for bird species in Himachal Pradesh that could be handed to birdwatching tourists with a request to provide details of those seen or heard.

Observers:
Contact address for further information:
Dates of trek:
Itinerary: Day 1 Day 6
Day 2 Day 7
Day 3 Day 8
Day 4 Day 9
Day 5 Day 10

Species	1	2	3	4	5	6	7	8	9	10
Lammergeyier										
Golden Eagle										
Black Eagle										
Himalayan Griffon Vulture										
Besra Sparrowhawk										
Common Buzzard										
Long-legged Buzzard										
Hen Harrier										
Himalayan Wood Owl										
Himalayan Jungle Owlet										
Collard Scops Owl										
Short-eared Owl										
Jungle Nightjar										
Monal										
Koklass										
Cheer Pheasant										
Western Tragopan										

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APPENDIX 1

Pilot project selection sites (from M.A. DeCoursey, "Taming the Wild Plant Trade in Great Himalaya National Park, India" A report submitted to the Wildlife Institute of India, Dehra Dun and Winrock International, Morrilton, Arkansas USA, November 1997)

Essential conditions for choosing pilot project sites:

1. Village must be located in or near large block of forest/thach containing (or previously containing) significant biodiversity values.
2. Village must be permanent and not subject to significant out-migration or in-migration.
3. There appears to be interest and demand for collaborative work in the village for wild plant management and value-addition.
4. There appears to be a willingness to accept responsibilities and share costs associated with potential joint activities, including protection and enforcement.
5. Village claims to a customary use area must have a legal or historical basis, and not conflict or contradict the claims of neighboring villages.
6. There appears to be consensus across the range of interest groups within the village that a project is welcome.
7. There is reasonable year-round access to the village
8. There are no physical or social impediments that are unavoidable and would prevent the project from working safely in a open, relaxed, and participatory manner.
9. Priority given to villages high in the catchment with less arable land and thus less options for agricultural improvements

Comparative Studies vs. Permanent Plots

Comprehensive population studies of commercial species present many challenges to researchers given the lack of site security and the extensive exploitation with has already taken place. Exclosures and permanent plots, while preferred, are best suited to areas where collection pressures are low or where local users have agreed to not disturb them. Comparative studies may be more useful, providing data on population size and viability according to habitat and use history/intensity.

Since the main biotic pressure currently comes from over-exploitation, it is the harvesting variable, as opposed to grazing, that should be the focus of study. The actual effect of grazing is more difficult to tease out because of the confounding effects of the commercial harvest.

An example of a comparative study is to measure population size and vigor (including # of inds., regeneration, and age classes) in areas of three collection intensity classes in the same ecological community type. Collection intensities can be divided into three classes: high (every year, many people), medium (fewer people, less often) and low (rarely collected, too remote or inaccessible). These should be conducted in areas with roughly the same amount of grazing pressure.

Assessing the impact of extraction on target plant populations (Hall and Bawa 1993)

The third method is actually a nested set of methods used to determine distribution and abundance of a single species, to measure effects of harvesting on population dynamics, and to assess the sustainability of extraction. The methods can easily be adapted to temperate forest species even though they were originally developed for tropical areas. The main components are Sustainability Assessment, Sampling for Distribution and Abundance, Determining Effects of Harvesting though Rapid Assessment, and Long Term Assessment (Appendix 5).

Permanent Plots to Determine Ecological Requirement, Monitor Productivity, Experiment with Treatment for Wild Mushroom (Villarreal and Gomez 1997)

Plots should be established in fairly accessible areas as they need to be visited frequently, especially during the growing season. Two 1 ha plots (50x 200m) should be established in each forest type. In each plot, a 10x10 meter area should be marked and subdivided into four 5x5 subquadrants. The subquandrants should be fenced with barbed wire to keep out large animals. Samples should be collected on a regular basis in each plot over a period of four years (weekly in each plot during the rainy season). One plot can be used as a control/ baseline, the other used to monitor the effect of different treatments.

APPENDIX 2

Latin names of plants and animals refered to in the report

Plants

Yew *Taxus baccata*

Morel (Gucci) *Morchella* spp.

Mammals

Bharal *Pseudois nayar*

Brown Bear *Ursus arctos*

Goral *Nemorhaedus goral*

Himalayan Black Bear *Selenarctos thibetanus*

Himalayan Tahr *Hemitragus jemlahicus*

Leopard *Panthera pardus*

Musk Deer *Moschus moschatus*

Birds

Black Eagle *Ictinaetus malayensis*

Golden Eagle *Aquila chysaetos*

Himalayan Griffon Vulture *Gyps himalayensis*

Koklass *Pucrasia macrolopha*

Lammergeyier *Gypaeetus barbatus*

Monal *Lophophorus impejanus*

Mountain Hawk-Eagle *Spizaeetus hodgsoni*

Western Tragopan *Tragopan melanocephalus*

APPENDIX 3

Timetable for the consultancy

1 Nov	Travel, Ottawa-London
9 Nov	Travel, London-New Delhi
10 Nov	New Delhi, meet Winrock representatives, try to sort out encashment of advance for per diem (could not be done, because of administrative problem).
11 Nov	Travel, New Delhi - Kalakad-Mudanthurai Tiger Reserve (arr. 7 pm)
12 Nov	Habitat orientation, dry deciduous forest type
13 Nov	Inspection of forest areas in Mudanthurai sector of the buffer zone (Mel Manimutthar), accompanied by members of the inventory team (Ronald, Jayanti Roy) and Mr Sugato Dutt (Joint PI)
14 Nov	Inspection of forest areas in northern sector of the buffer zone (Kadayam Dam, Kardananadi Dam), accompanied by Jayanti Roy.
15 Nov	Workshop on research and monitoring under the FREE Project (morning); travel to WII Field Station at Shingleterri, in the southern (Kalakad) part of the sanctuary (afternoon), arriving 7 pm.
16 Nov	Inspection of evergreen forest areas around WII Research Station, accompanied by T.R. Shankara-Raman (student at IISc, Bangalore)
17 Nov	Inspection of evergreen forest areas around WII Research Station, ccompanied by T.R. Shankara-Raman
18 Nov	Travel from KMTR to New Delhi (arrive midnight)
19 Nov	Travel from New Delhi to Dehra Dun, arriving 12.30 pm, meet Winrock Coordinator, Dr. K.C. Govil, make financial arrangements, discuss project with WII Director, Mr. Mukherji
20-22 Nov	Discussions with FREE Project biologists and investigators and review of project reports to date
23 Nov	Delhi (holiday)
24 Nov	Discussions with S.K. Pande, prospective principle CCF, Himachal
25 Nov	Planned, but flight cancelled.
26 Nov	Leave Delhi at 5 am, travel by road to Mandi (arive 7 pm)
27 Nov	Arrive at Banjar (11 am) and conduct discussions with WII biologists, Dr. Uniyal, T.R. Vinod, K. Ramesh and Badrish Mehra.
28-29 Nov	Field visit to Great Himalayan National Park with Dr. Unniyal
30 Nov	Travel to Shamshi; discussions with Nargesh Guleria, Great Himalayan Nation Park Director
1 Dec	Travel to Shimla to meet Dr Virinder Sharma, H.P. Council for Science Technology and Environment and Mr G.C. Gupta, Principal Chief Conservator
2 Dec	Travel to Dehra Dun (arrive 8.30 pm)
3-5 Dec	Discussions with investigators, report completion