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PART II

Statutory Notifications (S. R. O.)

GOVERNMENT OF GILGIT-BALTISTAN
LAW AND PROSECUTION DEPARTMENT
(Gilgat-Baltistan Secretariat)

NOTIFICATION

Gilgit, the 10th July, 2024

GILGIT-BALTISTAN FOREST WORKING PLAN CODE-2022
(For Sustainable Management of Forests, Biodiversity, Wildlife and NTFPs)

S.R.O. No. 2245(I)/2024.PREAMBLE.—The Government of Gilgit-Baltistan, Conscious of the intrinsic value of forests, biodiversity, wildlife and Non-Timber Forest Products (NTFPs) and their crucial role for the well-being of humanity on account of their provisioning services, regulating services, supporting services, and various ecological, genetic, social, economic, scientific, educational, cultural, recreational and aesthetic values;

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Noting that forests and other renewable natural resources provide foundations for life on earth through ecological functions, by regulating the climate and water resources and by serving as habitats for plants and animals; they also furnish a wide range of essential goods such as wood, food, fodder and medicines, in addition to opportunities for recreation, spiritual renewal and other services.

Conscious also of the importance of forests and biological diversity for evolution and for maintaining life sustaining systems of the biosphere;

Conscious further of the fact that today forests are under pressure from increasing demands of land-based products and services, which frequently leads to the conversion or degradation of forests into unsustainable forms of land use. When forests are lost or severely degraded, their capacity to function as regulators of the environment is also lost, increasing flood and erosion hazards, reducing soil fertility and contributing to the loss of plant and animal life. As a result, the sustainable provision of goods and services from forests is jeopardized.

Determined to conserve, develop and sustainably manage forests and biological diversity for the benefit of present and future generations.

Desiring to enhance and complement the existing management planning arrangements for the protection, conservation, development of forests and for biological diversity and sustainable use of its components,

And, in response to the growing demand for reliable information on forest and tree resources at Gilgit-Baltistan level, the Government of Gilgit-Baltistan initiated an activity to provide support to the regional forest monitor in grand assessment (RFMA) by establishing a Working Plans Forest Circle (WPFC) within its set-up of Gilgit-Baltistan Forests, Wildlife and Environment Department. The support of WPFC besides the preparation of Forest Working Plans includes developing a harmonized approach to regional forest monitoring and assessments, information management, reporting and support to policy impact analysis for regional and national level decision-making,

Taking stock of the fact that the purpose of the WPFC initiative, inter alia, is to introduce a programmatic approach designed to generate cost-effective

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information on forests and trees outside forests, including all bene and users of the resources and their management. Special atte placed on monitoring the state and changes of forests, and on their economic and environmental functions. Another main objective is to regional capacities and harmonize methods, forest related definitions classification systems for forest and other natural resources planning in province.

Noting that in Gilgit Baltistan, hitherto, private forests were being manag through working schemes on need basis till the year 1998. Documentati and data collection work was commenced during the year 1998 by M Muhammad Iqbal, Divisional Forest Officer, Gilgit-Baltistan Fore Department. Mr. Gani-ur-Rehman, a retired Chief Conservator of Fores from Khyber Pakhtunkhwa, was engaged as an advisor and was Ex-offici Chief Conservator of the Forests. He was the over-all in-charge an supervising the activity. Federal Government, on the directives of Federa Cabinet, through its letter No. F.5-3/2000-F-I dated 23rd December, 200(directed the concerned authorities to manage the Gilgit-Baltistan privat forests under integrated working plans instead of need based working schemes.



Cognizant of the fact that in recent years there has been paradigm shift in the policy and approach to the forestry sector both nationally and internationally. The focus has shifted from timber harvesting to environmental stability, biodiversity monitoring and management, restoration of ecological balance of the disturbed areas, protective function of the forest resource and other socio-economic benefits based on Non Wood Forest Products (NWFP).

Further cognizant of the fact that climate change phenomenon seriously affects and alters the distribution, type, composition, quality and mitigation potential of forests of the country especially in realm of non-climatic anthropogenic stressors.

Aware of the fact that involvement of forest fringe communities living close to forests in protection and management of forest resources and sharing of usufructs through micro-plan and eco-development plan has become imperative and must find linkage to the working plan. Working plan preparation should also capitalize on the gains of new space based technological advancements like remote sensing, GIS, GPS, computational & analytical systems at hand for real time monitoring of forests dynamics.

Consequent to the directions given by the federal cabinet with regard to ensuring of restocking/regeneration of any forest area before taking it up for any kind of felling as per the valid working plan duly approved by the designated authority and prepared in light of guidance of an appropriate Working Plan Code, it has thus become necessary to prepare and adopt a Working Plan Code.

Whereas, now it is expedient to develop a practical approach designed to generate cost-effective information on forests and trees outside forest areas,

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including all benefits, uses and users of the resources, and their planning and management.

Now therefore, a Working Plan Code of Government of Gilgit-Baltistan is hereby enacted to provide for planning and management of Private and Protected Forests as well as trees outside forests and for other matters connected with the protection, conservation, management & development of forest trees.

The Gilgit-Baltistan Forest Working Plan Code 2021 sub section (2) of section 82 of Gilgit-Baltistan Forest Act ,2019 is notified as under: -

"All such forests are areas shall be managed in accordance with a management plan that complies with the requirements by this Act or the rules made thereunder".



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CHAPTER 1
INTRODUCTION

1.1 BACKGROUND

Forests and other renewable natural resources of Gilgit-Baltistan, comprising of lands supporting natural forests, shrubs, plantations, grazing grounds and wildlife and fisheries found therein are all included in the designation Forests for the purposes of this Gilgit-Baltistan Forest Working Plan Code.

There are strong linkages between forest ecosystems and human well-being. Ecosystem services are the benefits people obtain from ecosystems. These include *provisioning services* such as food, water, timber, and fibre; *regulating services* that affect climate, floods, disease, wastes, and water quality; *cultural services* that provide recreational, aesthetic, and spiritual benefits; and *supporting services* such as soil formation, photosynthesis, and nutrient cycling. The human species, while buffered against environmental changes by culture and technology, is fundamentally dependent on the flow of ecosystem services.

For humans to be able to avail the full spectrum of forest ecosystems services and benefits, these need to be managed on a sustainable basis. Forest Working Plan or Forest Management Plan is a planning and management tool that professional foresters use for ensuring their sustainable management. Forest Working Plan is a written document describing the forests, results of past management practices and proposals for future forest management objectives and interventions for that particular forest area. Over the years it has evolved from a static document simplistically focused on a single forest objective to a living and adaptive document that is meant to achieve multiple management objectives. Not only its functional scope has expanded, but the nature and composition of stakeholders and interested parties and their expectations from forest management have grown tremendously. Now forests are to be managed not only from the perspective of local forest owning communities but the wider national and international goals with regard to different ecosystem functions will have to be kept in view.

All forests in Gilgit-Baltistan, therefore, need to be managed under the prescriptions of a forest working plan or forest working scheme or forests Management Plan which are prepared on the basis of principles of sustainable management of forests; conservation and maintenance of soil and water resources; conservation and development of biodiversity; and maintenance and enhancement of other ecosystem services including carbon storage and sequestration. Also, the participation of local people and other relevant stakeholder groups has to be ensured in planning and management of forest resources.

Working plan is prepared for large areas such as forest division, whereas working schemes are prepared for smaller areas for a specific purpose or for forest areas under the control/ ownership of such bodies as private, village, or government protected forests, etc.

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It is the duty of Forest Department to ensure preparation of the working plan / scheme for different areas under its management control and their implementation. On the explicit recommendation of the Chief Conservator Forests, Parks & Wildlife, the Provincial Government approves the working plan. Upon approval the working plan/management plans shall be executed and implemented by the Forests department. It is the duty of the Chief Conservator of Forests, Parks & Wildlife to approve all prescriptions of the working plan enter alia selection of felling series/sequence the volume of forests to be felled, marking, extraction and transportation etc. the Conservator Working Plan shall implement all the field operations as prescribed by the working plan with the approval of Chief Conservator of Forests, parks & Wildlife GB. the detail and responsibilities or elaborated further in this Code. Even working schemes have all major elements of working plan; and these schemes also need the sanction of competent authority designated for the purpose.

1.2 POLICY FRAMEWORK FOR FOREST PLANNING

The Draft Gilgit-Baltistan Forests Policy which is expected to promulgate by 2025 upon approval by the Provincial Government, provides the over-all framework for and strategic orientation for the preparation of forest working plans for forests in different eco-zones. The main objective directions set by the Forest Policy in this regard include general principles, management planning principles, conservation principles, sustainable use principles and implementation and law enforcement principles.

The general principles are that forest management plans are to-

(1) be consistent with and have regard for the Forest Policy and Strategy of Gilgit-Baltistan;
(2) adopt an integrated and multi-disciplinary approach;
(3) avoid over regulation, overreaching and over-prescription;
(4) ensure clarity in the institutional set-up and inter-institutional coordination;
(5) involve local communities and the private sector in forests, ecosystems, protected areas, wasteland and riverbeds protection, conservation, development and sustainable management; and
(6) guarantee public participation in decision-making.

The management planning principles in this regard are to-

(1) establish a system for continuous information gathering and monitoring;
(2) require management planning as a prerequisite to formal management;
(3) share management responsibilities between various levels of government authorities and with local communities and other stakeholders; and
(4) provide for national, regional and international cooperation where national, regional and multinational decision making and coordination are needed.

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The conservation related principles are to-

(1) use a species and conservation-based approach;
(2) use an area and ecosystem-based approach; and
(3) involve local stakeholders in forest conservation.

The sustainable use principles are to-

(1) define and regulate different types of forest functions and uses;
(2) accurately identify threatened and endangered species and medicinal and aromatic plants;
(3) provide for an adaptive, science-based determination of timber and other forest produce harvesting quotas and volumes;
(4) establish procedural mechanisms flexible and adaptive for forest produce harvesting and collection and harvesting season of various medicinal and aromatic plants;
(5) clearly define timber and other forest produce harvesting areas and medicinal and aromatic plants collection areas;
(6). regulate collection, harvesting and processing methods for timber and other forest produce;
(7). ensure a transparent and effective allocation of forest rights;
(8). involve local communities in the sustainable use of forests; and
(9). provide for promotion of regeneration of cut over and harvested areas as soon as possible;
(10). provide for the regulation of miscellaneous regulations of the working plan such as grazing control, firewood collection; soil and water conservation measures, various forest tending operations, hygienic and sanitary fillings etc; and
(11). paying due attention to the provisions of various multilateral environmental agreements.

The forest plans implementation, monitoring and evaluation mechanisms principles are to-

(1) provide incentives for complying with the forest plans prescriptions;
(2) return financial resources to improved forest planning and management;
(3) strike a balance between service provision to the local communities and the achievement of higher order national and international environmental objectives;
(4) provide human, financial and material resources for forest plans implementation, monitoring and evaluation; and
(5) develop a geographic and management information system in support of forest planning and management.

1.3 LEGISLATIVE FRAMEWORK FOR FOREST PLANNING

The legislative framework for forest planning is given in the Gilgit-Baltistan Forest Act, 2019. The duties and responsibilities of government with respect to forest planning given in the Act are to be followed in the preparation of forest working plans. These inter alia include following the

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Aarhus Convention provisions with respect to community participation in planning and decision making.

It also imposes restrictions on commercial harvesting of timber in certain cases and requires certain conditions to be met before undertaking or continuing commercial harvesting. These conditions include that the management plan or scheme for such forests:

(1). be supported by proof of availability of adequate funds for implementation purposes from the Gilgit-Baltistan Forests and Wildlife Fund or other sources;

(2). ensure the participation and assistance of communities in the regeneration of cut over areas, particularly owners, right holders, users and women as far as possible;

(3). include adequate measures and assistance of interested parties for protection against grazing and pasturing, or illicit removal of timber and forest produce;

(4). provide for mitigatory measures to alleviate hardship caused from closure of regeneration areas to particular segment of society like women or right-holding communities as a result of such closure.

Where the progress of regeneration in the area set aside for the said purpose is considered unsatisfactory, the Forest Officer may, after giving the grantee of the permission an opportunity of being heard, withdraw the said permission, whereupon the grantee shall cease the harvesting operations forthwith.

1.4 GUIDING PRINCIPLES FOR PREPARATION AND IMPLEMENTATION OF FOREST MANAGEMENT PLANS.

The following guiding principles will be reflected and kept in view by the Forest Department while preparing and implementing forest management plans. The principles are based on the tent's ecosystem-based management, adaptive management, public involvement and accountability.

Principle 1 - Ecosystem-based Management

1. The focus is on whole systems, rather than on individual resources or species;
2. The prime management objective is to maintain ecosystem integrity and health;
3. The most effective strategy for maintaining forest health and the potential for long-term forest sustainability is to emulate natural disturbance patterns;
4. Decisions are based on science, traditional knowledge and human values;
5. Long-term sustainability of renewable resources is a fundamental value;

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6. Decisions are based on sound ecological models and understanding;
7. Humans are an important component of the ecosystem and societal benefits are also to be considered and maintained.

Principle 2 - Sustainable Forest Management

1. Sustainable forest management is made up of three key facts, ecological sustainability, economic sustainability and social sustainability; therefore, forests are managed in order to sustain social, economic and ecological values for future generations;

2. Large, healthy, diverse and productive forest lands and their associated ecological processes and biological diversity are to be conserved;

3. Forest management planning is based on the concept of sustainable forest management and considers all forest resource values; and

4. The use of a performance framework will allow for the assessment of all forest resource values designated and included in Forest Management Plan.

Principle 3 - Open Consultation and Collaboration with Stakeholders

1. Different stakeholders in Gilgit-Baltistan, including private landowners and land managers, various levels of governments, members of interest groups, industry, contractors and other agencies, must work together to identify problems, opportunities and to find common solutions;

2. There are many benefits derived from an effective public involvement process. Input from all interested parties in forest management planning means better decisions, with consideration for the whole resource, before actions are taken; and

3. The consultation process is maintained through the continual involvement of all interested parties in the planning process, by keeping participants informed, and by reporting decisions and the reasons for those decisions.

Principle 4 - Social and Economic Sustainability

Forests provide substantial commercial benefits, including: timber and non-timber forest products, as well as water and land-based tourism. There are also non-commercial benefits, such as wildlife habitat, recreation opportunities, aesthetics, traditional land use values and wilderness values. The distribution of these benefits is a key aspect of both social equity and sustainable forest management, and requires forests to be managed to support these values over the long term; and

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2. Social and economic sustainability values that are directly influenced by forest harvesting operations and contractors are best tracked through a performance framework that continually measures and assesses the values as the Forest Management Plan is implemented.

Principle 5 - Adaptive Management and Continual Improvement

1. Scientific knowledge of forest ecosystems will continue to expand, which will modify our understanding of ecosystem dynamics and how they are influenced by human activity;

2. Monitoring processes, including the performance framework provided by the values, objectives, indicators and targets presented in the Forest Management Plan will assist in the process of learning from past experiences, evaluating the effects of forest management activities on the long-term health of forest ecosystems, and assessing progress towards Forest Management Plan objectives;

3. New understanding of sustainable forest management that becomes available to over time and learning gained through monitoring of current Forest Management Plans implementation will be incorporated into a revised Forest Management Plan as part of the adaptive management and continual improvement cycle;

4. Reporting on the results of forest management activities provides accountability by measuring progress and helping to determine the effectiveness of various planning strategies;

5. Forest management planning is a dynamic process which will reflect improvements to sustainable forest management practices as identified at various levels of management; and

6. Linkages between Forest Management Plans and subsequent operating plans must be built and maintained to ensure that Forest Management Plan objectives are carried consistently through plan implementation.

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CHAPTER 2
ESSENTIALS AND SELECTED TOPICS IN FOREST PLANNING

2.1 ESSENTIAL OF FOREST PLANNING

Forest Planning has to be based on the following principles of general land use planning.

1. **Forest planning aims at sustainability balancing social, economic and environmental needs;**
2. **Forest planning results in a managerially and technically binding forest land use plan** and/or forest land use rules. Formal recognition of the forest land use plan or land use rules is crucial for its implementation. Otherwise, key players such as sector ministries or private investors do not respect them;
3. **Forest planning is integrated into government institutions having the official mandate for inter-sector planning;**
4. **Forest planning is a dialogue.** A central part of any forest land use planning is the initialization of a communication process that allows all stakeholders to express their interests and enables them to agree on future land uses that respect all positions in a fair and adequate way;
5. **Forest planning is an all-inclusive process.** This requires that all stakeholder groups are represented: local direct and indirect users, public authorities, private investors, NGOs and CBOs. Depending on the level on which land use planning is done, stakeholders' participation can be direct or indirect;
6. **Forest planning is based on stakeholder differentiation and gender sensitivity.** To identify all relevant stakeholders, a gender differentiated analysis of all actors should be done in advance;
7. **Forest planning promotes civic engagement.** The population should actively participate in the land use planning. The results of planning and the implementation of measures can only be sustainable if plans are made with and by the people, not behind or even against them. Planning is, therefore, not just a matter for experts, but should be carried out together with those affected by it;
8. **Forest planning is realistic and oriented to local conditions.** Not only has the content of a land use planning to be adapted to local conditions. The methods too have to fit the technical, economic and organizational capacities of the local population as well as administration;
9. **Forest planning is based on a "light" methodology**, avoiding unnecessary data collection resulting in "data graveyards";
10. **Forest planning in terms of methodology and content differs** e.g. in scale, specificity, form of participation (direct vs. indirect), and technology at village, forest and higher level;
11. **Forest planning considers and valorises local knowledge.** Rural societies or groups often possess a complex autochthonous knowledge of their natural environment. They can contribute valuable information and should, therefore, be mobilized during the land use planning;



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12. **Forest planning takes into account traditional strategies for solving problems and conflicts.** Traditional rural societies have their own way of approaching problems and settling conflicts concerning land use. In the process of forest land use planning, such mechanisms have to be recognized, understood and taken into account;
13. **Forest planning follows the idea of subsidiarity,** i.e., all functions from planning to decision-making, implementation and monitoring are assigned to the lowest appropriate level of government in order to be responsive to the needs of citizens and to ensure effective control from below
14. **Forest planning integrates bottom-up aspects with top-down aspects ("vertical integration").** Forest land use planning needs to combine local needs and interests with provisions made by higher levels. This can only be achieved in a sustainable way if stakeholders from all levels participate in the process and directly talk and listen to each other;
15. **Forest planning is based on inter-disciplinary cooperation and requires sector coordination ("horizontal integration").** The diverse functions and (potential) use of land make it necessary to apply an interdisciplinary approach involving all sectors that have a stake in that area. This generally requires a longer support in institution building and improving cooperation between different sector ministries/agencies;
16. **Forest planning is a process leading to an improvement in the capacity of stakeholders.** The participatory methods used in all steps of land use planning promote the technical and organizational capabilities of all participants, thereby improving their capacity to plan and act. In the medium term, this leads to an improvement in the capacity of local groups or administrative entities (such as villages, valleys, districts and higher level) for self-determination;
17. **Forest planning requires transparency.** If there is no transparency on decisions about future land uses, risks are high that some people will be deprived of their rights and/or that future land use will not be sustainable;
18. **Forest planning is future-oriented ("visionary").** Forest land use planning is not only about mapping the current land uses or land covers. Forest land use planning determines how the land will be used in the future. This may differ more or less from today's utilization of the land;
19. **Forest planning is an iterative process.** Forest land use planning is more than the preparation of a planning document like forest working plan; it is an iterative process. Iteration is both the principle and the method. New developments and findings are specifically observed and incorporated into the planning process. It may lead to the revision of decisions and the repetition of steps already taken;
20. **Forest planning is implementation oriented.** Forest land use planning has to consider how the negotiated decisions and the solutions identified are to be implemented. It does not end with the land use plan. The implementation of limited measures right at the beginning of the process or parallel to it plays an important role in establishing villagers' confidence in the planning process;

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21. **Forest planning is linked to financial planning.** This is crucial for implementation. Forest land use planning needs to be aware of the designated uses of sector budgets as well as of the financial planning cycles of the relevant sector ministries (including their deadlines). At the same time, land use planning should influence the composition and intended purposes of budgets and funds;
22. **Forest planning relates to spaces and places ("spatial orientation").** In most situations many forms of planning and quite a number of plans exist. What most of them are lacking is the relation to space. Many development plans, for instance, state what has to be developed (mainly in terms of infrastructure) but don't indicate where. Forest land use planning puts the focus on spatial relations and differences. The spatial orientation of planning ensures the optimum distribution of investments and the most adequate use of any place and avoids (land use) conflicts.

2.2 SELECTED TOPICS IN FOREST PLANNING

2.2.1 BIODIVERSITY CONSERVATION AND DEVELOPMENT

Forests provide habitat for many plant and faunal species. The contribution of individual species to the overall diversity within a community or ecosystem varies to a great extent. The coexistence of organisms that differ widely from each other contributes more to overall diversity than the co-existence of very similar species. Functional diversity is considered to bone of the main factors determining the long-term stability of an ecosystem and its ability to recover from major disturbances. Assessment of status of plant and faunal species and their periodic monitoring can be helpful in formulating strategies for conservation, maintenance and enhancement of overall biodiversity through sustainable management and use practices. Assessment of biodiversity especially the lower forms of life (algae, fungi, lichens, epiphytes, parasites, etc.) of a forest division must be made an on-going program with support from relevant Biodiversity Organizations as it may be difficult for the working plan officer (WPO) to do it within two years, the normal time allotted for writing the plan. All these assessments will help updating and enriching the database and meeting other parameters of Pakistan's Biodiversity Action Plan.



2.2.2 JOINT FOREST MANAGEMENT

Joint Forest Management is sharing of responsibilities, authority and usufructs between the village community or the forest user group and the forest department on the basis of a memorandum of understanding (MoU) between the two. The management of the jointly managed forests is done through the provisions of a Joint Forest Management Plan (JFM) Plan prepared by the Forest Department in collaboration with the community on participatory rural appraisal (PRA) basis. JFM planning should be done in conformity with the overall working plan prescriptions of the forest division.

Approval of JFM Plan from higher levels may not be necessary and these approvals can be granted at the level of Conservator of Forests Working Plans and Conservator of Forests Territorial as they are covered by the macro level prescriptions of working plan of the forest division. Any

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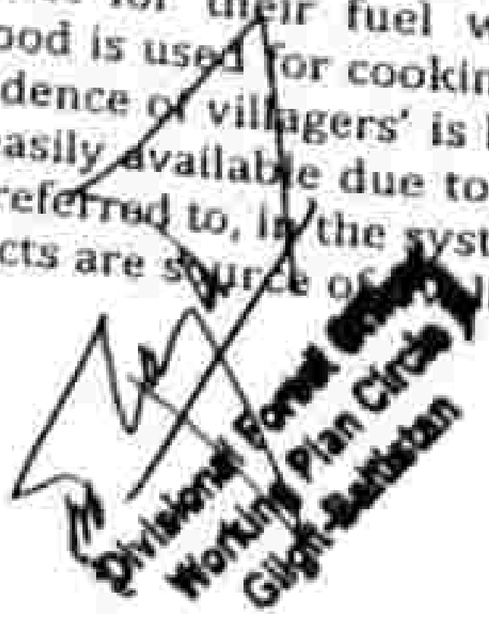
deviation from the macro level prescriptions will require prior approval of the Chief Conservator of Forests. The latest directives issued by the Department for preparation of JFM Plans should be incorporated in the JFM overlapping working circle. The compartments falling within any Jemma have to be realigned/ subdivided to keep them within the respective JFM/village boundary. Analysis of implementation of JFM program, grading of JFMC, award winning JFM, women's participation, etc. should be provided in the working plans. It should be made necessary to assess the dependence of villagers on the forests for their livelihood needs. Fieldworks like socio-economic survey including NTFP survey, problems of grazing and firewood needs should be analysed carefully before making prescriptions for JFM. The activities related to JFM during the past working plan period along with results and comments over the results should be included in the preliminary working plan report (PWPR) along with supporting data.

2.2.3 COMMUNITY FOREST MANAGEMENT

Forest community rights related to use of community forest resources like minor forest produce, grazing grounds, water bodies, etc. recognized under the provisions Gilgit-Baltistan Forest Act 2019 and of various applicable agreements and deeds like the Accession Agreement of 1952 of Government of Pakistan with the people of Darel and Tangir, and other relevant rules can be exercised within the frame of sustainable management. The term "sustainable use" is interpreted here to mean the use of components of forests and biological diversity in such a manner and at such a rate that does not lead to the long-term decline of forests or the biological diversity thereby maintaining its potential to meet the needs and aspirations of present and future generations. Details of existing rights are to be provided so as to assess their sustainability, reasoning for their continuity and enhancement of productivity. Therefore, special efforts in the form of good practice guidance, capacity building, orientation, provision of incentives for the exercise of rights would need to be provided not only for preparation of working plans of such community forests but also for creation of various working circles as per the prevailing conditions of the division to maintain the sustainability of these forests.

2.2.4 FRINGE FOREST MANAGEMENT

In general, the forest fringe area is conspicuously different from the inner forest due to close contact with local communities. Although the dependence of forest fringe villages and their interaction with forest is almost same, but the kind of interaction and its severity may vary from one type of forest fringe to another. The communities living in the forest fringes depend heavily on the forest for their fuel wood and fodder needs. In rural households, fuel wood is used for cooking and heating, more so in the hilly regions. The dependence of villagers' is heavy because commercial sources of energy are not easily available due to varied reasons. Non-timber forest products (NTFPs), referred to, in the system of national income accounts, as minor forest products are source of livelihood and food security for a large



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number of rural communities living in and around forests. They are important to rural households in terms of their contribution to health, food, energy and other aspects of rural welfare. The importance of management of the fringe forest lies in the fact that if properly managed, it can arrest people's entry into the forest by catering to their needs at the fringe only, thereby sparing the forest from the biotic pressure that has the potential to cause irreparable damage to the forest biodiversity and eco-system services. Forest fringe villages have been a major cause of forest fires due to increased dependency of people on forests as stated above, thus causing the forest more vulnerable in terms of fire. Alternatives may be discovered to reduce the dependency of people on forests residing in fringe forests.

2.2.5 WATER RESOURCES MANAGEMENT

Forests are also sources of water (surface, sub-surface and ground water). Over exploitation of the ground water resources results in declining ground water levels; there is an urgent need to augment the ground water resources through suitable management interventions. It is desirable to have forest management practices dovetailed with the principles of watershed-based development approach especially in the source areas of water. Such areas should have restrictions on tree felling but there should be operations to improve the water regimes and natural regeneration. As such, special provisions should be made in the working plan to sustain water resources and livelihood issues of the people living in and around natural inland water sources.

2.2.6 SOIL AND WATER CONSERVATION

Heavy rains and rapid run-off severely affect not only the top fertile soil but leads to formation of gullies within forest areas. Suitable management imperatives need to be formulated to stop forest degradation due to natural causes and calamities. Apart from silvicultural operations, it is also necessary to make appropriate prescriptions for conservation of soil and water in the forest areas. Areas susceptible to soil erosion such as steep slopes and areas in the vicinity of perennial streams, etc. should be focussed for soil and water conservation interventions with the provision of an overlapping working circle or exclusive watershed management/soil and water conservation working circle.

2.2.7 FOREST HEALTH AND DISEASES

The pests significant to the forests in the recent past in Pakistan are the Shisham mortality, poplar leaf defoliators etc. Interestingly, these pest phenomena cover both natural forests as well as plantations. Based on generalized symptoms (spots, wilt, etc.) and signs (mushroom like fruiting bodies); nature of pathogen- whether fungi, bacteria, nematode, plant parasite, etc.; pathogen survival especially in relation to weeds; photographic documentation of the problem and their confirmation through internet sources and expert advice; mapping of disease distribution may be done. Such details are very vital for timely diagnosis and effective management of the problem. Role of silvicultural practices that can reduce the pest problem; knowledge of species phenology to collect healthy seeds

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from the trees before they fall off on forest floor; scientific felling to reduce the standing tree damage as injury serves as an infection court for many heart rots, etc.; nutrient status of the soil governing the susceptibility/resistance of the host in many cases; identification and selection of superior individuals also as a source for resistance against the disease; identification and evaluation of lesser known species (and weeds) of an area for their biochemical profiling including bio-pesticide properties, etc. can be an effective, eco-friendly, economical and easily available source for pest/disease management.

2.2.8 FOREST FIRES AND PROTECTION

Forest fires are as old as the forests themselves. They sometime pose serious threat to the biodiversity and ecology. Forest fires have environmental impact in terms of biomass burning, which produce large amount of trace gases, aerosol particles, and play a pivotal role in troposphere chemistry and climate aberrations. Thus, there is a need to carry out fire frequency and burnt area mapping for fire vulnerability on one hand and operational fire monitoring in real time/near real time for effective response on the other. Elsewhere in the world and even in neighbouring India real time monitoring of forest fires is being carried out by using MODIS sensor fire alerts on-board two of the satellites – Torrand Aqua. The processed signals on forest hot-spots are being transmitted to on regular basis during fire season. Hence real time monitoring of forest fires is a process now in operation to curtail fire severity and sensitize Forest Department at operational level to prevent normal fires in getting converted into wild fires. The online feedbacks on forest fires which are a part of this system could help estimate the actual loss of forest strata as well as the loss caused to top-soil.

2.2.9 FORESTS AND CLIMATE CHANGE

Climate is an active factor in the physical environment of all living things. Climate change and variability are impacting forest ecosystem processes and functioning. Response time of forest ecosystems to disturbances ranges from a very short duration to decades and even centuries, depending on the condition of the system and the type, intensity and duration of the external stimuli. The actual state of forest ecosystem largely depends on processes and practices of the past. Therefore, forests are extremely complex to understand their functioning. Climate change further magnifies those complexities and adds more uncertainties. Forests are linked to climate change in three ways; I) they are source of greenhouse gas (GHG) emissions; ii) they offer mitigation opportunities to stabilize GHG concentrations; iii) they are impacted by climate change. Impacts of climate change on forest ecosystem are getting manifested as species range shifts, changing biodiversity, physiological changes in plant life cycles, forest growth pattern of species, changing boundaries of ecosystems and other biotic and abiotic responses/ stresses. There are evidences of increase in the frequency and severity of forest fires, changing water regimes and expanding forest insect infestation. Since forest ecosystems operate on large temporal scales, long observational studies are necessary to identify the key changes. Accordingly

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grid based sampling is designed to provide relevant information to cover the characteristic time scales.

2.2.10 CARBON SEQUESTRATION AND MITIGATION

Forests and wood products can effectively reduce the process of climate change in sever always. Growing trees absorb carbon dioxide from the atmosphere and store the carbon so efficiently that about half the dry weight of a tree is carbon. This carbon remains locked up in the form of wood and wood products. Sustainably grown and harvested wood (and other biomass) also provides a renewable alternative to fossil fuels and enhance carbon storage. Enhanced carbon sequestration through recognised and innovative silvicultural practices, Eco restoration of degraded/mined out forestlands, improved biomass productivity, etc. will help in improving forest health and vitality. Forest soil must be kept healthy and fertile. The growth of forest crops must be kept vigorous to attain the most desirable level of biomass production within an optimal time scale.

2.2.11 REDD+

REDD stands for reducing emissions from deforestation and forest degradation. REDD+ (Plus) includes forest conservation, sustainable management of forests and enhancement of carbon stocks, and has been adopted by the United Nations Framework Convention on Climate Change (UNFCCC) as a tool for climate change mitigation. Deforestation happens when forests are cleared and such land is put to other than forest land use. Forest degradation implies a gradual depletion of forests driven by demand for biomass and disturbances like fire and soil erosion, which, result in dwindling carbon density and ultimately leading to complete loss of forests. Implementation of REDD+, therefore requires efforts/mechanisms to measure forest carbon, interventions and payments to local people in addition to alternative activities such as fodder development to avoid lopping of tree branches, efficient cooking energy devices, etc.

2.2.12 APPLICATION OF MODERN TECHNOLOGIES

Geomatics (Remote sensing, GIS and GPS) has got a wide range of applications in forest management. One can find application of geomatics in almost every forest management practice e.g., forest cover mapping in different canopy density classes, change detection (degradation as well as improvement), forest fire detection, burnt area mapping, biodiversity mapping, afforestation planning, wildlife habitat suitability mapping, boundary demarcation, encroachment mapping and so on. For many of these applications, there are no practical alternatives to geomatics based methods.

A spatial database on forest in GIS is a set of geo-referenced layers of spatial data of an area on different themes relevant to forest management along with related text and statistical data. In each spatial layer, attribute data with every feature appearing as point, line or polygon (e.g. afforest patch, compartment, village, plantation, etc.) can be attached for analysing management alternatives, creating scenarios, building queries or general

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database applications. Spatial database of a forest division with spatial layers will be of immense use in preparation of working plan and later in day-to-day forest management decisions for the forest division.

Further, there is a need for standardized framework of spatial database at Pakistan level for capturing, storing and managing all spatial and non-spatial data using modern technology under the aegis of Pakistan Forest Institute. The purpose is to integrate the divisional level information at Gilgit-Baltistan level and further at national level in a standardized framework. PFI and SUPARCO and its centres should provide requisite support including capacity building and relevant software for WP data processing to Forest Departments so that WPO is provided with ready to use thematic layers for forest planning. Every WPO must also be equipped with GIS Cell/Lab. Multi-dated satellite images may be used by the GIS Cell/Lab for change analysis and preparation of change matrix. Change matrix describes the change in forest cover of the division over the period of last plan or between any other two assessments by showing the areas changing from one class of land/forest cover to another. This qualitative information may be used during forest resource assessment for identifying the drivers of change. If necessary, institutional sources like PFI and SUPARCO may be approached by the GIS Cell/Lab for procurement of forest cover layers of the required period.

2.2.13 FOREST INVENTORY, SURVEY AND MAPPING

Information on growing stock and its growth is necessary for efficient planning and management of forests. The forest inventory, survey and mapping provide this important input. Assessment of forests resources makes use of a combination of geomatics and field inventory data. Inventory and mapping of the entire vegetation including herbs, shrubs, grasses and climbers along with trees, needs to be brought within the ambit of the forest resource assessment. This will also include inventory of the non-timber forest products (NTFPs) and medicinal and aromatic plants (MAPs) which will ultimately help to prepare the livelihood plans for the local communities in a more effective manner. Fragmented patches of forest need to be covered in the survey and assessment so as to provide focused management prescriptions for ensuring no discontinuous forest patch is left out from the purview of survey.

2.2.14 GRID BASED SAMPLING DESIGN

The existing survey and assessment of forest resources for the working plan is carried out on the basis of random sampling with the aim of collecting information mostly on forest timber production and very limited information on forest biodiversity. In the present changing scenario of forest resource management at the global level with regard to biodiversity, climate change and carbon emission/sequestration; it is necessary to have monitoring and assessment of forest resources on the basis of grid based systematic sampling, wherein the distribution of the sample plots within the surveyed population is homogeneous. The purpose is to provide new qualitative and quantitative information at divisional level which may be integrated and upscaled to state and national level in a standardized framework. The

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assessment covers a wide range of parameters which will provide a holistic view of land use and its impact for the country as a whole. This information can be used to plan, design and implement national and international policies and strategies for sustainable use and conservation of forests. Grid based systematic sampling design offers best opportunity to revisit the area for change detection and its attribution to climate change. It can be used for species distribution models (SDMs) and also offers opportunity to validate dynamic vegetation models. Some of suitable sampling plots can even be used for regeneration, growth and carbon sequestration studies. The working plan prescriptions facilitate systematic observations on a continuous basis with improved coverage for scientific analysis of forest ecosystem functioning. The survey of forest resources on scientific lines is also required to be conducted for periodic collection, collation and publication of reliable data on relevant aspects of forest management.

2.2.15 GROWTH DATA AND CARBON SEQUESTRATION

A network of grid based permanent sample plots should be identified and established indifferent strata of the forests to provide necessary database for growth/increment. These permanent sample plots are necessary to assess the role of forests as source or sink for greenhouse gases on a long term basis and to study carbon sequestration and storage in trees both above and below ground biomass (stem and roots), deadwood, litter, soil and harvested wood products for different forest types of Gilgit-Baltistan with an emphasis on different management regimes. Establishment and maintenance of these plots be carried out by the department in collaboration with silvicultural and mensuration wings of PFI for continuous collection of data.

2.2.16 LINKAGE WITH NATIONAL FOREST INVENTORY

There shall be a backward and forward linkage between forest inventory under Regional Forest Resource Assessment for working plan and National Forest Inventory. For forward linkage to national forest inventory, forest resource data based on systematic sampling can be standardized following the procedure (including the coding) provided in PFI Atlas of Land Cover in Pakistan for national forest inventory since same methodology for collection of data has been provided in this code. The national inventory data as is developed under the framework of a National REDD+ Project for Pakistan can be used as historical reference for a particular grid as backward linkage. The provision of staggering of working plan preparation can even take care of physiographic stratification adopted for national inventory. A robust and dynamic national carbon MRV (measuring, reporting and verification of carbon stocks) based on forest resource assessment of working plan can also be realised for REDD+ provided sufficient resources are made available to the regions/provinces/territories by the federal government for estimating carbon from different pools of forests.

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2.2.17 TREES OUTSIDE FOREST (TOF)

Trees outside forests (TOF) are located on the lands other than forests, including agricultural lands (e.g. agro-forestry systems, farm forestry, industrial plantations, hedgerows, woodlots), built-up areas such as

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settlements and infrastructure (e.g., street trees, parks and other urban tree systems) and bare lands (e.g., dunes, both abandoned and accomplished mining sites). They not only contribute nearly one fourth of the total growing stock of the country but also have become major source of wood in Pakistan and Gilgit-Baltistan. So there is a need to describe and comprehend the dynamics of trees and shrubs on rural and urban land, and their interaction with forest ecosystem. This will lead to a better understanding of off-forest tree management and towards integrated and sustainable management of forests as natural resources. Based on plot description and enumeration for areas outside forests, assessment will be done with respect to present scenario and their potential for forestry outside forests as part of sustainable land use management at landscape level within the forest division. The focus of forestry outside forest areas is on production forestry, revitalization of rural economy and expanding economic opportunities through innovations. This requires inter-sector synergy and convergence. WPO may therefore prepare a separate strategy as a new chapter, not being part of general prescription of working plan to address the concepts and issues related to TOF. Forest certification guide as marketing tool may also be developed for the trees outside forests.

2.2.18 Non-Timber Forest Products including Medicinal and Aromatic Plants (MAPs)

Gilgit-Baltistan has a vast resource of different Non-Timber Forest Products (NTFPs) including Medicinal and Aromatic Plants (MAPs). Currently, no systematic system exists for the survey, assessment and documentation of these valuable resources. Department has developed and notified rules for NTFPs and MAPs. As per these rules, Department in collaboration with local communities and other interested stakeholders, shall gather any spatial or non-spatial data or information which is necessary for the protection, conservation, development and sustainable management of NTFP/MAPs. Data and information so gathered shall be stored, archived, retrieved, or processed in any manner deemed fit and necessary. Department is also to document the information gathered for use by communities, collectors, permit holders, interested parties and other stakeholder groups. These rules require that the Department, in collaboration with relevant communities and other interested stakeholders, shall periodically and regularly carry out NTFPs/MAPs resources and habitats surveys, and of relevant socio-economic, cultural, political, institutional, traditional knowledge, etc. issues related to NTFPs/MAPs protection, conservation, collection, storage, processing, utilization, trade and management. Also, the Department, in collaboration with communities, collectors, experts and other relevant stakeholders, shall prepare manuals on how to conduct NTFPs/MAPs Surveys and Assessments. Department may procure Topographic Maps and other maps from Survey of Pakistan, Government of Pakistan. It may procure aerial photos, satellite or radar imageries or any other types of remote sensing imageries or photos and is to prepare MAPs Maps and Baltistan. Department and Baltistan. Department and of different areas in Gilgit-Baltistan. Department shall make use of and promote any survey and measurement systems, methods, techniques, tools, etc. including global

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positioning system, photogrammetry, LiDAR, or any other technique that is currently available or will become available in future.

In addition, Department shall establish a Monitoring and Evaluation (M&E) System and develop a system of Criteria and Indicators for the M&E System of MAPs. It is required to prepare a MAPs database and Management Information System and may make use of its GIS Laboratory for the purpose.



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CHAPTER 3
BENEFITS, OBJECTIVES AND TIERS OF FOREST MANAGEMENT PLANNING

3.1 BENEFITS OF FOREST PLANNING

Apart from meeting policy and legislative requirements, the most compelling reason for formulation of Forest Management Plans are that this exercise conserves the forest ecosystems, improves their health and vitality and provides benefits to the forest area and those who rely upon its good management. A good management planning process which has the support of forest staff and local people, provides the following benefits:

1. Improved management of the forest area

The primary product of management planning has to be the more **effective management** of the forest area. Forest Management planning encourages more effective management by:

(a). ensuring that management decisions are based on a clear **understanding** of the forest area, its purpose, and the important resources and values associated with it;

(b). providing **guidance for managers** in the form of a framework for day-to-day operations and long-term management. A Management Plan should provide the manager with a long-term vision for the forest area, as well as guidance on how to direct the management of the forest area towards this vision. It should assist in day-to-day decisions about complex problems, by clarifying management objectives and prioritising them. This should resolve conflicts, address bad risks, remove ambiguity on how the area is to be managed and explain how the decisions were arrived at;

(c). providing **continuity** of management. Having an agreed Management Plan in place provides a useful briefing document for all staff and helps them to maintain the direction and momentum of management. This is particularly important in situations where there are staff transfers, and management may be carried out by a succession of staff; and

(d). by helping to identify and define management '**effectiveness**'. If the management objectives within a Management Plan are well written, specific and can be measured, they can be used as a basis for determining whether management of the forest area is effective or whether changes in management (or indeed in the plan) are required.

2. Improved use of financial and staff resources

Management planning can help make sensible use of resources. For example:

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a. Management Plans (and any associated operational or vill plans) identify, describe and prioritise the management acti required to achieve the objectives for the forest area. This list tasks helps managers to allocate the staff, funding and materi required. Department may also link its annual work plans f forest areas to annual budgets, ensuring more efficient financ planning and control.

b. Management Plans may also highlight where additional resource are required. In this way a plan can act as a fundraising too although if the Department cannot meet the total resource required to implement the plan, it would be better to modify it than allow it to become a mere 'wish list'.

3. Increased accountability

Management planning can provide a mechanism for increasing the accountability of:

a. **the forest area manager(s)**. The manager should be mandated to work within the Management Plan, which can then be used to identify targets to reach and performance standards to attain. The plan can also be used by managers to draw up work plans for staff, assign duties, and monitor and assess performance. It also discourages a manager from 'acting on whim'.

b. **the department**. A plan can act as a sort of public contract between the manager, local communities and other stakeholders on how the area will be managed and protected in future. Thus the Management Plan can provide away by which the public can examine management decisions and monitor delivery against targets.

4. Improved communication

The management planning process can provide a useful link between the forest area manager and those with an interest in the area, its management and future. It does this by:

a. identifying **key audiences** with whom the manager needs to communicate, and clarifying the messages to be communicated.

b. providing a means of **communication with the public**, to explain policies and proposals. In particular, the Management Plan (and the planning process) can be used to gain the co-operation of the public and non-governmental organisations.

c. promoting and publicising the forest area to a wide range of **stakeholders**.

3.2 OBJECTIVES OF FOREST MANAGEMENT AND PLANNING

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Forest Working/Management Plans will be prepared in an integrated and participatory manner using relevant and reliable biophysical and socio-economic so as to achieve the following objectives:

1. Maintenance of health and vitality of forests;
2. Conservation and maintenance of soil and water resources;
3. Enhancement of role of forests in global carbon cycles;
4. Conservation, maintenance and enhancement of biodiversity;
5. Conservation, maintenance and enhancement of production of different forest produce;
6. Conservation, maintenance and enhancement of scientific, educational, cultural and recreational functions of forests;
7. Enhancement of the role of forests in meeting various subsistence needs of indigenous and forest dependent local communities;
8. Enhancement of the role of forests in income and employment generation, poverty alleviation and rural economic development;
9. Enhancement of the role of forests in local environmental protection and improving quality of life;
10. Enhancement of the role of forests in local level governance improvement, institutional development and organizational strengthening; and
11. Enhancement of the role of forests in property rights and tenure security.

3.3 TIERS OF FOREST MANAGEMENT PLANNING

Forest Management Planning in Gilgit-Baltistan may be prepared under a tiered approach, viz., the Strategic Forest Plan or Forest Policy/Forest Vision for the whole of Gilgit-Baltistan. This Forest Policy/Forest Vision is translated at the Forest Level in the form of Forest Working Plans or Operational Plans. These Plans in turn may optionally be elaborated or supported through the preparation of Village Plans. This lower tier of Village Plans is optional and is not a requirement but the Forest Policy/Forest Vision and Forest Working Plans tiers are mandatory.

3.3.1 STRATEGIC FOREST PLAN OR FOREST POLICY/FOREST VISION (SFP)

Strategic Forest Plan is a higher and Gilgit-Baltistan level Forest Policy or Forest Vision, which will be meant to:

(a) state the objectives for the forest sector as a whole;

(b) describe and analyse the financial, technical, biological, social and environmental constraints to forest protection, conservation, development and sustainable management in Gilgit-Baltistan; and

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(c) provide the simplest possible strategies and guidelines as to how the sectoral objectives will be achieved and also describe how those achievements will be measured.

A Strategic Forest Management Plan or Forest Policy/Forest Vision is a long-term plan prepared for the forestry sector as a whole. As a planning tool it provides vision, mission, sectoral objectives, and management strategies and activities with targets indicators that measure performance in terms of effectiveness, efficiency and equity. In order to do this it is necessary to describe the resource as it stands at the present, the past events that have shaped it and the biophysical and social factors that affect it presently and may affect it or associated management activities in the future. The purpose of the Strategic Forest Plan or Forest Policy is to describe the specific considerations and constraints based on which the operational objectives, targets, management strategies and management guidelines for individual forests are suggested and prescribed. It may address the following higher level and strategic questions:

What are the current condition and trends of ecosystems, ecosystem services, and human well-being?

What are plausible future changes in ecosystems and their ecosystem services and the consequent changes in human well-being?

What can be done to enhance well-being and conserve ecosystems?

What are the strengths and weaknesses of response options that can be considered to realize or avoid specific futures?

What are the key uncertainties that hinder effective decision-making concerning ecosystems?

What tools and methodologies developed and used in the Forest Planning and Management Systems can strengthen capacity to assess ecosystems, the services they provide, their impacts on human well-being, and the strengths and weaknesses of response options?

3.3.2 FOREST WORKING PLANS OR OPERATIONAL FOREST MANAGEMENT PLANS (OFMP)

Forest Working Plans or Operational Forest Management Plans are prescriptive or tactical. They follow directly from the Strategic Forest Plan or Forest Policy/Forest Vision. A Forest Working Plan needs to be kept as concise as possible and relevant to the strategic objectives of forest management. Hence, they define the schedules of work and the operational targets for the specific forests in the working plan area, forest working circles and forest compartments, which in turn serves as the basis for the preparation of the three- or five annual operational plans for that forest compartment.

They prescribe the silvicultural system to be employed and the specifications for the road network and other infrastructure and the construction and

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extraction equipment. The guidelines and time scale for the preparation of annual operational plans for the forest compartment and the post-harvest treatment of the forest stand should also be outlined. The plan shall include prescriptions for both immediate (harvesting) and long-term (fire control, hunting, illegal logging) monitoring and control measures. A brief description of data management and reporting procedures that will be employed both during the harvest and over the duration of the felling cycle is also required.

Forest Working Plans have a standard format on which they are prepared and they include both prescriptions and suggestions as well as monitoring and control measures and forms.

3.3.3 VILLAGE FOREST MANAGEMENT PLANS

This is a purely optional tier and may be prepared only in cases where the village or community is organized and want to prepare a Land Use Plan for their valley or village area. It is simpler in format than a Forest Working Plan and usually will divide the village land into different Management Units, such as Village Settlement Management Unit, Agricultural Land Management Unit, Range Land Management Unit and Forest Land Management Plan. Where such plans are prepared, they will be prepared following a structured village land use planning process (VLUP). As part of this VLUP, the local community gets organized into village development committee (VDC) and Women Organization (WO).

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CHAPTER-4
FOREST ECOSYSTEM FUNCTIONS AND SERVICES

4.1 FOREST ECOSYSTEM SERVICES

The ecosystem function approach provides a holistic view of forest based goods and services, and by paying more attention to ecosystem-based services this closely relates to the characteristics of forest ecosystems. Forest Ecosystem Function is the capacity of natural processes and components of forests to provide goods and services that satisfy human needs, either directly or indirectly. By following this definition, ecosystem functions are conceived as a subset of ecological processes and ecosystem structures. Each function is the result of the natural processes of the total ecological sub-system of which it is a part. Natural processes, in turn, are the result of complex interactions between biotic (living organisms) and a biotic (chemical and physical) component of ecosystems through the universal driving forces of matter and energy.

There are four primary groups of forest ecosystem functions, viz., (1) Provisioning Functions and Services, (2) Regulatory Functions and Services, (3) Supporting Functions and Services, and (4) Information Functions and Services.

(1) ***Regulatory functions:***- this group of forest functions relates to the capacity of natural and semi-natural forest ecosystems to regulate essential ecological processes and life support systems through bio-geochemical cycles and other biosphere processes. In addition to maintaining the ecosystem (and biosphere health), these regulatory functions provide many services that have direct and indirect benefits to humans (i.e., clean air, clean water, floods control, soil erosion regulation, and biological control services).

(2) ***Supporting functions:*** - natural forest ecosystems provide supporting functions such as primary production, nutrient cycling, soil formation and retention, and a refuge and a reproduction habitat to wild plants and animals and thereby contribute to the (in situ) conservation of biological and genetic diversity and the evolutionary process.

(3) ***Production functions:*** - Photosynthesis and nutrient uptake by autotrophs converts energy, carbon dioxide, water and nutrients into a wide variety of carbohydrate structures which are then used by secondary producers to create an even larger variety of living biomass. This broad diversity in carbohydrate structures provides many ecosystem goods for human consumption, ranging from food and raw materials to energy resources and genetic material.

(4) ***Information functions:*** - Since most of human evolution took

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place within the context of an undomesticated habitat, natural forest ecosystems provide an essential 'reference function' and contribute to the maintenance of human health by providing opportunities for reflection, spiritual enrichment, cognitive development, recreation and aesthetic, experience.

The following table is illustrative of the various forest ecosystem functions and services:

Category of Function and Service	Example of Function and Service
1. Provisioning Functions and Services	
	1. Food
	2. Fibber
	3. Fodder
	4. Timber & Fuelwood
	5. Water
	6. Genetic Resources
	7. Biochemicals
	8. Ornamental Resources
2. Regulating Functions and Services	
	1. Gas Regulation
	2. Climate Regulation
	3. Disturbance Regulation
	4. Water Supply and Flood Regulation
	5. Soil Erosion Control and Regulation
	6. Pollination Regulation
	7. Biological, Diseases and Insects Control/Regulation
	8. Waste Treatment and Regulations
3. Supporting Functions and Services	
	1. Primary Production
	2. Nutrient Cycling
	3. Soil Formation
	4. Refugium Function
	5. Nursery Function
	6. Biodiversity Conservation Function
4. Information Functions and Services	
	1. Aesthetic Information and Function
	2. Recreation and Eco-tourism Function
	3. Cultural and Artistic Inspiration and Function
	4. Scientific and Educational Information and Function
	5. Spiritual and Historic Information and Function

The suggestions and prescriptions made under various Forest Working Circles and Miscellaneous Regulations in the Forest Working Plans to be prepared under this Working Plan Code will be directly or indirectly supporting the achievement of the above functions and services of forest ecosystems.

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CHAPTER-5
CRITERIA AND INDICATORS OF SUSTAINABLE FOREST MANAGEMENT

The use of Criteria and Indicators (C&I) of Sustainable Forest Management (SFM) will help Gilgit-Baltistan better manage its forest resources. With the use of C&I the Government of Gilgit-Baltistan, Forest Department and local stakeholders will be better able to understand the options available for managing the forest, provide more meaningful input, and participate more actively in decision making. The Forest Working Plans Code through its use of C&I of Sustainable Forest Management will facilitate forest management and reporting, and will help establish a mechanism to compile and provide timely and coordinated access to accurate forest information. A GIS Laboratory will be established in the Working Plans Forest Circle. This GIS Lab will serve as Repository of Forest Information System (FIS) and Forests and Forestry Database (FFDB).

As result of the adoption of C&I the Forests and Forestry Database (FFDP), which currently collects and stores various data for forestry statistics in Gilgit-Baltistan, will be expanded to collect and store the data required for all the C&I of SFM indicators. Second, the Forest Information System (FIS) which will be developed as part of this Working Plan Code, when fully developed, will provide with access to data via the Web and Internet as part of E-Government. Third, this Forest Working Plan Code will also enable trend estimates for many of C&I indicators and will complement the FFDP and FIS and enhance Gilgit-Baltistan's capacity to assess the sustainability of its forests.

Further and future efforts are needed to improve the ability to assess the indicators and judge progress toward sustainability. This could include the further development of reference values for the various Criteria Categories, which aid in interpreting indicator trends, or the development of more sophisticated tools to assess progress. One potential tool is the multi-criteria analysis technique in which members of the forest community are invited to score indicator reports. The results can show how different sectors of society evaluate progress toward sustainable forest management, thereby providing feedback into the policy making forum. Techniques such as this one can build on the foundation of solid forestry data already in place to gain a better understanding of Gilgit-Baltistan's progress toward sustainable forest management. For the moment, the following criteria are suggested for use to see sustainability of management practices in Gilgit-Baltistan.

5.1 CRITERION 1: EXTENT OF FOREST RESOURCES

The extent and change in extent of forest resources are main indicators of how sustainably these resources are managed. Forest degradation refers to changes within the forest class, therefore one must assess not just the direct field measurements and observations of forest degradation indicators but also the forest type classification by, e.g., designated function, biomass class, canopy cover, phenology, species composition, management regime, protection status, age-class or diameter distribution, naturalness and development status, among many others. These can all be very good

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indicators of the degree of forest degradation in any given forest. In order to derive quantitative estimates of forest degradation, it is essential to monitor the changes in extent of different forest types. The Forestry Sector Master Plan (1992) and the Pakistan Forest Institute Land Cover Study of 2012 estimates the extent of forest resources through land use/land cover mapping of the field plots and through remote sensing surveys (RSS).

Mapping of forest resources in the field plots is carried out during the field inventory and makes it possible to detect, from the ground, detailed changes and degradation in the forest characteristics and to directly relate that information to other parameters estimated on the plots. Through integrated interviews with key informants and local users of forest resources the field inventory also collects information on the drivers of changes in the extent of forest resources and also on other reliable indicators of trends in forest degradation like the historical extent of forest types as well as the planned future changes in the extent of forest resources.

Remote sensing (RS) techniques are applied to map the extent and distribution of forest types. Both wall-to-wall and sample-based remote sensing surveys (RSS) are possible. Estimations of forest resources using RS techniques have an advantage compared to field plot mapping, in that they are more cost-effective, easier to cover larger areas and thereby able to detect rare occurrences of forest types. Moreover, it is easier to understand the larger context in which a specific forest resource is located and to detect patterns in the landscape, such as fragmentation.

Costs for sample-based RSS are lower than for wall-to-wall RSS and therefore it has the advantage of allowing in-depth studies to monitor land cover and land cover changes using RS data of very high geometric and radiometric resolution, while wall-to-wall RSS can produce a full cover land use/land cover map representing the spatial distribution of the forest resources. The combination of field-based inventories on systematically sampled field plots and remote sensing surveys offers a unique possibility to integrate data from different sources that, if taken individually, would otherwise have some weaknesses. This enables the generated data to be optimized for its particular scope and strength. Therefore, it is also recommended to combine an in-depth RSS through sampling with a wall-to-wall RSS in order to optimize information generation on extent of Gilgit-Baltistan's forest resources at some future time when technology and cost parameters permit doing the same.

5.2 CRITERION 2: FORESTS AND BIODIVERSITY

Biological diversity, or biodiversity, is the variability found among living organisms and the ecosystems that harbour them. The Forests of Gilgit-Baltistan are the biggest source of terrestrial biodiversity in the area. Forest Biodiversity can be measured at the ecosystem, species, and genetic levels.

Ecosystem diversity is the variety and relative abundance of ecosystems and their plants, animals and micro-organisms communities as well as the abiotic environment and the interactions that are there. Forests and Protected Areas of Gilgit-Baltistan contain numerous types of forests, age

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classes, and soil types. There are also a number of wetlands areas found in Gilgit-Baltistan. Forest Management Planning, therefore, has to be cognizant of this fact and monitor ecosystem diversity as part of the forest planning and management.

Species diversity refers to the number and relative abundance of species found in an area. In Gilgit-Baltistan there are a number of forest-associated species known to be threatened and at risk. The risk level for these species has not decreased over time and, in fact, have increased in some cases. This is a point of concern from forest management perspective. Tracking changes in the populations of selected forest-associated species is also an excellent indicator of species diversity. Therefore, a mechanism will be put in place to monitor species diversity as part of the Forest Management Planning Process.

Genetic diversity, or the variation of genes within a species, provides the material needed for evolutionary change. Forest Department therefore will take steps and ensure that the trees or seed used to regenerate harvested areas have sufficient genetic diversity to respond to changing environmental conditions. Only a small percentage of area of forests harvested in Gilgit-Baltistan is artificially regenerated through planting or seeding. Majority areas are regenerated through reliance on natural regeneration. However, most of the seed stock used for planting or seeding degraded or barren areas is collected from natural stands in Gilgit-Baltistan or procured from sources in Khyber Pakhtunkhwa or Azad Jammu and Kashmir. Thus, the seed stock used for planning or seeding likely has all the genetic variation present in the natural population of Gilgit-Baltistan as well as that of adjoining areas. There are no seed stands or seed orchards for seed collection in the area. Gene resource information programs would be established to help monitor genetic resources. The conservation of forest genetic resources in Gilgit-Baltistan needs to be achieved through the combined efforts of federal government, other provincial/territorial governments in Pakistan, various research institutes and nongovernmental agencies. So far, though no systematic initiatives are underway to conserve forest genetic resources.

5.3 CRITERION 3: ECOSYSTEM CONDITION AND PRODUCTIVITY

Gilgit-Baltistan's forest ecosystems have evolved to cope with, and recover from, natural disturbances while maintaining productivity. Humans, however, have generated new disturbances, such as harvesting, that may come at a rate and scale that sometimes exceed the natural rate of change typically experienced by forests. To maintain a sustainable flow of benefits from the forest, it is important to understand whether the total impact of these stressors falls within the impact range of the natural disturbances forests have evolved with. Over the past years Human led harvesting and deforestation and Natural disturbances have affected much larger areas of Gilgit-Baltistan's forests than their disturbance coping ability. About 7.758 million cubic feet of merchantable wood have been harvested from the private forests of Gilgit-Baltistan over the past 20 years, representing about [illegible]% of the estimated 400.000 million cubic meters of total growing stock available in the private Forests of Gilgit-Baltistan which is included in present working plan. More permanent deforestation (i.e., through

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conversion to settlements, conversion to agriculture, forest roads construction, etc.) occurs on between 5000 hectares to 6000 hectares annually approximately which is 2% deforestation rate. However, with the initiation of Green Pakistan Pegram, 10 billion Trees Tsunami Program, the enactment of GB Forest Act 2019, deployment of LEAs, provision of logistics and other supports to forest field staff and better coordination between government departments have very positive impact on forest wealth and in decreasing pressure on forest resources including encroachment of forest lands. While afforestation (the establishment of a forest in an area where none has existed for at least 50 years) has some potential to increase Gilgit-Baltistan's forest base, current estimates indicate that only about 5000 ha to 6000 ha are afforested each year. Again, afforestation/reforestation has gained momentum with the initiation of 10BTTP Program, and it is expected that 1.3% forest cover will be increased in GB through this mega program by the time it is completed. Research efforts are needed to clarify the real impacts of climate change on forests; however, much of the forest landscape Gilgit-Baltistan so far has not been affected significantly by this phenomenon. Similarly, the impacts of insects, diseases, fires, floods, grazing and other such phenomena has not been studied and so no authentic data is available about their effects on forests. But the cumulative and combined effects of climate change and these other factors are issues that need to be studied and paid attention to prompt regeneration of harvested areas is necessary to maintain ecosystem productivity and ensure a sustainable flow of wood products. The Gilgit-Baltistan Forest Act 2019 requires Government and other Stakeholders, who will be doing commercial harvesting from now onwards, to ensure that adequate funds are available for sufficient forest regeneration to re-establish thriving forest ecosystems on harvested sites. Overall, natural regeneration has played a much larger role in Gilgit-Baltistan forestry than planting or seeding, accounting for more than 95 % of the approximately 40000 hectares of forest land that had been successfully regenerated up to 2020. The most recent data indicates though that the area of non-stocked forest land is increasing and not shrinking. By 2016, it had increased to 249000 hectares from 234000 hectares in 1993. This demonstrates that recent regeneration efforts have to be increased substantially if forests of Gilgit-Baltistan are to be re-stocked successfully.

5.4 CRITERION 4: SOIL AND WATER

Gilgit-Baltistan's forests protect surface and subsurface waters, act as filters for pollution, and are prime habitat for many aquatic and riparian species. Forest management activities can modify forest soils through disturbance, erosion, and compaction. Modifying management techniques to protect soil and water can minimize these impacts.

The Forest Department has been cognizant of and have been active in monitoring and enforcing standards and regulations governing forest harvesting to protect the integrity of forest soils and water. Further efforts will be made to increase the rate of compliance with soil disturbance standards so as it ranges from 80 to 100%. The Department will also in due course of time monitor compliance with locally applicable road construction, stream crossing, and riparian zone management standards, and make efforts so that rates of compliance however in the 60–99% range. Whenever

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noncompliance will be established, rectification and changes in operational practices will be implemented, and rules and regulations will be made so that enforcement penalties and remediation actions are in place and are regularly assessed.

Measuring the amount of stand-replacing disturbance within watersheds is an important indicator of the potential impacts of forest management on stream water quality and quantity. Unfortunately, at this time, data are not collected or are insufficient to properly assess this indicator; however, future and the current institutional reforms in the forestry sector of Gilgit-Baltistan and the Working Plan Code measures are aimed at determining the proportion of watersheds that can be harvested without causing unacceptable damage to a range of forest values is progressing.

5.5 CRITERION 5: ROLE IN NATIONAL AND GLOBAL ECOLOGICAL CYCLES

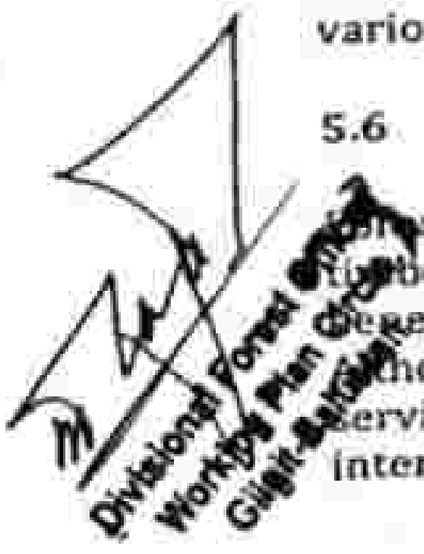
Forests absorb and store atmospheric CO2, one of the main greenhouse gases (GHG), thereby helping to mitigate climate change. Since Gilgit-Baltistan holds approximately 15% of Pakistan's forests, it has a responsibility to improve its understanding of its forests' contribution to national and global carbon cycles.

Government of Gilgit-Baltistan is actively pursuing a REDD+ Readiness Program so that it can participate in forest climate change mitigation initiatives at the Project Level, Sub-national Level and National Level. Because of the current lack of data on carbon stocks and Forest Emissions Reference Levels (RELs)/Forest Reference Level (RLs), it will have to establish a Baseline Scenario so that it can participate in Forest Carbon Performance Markets. Gilgit-Baltistan so far is doing good on this count and hopefully will be REDD+ Ready in 2022 or 2023 when it has in place REDD+ Strategy and Action Plan, a new Forest Policy, and a new Organizational Structure with complete Forest Management & Monitoring Information System in place that will all be supportive of implementing Forest Carbon Projects. Gilgit-Baltistan Forest Act 2019 covers all aspects of climate change and REDD+ activities including carbon trading and carbon credits.

Carbon stored in forest products remains locked up for days, years, or decades, depending on how the products were manufactured and used, and can affect an area's overall carbon balance. Efforts will also be made that Forest products carbon stocks increase with passage of time through various measures.

5.6 CRITERION 6: ECONOMIC AND SOCIAL BENEFITS

Forests provide substantial commercial benefits, including timber, non-timber forest products, water, and tourism, and significant non-commercial benefits, including wildlife, recreation, aesthetics, and wilderness values. Although not always measurable in monetary terms, all these goods and services are highly valued by the people of Gilgit-Baltistan, Pakistan and international community at large and provide significant benefits to local



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community and society. Sustainable forest management requires that forests be managed to provide these goods and services over the long term.

Significant economic benefits accrue to the people of the area from the forest. The most recent information shows that sales of timber products are valued greatly in the local rural economies and the contribution of the forest industry to Gilgit-Baltistan's gross domestic product is on the increase. Growth in the forest sector lagged behind that of the rest of the Gilgit-Baltistan's economy for some time, but is now, on average, catching up. Gilgit-Baltistan's forests produce a diversity of non-timber products. Although they are small in economic terms, there is considerable potential to grow and they have an important role in the economies of rural communities.

Economic, social, and environmental sustainability goals depend on a level of resource use that does not exceed the long-term productive capacity of the resource base. Although it is still difficult to assess whether the extraction of non-timber forest products falls within sustainable levels, efforts will be made under this Forest Working Plan Code to collect relevant data on non-timber forest products to better understand the management options and
harvesting impacts.

Timber product extraction takes place at levels below prescribed allowable annual cuts at present in some forests. Competitive and vital forestry sector is necessary to ensure that economic benefits continue to flow to the people of Gilgit-Baltistan. The average rate of return on capital employed (ROCE) in the forest sector has not been estimated so far in Gilgit-Baltistan. The forest sector also continues to provide thousands of jobs. Despite recent declines, the sector has generated quite a few direct jobs.

5.7 CRITERION 7: SOCIETY'S RESPONSIBILITY

Sustainability involves not only the values related to the forest resource itself but a human dimension well. Forest operations take place often on private lands that are located close to or within the boundaries of local communities. Furthermore, many rural communities depend on the forest sector for their economic and social well-being. Therefore, forest practices should reflect social values in order to be considered as effective means to achieve sustainability.

Governments and the forestry sector have significantly improved the way they consult with the local communities and other groups and communities in forest management planning. Accession Deed of 1952 between Government of Pakistan and the local people of Darel and Tangir have helped local people to gain owner ship of their land and forests in their areas, which in turn lead to better control over resource access, and enhanced long-term sustainable employment opportunities.

Government and Forest Department have also undertaken efforts to gather information on traditional ecological knowledge, funding studies to map the location of areas tradi[illegible]lly used by and of cultural importance to local

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peoples. Still, while progress is being made, efforts are needed to provide more complete and more recent information on land ownership and traditional ecological knowledge to better inform decision making.

Forests support a lot of communities across Gilgit-Baltistan, most of which are rural. Sustainable forest management is particularly important to rural forest-dependent communities because they are more likely to suffer the high potential social costs of unsustainable practices than larger towns and urban centres. The well-being and resilience of these communities can be examined by measuring specific human, economic, and social assets within the communities that provide the resources needed to respond to constant changes in their social, economic, or environmental systems. Many local forest dependent communities across Gilgit-Baltistan enjoy higher than average levels of economic diversity, suggesting that they are better able to withstand a downturn in one sector of the economy than are other non-forest owning rural communities. However, they also tend to report lower than average education attainment levels, lower employment rates, and a higher incidence of low income compared with town and urban areas communities.

Fair and effective decision making is an important social aspect of sustainable forest management. The Government and Forest Department public involvement in their forest management decision-making processes to incorporate the full range of social values and ensure a quicker response to changes in these values over time. Surveys show that quite as substantial proportion of nongovernment participants in these processes are satisfied with their involvement. Most commented that they found the process fair and worthwhile, despite the complex and demanding nature of the exercise. Recent developments in forest management have focused on progress toward sustainable forest management plan approach that balances environmental, social, and economic objectives. Perhaps the most dramatic change has been the large increase in local consultation and conflict resolution processes in decision making about forests. Since the 1990s, forest managers and policy makers have increasingly consulted with stakeholders (forest owners, local communities, NGOs, etc.) to identify appropriate forest strategies, legislation, and management plans.

Approaches to forest management that incorporate broader array of values are now widely accepted and implemented. These approaches recognize the dynamism of ecological and social systems, the benefits of adaptive management, and the importance of collaborative decision making.

The main criteria and indicators to be collected as part of the Forest Information System in Gilgit-Baltistan, will follow the C&I System developed by the International Community in 2005 and is depicted below:

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CRITERIA AND INDICATORS FRAMEWORK

1 Biological Diversity	2 Ecosystem Condition and Productivity	3 Soil and Water	4 Role in Global Ecological Cycles	5 Economic and Social Benefits	6 Society's Responsibility

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1.1 Ecosystem Diversity	2.1 Total growing stock of both merchantable and non-merchantable tree species on forest land	3.1 Rate of compliance with locally applicable soil disturbance standards	4.1 Carbon Cycle	5.1 Economic Benefits	6.1 Local Community and Accession Deed Rights
1.1.1 Area of forest, by type and age class, and wetlands in each eco-zone	2.2 Additions and deletions of forest area by cause	3.2 Rate of compliance with locally applicable road construction, stream crossing, and riparian zone management standards	4.1.1 Net change in forest ecosystem carbon	5.1.1 Contribution of timber products to the gross domestic product	6.1.1 Extent of consultation with locals in forest management planning and in the development of policies and legislation related to forest management
1.1.2 Area of forest by type and age class, wetlands, soil types, and geomorphological feature types in protected areas in each eco-zone	2.3 Area of forest disturbed by fire, insects, disease, and timber harvest	3.3 Proportion of watersheds with substantial stand-replacing disturbance in the last 20 years	4.1.2 Forest ecosystem carbon storage by forest type and age class	5.1.2 Value of secondary manufacturing of timber products per volume harvested	6.1.2 Area of forest land owned by local peoples
1.2 Species Diversity	2.4 Area of forest with impaired function due to ozone, climate change and other environmental factors 2.5 Proportion		4.1.3 Net change in forest products carbon	5.1.3 Production, consumption, imports, and exports of timber products	6.2 Local Communities land use and forest-based ecological knowledge

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	of timber harvest area successfully regenerated				
1.2.1 Status of forest-associated species at risk			4.1.4 Forest sector carbon Emissions and removals	5.1.4 Contribution of non-timber forest products and forest-based services to the gross domestic product	6.2.2 Area of forest land with traditional land use studies
1.2.2 Population levels of selected forest-associated species				5.1.5 Value of un-marketed Non-timber forest products and forest-based services	6.3 Forest Community well-being and resilience
1.2.3 Distribution of selected forest-associated species				5.2 Distribution of Benefits	6.3.1 Economic diversity index of forest-based communities
1.2.4 Number of invasive, alien forest-associated species				5.2.1 Forest area by forest tenure	6.3.2 Education attainment levels of forest-based communities
1.3 Genetic Diversity				5.2.2 Distribution of financial benefits from forests and forest products including non-timber forest products	6.4 Fair and Effective Decision Making
1.3.1 Genetic				5.3 Sustainabilit	6.4.1 Proportion

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diversity of afforestation and reforestation seed lots				y of Benefits	of participants who are satisfied with public involvement processes in forest managemen t in GB
1.3.2 Status of in situ and ex situ conservation efforts for native tree species in each eco-zone				5.3.1 Annual harvest of timber relative to the level of harvest deemed to be sustainable	6.4.2 Rate of compliance with forest managemen t laws and regulations
1.1.1 Core Indicator 1.1.1 Supporting Indicator				5.3.2 Annual harvest of Non-timber forest products relative to the level of harvest deemed to be Sustainable	6.5 Informed Decision Making
				5.3.3 Return on forestry investments and capital employed	6.5.1 Coverage, attributes, frequency, and statistical reliability of forest inventories
				5.3.4 Productivity index	6.5.2 Availability of forest inventory information to the public
				5.3.5 Direct, Indirect and Induced employment	6.5.3 Investment in forestry extension, training and capacity

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					and forestry research
				5.3.6 Average income in major employment categories	6.5.4 Status of new or updated forest management guidelines and standards related to ecological issues

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CHAPTER 6
ORGANIZATIONAL STRUCTUREAND OTHER INSTITUTIONAL PARAMETERS FOR FOREST PLANNING AND MANAGEMENT

Forestry is a provincial subject as per Constitution of Pakistan. Accordingly, each Province or Territorial/Administrative Unit has its own organizational structure for managing the affairs of the forestry sector. In addition to the different Provincial Structures, there is a Federal Forestry Set-up as well. The Federal and Gilgit-Baltistan Forestry Set-ups are discussed below.

6.1 FEDERAL LEVEL FORESTRY SET-UP

The Climate Change Divisions the main federal level institution responsible for planning and coordinating activities pertaining to forestry, wildlife and environmental protection. Within the Climate Change Division, the Office of Inspector General of Forests (O-IGF) looks after the affairs of forestry and wildlife. The professionals in the Office of Inspector General of Forests include the Inspector General of Forests (IGF), Deputy Inspector Generals of Forests (D-IGFs), and Assistant Inspector General of Forests (A-IGF). The main role of O-IGF is the coordination of forestry and wildlife related activities at the national and international level. The Office collects and publishes national level statistics on forestry and coordinates the affairs of different multilateral environmental agreements related to forestry. The IGF is also the Focal Person for REDD+. He is also the liaison person at the federal level with the Government of Gilgit-Baltistan and Gilgit-Baltistan Forest Department regarding forestry issues of Gilgit-Baltistan that need to tackled at the federal level.

Therefore, a strong liaison will be developed with the Office of IGF regarding forestry planning issues requiring federal level support in the Ministry of Climate Change at Islamabad.

6.2 GILGIT-BALTISTAN LEVEL FORESTRY SET-UP

In Gilgit-Baltistan, until recent past, the department was being run without the legally and technically required essential post of Chief Conservator of Forests. Now, with the creation of the post of the Chief Conservator of Forests, Parks & Wildlife/ Chief Technical Advisor, with three territorial forest circles for forests and 01 territorial circle for wildlife, the Department has been equipped partially with required human resource. However, despite of the approval of the Provincial cabinet, the working plan circle, to be headed by an independent Conservator of Forests Working Plans Circle is required to be established on regular footings. Currently, the Working Plan Circle has been established through FWF funded development project. The Working Plans Forest Circle has skeleton staff which is not adequate to do the job, hence there are a number of areas where the planning and management capabilities of GB Forest Department will have to be built up. The Action Areas for building the planning and management capacities of GB Forest Department are categorized as under:

Area of Action	Proposed Timeframe for addressing the Action Area

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Priority Action (PA) Areas	Two years.
Short-term Action (STA) Areas	Five years
Medium-term Action (MTA) Areas	Ten years
Long-term Action (LTA) Areas	Fifteen to twenty years

The following areas are highlighted as Areas for Action during the coming years.

6.2.1 *Institutional Strengthening*

When alpine pasture lands are included in forest cover statistics, GB is the next most forested region of Pakistan following Khyber Pakhtunkhwa, which has forest area of 2,158, 325 hectares. GB has a total forest area of 973,616 hectares (inclusive of 636,125 hectares of alpine pastures), as opposed to the forest areas (inclusive of alpine pasture lands) of Punjab, Sindh, Baluchistan and AJK which respectively have 553,862; 660,584; 498,906; and 519,394 hectares. Despite their lower forest areas, other provinces and territories have adequate and an expanded human resource and organizational structure to manage and coup with all allied disciplines associated with forestry. Specially, when the world is heading towards landscape level ecosystem management approach, by integrating all such resource management works and initiatives, it is high time to provide adequate human resource and organizational setup to manage all these resources in efficient manner. Despite this large and more productive and highly valuable forest area, GB Forests, Parks & Wildlife Department was not provided the essential post of Chief Conservator of Forests till recent past. With the creation of the post of Chief Conservator of Forests, this high priority area has been addressed. However, establishment of Working Plan Circle and creation of essential posts in this circle including the post of the Conservator of Forests (BS-19) Working Plan Circle and Working Plan Officer (BS-18) shall be treated as a Priority Area.

Similarly, it is deficient in Other Professional and Specialist Categories, e.g. Data and Forestry Information Collection and Forestry Planning capacities need appropriate strengthening. There has to be built a Forest Management Information and Planning System in GB with clear delineation of responsibilities and technical and managerial capacities to ensure the integrity and quality of the statistics and information produced and forest plans prepared in light of this relevant information. This would require not only the establishment of a GIS Laboratory in the Working Plans Forest Circle but also enhancing human resources, physical and financial resources of the Working Plans Forest Circle. These too have to be dealt with as Priority and Short-term Action Areas.

6.2.2 *Co-ordination*

In Pakistan there is very little coordination between the Bureau of Statistics and Forest Agencies. Forest surveys and other statistical inquiries are often undertaken in isolation. There is a general lack of understanding and co-ordination between forestry statistics bureaus which are the producers of forestry statistics and general statistical agencies producing socio-economic

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data used by forestry agencies. Also, the data producers and offices undertaking economic analysis, planning and decision-making (data users) are not very well coordinated.

Coordination of activities is also essential both between the various producers of forestry statistics and also between the forestry statistics system, other sectoral statistical systems and within the overall national statistics system. This co-ordination is best achieved through the establishment of a 'high-level' steering group and technical working groups. Not only coordination among data producers, but also co-ordination between producers and users of statistics is an essential key to ensure the relevance and the sustainability of the forestry information system.

Better coordination between the Forest Information System and over-all Socio-economic Information System is therefore required and would be addressed through Short-term and Medium-term Actions.

6.2.3 Data collection, validation and dissemination

Poor data integration from various sources and a lack of 'value added' through poor access and use of available data is another weak area of information. There is also this problem of poor data management characterised by poor data access, a multiplicity of data sources and conflicting datasets, a general lack of analysis and data use and difficulties in integrating data from different sources. The overall effect of this poor data management is that available data have little or no intrinsic value.

Other related problems in this regard include a weak over-all country level institutional capacity to collect problem-oriented data, to properly process and analyse the collected data, and to disseminate required information; lack of transparency and accessibility of collected and needed information; lack of tested procedures for collecting essential but missing data for sustainable forest management; and failure in forest policy (strategy) implementation.

These data collection, validation and dissemination problems will need be addressed through Priority Action, Short-term Action and Medium-term Action Interventions.

6.3 OPPORTUNITIES AND CHALLENGES

6.3.1 New methodologies and technologies

Advantage should be taken of new methodologies and technologies. While much research has been carried out on developing new and appropriate methodologies for collecting forestry statistics in rest of the world, the results of these have rarely been put into practise in GB. These research findings need to be consolidated and documented and practical manuals, like this Working Plan Code, developed so that FD personnel in GB can use these new methods for collecting forestry data. There have also been very rapid advances in technology associated with data collection, processing and dissemination and these new technologies need to be introduced where

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considered appropriate and cost effective. These technological and data processing and dissemination advances will be developed as Short-term Actions in GB.

6.3.2 Human Resources and their Skills

Currently skills and human resources at GB level are not adequate for the job. Human resource base and their skills enhancement need to be done as a continuous process as Priority Action, Short-term Action, Medium Term Action and Long-term Action Areas. In this connection national and regional networking may be attempted to take full advantage of the considerable skill and human resource base that exists in the country and within the region. This national and regional resource base will have to be used to its full advantage through the promotion of technical co-operation and networking among participating provinces of Pakistan and countries in the region and the mutual sharing of experiences.

6.3.3 New Information areas

Any intervention in the forestry sector has to be considered in the context of an agreed policy framework at the local and national level. The assessment of GB Forest Policy and national forestry policies has to be based on a sufficiently good database and analysis. The need for a database expanded beyond forest cover, production and trade to a broader base of information, is required for to define the criteria and indicators of sustainable forest management as proposed in this Working Plan Code.

Examples include data on sustainable wood supply potentials from different parts of Pakistan, information on trees outside forests and plantation forests; more in-depth analysis of fuelwood consumption and production at GB and Pakistan level; non-wood forest products; and social contributions of forests.

6.4 KEY STRENGTHENING PROCESSES IN FORESTRY INFORMATION SYSTEM

6.4.1 Institutional strengthening

Appropriate institutional arrangements will be set-up in support of the system of forestry statistics as part of the on-going institutional reforms program in the forestry sector of GB.

Functions, duties and responsibilities will be defined at all levels of the system and linkages

established. Coordinating mechanisms will be put in place. Skill levels will be enhanced to

ensure adequate managerial and technical capacity exists to enable the system to operate

efficiently.

6.4.2 Data collection process

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An integrated data collection system is a key component of the Forestry Information System. Data collection exercises (surveys) would be integrated, to the extent possible, to enable the widest possible use of the data. Master sample frames, panel surveys and extended household surveys will all be considered. Appropriate methodologies will be developed to provide cost efficient and reliable data at various levels of disaggregation.

6.4.3 Data processing process

An efficient data processing system is an essential component of the forestry information system. In order to promote ownership of the data at the GB and District level, decentralized data capture, editing and validation will be enccuraged where facilities and resources permit. Likewise vertical information flows will be designed as two-way with information flowing from the GB level to the Office of IGF, other national authorities and other Provinces and Territories in Pakistan and the processed data flowing back for use by the GB Forest Department for analysis and policy formulation.

6.4.4 Data storage and dissemination process

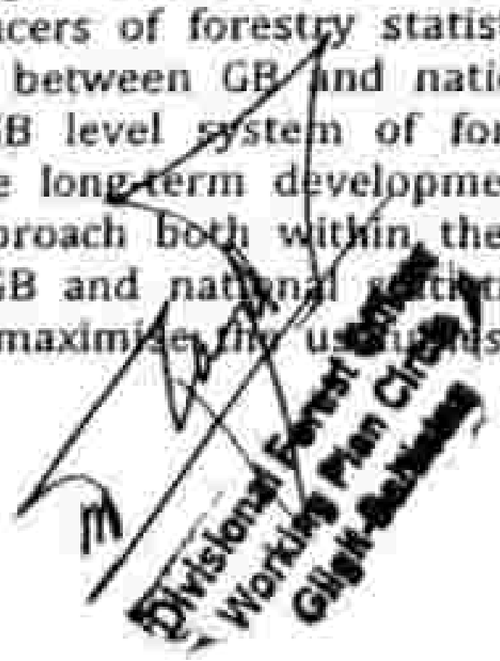
Data storage and dissemination are key factors in providing access to the data. Advantage will be taken of recent technological developments in data transmission, to the extent that facilities allow and resources are available. An optimal model is to establish a data bank (one-stop-centre) to provide a single source of forestry statistics and designed as a sectoral data bank within the larger GB level statistical information system. Focus will be placed on the widest possible dissemination of information within the GB as well as establishing external data flows with other Provinces, Territories and Pakistan level.

6.4.5 Data analysis and data use process

The use of the data is the point at which value is attached to the data. If the data is not used it has no value and should, therefore, not have been collected. In order to maximize the value of the data, emphasis will be placed on data analysis for a wide variety of purposes. As well as providing direct input to decision making and a better understanding of development issues, the analysis of the data is expected to highlight weaknesses in the present system and lead to improvements in the future systems thus creating a continuous analysis and improvement cycle.

6.5 STRATEGIES ON ENHANCING THE FORESTRY INFORMATION SYSTEM

Ideally, strategies will be based on a partnership approach between the various producers of forestry statistics, the producers and users of these statistics and between GB and national level as well as the international community. GB level system of forestry statistics is conceived within a comprehensive long-term development framework and the adoption of an integrated approach both within the sectoral statistical system and within the broader GB and national statistical system to minimize duplication of effort and to maximize the usefulness (value) of the data. Co-ordination is



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essential for a successful programme. Co-ordination is expected to take place both between the statistical activities within GB and with the National Government and, where applicable, the donor community supporting statistical development. Coordination between donors is also essential and external technical and financial support and interventions are anticipated to support the establishment of and further strengthening of the established forestry statistical program of Government of GB.

One useful means of promoting stronger GB level, national level and international level systems is to build regional networks among national statistical correspondents to increase the exchange of data and information management methods; this can be accomplished through meetings in conjunction with the regional workshops. During the workshops the participants can review the particular challenges faced in each Territory, country and to share experienced solutions to common problems.

Depending on resources availability, the above interventions about forestry information system building in GB will be implemented in phases through various short-term, medium term and long-term action areas.

6.6 MANDATE OF WORKING PLANS FOREST CIRCLE

The current Working Plans Circle of GB will be strengthened and its mandate clarified and expanded as follows:

- Conduct comprehensive inventories of forest resources, including timber, non-timber forest products, wildlife, and biodiversity.
- Evaluate forest health, soil quality, water resources, and overall ecosystem status.
- Gather data on forest-dependent communities and their interactions with forest resources.
- Develop detailed Forest Working Plans outlining objectives, strategies, and management practices for sustainable forest management.
- Engage with local communities, government agencies, non-governmental organizations, and other stakeholders to incorporate their inputs and address their concerns in Forests working plan.
- Ensuring that the plan aligns with national and regional forest policies, laws, and international agreements.
- Plan and oversee natural and artificial regeneration activities, including planting and seeding operations under working plan.
- To define sustainable harvesting techniques and ensure adherence to these methods.
- Promoting the involvement of local communities in forest management activities.
- Develop mechanisms to ensure equitable sharing of benefits derived from forest resources under working plan execution.
- To establish indicators and conduct regular monitoring to assess the implementation of the Forest Working Plan.
- To conduct impact assessments to evaluate the ecological, social, and economic outcomes of the plan.

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- To prepare and submit periodic reports to higher authorities and stakeholders, documenting progress and challenges.
- Conducting training programs for forest staff and local communities to enhance their skills in sustainable forest management.
- To organize awareness campaigns to educate the public and stakeholders about the importance of forest conservation and sustainable practices.
- Coordination with other government departments, research institutions, and non-governmental organizations to ensure integrated forest management.
- Raise collaboration among various stakeholders, including private sector entities and community-based organizations.
- Periodically review and revise the Forest Working Plan based on monitoring results, changing conditions, and new scientific knowledge.
- Ensure the implementation of national and regional forest policies, laws, and regulations and aligning working plan accordingly.
- Identify and mobilize financial resources from various sources, including government funds, grants, and private sector investments for preparation, implementation, execution, monitoring and evaluation of working plan.
- Carry out inventories of forests and other renewable natural resources which are within the mandate of GB Forest Department.
- Collect, process, analyse and store the spatial and non-spatial data on forests, other renewable resources and socio-economic conditions and provide specialized input in forest planning and investment at GB level.
- Ensure quality control of the data, processes and methodologies of strategic and operational forest planning and facilitate in local level planning with the involvement of VDCs/VCCs, WOs and JFMCs.
- Develop and maintain Management Information System (MIS) and Geographic Information System (GIS) for planning, monitoring & evaluation and for making necessary adjustments of forest working plans, operational plan, resource mobilization etc.
- Liaise with national, other provincial and international level agencies for forestry statistics and forest planning and other related functions.

6.7 FUNCTIONS AND DUTIES OF THE CHIEF CONSERVATOR OF FORESTS.

The Chief Conservator of Forests, Parks & Wildlife as head of the attached Department/Chief Technical Advisor will perform the following functions

Roles, Functions, Duties and Tasks under working plan

- Provide strategic direction and guidance for the preparation, implementation, and revision of Forest Working Plans.
- Oversee the overall functioning of the FWPC, ensuring adherence to sustainable forest management practices and policies.

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- Recommends working plan for Approval and ensure they align with national and regional forest policies.
- Supervise the preparation, execution, and monitoring of Forest Working Plans by the FWPC.
- Ensure that forest management practices comply with national and regional forest policies, laws, and international agreements.
- Develop and implement guidelines and procedures for implementation of working plan for forest management and conservation.
- Oversee the preparation and management of budgets for forest management activities.
- Allocate financial, human, and technical resources for the implementation of Forest Working Plans.
- Coordinate with other government departments, research institutions, NGOs, and private sector entities to promote integrated forest management.
- Establish and monitor key performance indicators to assess the effectiveness of forest management plans.
- Conduct periodic impact assessments to evaluate ecological, social, and economic outcomes of forest working plan.
- Ensure timely and accurate reporting of forest working plan and outcomes to higher authorities and stakeholders.
- Promote socio-economic development programs that support sustainable livelihoods for forest-dependent communities.
- Develop and implement benefit-sharing mechanisms to ensure equitable distribution of forest-derived benefits.

Administrative Roles, Functions, Duties and Tasks

- Administer the staff of Working Plans Circle.
- Assign Working Plans staff to Territorial Forest Circles and provide technical supervision.
- Design internal task division, communication and procedures for Working Plans Circle in consultation with the Conservator of Forests Working Plan & territorial Conservators of Forests.
- Timely respond to all type of inter and intra organizational correspondence.
- Oversee all affairs related to Working Plans activities at all levels and take necessary steps and/or provide needed assistance to all concerned.
- Develop and maintain liaison with relevant agencies /organizations, network etc.

Managerial Roles, Functions, Duties and Tasks

Develop and maintain an effective policy formulation and review mechanism in consultation with the Conservator of Forests Working Plan, territorial Conservators of Forests and other relevant agencies in GB, get this approved by competent authority, and practice it for forest

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policy formulation and periodic review with respect to forests and forestry other regional development aspects as and when required.

- Facilitate in formulation, review and execution of strategy of the forest policy and programs (including sector and sub-sectors) with the input of other stakeholders.
- Gather information on relevant policies by other government agencies analyse them in order to see whether these fit in implementation of forest policy and to identify the areas of collaboration at various levels.

Technical Roles, Functions, Duties and Tasks

- Provide technical guidance to Working Plans Forest Circle unit teams for preparation of strategic plan and forest working and other forestry plans by collection of socio-economic data and planning data from secondary sources in consultation with and collaboration of all concerned following the already experienced and approved steps:
  1. Land Use Mapping
  2. Cluster sampling for overall land use.
  3. Grid sampling for commercial forest: Private and Protected Forests.
  4. Field inventory.
  5. Socio-economic survey
  6. Data analysis (partly with the use of software)
  7. Write-up.
  8. Reviews and discussions
  9. Submission to CCF for approval
- Provide guidance and assistance to Forest Department staff and other stakeholders for preparation of operational plans, village/valley plans and joint forest management plans.
- Facilitate FD staff particularly at circle level using MIS in prioritizing, adjustments, fine-tuning of annual work plans in light of available resources (human, logistics and financial resources)
- Ensure the preparation of Forest Working Plans Code and its further elaboration and implementation through Field Manuals.
- Procurement, storage, processing and analysis of remote sensing material (satellite images, aerial photographs etc) in a Geographic information System (GIS)
- Ensure operational quality and O&M of MIS and GIS laboratory.
- Provide guidance, assistance and advice to Forest Department staff in collection, processing and analysing monitoring data at Central Forest Circle level and on internal monitoring systems.
- Compile the monitoring data at Forest Circle and GB level, analyse the data and prepare progress, process and effect monitoring reports and/or maps in light of already developed progress, process and effect indicators with respect to WPs and OPs on NRM and socio-economic development
- Use and promote use of monitoring data to support all other activities and to formulate research topics for applied research in collaboration with concerned agencies.

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Financial Roles, Functions, Duties and Tasks

- Finalize the consolidated budget and the appropriation proposals for the Working Forest Circle.
- Arrange the required financial resources for various forest planning and management activities.
- Accord sanctions for various Forest Circle activities In the light of prevailing rules of business of the government and financial powers.

Reporting, Monitoring and Record Maintenance Roles, Functions, Duties and Tasks

- Ensure internal reporting by Working Plans Forest Circle, and thereafter monitoring of the Working Plan Circle.
- Monitor the Planning and Monitoring activities through developed monitoring system and field tours/visits and provide on-spot guidance/advice for further improvement, as per need.
- Prepare and/or compile the reports of all P&M activities and submit to all concerned for sharing information and records.
- Approval of work plan and other needed progress reports and sharing these two quarters concerned.

FUNCTIONS AND DUTIES OF CONSERVATOR OF FORESTS, WORKING PLAN CIRCLE

The Conservator working plan as head of working plan circle will perform the following functions

Roles, Functions, Duties and Tasks under working plan

- Oversee comprehensive surveys and data collection on forest resources, biodiversity, and socio-economic factors.
- Conduct assessments of forest health, soil quality, water resources, and ecosystem status.
- Develop detailed Forest Working Plans with specific objectives, strategies, and management practices.
- Ensure the effective implementation of the Forest Working Plans.
- Establish mechanisms for continuous monitoring and periodic evaluation of plan implementation.
- Manage and allocate human resources efficiently for plan implementation.
- Oversee budget preparation, allocation, and management for various activities under the plan.
- Coordinate with other government departments, research institutions, and non-governmental organizations and to engage with local

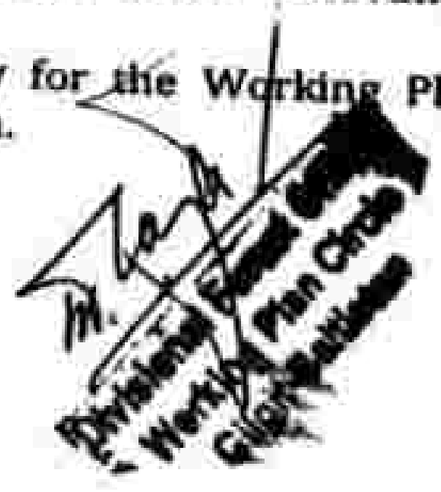
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communities, indigenous groups, and other stakeholders in the planning and implementation processes.

- Provide guidance for the preparation and execution of Forest Working Plans.
- Lead and manage the FWPC team to ensure effective plan implementation.
- Provide technical guidance and expertise in forestry practices and sustainable management techniques.
- Conduct training programs for FWPU staff and other stakeholders on sustainable forest management.
- Establish key performance indicators and monitor the progress of plan implementation.
- Prepare and submit detailed progress reports to the Chief Conservator of Forests and other relevant authorities.
- Promote the involvement of local communities in forest management activities.
- Ensure proper documentation and management of data collected during surveys and assessments.
- Oversee the preparation and management of budgets for forest management activities.
- Ensure accurate and timely financial reporting to higher authorities.
- Ensure that all activities under the Forest Working Plan adhere to national and regional forest policies and regulations.
- Develop and update guidelines for the execution of various components of the Forest Working Plan.
- Address and resolve conflicts related to forest land use, resource allocation, and community rights.

Administrative Roles, Functions, Duties and Tasks

- Supervise the staff of Working Plans Circle.
- Develop and implement a procedure for priority setting and circle level planning and provide professional support to concerned Conservators of Forests for planning in their respective Forest Circles.
- Develop and strengthen liaison with all relevant agencies/organizations, network etc at GB as well as national and regional level to share the updated information and experiences, utilizing their expertise/services during and post project period as and when required. Also explore the possibilities of getting support from these agencies /organizations in conducting impact studies, reviewing and modification of participatory planning, monitoring and evaluation methodologies.
- Develop a special information storage and retrieval system in the Working Plans Circle for easy reference by other forestry staff of GB Forest Department and other relevant stakeholder groups and researchers.
- Develop overall policy for the Working Plans Circle and to ensure its proper implementation.



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- Arrange periodic seminars, workshops, discussion forums on various planning, monitoring and evaluation procedure/systems, formats developed for the purpose in collaboration with office of Chief Conservator of Forests for better understanding the need and importance of such activities.
- Evaluate performance and professional capacities of the Circle staff, identify training needs and arrange necessary trainings in collaboration with relevant training agencies and PFI, exposure visits and on-job training etc to enhance their competencies for a quality professional support to the area management and other GB Forest Department staff and communities.
- Develop and maintain an environment of close coordination and collaboration with other GB Forest Department and stakeholders on tasks, strategies and implementation and in provision of needed sectoral assistance/support.
- Follow-up and remain informed of relevant development elsewhere in Forest Planning and Monitoring planning and participatory approaches and incorporate useful and applicable innovations to the system/methodology.
- Assign Working Plans staff to Territorial Forest Circles and provide technical supervision.
- Design internal task division, communication and procedures for Working Plans Circle in consultation with the Conservator of Forests Working Plan & territorial Conservators of Forests.
- Timely respond to all type of inter and intra organizational correspondence.
- Oversee all affairs related to Working Plans activities at all levels and take necessary steps and/or provide needed assistance to all concerned.
- Develop and maintain liaison with relevant agencies /organizations, network etc.

Managerial Roles, Functions, Duties and Tasks

- Facilitate in formulation, review and execution of strategy of the forest policy and programs (including sector and sub-sectors) with the input of other stakeholders.
- Gather information on relevant policies by other government agencies analyse them in order to see whether these fit in implementation of forest policy and to identify the areas of collaboration at various levels.

Technical Roles, Functions, Duties and Tasks

- Provide guidance and assistance to Forest Department staff and other stakeholders for preparation of operational plans, village/valley plans and joint forest management plans.
- Assist the Chief Conservator of Forests and Other Conservators of Forests to identify and formulate the training needs of Forest Department staff in Working Plans (WP), Operational Plans (OP),

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Village/Valley Plans (VP), Joint Forest Management Plans (JFMP) preparation following the agreed steps.

- Evaluate the WPs, OPs, VPs, JFMPs, in light of collected monitoring data and also review these plans as per criteria/mechanism developed for the purpose.
- Facilitate FD staff particularly at circle level using MIS in prioritizing, adjustments, fine-tuning of annual work plans in light of available resources (human, logistics and financial resources)
- Draft the issues, adjustments, improvements and other changes experienced/required in approaches, procedures and methodologies on WPs, OPs, JFMPs preparation, communicate and discuss these with FD staff and stakeholders, finalize, put in practice and periodically review for further tuning if needed.
- Ensure the preparation of Forest Working Plans Code and its further elaboration and implementation through Field Manuals.
- Undertake research aimed at resource inventory, remote sensing and GIS, socio-economic data collection methods, planning and management in collaboration with PPFI and other relevant agencies and incorporation of research results into planning routines and manuals.
- Provide input in reviewing the Training Modules of GB Forest Department, PFI and Other Training Institutes.
- Provision of GIS based land cover, land use and land status maps, population and socioeconomic data and suitability maps for WPs, OPs, VPs, JFMPs & NRM interventions.
- Ensure operational quality and O&M of MIS and GIS laboratory.
- Provide guidance, assistance and advice to Forest Department staff in collection, processing and analysing monitoring data at Forest Circle level and on internal monitoring systems.
- Develop Progress, Process and Effect Indicators for Forest Planning and Management.
- Compile the monitoring data at Forest Circle and GB level, analyse the data and prepare progress, process and effect monitoring reports and/or maps in light of already developed progress, process and effect indicators with respect to WPs and OPs on NRM and socio-economic development.
- Use and promote use of monitoring data to support all other activities and to formulate research topics for applied research in collaboration with concerned agencies.
- Initiate and commission impact studies in consultation with Chief Conservator of Forests.
- Monitor and plan for maintenance and enhancement of MIS& GIS facilities and equipment.
- Coordinate with and provide technical guidance to Working Plans staff posted to Forest Circles.
- Guide and assist FD staff, Communities and NGOs in Planning &Monitoring activities including participatory planning and implementation of community extension and women development interventions.

Financial Roles, Functions, Duties and Tasks

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- Submit the consolidated budget and the appropriation proposals for the Working Forest Circle.
- Assist the department in preparation of the development budget.
- Prepare and submit the YPO of the Working Plans Foret Circle to the Chief Conservator of Forests for preparing the overall YPO of the department and its approval from the authorities concerned.
- Accord sanctions for various Forest Circle activities in the light of prevailing rules of business of the government and financial powers.
- Submit the monthly and periodic accounts of all expenses of the Circle to the concerned authority.
- Keep and maintain records of all financial matters of the Forest Circle for audit purposes.

Reporting, Monitoring and Record Maintenance Roles, Functions, Duties and Tasks

- Ensure internal reporting by Working Plans Forest Circle staff.
- Develop and maintain the internal filing system for WPs, Ops, VPS, JFMPs both in hard as well as soft copies form.
- Facilitate the Office of Chief Conservator of Forests and Territorial Forest Circle in monitoring of the progress of annual development budget works and over-all forest conservation, development and management.
- Consolidate the required periodic reports based on the information received from the Circle staff and submit these to the government.
- Monitor the Planning and Monitoring activities through developed monitoring system and field tours/visits and provide on-spot guidance/advice for further improvement, as per need.
- Prepare and/or compile the reports of all planning and development related activities and submit to all concerned for sharing information and records.
- Ensure continuous improvement in P&M activities through effective monitoring and evaluation system developed for the purpose.
- Prepare and/or compile the reports of all P&M activities and submit to all concerned for sharing information and records.
- Guide and assist the area management, communities and NGOs on participatory monitoring and evaluation of various NRM related and other activities mentioned in the interventions menu. Whenever and wherever feasible
- Prepare work plan and other needed progress reports and submit these two quarters concerned.

6.8 WORKING PLANS UNIT

The Working Plan Unit (WPU) is headed by a Conservator of Forests. His team members include one Working Plan officer/Divisional forest officer, two Assistant Conservator of Forests (ACF)/Sub-Divisional Forest Officer (BS-17), four Range Forest Officers (BS-16), Eight Foresters (BS-11) and Sixteen Forest Guards (BS-09). There may be other Specialized staff such as Remote Sensing and GIS Analyst/Mapping Specialist, Biodiversity Assessment Specialist, Forest Ecologist, Rural Sociologist, Socio-economist

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and Statistician/Data Analyst posted with him when such staff positions become available over time in the Department.

Till the time regular positions are not available in the organization, Working Plans Forest Circle/Forest Department will engage various Specialist Positions on contract-basis or outsources some of the functions for carrying out through private consultants.

6.9 WORKING PLAN PERIOD AND TIME REQUIRED FOR PREPARATION OF WORKING PLANS

Generally, Forest Working Plan remain operative for 10 to 15 years and a Revised Working Plan must be available on completion of the time period of the previous working plan. However, it is at the discretion of the Government to implement a working plan beyond such period for valid reasons on the explicit recommendations by the Department through the office of the Chief Conservator of Forests. The time required for the preparation of the working plan of a Forest Area/Territorial Forest Division is usually two years. This may vary depending on the volume of work to be done and the human, financial, technical and other resources made available for doing the job and continuity of the human resources on the job who are assigned to do the job.

6.10 WORKLOAD ASSIGNMENTS AND NUMBER OF WORKING PLAN UNITS

Number of Working Plan Units in a Forest Circle depends upon the workload, i.e., number of territorial divisions for which working plans are to be prepared/ revised for the cycle of 10 to 15 years. Generally, one Working Plan Unit may undertake the work of preparation of Working Plan for an area of 40,000 to 60,000 hectares and may cover four or five Forest Management Plans Areas/Forest Divisions in a cycle of 10 years.

A Conservator of Forests can supervise the work of 4-5 Working Plan Units.

Working Plans need to be prepared for all areas under the management control of the Forest Department. Gilgit-Baltistan Forest Department is managing most of the forest area in Gilgit-Baltistan, be it Private Forests or Protected Forests.

6.11 IDENTIFICATION OF FOREST AREA FOR WHICH WORKING PLAN IS TO BE PREPARED

The Chief Conservator of Forests/Head of the Forests, Park & Wildlife Conservation Organization is responsible for and has to ensure that all forests in his jurisdiction are being managed under a valid Forest Working Plan/Management Plan. Therefore, the Chief Conservator of Forests in consultation with the Conservator of Forests Working Plans and the Territorial Conservators arranges for and makes plans through the Conservator of Working Plans that the preparation of Working Plans for all Forest Divisions is done in timely manner keeping in view the time required

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for the preparation of the Working Plan and the work load that can be handled by each Working Plan Unit.

If for some reason, the Working Plan Revision work cannot be done as per schedule, the plan period of some Working Plans can be changed (increased or decreased) for staggering and streamlining Working Plan preparation in the province.

However, it is also the responsibility of the Chief Conservator of Forests to ensure that all Working Plan Prescriptions of an Approved Plan are implemented in their letter and spirit.

6.12 TENURE OF WORKING PLAN OFFICER AND OTHER WORKING PLAN UNIT MEMBERS

For timely completion of work and consistency reasons, it is preferable that the Working Plan Officer (WPO) and other members of Working Plan Unit continue working on the assignments they have been given and are not be transferred during the preparation of the Working Plan.

6.13 HEADQUARTER OF THE WORKING PLAN UNIT

The Working Plan Circle will be based at Gilgit as an attached office of the Chief Conservator of Forests, Parks & Wildlife GB. This circle will be transformed into Planning & Development Circle thereby integrating all associated activities and specialized activities of the department, and activities related with management planning of both Private Forest & Protected Forests. Such an arrangement facilitates proper coordination and smooth flow of information/records.

6.14 STATUS AND ALLOWANCES

For all practical purposes, the Working Plan Circle is treated as a functional charge, and the Conservator of Forest, Working Plan Circle shall be given the status and administrative and financial powers of a Conservator of Forests. Members of the Working Plan Circle shall be part of the Forest Establishment and Forest Force except ministerial staff and shall exercise the legal powers as envisaged in the law including magisterial powers as per provisions and admissibility.

The Conservator of Forest, Working Plan Circle shall be assisted by the Working Plan Officer (WPO), who shall be a Divisional Forest Officer (BS-18) from amongst the serving DFOs of the Department.

The Conservator of Forests Working Plan Circle, WPO and other supporting officer/staff of the Working Plan Circle shall be entitled to special pay equivalent to the best option of such allowance permissible, e.g., 30% of running basic pay subject to admissibility as per law & rule.

06.00 BUDGET AND ACCOUNTS AND OFFICE MANAGEMENT

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Appropriate and timely budgetary allocation is a pre-requisite for timely completion of Forest Working Plans/management Plans. Budget spending powers and accounts maintenance and other related issues are to be done in accordance with the prevailing Rules and Regulations of Government of GB and GB Forest, Parks & Wildlife Department.

The proposed budget estimate is prepared by the Conservator of Forests Working Plans in consultation with the Working Plan Officer a year before the working plan revision is due to commence. Copies of the budget are sent to the Chief Conservator of Forests who prepares a Consolidated Budget for the entire attached Department of Forest, Parks & Wildlife.

The allotted and released budget is spent by the Working Plan Circle through Working Plan Unit (Office of the Working Plan Officer). For this purpose, the WPO or his sub-ordinate officer exercises the powers of a Drawing and Disbursing Officer (DDO) & Sub Drawing and Disbursing Officer (Sub-DDO) respectively as in vogue in the Department of Forest, Parks & Wildlife.

The Office management and maintenance of records, reporting of progress of work, and expenditure are according to the procedures laid down by the Government of GB and Forest, Parks & Wildlife Department.

6.16 CO-OPERATION OF TERRITORIAL AND ASSISTANCE FROM OTHER SPECIALIZED INSTITUTIONS

It is mandatory for the in-charge of the Territorial Forest Circle and Forest Divisions to extend full cooperation and assistance to the CF Working Plan and WPO for fieldwork and provide logistical support, access to official records and other information. The WPO may also seek assistance from specialized institutions like PFI and Universities etc. for preparation of working plans as and when required.

6.17 OFFICE AND RESIDENCES

Government and Forest, Parks & Wildlife Department are to provide necessary office and residential accommodation to all officials of Working Plan Circle both at head quarter and field levels as per rules and norms in force and applicable to their rank and status.

6.18 EQUIPMENT AND FURNITURE

The Working Plan Unit is be equipped with necessary equipment and furniture as per requirement including tents, boxes, folding chairs and tables, cots, wedge prisms, diameter tapes, axes, prismatic compasses, Abney's level, planimeters, acre square, drawing board, drawing instruments, GPS, printers, computers and its accessories along with necessary software e.g. GIS software etc.

6.19 TRANSPORTATION AND COMMUNICATION

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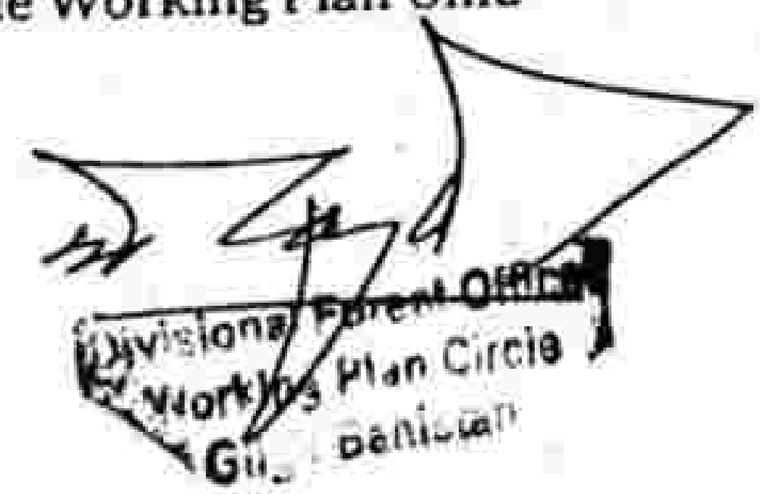
The WPO is allowed the same scale of transport and communication facilities as per his rank. Appropriate transportation and communication facilities are also to be given to the other team members, particularly the Assistant Conservator of Forests and Range Forest Officer. If official transport is not available for some reason, necessary hiring of vehicles will have to be authorized so that they can carry out forest inventory and ground-checking etc. as per requirement in the field.

6.20 STATIONERY AND BOOKS

Adequate stock of stationary and forms will have to be provided to the WPO. The procedure (type, quantity, and rules for procurement and record keeping) is as laid down by the GB Government.

Following books are generally required by the Woodforest Manuals, Financial Hand Books, Practical Forest Management, Forest Pocket Book, Forest Policy of the region/province and the National Forest Policy, Forest Laws, JFM Guidelines, Eco-development Guidelines, Working Plan Code, working plan under revision and older working plans, Forestry Action Plan, PFI reports on forest cover, annual forest statistics, technical books and forestry journal etc. Policies and Laws of other relevant departments may also be required. These include the Land Acquisition Act, Revenue Manuals, Survey of Pakistan Manuals, Environment Policy and Act, Climate Change Policy, Development Policy, Agriculture Policy, etc.

An information library, with computers and internet connections and other communication facilities; and digital store house of all relevant working plans and maps along with necessary database will have be established and maintained in the Working Plan Unit.



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CHAPTER 7
RESOURCES AND OTHER INPUTS FORFOREST PLANNING

7.1 MAPS, THEMATIC LAYERS AND REMOTE SENSING SATELLITE IMAGERY

DFO territorial traditionally supplies toposheets of 4" to 1 mile or higher scale for stock mapping along with two sets of 1:25,000 and six sets (two cut and mounted and rest four uncut and un-mounted) of 1:50,000 scale maps to the WPO. These toposheets are used as follows:

- The WPO uses two cut and mounted sets of 1:50,000 scale maps in office and field.
- One set each of stock maps on 1:50,000 scale is sent to the Conservator of Forests Working Plans and the DFO.
- One set each of the management maps on 1:50,000 scale to the Conservator of Forests Working Plans and the DFO.
- One set each of working plan maps on 1:25,000 scales to the Conservator of Forests Working Plan and the DFO.

Additional copies of management and working plan maps may be made by the DFO as per the requirement.

The WPO is also to be provided digital maps of the division based on latest, cloud free, good quality satellite imagery along with the several copies of print outs of the map on 1:25,000 scale from the GIS Lab of the Working Plan Circle or the Forest, Parks & Wildlife Department, whichever is applicable. Relevant and latest satellite data with spatial resolution of 5.8m or higher can be used for generating maps up to the scale 1:12,500. The satellite imagery-based information can be used for various steps in preparation of working plan including:

- Forest cover map
- Stock map
- Picking up details for creating management maps
- Planning surveys and field inventory
- Base line reference map

A map showing forest fire spots detected in the last five years may also be part of the working plan.

Scale of the maps used for different purposes in preparation of working plans and also maps produced as output of the exercise may be specified as follows:

i. Survey of Pakistan (SOP) topographic sheets on 1:50,000 or 1:25,000 scale if available for the area to be used as base map.

ii. Forest cover and forest type maps from PFI or some other GIS Lab on 1:50,000 scale for posting boundaries of forest division, forest range, forest blocks, forest beats, forest compartments and sub-compartments and for stratification of forest for sampling for resource assessment. If possible, the

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WPO is to be provided *Geomatic Support System (hardware - workstation, DGPS/GPS; software - Digital Image Processing (DIP), Geographic Information System (GIS) etc.*). Multi-dated forest cover and forest type maps (PFI) in digital and hard copy form on 1: 50,000 scales will be useful and can be used for change matrix analysis.

iii. Forest cover mapping using at least IRS P6 LISS IV data on 1:12,500 scale may be obtained from sources like PFI or other GIS Lab. This will help in maintaining a record of synoptic coverage (of satellite image) of entire forest area under the division on a fairly large scale and also be useful in working plan preparations in several ways.

iv. All management/working circle maps, stock map-1:12,500 scale.

7.2 SPATIAL DATABASE IN GIS

Spatial database of the working plan area/forest division with spatial layers is, if available, of immense use in preparation of working plan and later in day-to-day forest management
decisions of the Forest Division.

7.3 COMPARTMENT HISTORIES, CONTROL FORMS AND DEVIATION STATEMENTS

The WPO is supplied with updated compartment / village/ management unit history, deviation forms, control forms and all other base line data required for working plan along with the list of JFM areas and work done by the DFO territorial.

7.4 PRELIMINARY WORKING PLAN REPORT (PWPR)

PWPR is of considerable importance as it forms the basis of the WPO's intensive fieldwork. Therefore, the WPOs should be provided with PWPR with necessary details of the working plan area, review of management practices adopted during the working plan period including the extent of harvesting, proposed maps to be prepared or revised, information to be collected and sources of information, list and type of field work to be done, and time schedule for various works to be done by the WPO. Specific comments are made on Part I of the working plan regarding such sections which are required to be updated. Necessary information and database must be made available to WPO in this regard. The PWPR also indicates the work that the WPO has to do during first year's field work, makes clear what information he has to collect and what information is already available, what maps he has to prepare and what maps are available to him, the kind of vegetation and other survey he has to undertake and the kind of studies already done for the area, the type and intensity of enumerations he has to do in each working Circle, and so on.



Part II requires detailed comments and in-depth analysis of the results of the past management for each Working Circle separately. Success or failure and reasons, if known, are taken note of; the impact of the past working plan and the extent of harvesting are reviewed. While writing Chapter on

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"Past Systems of Management" critical analysis should be done about deviations /failures in fully achieving the past prescriptions. As far as possible, attempt should be made to quantify the achievements of past prescriptions.

Preliminary Working Plan Report shall aim at ensuring sustainable management of forests through existing or suitable innovative silvicultural systems for maintaining and enhancing supply of Medicinal and Aromatic Plants (MAPs), NWFPs, along with other forests goods and ecosystem services for the benefits of local people.

7.5 PREPARATION OF PWPR

During the following working season, i.e., in the working season immediately preceding that, in which the working plan revision is due to commence (at least three years before the expiry of current working plan period), the concerned DFO territorial shall be directed by Head of the Territorial Forest Circle to initiate preparation of the preliminary working plan notes. These notes briefly review the results of management during the past years, and point out whether the general system of management is satisfactory or not, and suggest any necessary change for improvement. He must complete the notes within two months' time and submit the note to Head of the Territorial Forest Circle. Territorial Circle In-Charge inspects the forests concerned, and writes the Preliminary Working Plan Report (PWPR) during or soon after his tour within two months' time and submits the draft to the Chief Conservator of Forests for consideration in the consultative body. A check list of necessary information and inputs to be provided to WPO should be annexed along with PWPR for the scrutiny of and guidance from the body.

7.6 CONSULTATIONS WITH LOCAL STAKE HOLDERS

The Territorial Circle In-Charge during his PWPR preparation will hold consultation with the local people forum, VDC/VCC and JFMCs, if existing. The expectations of the owners, locals and forest dependent communities shall be accommodated to the extent possible and in light of their feasibility and desirability from the perspective of long-term and sustainable management of forests.

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CHAPTER 8
CONSULTATION, DRAFTING, FINALIZATION, APPROVAL, PRINTING, AMENDMENTS MAKING AND MONITORING PROCESSES

8.1 STANDING CONSULTATIVE COMMITTEE

There shall be a Standing Consultative body at the level of Gilgit-Baltistan. This Standing Consultative Body shall be chaired by the Chief Conservator of Forest, Parks & Wildlife, Gilgit-Baltistan and shall have representation of experts from the federal government, Conservator Wildlife Gilgit-Baltistan, Conservator of Forests Working Plans Circle, Territorial Conservators of Forests and concerned Divisional Forest Officers and Working Plan Officer. Representatives from PFI, Conservation Organizations like IUCN, WWF, Research Organizations and Other relevant agencies may be invited on need basis if deemed necessary to this Consultative Body, as assessed by the Chief Conservator of Forest, Parks & Wildlife.

8.2 FINALIZATION OF PWPR

The draft PWPR is deliberated upon in the Standing Consultative Committee and the final draft is prepared in light of the comments received during the consultation.

The approval of Preliminary Working Plan Report by CCF is to be granted at least two and half years prior to the expiry of the current working plan, so that the preparation of working plan by the WPO, approval by the competent authority and delivery of approved working plan to the DFO concerned for implementation can be completed prior to expiry of the current plan.

8.3 DRAFT WORKING PLAN

It is advisable for the WPO to submit first draft of his plan within one and a half year (one year for data collection and six months for writing) as per the approved PWPR and time frame. By this time the WPO has completed collection of forest resource inventory data, growth and yield statistics, and completed stock mapping.

Part I of the working plan provides the information generated from various sources including Forest Inventory and Assessment. The Chapter on "Past Systems of Management" and on "Statistics of Growth and Yield" should be written as comprehensively as possible and should be completed soon after the data has been compiled and analyzed.

Part II will be written chapter by chapter, and using more or less standardized paragraph headings in their proper order. The write up of Part II shall be based on information provided in Part I.

The draft working plan is to be self-contained so that it is not necessary to refer to any other document to understand it. This should be accompanied by a short explanatory note stressing upon any point of importance and drawing the attention of the Conservator of Forests Working Plans to any

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deviation from the PWPR or subsequent instructions. The complete plan along with required maps is first vetted by the Conservator of Forests Working Plans. He then sends sufficient copies to the Chief Conservator of Forests for circulation to the other members of the Consultative Body.

Copies of the draft plan shall be sent to the members of the Consultative Committee at least 45 days prior to the final meeting of the Standing Consultative Committee. This should be deliberated in the meeting and commonly acceptable suggestions/alterations/modifications will be incorporated in the final draft working plan. In case of any serious and irreconcilable difference of opinion between the Forest Department, federal government and other stakeholders, the matter may be referred by the CCF to convene another meeting of the Consultative Body which will be chaired by the Secretary Forests, Government of Gilgit-Baltistan, for final decision in the matter.

8.4 SUBMISSION OF THE PLAN

Draft WP as deliberated in the Standing Consultative Committee and as revised after incorporating the suggestions of the committee will be is sent to the Chief Conservator of Forests-GB by the Conservator of Forests Working Plan Forest Circle.

8.5 SANCTION OF THE PLAN

After its examination and endorsement by the Chief Conservator of Forests-GB, the draft working plan will be sent to the Secretary Forests, for its approval from Government of GB through the Cabinet as such or with necessary suggestions, directions and modifications within 3 months.

8.6 PRINTING OF THE PLAN

Sufficient copies of the plan as approved by the Government may be printed and soft copies (SC) uploaded on the website. Copies of the Working Plan will be sent to the following offices/officers:

- Office of the Chief Conservator of Forests, GB-5 copies
- Office of the Conservator of Forests Working Plans- 5 copies
- All Territorial Forest Circle in GB- 3 copies each Forest Circle
- Each Territorial Forest Division in GB- 1 copy each
- Concerned Forest Division-7 copies
- Office of the WPO-5 copies
- Forest Library in GB-10 copies
- GIS Lab in GB- 5 copies.
- Climate Change Division/Office of IGF Islamabad- 1 copy
- PFI Library- 1 copy
- Conservator of Wildlife-GB- 1 copy
- Office of the Deputy Commissioner concerned- 1 copy
- One complimentary copy each may be sent to Conservation Organizations such as IUCN, WWF, etc.

8.7 AMENDMENTS

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Any amendment in a plan involving point of technical importance or leading to deviations from the prescriptions, which is proposed by a Territorial Conservator of Forests will be sent with the necessary draft amendment to the Conservator of Forests Working Plans. The Conservator of Forests Working Plans will send the needed amendment after his satisfaction and verification to the Chief Conservator of Forests-GB, who in turn will send it to the Secretary Forests-GB with his recommendations. The Secretary Forests is the competent authority for the amendment in the Working Plan on the explicit recommendations of CCF.

After approval of the amendment by the Secretary Forests, the WPO will make the necessary amendments and arrange for printing sufficient copies of the amendments. The Office of Chief Conservator of Forests will send the amendments to all concerned. Amendments are serially numbered; the number and date of sanctioning letter is also given.

The territorial DFO shall update the digitized maps and data at the time of preparation of annual report indicating fire damage, encroachment and landslide, plantation raised with latitude and longitude etc. and submit the same to the Conservator of Forests, who in turn will send it to the Chief Conservator of Forests. The Chief Conservator of Forests may send it to Secretary Forests for information of the government.

Se	Activity	Authority
1	Felling sequence	Felling sequence as enlisted in working plan will be approved by Secretary Forests on the explicit recommendation of Chief Conservator Forests for that particular year. The Chief Conservator Forests shall clearly mention availability of standing volume to be harvested as per Silvicultural requirements, and mentioned in working plan book after getting a complete and explicit report from Working Plan Circle. CCF office shall further examine and scrutinize the report of CF working plan through field verification. CF working Plan shall revalidate all compartments through dedicated teams before furnishing data to CCF office.
2	Marking Order	Marking orders of compartment falls under the specific operational year felling sequence shall be notified/ordered by CF Concerned after approval of felling sequence is made by Secretary Forests and Communicated by the CCF. The marking order shall clearly mention standing volume of the each compartment.
3	Marking officer	RFO Concerned shall be the marking officers of the compartments falls under their respective ranges and shall be notified by DFO. Marking shall be done by marking officer as per marking rules as mentioned in working plan code and prevalent law. The RFO/marking officer shall submit marking list along with abstract to DFO

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		concerned. On satisfaction of DFO, he shall recommend for approval of Marking lists and recommends for issuance/approval for Start order from CCF through CF concerned. Marking list shall be endorsed by community elder of concerned community. DFO shall cross check marking of 30% trees by himself. CF shall cross check marking of 10% trees by himself.
4	Start Order/ Work order	Start order/ Work order shall be issued by the DFO concerned after approval of Chief Conservator Forests on the recommendation of Conservator Forests concerned. The CCF shall issue approval to issue start order after having his satisfaction on marking lists and volumes recommended under standing volume(revalidated volume), marked volume and working plan book volume.
5	Extraction and transportation to transit Depots	Extraction of timber/logs made under start order/work order from forest and shifting a transit depot nearby for measurements purpose shall be made after approval and orders of DFO under intimation of CF office. The RFO shall ensure marking of each log/sleeper with tree number and log number to avoid admixing and shall furnish such list to DFO for soughting approval of CF
7	Measurement list	Measurement lists of each compartment material shall be made at transit depot/main depot jointly by the Forester, RFO and community elder (notified by CF Office). The RFO shall recommend DFO for issuance of TPs.
8	Transport Pass	One-time approval of volume extracted under Start order/work order for issuance of Transport passes shall be accorded by the CCF GB on the explicit recommendation of CF & DFO concerned. Transport passes shall be issued by DFO Concerned.
9	<u>All Supplementary Tree Marking:</u> i. Road Marking ii. Patro/Skid Trails marking iii. Boundary Marking iv. Entangled Trees marking v. Complex Areas marking	Marking officer shall ensure that Marking of compartment has been made in such a manner that it is uniformly distributed in all the compartment. In addition, the RFO/marking officer shall ensure that the marking has been made in way that no further marking for road/patro/Skid trail/entangled/complex area marking is required. However, in case of extreme urgency and requirement, these markings shall be allowed/approved for a single compartment cumulatively of all types of marking as per following tiers: i. Upto 5% cft of standing volume of the compartment by DFO on the explicit recommendation of RFO concerned. ii. Upto 7% cft of standing volume by CF on the explicit

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	vi. Portion marking vii. Any other marking other than prescribed volume marking	recommendation of DFO concerned. iii. Upto 10% cft of standing volume by CCF on the explicit recommendation of CF concerned. iv. More than 10% cft and upto 15% of standing volume by Secretary Forests, Wildlife & Environment on the explicit recommendation of CCF.
10	Final Checking	Final checking of a compartment under a working plan is a central step in execution of Working plan, ensuring that all activities comply with the plan's objectives and regulations. RFO concerned shall submit a report to DFO about final checking after thorough inspection and assessment of the compartment to verify that the prescribed operations, such as felling, extraction, and regeneration, have been properly executed. DFO on his satisfaction shall send this report to CF. CF will request for committee formulation for cross examining the final checking report. Final checking team shall consist of technical officers/officials from the offices of CCF, CF Working plan and CF territorial. Report of this committee shall be presented before CCF for getting approval and endorsement of Secretary Forests on the recommendation of committee.
11	Security bond/ Surety bond /CDRs	The Security amount in term of CDRs etc shall be released only after fulfilling and meeting recommendation of final checking committee approved by Secretary forests, Wildlife and environment.

Any ambidgutiy in authorities during execution and implementation of approved working plan shall be decided by Secretary forests on the explicit recommendation of CCF GB

8.8 MONITORING BY FEDERAL GOVERNMENT

The Climate Change Division of the Federal Government through the Office of Inspector General of Forests shall coordinate with the Chief Conservator of Gilgit-Baltistan so that implementation of the approved Forest Working Plans is in consonance with the national priorities regarding forestry affairs in Gilgit-Baltistan.

The Working Plan Code implementation responsibility lies at the Gilgit-Baltistan Forest Department level which has to ensure that the Code is followed by each Forest Division because it is applicable to all categories of forests, whether Private Forests, or Protected Forests. The Chief Conservator of Forests will especially monitor following points:

- Process of working plan preparation for the entire region is staggered over the period of 10 years and the revision of working plan does not get accumulated;

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- Preparation of the working plan is according to prescribed procedure, i.e., Consultations, Field visit, PWPR, Writing of working plan, Preparation/updating of maps, Writing/Editing of Compartment Histories, and Prescribing of Control Forms;
- The working plan prescriptions are being followed and the system of annual updating of Compartment Histories and Control Forms is in place;
- Harvesting is not exceeding the natural regeneration. This can be monitored through field visits, reports, and money provided in the budget for plantations and silvicultural operations..

Under the principle of devolution, the all the modalities regarding planning for, the preparation of the working plan as well as its implementation the matters will be decided at GB level. All the technical matters will be decided at the local level. These among other include:

- Organizational matters
- Administrative matters
- Intensity of sampling
- Carbon Pool Stock Estimation
- Soil survey and assessment
- Plot Approach Form
- Plot Description Form
- Plot Enumeration Form
- Formats of Compartment Histories
- Formats of control forms
- Additional chapters/ information in the working plan (deletions are not allowed)
- Matters related to prescriptions under Non-wood Forest Products (inclusive of medicinal and aromatic plants), Climate Change Mitigation/Carbon Sequestration Working Circle and Biodiversity Conservation Working Circles
- Trees Outside Forests
- Scale of maps (they have to be SOP maps in any case) and Color schemes of relevant maps
- Registers and records

In case of any ambiguity with the Federal Government, the matter may be resolved between Government of GB and the Climate Change Division as per procedure laid down in the Rules of Business.

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Gilgit-Baltistan

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CHAPTER 9
PHASES AND PROCEDURES FOR FOREST PLANNING

9.1 GENERIC STEPS IN FOREST MANAGEMENT PLANNING PROCESS

The general process for preparing a Forest Working Plan will follow the following generic steps:

Step 1. Pre-planning phase
Step 2. Data collection, background research and initial fieldwork
Step 3. Evaluating the information
Step 4. Identifying constraints, opportunities and threats
Step 5. Developing management vision and objectives
Step 6. Identifying and evaluating options including zoning
Step 7. Integration into a draft plan
Step 8. Public consultation, including public exhibition of the draft plan
Step 9. Revision of draft and production of final plan
Step 10. Approval of plan
Step 11. Implementation of the Management Plan
Step 12. Monitoring and review
Step 13. Decision to review and update the Management Plan

9.2 PHASES OF FOREST INVENTORY AND ANALYSIS

Forest Inventory and Analysis (FIA) for preparation of Forest Working Plan will be carried out in three phases, viz., Phase 1 (P1), Phase 2 (P2) and Phase 3 (P3).

9.2.1 PHASE 1:

Phase 1 is the aspect of data collection related to remote sensing. This activity is conducted in the GIS Laboratory and office. For Phase 1 reliance is made on satellite images of appropriate resolution (spatial, spectral, etc.) for classifying land into land cover classes as described below:

- A Phase 1 "photo point" is evaluated for approximately every 240 acres.
- Each "photo point" is characterized as forest or non-forest.
- A subset of the photo points are selected for field data collection (Phase 2).
- A subset of photo points is also ground checked by the field crews during the Phase 2data collection. It is from these ground checks of Phase 1 "photo points" that the forest/non-forest proportions are corrected to use in data processing.

9.2.2 PHASE 2:

Phase 2 is the field data collection activity. The field plots are selected systematically regardless of whether they are forest or non-forest in Phase 1. Forested plots are installed and measured regardless of intended use or any restrictive management policy. Plots are also installed on all ownerships,

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whether Protected Forests or Private Forests. It is on these field locations that the majority of data collection activities occurs.

- All tree measurements such as diameter, height, damage, cull, and grade;
- Counts of tree regeneration;
- General land use is determined on all plots.
- On forested plots, general stand characteristics are also collected such as forest type, stand age, and disturbance.
- By re-measuring plots from the previous time frame, estimates of growth, mortality, and regeneration are made at both the tree and plot level.
- Changes in land use and general stand characteristics are determined by revisiting plots from the previous time period.

9.2.3 PHASE 3:

On a subset of the Phase 2 plots, a more extensive set of data is collected. These measures relate to forest ecosystem function, condition, and health. Due to the seasonality associated with some of these measurements, the Phase 3 data are generally collected during a three-month window – June, July, and August. The current measurements on the Phase 3 subset of plots can be grouped into the following categories:

- Crown Conditions – generally poor crown conditions are symptoms of trees under stress and trees with good crown conditions are vigorous.
- Soil Erosion Potential – estimates of soil erosion potential help identify areas that may contribute to water quality degradation.
- Soil Chemical Analyses – collection of and analysis of soil samples include estimates of site fertility and in some cases potential toxicity relating to acidic soils that relate to productivity.
- Lichen Communities – the presence or absence of certain lichen species is indicative of air quality and climate changes.
- Ozone Bioindicator Plants – are plants with known sensitivities to ground-level ozone, although not necessarily collected on the Phase 3 plots (this effort can occur in the general plot area).
- Vegetation Structure – is the composition of vegetation (species and growth forms), abundance, and spatial arrangement in the forest. Also the presence of exotic and introduced plant species can be extracted from the collected data.
- Down Woody Debris – this measurement is useful in determining fire fuel potential and this information with the vegetation structure data can be used in wildlife habitat models.

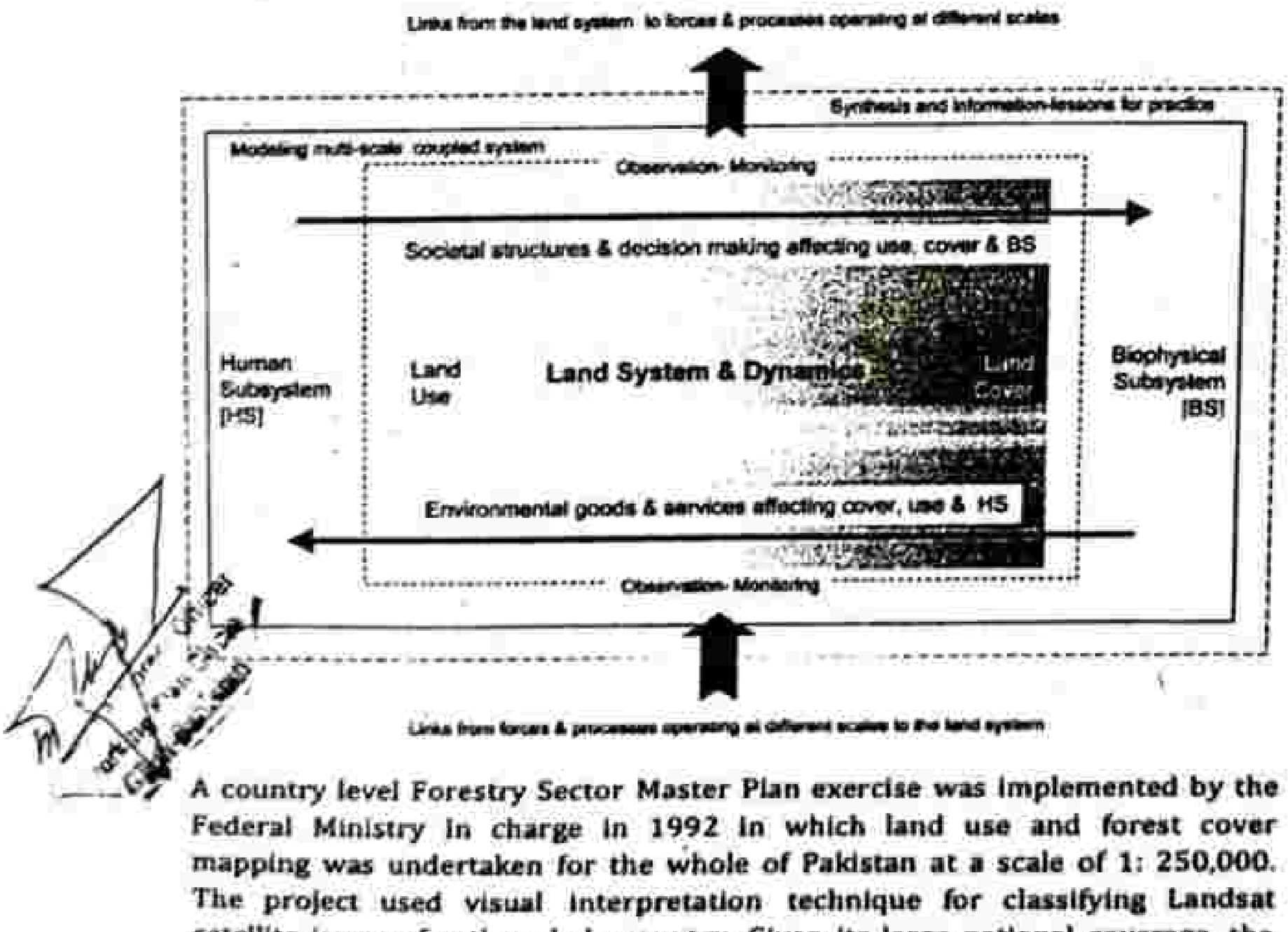
9.3 LAND COVER AND LAND USE CLASSIFICATION OF SATELLITE IMAGES

The terrestrial surface of the Earth depicts Land Use and Land Cover Change (LULCC) over time and is the result of the interaction of natural processes/factors and human-caused processes/factors. Included in the

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natural factors are natural disasters and natural degradation. Human factors playing their role, inter alia, include human population growth, economic policies and the developments that come as a result of those policies, social policies and the outcomes impacts of those social policies, livelihoods and livelihoods approached pursued by local communities, and environmental and land use policies of the society.

Lands under different vegetation types, including forests, range lands and agricultural lands have thus been and are being converted to other uses due to and in support of economic development, livelihoods and for promotion of transportation and trade. On the other hand through afforestation, reforestation, farm forestry and different range lands rehabilitation and restoration measures vegetative cover is being restored on the degraded forest and range lands as well as on farm lands. Thus there is a force field phenomenon (some negatively affecting vegetation and others positively re-vegetating degraded lands) playing its role in the case of Land Use and Land Cover (LULC). The following model is a representation of the dynamics and linkages between the human subsystem and the biophysical subsystem.



A country level Forestry Sector Master Plan exercise was implemented by the Federal Ministry in charge in 1992 in which land use and forest cover mapping was undertaken for the whole of Pakistan at a scale of 1: 250,000. The project used visual interpretation technique for classifying Landsat satellite images for the whole country. Given its large national coverage, the study used general land use and land cover classes. These classes have

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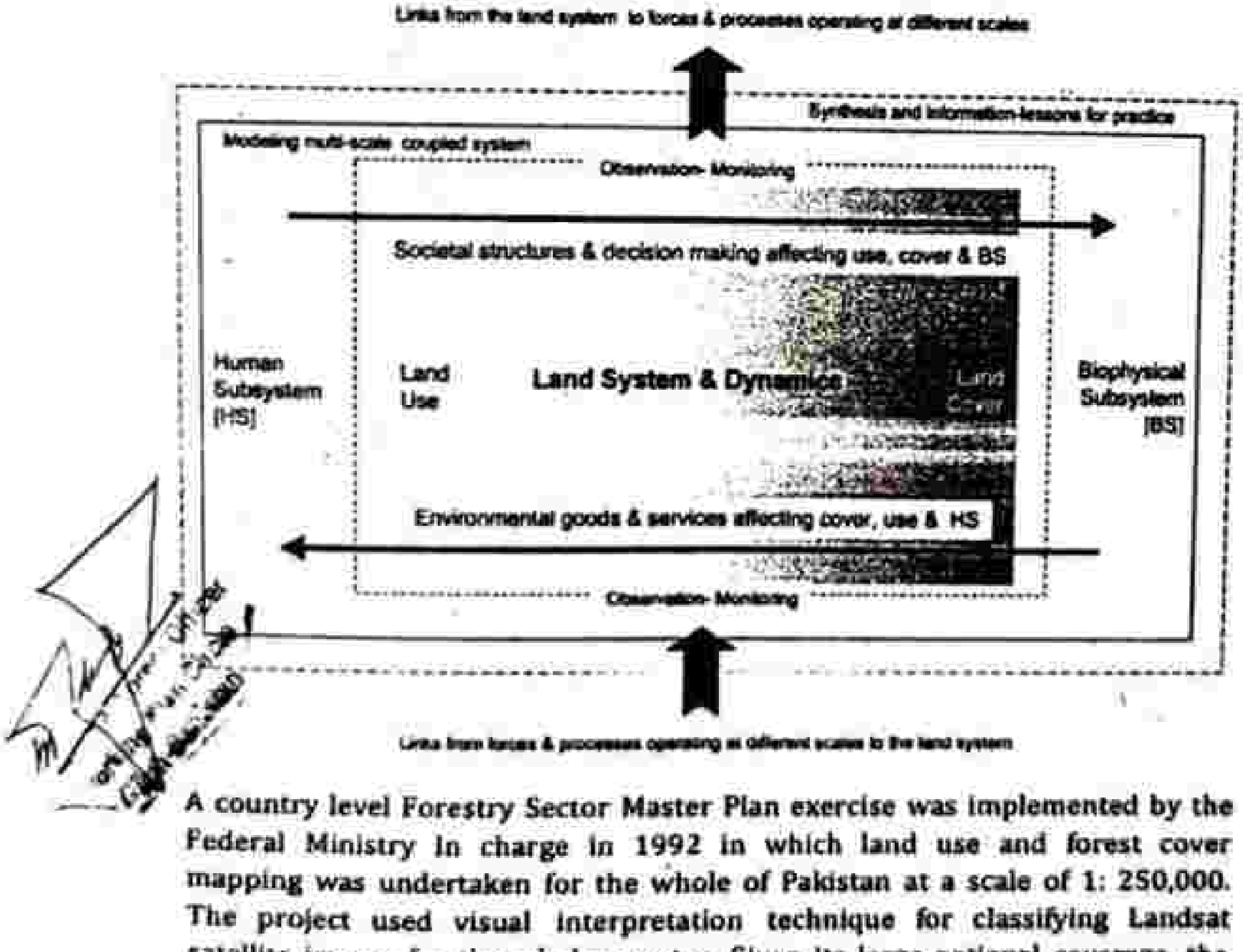
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been subdivided into sub-classes. Table below gives these land use and land cover classes and their codes.

Land Cover/Land Use Type	Code
Forested Land	
Coniferous Forest-Dense	Dc
Coniferous Forest-Sparse	Sc
Scrub and Other Non-Coniferous	Fou
Riverine Forest-Dense	Ford
Riverine Forest-Sparse	Furs
Mangrove Forest-Medium	Fmm
Mangrove Forest-Sparse	Fms
Plantation-Dense	Fpd
Plantation-Sparse	Fps
Plantation-Open	Fpo
Plantation-Small	P
Agricultural Land	
Irrigated	Al
Rain-fed	Ar
Range Land	
Degraded	Rd
Non-Degraded	Rn
Alpine Grassland	Ra
Barren Land	
Snowfield and Glacier	Bs
Rock, Gravel	Br
Desertic	Bd
Tidal Flat	Bt
Water Bodies	

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Riverbed	Wr
Lake	Wl
Reservoir, Dam	Wd
Swamp	Ws
Other	
Urban	U
Unclassified above 3650 m (12,000 feet)	> 12
Unclassified below 3650 m (12,000 feet)	< 12

The above land cover classification is rather too detailed and contains land cover and land use classes that are not found in Gilgit-Baltistan. Therefore, a simplified version of land cover classification used by Bukhari and Haider (2012) for the preparation of land cover atlas of Pakistan will be used in GB. The following land cover classes, where applicable, will be adopted for satellite image classification in Gilgit-Baltistan.

Major Land cover Class	Sub-type Cover Class
Forest Cover	Alpine Pasture
	Sub-Alpine
	Dry Temperate Forest
	Dry Temperate Oak Forest
	Moist Temperate Forest
	Sub-Tropical Pine Forest
	Sub-Tropical Broadleaf Evergreen Forest
Other Land cover Class	Shrubs and Bushes
	Range Lands
	Snow and Glaciers
	Agricultural Lands
	Barren Lands

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	Fruit Orchards
	Settlements
	Water Bodies

The following broad steps will be followed in Phase 1:

- **Data Acquisition** (satellite images, topographic sheets, SRTM DEM, Google Earth Image, GPS Readings, and Other Ancillary and Attribute Data)

  The topographic sheets will be first geo-referenced using ERDAS IMAGINE. Mosaicking will then be performed on topographic sheets so that the image after mosaicking could give a complete view of the study area. These mosaicked images will be used to overlay the satellite images.

- **Geo Referencing**

  The satellite imagery will be geo-referenced using the mosaicked topographic sheets as the reference image. An adequate number of five ground control points (GCP) will be chosen keeping in view the acceptable Root Mean Square Error (RMS), while undertaking georeferencing.

- **Development of a Landcover/Land use classification scheme**

  The following table gives broad classification scheme for the different land cover and land use classes that may be adopted in the Working Plan Area:

S.No.	Landcover Class	Definition of Landcover Class
1.	Forest/Plantation/Bushes and Shrubs	Forests/Plantations are those areas whose spatial extent is at least 0.05 hectares and which are covered with vegetation that have a minimum height of 5 meters or are able to achieve this height at maturity in situ and whose crown cover or stocking density is at least 10% of the area. Bushes and Shrubs are woody plants of relatively low height having several stems arising from the base and lacking a single trunk, none of which is dominant and is usually less than 3 meter tall. A bush or shrub is distinguished from a tree by its multiple stems and shorter height.
2	Range Lands	Range Lands are areas on which the indigenous vegetation (climax or natural potential) is predominantly

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		grasses, grass-like plants, forbs, and is managed as a natural ecosystem.
3.	Agricultural Lands	Agricultural Lands are areas covered with non-woody vegetation which is planted and which are managed as human managed systems as opposed to natural ecosystems.
4.	Barren Lands	Barren Lands are not supporting any major vegetation types.
5.	Settlements	These are collection of dwellings forming a community or a place where community lives, interacts or otherwise uses it for different purposes.
6.	Water Bodies	Water Bodies include rivers, streams, lakes, etc.

Image Classification/Visual Interpretation

Images and data generated through different data acquisition techniques have to be interpreted/analysed using different image interpretation and classification techniques so as to generate meaningful information. Image classification of satellite data is a process that involves characterizing/classifying all pixels in an image into several land cover classes or themes. This interpretation can be done visually by a human analyst or by using a computer for digital data. Computer assisted classification can be unsupervised classification or supervised classification.

Before attempting image interpretation and producing outputs, certain broad categories of computer-assisted operations are performed so as to remove different errors introduced during the image acquisition process and to improve the quality and interpretability of the image. The operations that are performed before interpretation/classification are sometimes also called image pre-processing operations.

While undertaking image interpretation/classification for producing useful information, the following operations may be performed:

1. Image rectification and restoration

The purpose of these operations is to correct distorted or degraded image data so that a more corresponding and faithful representation of the original image is created. The operations typically performed here include the initial processing of raw image data to correct for geometric distortions, to calibrate the data radiometrically and for noise elimination. Thus the three main operations undertaken here include: geometric correction, radiometric correction and noise removal. The nature of any particular image restoration process is dependent on the characteristics of the sensor used for data acquisition.

The geo-rectification is necessary for positional accuracy, relief displacement and to eliminate/reduce other distortions. These operations include corrections for geometric distortions due to sensor, earth geometry variations and conversion of the data to real world coordinates of the map

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based on latitudes and longitudes of the earth surface so as to make the satellite images compatible with the geometry of large scale maps.

These operations are generally performed by the vendor/supplier of the imageries.

2. Image enhancement

These procedures are applied to image data so as to more effectively display or record data for subsequent visual interpretation. Usually, these involve techniques that increase the visual distinction between features in a scene. The process of visually interpreting digitally enhanced images attempts to optimize the complementary abilities of the human mind and the computer. The range of possible image enhancement and display options available is very wide. Most enhancement techniques may be categorized as either point or local operations. The former modify the brightness value of each pixel in an image data set independently. The later operations modify the values of each pixel based on neighbouring brightness values. Either of these two forms of enhancement can be performed on single band (monochrome) images or on the individual components of mutlti-image composites.

Following are the most commonly applied digital image enhancement techniques:

- Contrast Manipulation—Gray-level thresholding, level slicing and contrast stretching.
- Spatial feature manipulation- Spatial filtering, edge enhancement and Fourier analysis.
- Multi-image manipulation- Multispectral band rationing and differencing, principal components, canonical components, vegetation components, intensity-hue-saturation (HIS) colour space transformations and de-correlation stretching.

The different image enhancement methods are often used in combination for getting overall better results.

Sometimes, these Image Enhancement operations are performed by the supplier of the imageries.

3. Image classification

The overall objective of image classification procedures is to automatically categorize all pixels in an image into land cover classes or themes. Three different types of pattern recognitions (spectral, spatial and temporal pattern recognition) are employed for image classification. Spectral Pattern Recognition refers to the family of classification procedures that utilize pixel-by-pixel spectral information of various wavelength bands as the basis for automated land cover classification. Spatial pattern recognition involves the categorization of image pixels on the basis of their spatial relationship with pixels surrounding them. Spatial classifiers consider such aspects as image texture, pixel proximity, feature size, shape, directionality, repetition, and context. Temporal pattern recognition uses time as an aid in feature identification. These image classifiers are often used in combination in a hybrid mode.

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4. Data merging and GIS Integration

These procedures are used to combine image data for a given geographic area with other geographically referenced data sets for the same area. These other data sets might simply consist of image data generated on other dates by the same sensor or by other remote sensing systems. Frequently, the intent of data merging is to combine remotely sensed data with other sources of information in the context of a GIS. For example, image data are often combined with soil, topographic, ownership, zoning and assessment information.

Generally, multi-temporal data merging will be attempted for change detection purposes.

5. Biophysical modelling

The objective of biophysical modelling is to relate quantitatively the digital data recorded by a remote sensing system to biophysical features and phenomena measured on the ground such as in concert with GIS techniques to facilitate environmental modelling.

6. Image transmission and compression

For data portability and transmission, at times image compression techniques may be used so as to facilitate the handling of large volume of data. Wavelet transforms are an example of this operation.

7. Visual Interpretation

An image is a record of the feature on the ground at the time of data collection. Such images can be analysed at different levels of details. The detail to which an image can be analysed depends on the scale of the image. Visual interpretation generally will makes use of the following basic elements/characteristics and their variations.

Element	Common Adjectives (quantitative and qualitative)
x,y location	x,y image coordinates: column (x) and row (y) coordinates in an unrectified image x,y image map coordinates: silver halide crystals or pixels in photograph or image are rectified to a map projection (e.g., UTM)
Tone/Colour	gray tone: light (bright), intermediate (gray), dark (black). colour: IHS= intensity, hue (colour) and saturation; RGB= red, green and blue; Munsell
Size	length, width, perimeter, area (m^2) small, medium (intermediate), large
Shape	an object's geometric characteristics: linear, curvilinear, circular, elliptical, radial, square, rectangular, triangular, hexagonal, pentagonal, star, amorphods, etc.

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Element	Common Adjectives (quantitative and qualitative)
Texture	characteristic placement and arrangement of repetitions of tone or colour smooth, intermediate (medium), rough (course), mottled, stippled
Pattern	spatial arrangement of objects on the ground: systematic, unsystematic or random, linear, curvilinear, rectangular, circular, elliptical, parallel, centripetal, serrated, striated, braided
Shadow	a silhouette caused by solar illumination from the side
Height/Depth/ Volume/Slope/Aspect	z-elevation (height), z-bathymetry (depth), volume (m^3), $slope^0$, $aspect^0$
Site, Situation, Association	Site: elevation, slope, aspect, exposure, adjacency to water, transportation, utilities Situation: objects are placed in a particular order or orientation relative to one another Association: related phenomena are usually present

The process of visual interpretation is to associate these characteristics seen on the image with real features on the ground. Multispectral images are preferred over images for visual image interpretation. When multi-spectral data is used, the task is to identify the optimal three bands to generate the colour composite. False Colour Composite (FCC) using green, red and Near-Infrared (NIR) are the most preferred combination for visual interpretation. However, it is advisable to experiment with different band combinations, ratios and simple enhancements on images to assess which is best suitable for the analysis in question.

In Advanced Countries like USA, the following three levels of classification are being used. Given its mandate for forests and rangelands management, and resources and capacity limitations, Gilgit-Baltistan Forest Department at the moment will go for land cover classification at Level I only for broad land cover classes and Level II for forests and range lands. At some future point in time, the following sample of Land cover and Land use classification system could become a possibility for remote sensing data:

Level I	Level II	Level III
1. Urban or built- up land	11. Residential	111. Single family units
		112. Multi-family units
		113. Group quarters
		114. Residential hotels
		115. Mobile home parks
		116. Transient

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Level I	Level II	Level III
		lodgings
		117. Other
	12. Commercial or service	
	13. Industrial	
	14. Transportation, communication and utilities	
	15. Industrial and commercial complexes	
	16. Mixed urban or built-up land	
	17. Other urban or built-up land	
2. Agricultural land	21. Crop land and pasture, Orchards, groves, vineyards	
	22. Nurseries and ornamental horticultural areas	
	23. Confined feeding operations	
	24. Other agricultural land	
3. Range land	31. Herbaceous range land	
	32. Shrub and brush range land	
	33. Mixed range land	
4. Forest land	41. Deciduous forest land	
	42. Evergreen forest land	
	43. Mixed forest land	
5. Water	51. Streams and canals	
	52. Lakes	
	53. Reservoirs	
	54. Bays and estuaries	
6. Wetland	61. Forested wetland	
	62. Non-forested wetland	
7. Barren land	71. Dry salt flats	
	72. Beaches	
	73. Sandy areas other than beaches	
	74. Bare exposed rock	
	75. Strip mines, quarries and gravel pits	
	76. Transitional areas	
	77. Mixed barren land	
8. Tundra	81. Shrub and brush tundra	
	82. Herbaceous tundra	
	83. Bare ground tundra	
	84. Wet tundra	
	85. Mixed tundra	
9. Perennial snow or ice	91. Perennial snow fields	
	92. Glaciers	

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Image Classification

The image classification process, which can be done visually or computer-based, process involves the following steps:

- Object Detection on the Image (This involves the detection of an object from the background;
- Object Recognition (Recognizing this object to a certain thing);
- Object Identification (Identifying this thing to be of particular variety);
- Object Classification (Classifying this particular thing to one of the defined classes);
- Object Classification Accuracy Assessment (Ground Truthing Data Collection to assess the accuracy of classification); and
- Comparing the Classification Results with Other Studies.

Different elements of image interpretation were used in this analysis process. These included shape, size, pattern, tone, texture, shadows, site, association, and resolution.

Accuracy Assessment and Ground Verification

Ground verification is done for the different land cover classes in different parts of the Management Plan Area for accuracy assessment of land cover classification. An adequate number of ground verification points are selected for ground verification and accuracy assessment purposes keeping in view the existing variability. The GPS readings of these locations are reported as per following suggested format.

S.No.	Land Cover Class	Longitude/X-Axis	Latitude/Y-Axis
I.	Agricultural Lands		
1.	Point 1		
2.	Point 2		
3.	Point 3		
4.	Point 4		
5.	Point 5		
II.	Range Lands		
1.	Point 1		
2.	Point 2		

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S.No.	Land Cover Class	Longitude/X-Axis	Latitude/Y-Axis
3.	Point 3		
4.	Point 4		
5.	Point 5		
III.	**Barren Lands**		
1.	Point 1		
2.	Point 2		
3.	Point 3		
IV.	**Shrubs and Bushes**		
1.	Point 1		
2.	Point 2		
3.	Point 3		
4.	Point 4		
5.	Point 5		
V.	**Water Bodies**		
1.	Point 1		
2.	Point 2		
3.	Point 3		
4.	Point 4		
5.	Point 5		
VI.	**Settlements**		
1.	Point 1		
2.	Point 2		
3.	Point 3		
4.	Point 4		
5.	Point 5		

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S.No.	Land Cover Class	Longitude/X-Axis	Latitude/Y-Axis
VII.	Forest Lands		
1.	Point 1		
2.	Point 2		
3.	Point 3		
4.	Point 4		
.			
.			
n.	Point n		

Creating Land Cover/Land Use Maps

Land Cover/Land Use Maps are prepared from the classified images using ArcGIS software.

Developing Statistical Results from The Land Cover/Land Use Maps

Statistical Results of the Land Cover/Land Use Maps preparation and accuracy assessment is done.

Accuracy Assessment

Accuracy assessment is an important step in the image classification process. Accuracy assessment is done by developing an error or confusion matrix. These matrices compare the relationship between the classified images and the reference data, such as field observation, high resolution satellite images, aerial photographs, and/or thematic maps. Based on the error matrix, overall accuracy, producer's and user's accuracies, omission and commission errors, and Kappa statistics can be developed.

Commission Error (CE)—Commission error occurs when samples from other classes are misclassified and added to the class. That is to say, samples are added (committed) to the wrong class, there is commission into another category.

Omission Error (OE)—The class for which accuracy is estimated is classified as another class, i.e., the sample is "omitted" from the true class or there is omission from correct category.

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Overall Accuracy is computed by dividing the total number of correctly classified samples (i.e., the sum of the elements along the major diagonal) by the total number of samples. Therefore, overall accuracy in our case is (16+15+16+15+16+17)/103= 95/103= 92.23%.

Producer's Accuracy (PA) is the number of correctly classified samples of category x, divided by the total number of that category observed on ground. The producer of the classified map is interested in how well a specific area on earth can be mapped.

Consumer's or User's Accuracy is the number of correctly classified samples of category x divided by the total number of samples that were classified as category x. It is of importance to the user, because the map user is interested in the reliability of the map, or how well the map represents what is really on the ground.

The table below illustrates the calculation of accuracy assessment:

Field Observation or actual Landuse and Landcover	Map Class or Interpreted Land Use									PA %l	OE %
	Forest Land	Agri. Land	Range Land	Barren Land	Trees, Shrubs and Bushes	Settle-ments	Water Bodies	Omission Error	Total		
Forest Land											
Agri. Land											
Range Land											
Barren Land											
Trees Shrubs and Bushes											
Settle											

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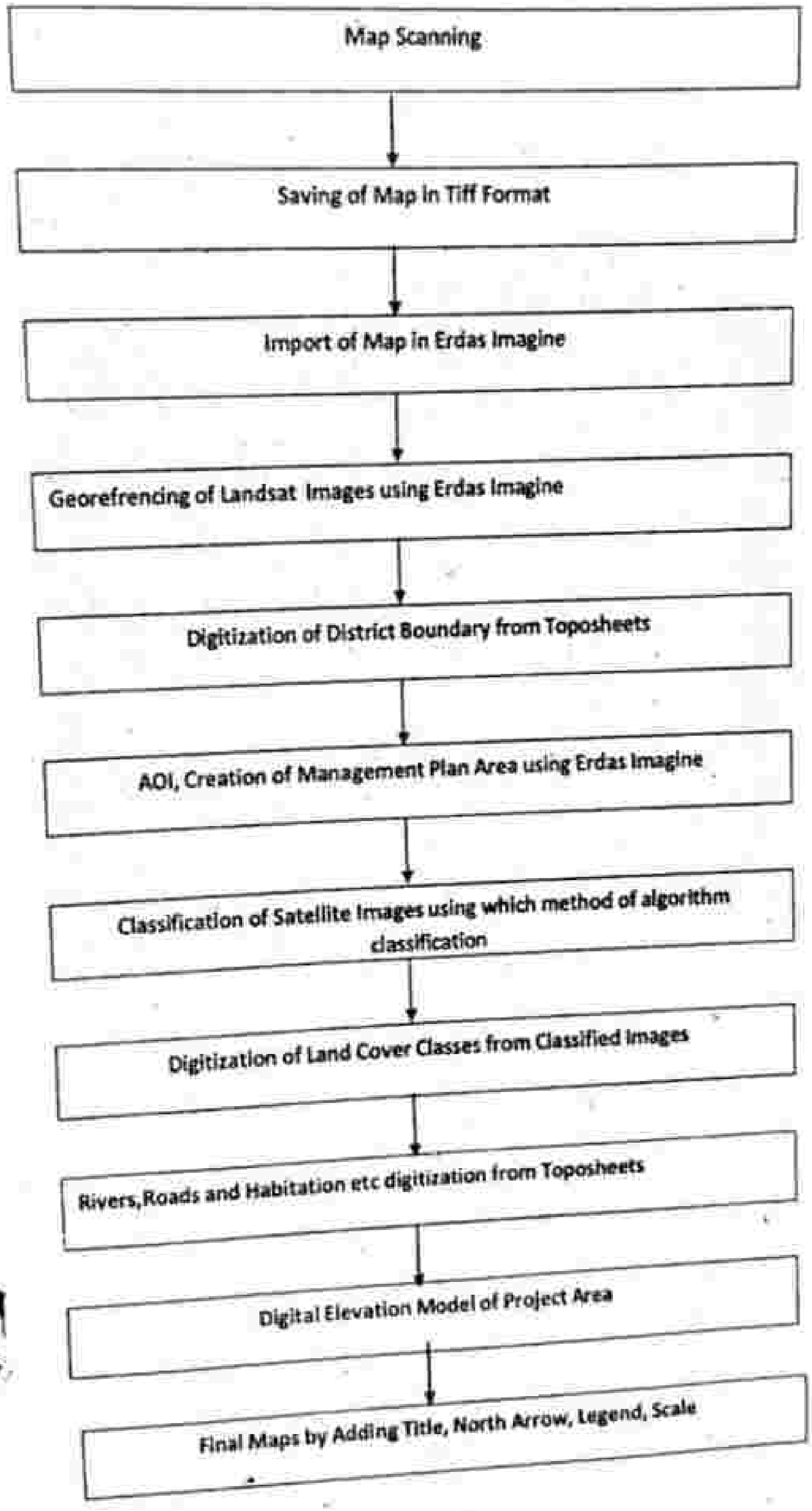
ments											
Water Bodies											
Commission Error											
Total											
Consumer's Accuracy (CA)											
CE %											

CA=Consumer's or User's Accuracy; PA= Producers's Accuracy; OE= Omission Error;
CE= Commission Error

Land Cover Class	Producer's Accuracy	Consumer's or User's Accuracy	Over-all Accuracy
Forest Lands	16/17= 94.12 %	16/19= 84.21 %	(16+15+16+15+16+17)/(17+17+17+18+17+17) =95/103= 92.23 %
Agricultural Lands	15/17= 88.23 %	15/18= 83.33 %	
Range Lands	16/17= 94.12 %	16/18= 88.89 %	
Barren Lands	15/18= 83.33 %	15/18= 83.33 %	
Trees, Shrubs and Bushes	16/17= 94.12 %	16/17= 94.12 %	
Settlements	16/17= 94.12 %	16/17= 94.12 %	
Water Bodies	17/17= 100.00 %	17/17= 100.00 %	

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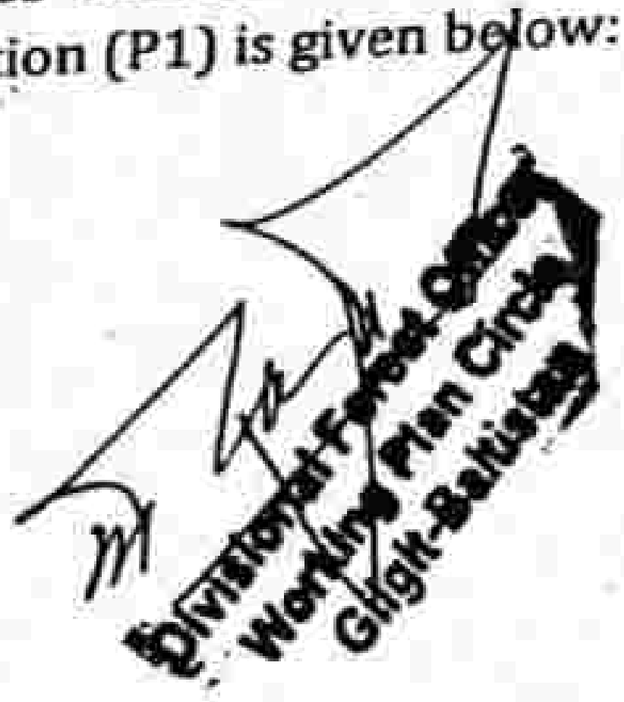
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The probability that a reference pixel correctly classified is determined by the producer's accuracy. The probability that a classified pixel from the land cover map accurately corresponds with the referenced data is determined by the user's accuracy. The Khat Coefficient ($\wedge K$) or Kappa statistic measures the difference between the true agreement of classified map and chance agreement of random classifier compared to reference data. Kappa values of more than 0.80 indicate good classification performance. Kappa values between 0.40 and 0.80 indicate moderate classification performance and Kappa values of less than 0.40 indicate poor classification performance.

A Flowchart highlighting the Activities undertaken in this Remote Sensing, Image Interpretation and Map Preparation (P1) is given below:



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CHAPTER 10
SURVEY AND ASSESSMENT OF FORESTS AND OTHER RENEWABLE NATURAL RESOURCES IN FOREST PLANNING

10.1 EXAMINATION OF TERRITORIAL UNITS

It is advisable to digitize the forest boundary and generate geo-referenced version of map of scale1:50,000 or higher after complete verification. There should be regular updating of data on the basis of continuous inputs. The first duty of WPO in the field is to inspect and examine the forest area for which working plan is to be prepared, including the forest range, forest block, forest beat, and forest compartments and sub-compartment to ascertain that the
extent of forest cover is properly maintained on following counts:

- Area of forests under different legal classes (Protected Forests and Private Forests);
- Forest area under different working circle/ management plan;
- Percentage of forest with secured boundaries;
- Land use, land use change and forestry (LULUCF);
- Distribution of different forest types.

Their boundaries are demarcated on the ground by GPS and using digitized version of map of scale 1:50,000 which has been prepared for the purpose of new plan preparation. For further demarcating forest boundaries, use of differential GPS may be done. Latitude and longitude of the boundary pillars may also be taken with the differential GPS with sub-meter accuracy. Changes in the boundary of blocks and compartments are not made by the WPO as the rights and concessions of villagers are associated with these. However, changes in the boundaries of the sub-compartments may be made for management purpose, with the consent of Conservator of Forests Working Plans Forest Circle.

10.2 FOREST RESOURCE ASSESSMENT

Assessment of forest resources is an essential and integral component of the forest
management planning. On the basis of this assessment, past performance is evaluated and
future management will be prescribed. In forest crops one has to identify multi-dimensional
populations with various parameters and attributes. Forest data to be collected as per the
forest resource assessment methodology for the preparation of working plan shall cover the following aspects:

- **Maintenance, Conservation and Enhancement of Biodiversity:** Forest composition and distribution, plant species diversity, status of biodiversity conservation of forests, status of species prone to over exploitation, conservation of genetic resources, fauna and their habitats, threats and challenges to wildlife, protection and

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management of fauna. This biodiversity assessment is done at ecosystem level, species level and genetic level. A part of this assessment may be done through vegetation survey which includes enumeration of species composition such as dominant and co-dominant tree species, shrubs, herbs, climbers, lichens, algae, fungi, epiphytes and parasites for their density, frequency, dominance and abundance values. This survey is necessary for study of Phyto-sociological interactions, status of regeneration, geographic distribution and environmental relationships of plant communities, assessment of medicinal and aromatic plants; and other non-wood forest products species.

- **Maintenance and Enhancement of Forest Health and Vitality:** Status of regeneration, area affected by forest fires, area damaged by natural calamities, area protected from grazing, lopping practices, area infested by invasive weed species in forests, incidences of Pest and diseases, forest degradation and its drivers;

- **Conservation and Maintenance of Soil and Water Resources:** Assessment of excess runoff from discharge zone and conservation measures for soil, groundwater, and soil moisture. Area treated under soil and water conservation measures, duration of waterflow in the selected seasonal streams, wetlands in forest areas, water level in the wells in the vicinity (up to 5km) of forest area, status of aquifers;

- **Maintenance and Enhancement of Forest Resource Productivity:** Individual tree species stand or forest type; form and composition of tree crop according to age, quality, extent, etc. and distribution; growing stock of wood; statistics of growth and yield through stump and stem analysis as well as from other available records; increment in volume of identified timber species; efforts towards enhancement of forest productivity through quality plantation activities; biomass and carbon stock assessment; carbon sequestration and climate change mitigation potential assessment; status of natural regeneration; artificial regeneration done and forest plantations raised; etc.

- **Optimization of Forest Resource Utilization:** Recorded removal of timber, fuel wood, fodder, nuts, and locally important NTFPs including MAPs, demand and supply of timber and important non-timber forest produce, removal of fodder, valuation of the products;

- **Maintenance and Enhancement of Social, Economic, Cultural and Spiritual Benefits:** Number of JFM committees and area protected by them, status of empowerment Benefits: Number, labour welfare, use of indigenous knowledge, extent of cultural/ sacred groves, social-customs, status of compliance of Forest Law and Local Rights, other rights and concessions, ecotourism areas and activities, etc.

10.3 GROWING STOCK ESTIMATION

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From the enumeration/field data, species wise distribution of trees in each diameter class will be generated for compartment/village/any other management unit. This data would be used for population structure and to identify the old growth and unique forests. The growing stock of trees must be so managed that it regularly provides the greatest possible quantity of the desired products including intangible benefits. Ratio method of estimation will be used for estimating the growing stock of important tree species using local volume tables developed by PFI rounder previous working plans. Fresh local volume tables may be prepared, if required. Adding the growing stock of all compartments, the growing stock of the block will be estimated, which will be again integrated up to range level and further at divisional level. Stratification developed by PFI or some other organization based on forest type, density, land use using GIS can be used for increasing the precision of the estimates. Any gap in research results with respect to estimation of growing stock will be brought out clearly.

10.4 ASSESSMENT OF NON-TIMBER FOREST PRODUCTS (INCLUDING MAPs)

WPO may plan and undertake survey, sampling and assessment for estimation of few prioritised species of NTFPs/MAPs to start within the selected grids. In general, WPO does the assessment of potential NTFPs/MAPs through available old records, local enquiry, and plot enumeration data. If few NTFP/MAPs species have been identified then the estimation of resource species can be carried out using plot enumeration, shrubs, herbs and climbers data. Data collected under different studies and/or maintained in the JFM areas may be used. Summarized estimated quantities may be recorded for every compartment /village/any other management unit in terms of their scientific name, local name, type of plants, their part and its utility, area(ha), quantity per hectare, estimated harvest/hectare, etc. for species of trees, shrubs, climbers, grasses, herbs, lichens, fungi, etc. A separate estimation may be done for MAPs.

For estimating the production of NTFPs/MAPs (fruits, flowers, leaves, seeds, etc.) of tree origin, total harvest of the desirable part(s) should be enumerated (for two consecutive seasons from same trees) from at least three trees of different diameter class. The fresh and dry weight of each should be recorded. The drying of the harvested parts may be carried out by using a laboratory oven if possible or sun drying. The yield of products (wet or dry) obtained should be multiplied by the number of trees of a particular species enumerated for the compartment/village/another management unit at different diameter class level. For estimating the production from shrubs, the useful part should be harvested from at least five plants and the fresh and dry weight of the same would be recorded. The yield of the products would be calculated as described above. For estimating the production of herbs, at least 10 to 20 numbers of each species should be harvested and fresh and dry biomass of the useful parts should be determined as described above.

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10.5 BIODIVERISTY ASSESSMENT

The data collected during enumeration such as, the number of individuals of each species and the dBh of each tree, are utilized to derive secondary attributes like basal area (BA, m^2/ha), density (D, trees per ha) and frequency (F, number of quadrates where trees occur). Relative values will be calculated. The Importance Value Index (IVI) is calculated by adding up relative frequency (RF), relative density (RD) and relative dominance (RBA). However, in the case of shrubs, herbs, saplings and for regeneration, the IVI is calculated based only on relative values, i.e., relative frequency and relative density. It is assumed that the dominance of a species increases with an increasing importance value, and that the species with lowest importance value is the least dominant one. The maximum IVI value is 300. Basal area and density of the tree species should be converted to a hectare basis. To estimate the regeneration structure, all tree species should be grouped under different dbh classes. The total number of individuals belonging to each dbh class should be calculated for each species for each site.

Ds =Total number of individuals of species/Total area of quadrats studied

$$F_s(\%) = \frac{number\ of\ quadrats\ in\ which\ species\ x\ occurs}{total\ number\ of\ quadrats\ studied} x100$$

$$RD_s = \frac{Density\ (D_s)\ of\ species\ s}{Total\ density\ of\ all\ species} x\ 100$$

$$RF_s = \frac{Frequency\ (F_s)\ of\ species\ s}{Sum\ of\ frequencies\ of\ all\ species} x\ 100$$

$$RBA_s = \frac{total\ basal\ area\ of\ species\ x}{total\ basal\ area\ of\ all\ species} x\ 100$$

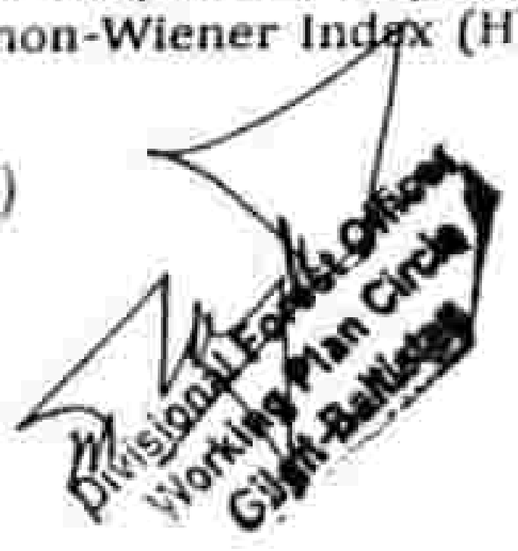
$$IVI_s = RD_s + RF_s + RBA_s$$

(where 's' denotes a particular species for which these variables are calculated)

Species diversity is an expression of community structure and is a characteristic unique to the community level of organization. The number of species in a community is referred to as species richness. The relative abundance of rare and common species is called evenness. Species diversity includes both species richness and evenness. A community demonstrates a high species diversity if many equally or nearly equally abundant species are present. Communities with a large number of species that are evenly distributed are the most diverse and communities with few species that are dominated by one species are the least diverse. If a community is composed of only a few species, or if only a few species are abundant, then the species diversity is low. Species diversity indices like Shannon-Wiener Index (H') and Simpson's Index (λ) are calculated as:

Shannon-Wiener Index of species s: $H_s = -\sum_{i=1}^{s} p_i \cdot ln(p_s)$

Simpson's index for species s: $\lambda_s = \sum_{i=1}^{s} p_i^2$



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Where, p_s is the number of individuals of species s (n_s) divided by the total number of individuals (N) observed (n_s/N) and S is total number of species. The Shannon-Wiener index combines the number of species within a site with the relative abundance of each species. The number of species (species richness) in the community and their evenness in abundance (or equitability) are the two parameters that define H'. This index is a measure of the average degree of uncertainty in predicting to what species individuals chosen at random from a collection of 'S' species and 'N' individual will belong. When all species in the dataset of interest are equally common, all PS values equal 1/S, and the Shannon index takes the value ln(S). The more unequal the abundances of the individual species, the greater is the weighted geometric mean of the PS values, and the smaller is the corresponding Shannon entropy. If all abundance is concentrated to one type, and the other types are very rare in relative terms (even if there are many of them in absolute terms), the Shannon entropy approaches zero. When there is only one species in the dataset, the Shannon entropy equals zero exactly.

Similarity index (community coefficient) is calculated for determining the number of species which are shared among the sites to assess the extent of variation in the species composition. This is known as the β-diversity (Jaccard, 1908) or index of biotic similarity (Sorenson, 1948).

$$Cj = \frac{J}{a+b-J}$$

Where J is the number of species common to both sites, 'a' is the number of species in site A and 'b' is the number of species in site B. A value of Cj closer to 1 indicates greater dissimilarity or greater beta diversity and a value closer to 0 indicates greater similarity of species.

10.6 ASSESSMENT OF REGENERATION STATUS

Young plants of tree species up to 10 cm diameter are taken into consideration for assessment
of regeneration status of a particular species as practiced in National Forest Inventory by FSI.
Data collected from the square plots of 3x3m for saplings (2cm to 10 cm collar diameter) and
from the square plots of 1mx1m for seedlings will be generally used to assess the regeneration status of species in the management unit (compartment, village or any other unit). Based on the phytosociological data from plot level enumeration, the regeneration status of the sampled species may be assessed in the following categories:

a. Good regeneration, if seedlings are more in numbers than the saplings and likewise saplings are more than that of adults.

b. Fair regeneration, if seedlings are more in numbers than the saplings but the
saplings are equal or less than that of adults.

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c. Poor regeneration, if a species survives in only sapling stage, but not as seedlings
(Though sapling may be less, more or equal to adults).

d. No regeneration, if a species is absent both in sapling and seedling stage, but
present as adult.

e. New regeneration, if a species has no adults but only sapling and/or seedlings

The lower categories of regeneration such as established, un-established (whippy and
Sub-whippy), recruits, etc. giving value to each category and calculating total regenerative
percentage may be required, in case, above classifications are absent or insufficient to indicate regeneration status.

10.7 PLANTATION SURVEY AND ASSESSMENT

Valuable forest resource has been created throughout Gilgit-Baltistan under various schemes of afforestation, social forestry, federally and locally funded projects, etc. An up-to-date and reliable knowledge of these man-made forest plantations is necessary in respect of species planted, crops harvested and corrective measures taken as required for the plantation. The assessment of growing stock of old plantations, which attains a minimum size of 10 cm DBH or age of 10years can be done based on plot enumeration data for such plantation areas for sustainable management of plantations and their contributions in enhancing timber production and carbon sequestration. But there is a need for assessing the status of young plantations having less than10 cm DBH or age of 10 years for maintenance of biodiversity; soil and moisture conservation and other socio-cultural benefits, which should be assessed and recorded. Plantation journals offer the best option for assessing such young plantations. Plantation journals should have provision for suitable sampling strategy for the survey. Results of such survey are to be recorded in the plantation journals, which are made available to WPO by the DFO concerned for assessment of young plantations. Nowadays the plantations are well recorded and in many of the cases their positional coordinates are also mentioned in the records. However, to monitor the success and the growth of such trees, high resolution satellite data mapping would be useful that are capable of detecting small size plantation growth.

10.8 SOIL SURVEY AND ASSESSMENT

Proper examination of soil profile leads to understanding the genesis of soil. Analysis of soil reveals its fertility, constraints thereof, if any, the required soil management strategies and suitability of species. Soil properties along with site features like slope, aspect, erosion, climate, etc. brings out information about the land capability class, land suitability, etc. For survey, soil samples may be collected in the selected grids from different horizons i.e. from soil surface 2m depth. The soil samples may also be collected from pre-determined depths like 0-15cm, 16-30cm, 30-60cm, 60-100cm, etc. The

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sampling may be carried out by excavating a soil profile or by auger method. The soil samples are collected, labelled and carried to laboratory for the analysis of physical properties such as texture, bulk density, moisture, water holding capacity, field capacity, depth and colour and chemical properties such as pH, organic matter and nutrients. The nutrients mainly include nitrogen, phosphorus, potassium, calcium, magnesium. In case of soils suffering from salinity/ sodality, the estimation of attributes like exchangeable sodium percentage, sodium absorption ratio and electrical conductivity may also be needed. However, the detailed soil survey is not required during the revision of working plan. WPO may take help from the secondary sources for the assessment of the forest soil.

10.9 SOCIO-ECONOMIC SURVEY AND ASSESSMENT

It is necessary to assess the dependence of villagers on the forests for their livelihood needs especially in the perspective of lifestyle change. It is also important in the context of preparation of micro-plans for Joint Forest Management and forest fringe management. Available information on socio-economic status of the people living in forest fringe villages should be collected and assessed to bring forth the role of forest products and ecosystem services in their lifestyle. This is necessary to formulate suitable management strategies to improve their socio-economic status particularly that of tribal and economically backward communities living in fringe villages and partially or wholly dependent on forests for their livelihood. Socio economic survey shall include dependency on timber, fuel wood, fodder, grazing, other NTFPs and livelihood aspects. Since this is also a very important aspect of forestry, it has to be done with all seriousness; and help of sociologist/economists/ socioeconomics/recognized institutes may be taken. The detailed survey is not required to be undertaken by WPO during the revision of working plan.

Socio-economic survey shall entail collecting information on socio-economic status of the people living in and around the forest and their dependence on the forests for their livelihood needs. The villages situated within the limit of 3Km from the forests will be considered as forest fringe villages for the assessment. Stratified multistage random sampling will be deployed for the socio-economic survey. The first stage sampling units will be the fringe villages and the second stage sampling units will be the households. The first stage sampling units i.e. fringe villages within the division will be stratified based on the population of the villages, their distance from the road and market, range, block etc. Representative fringe villages will be randomly selected from each stratum of the division. In the selected fringe villages, the VLUP methodology provided for village plan preparation may be adopted for assessment of socio-economic benefits and dependence on forests.

10.10 ASSESSMENT OF WILDLIFE HABITATS AND SPECIES

The WPO is not required to undertake an estimation of faunal populations. Advantage should be taken of ongoing efforts such as estimation of predators, co predators and prey in GB or other areas or surveys and assessments carried out by WWF, IUCN or any Other Conservation

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Organization. The WPO should identify flagship species including mammals, birds, reptiles, amphibians, plants etc. which may be significant for the area. The WPO should identify suitable habitats and micro habitats for such key wildlife species and appropriate measures needed to conserve and improve the same. Special attention should be given to forest areas in proximity to protected areas which also serve as extended habitats for many rare and endangered species. The maintenance and restoration of grasslands, wetlands, wildlife corridors and water points must be identified. Threats, such as habitat loss and/or fragmentation; illegal trade; road and rail networks; etc. should be identified and appropriate corrective measures should be suggested for implementation. Similarly, areas of human-animal conflict deserve special attention for amelioration.

10.11 ASSESSMENT OF TREES OUTSIDE FOREST (TOF)

For assessing TOF, geometrically rectified SPOT, IRS P-6 LISS IV (5.8m) or any other higher version imageries may be procured from wherever they are available. Forest area of the division is masked out from them and classified map is generated having different strata namely, block plantation, linear trees, scattered trees, area with no trees, cropland etc. Stratified random sampling may be undertaken to assess the growing stock and the potential area for extension of forestry outside forests and sustainable land use management within the forest division. This requires intersectoral synergy and convergence. WPO may therefore prepare a separate strategy as new chapter, not being part of general prescriptions of a working circle for forests.

10.12 LAYING OUT GRIDS ON THE TOPOSHEET AND SAMPLE UNIT

For forest resource assessment of working plan, the sample plots are systematically laid out in the forest area which is indicated on the Survey maps and toposheet on the scale of at least 1:50,000. The grids are laid out by dividing the toposheets of 1:50,000 scale (size 15' X 15' i.e. 15 minute latitude and 15 minute longitude) falling within the division/district boundary into 144 grids of 1 ¼' x 1 ¼'. To carryout Forest Resource Assessment for Working Plan, each of these 1 ¼' x 1 ¼' grids are further sub-divided into 9 sub-grids for forming the basic sampling frame of 25" x 25" (sub-grid of twenty five seconds latitude and twenty five seconds longitude representing approximately 60 ha on the ground). All the sub-grids of 25"x 25" are to be surveyed. The intersection of diagonals of sub grid is marked as center of sub-grid on the map. The latitude and longitudes of the intersection of diagonals of sub grid will be identified as the center of the sub-grid. These latitude and longitudes will be used for reaching the center of the sub-grid by using GPS. The grids of 1 ¼' x 1 ¼' and sub-grids of 25" x 25" are conveniently serial numbered by WPO. A sample unit with a radius of 80 m covering an area of 2 hectare is taken at the center of the sub grid without actually laying out the plot.

Satellite imagery of recent version in digital form for the whole division may be used to determine the possible accessibility and location of sample unit

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and its land use. The land use may be classified into closed forest, dense forest, open forest, scrub, shifting cultivation, young plantations of forest species, tree in line (Avenue plantation), forest roads, grass lands, barren lands, agricultural land without trees in surround, agricultural land with trees in surround, habitation, water bodies etc.

10.13 DESCRIPTIVE WORK WHILE REACHING THE SAMPLE UNIT AND SAMPLE PLOTS

After deciding the grid and sub-grid numbers to be surveyed, the team leader i.e., forester in charge should find a nearest convenient route so that they reach the sample unit i.e., center of the sub-grid from minimum traverse by vehicle or foot. After reaching at a nearby location of the plot, the next job would be to search a reference point, which can be identified on the map as well as can be located on the ground. The sub-grid center is reached after covering desired distance and bearing from the reference point. The reference point selected on a map should not be a temporary structure. The possible reference points may be Village tri-junction points, Bridges and culverts, , mosques, road, rivers, streams; Ponds and wells; Mile stones or kilometer stone or prominent trees etc. The location of reference points and its correct description recorded in the form is very important to re-visit the sample unit in future.

10.14 STOCK MAPPING

While approaching the sample unit, stock assessment and mapping (earmarking the stocked area on the map) should be done ocularly traversing the forests (compartment/village /any other management unit), so as to cover the entire area making observational assessment of site quality, tree species composition, its health (including injury to the tree crop), density and crop age, etc.; All locations where any of the parameters change should be described in PLOT APPROACH FORM (Annexure II) and depicted/delineated on the map. Presence of special features within the compartment/village/other management unit, namely grassy patches, scattered trees, plantations raised, etc., should also be described in PLOT APPROACH FORM and depicted on the stock map. Regeneration status of main species should also be observed.



PLOT APPROACH FORM also contains general observational information on undergrowth – climbers, important herbs, shrubs, medicinal and aromatic plants (MAPs), NWFP yielding species; intensity of invasive species; flagship faunal species and their traces, special wildlife features and their interface with humans, biotic factors, and any other thing or special treatment required should find a mention here. For accurate identification of herbs, shrubs, creepers, grasses, epiphytes, lichens, etc., services of taxonomist/experts may be hired.

Drivers of forest degradation, forest resource utilization, dependence of local people on forest; and their social, cultural and spiritual aspects, may be explored. The notes prepared by the WPO and his team during the field visit are very important as they form the basis of the description of compartment/village/other management unit, which again form the basis of

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future management. Notes are taken under the headings mentioned in the PLOT APPROACH FORM.

An effort should be made by the WPO and his team to use GPS Track facility to make the above observational information, spatial, as far as possible, and develop fully functional GIS based maps as an integral part of working plan exercise, and train the staff to use the same in the collection of data and preparation of reports.

10.15 LAYOUT OF SAMPLE PLOTS IN THE FIELD

After reaching the sampling unit i.e., the center of the sub-grid, a square plot of 0.1 ha (Central plot) will be laid out by measuring 22.36 m horizontal distance i.e., half of the diagonal in all the four directions at 45° in North-East, at 135° in South-East, at 225° in South-West, and at 315° in North-West corners of the plot from the true north. Check the dimensions of the plot, i.e. all sides should measure 31.62 m horizontal distance. Care should be taken for laying out the proper dimensions of the plot. Each sampling unit may contain 5 sample plots of 0.1 ha (31.62m x 31.62m) each for tree inventory. Four side plots (namely North Plot, East Plot, South Plot and West Plot) of 0.1 ha (31.62m x 31.62m) will be laid at a distance of 50m from the center of the central plot to their center in all the four directions i.e. north, east, south and west. Nested quadrates of size 3m x 3m and 1m x 1m will be laid out at a distance of 30 meters from the center of the central plot in all four directions along diagonals in non-hilly area and along trails in hilly areas for the enumeration of shrubs (including regeneration status) and herbs respectively. The provision of side plots in each sampling unit for enumeration of trees may be systematically reduced by Forest Department subject to local conditions and objectives of the management.

Three nested quadrates of size 5m x 5m, 3m x 3m and 1m x 1m may be laid at the center of the central plot for the estimation of carbon stock, if resources availability permit. In 5m x 5m, all the dead wood above 5cm diameter would be collected, weighted and recorded. In 3m x 3m, all the woody litter, that is all branches below 5cm diameter, would be collected, weighted and recorded. All shrubs (including all the trees below 10cm dbh) and climbers in 3m x 3m plots would be up-rooted, weighted and recorded. For trees, allocation of carbon in root, stem, branch, twigs and leaves may be obtained separately. In 1m x 1m, all the herbs including leaf litter would be collected, weighted and recorded. Dry biomass would be converted into carbon stock. For collecting data on humus and soil carbon, forest floor of 1m x 1m plot would be swept and materials thus collected, would be weighed and a portion of the same would be kept for the carbon analysis. After that, a pit of 30cm x 30cm x 30cm would be dug at the center of the 1m x 1m plot and a composite sample of soil weighing 200gm would be kept for organic carbon analysis.

10.16 GENERAL PLOT VARIABLES TO BE RECORDED

General information related to land use, physiographical features like altitude, aspect, slope, soil and water resources; crop composition, regeneration status, injury to the crop, fire incidence, grazing incidence,

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presence of weeds, presences of grasses, plantation status, distance from water course, drivers of degradation, etc. should be recorded for every sampling unit of 2 (two) hectare area in the PLOT DESCRIPTION FORM (Annexure III). This information along with the general observations made in PLOT APPROACH FORM (Annexure II) will be used for writing the compartment description. General definition and description of terms not specifically mentioned here may be taken from the PFI.

10.17 PLOT ENUMERATION

For the Sample Plot, which cannot be laid out due to steep slopes or other conditions, may be left out of enumeration and its inaccessibility conditions need to be mentioned in Plot Enumeration Form (Annexure IV). All trees having diameter 10 cm and above will be enumerated, species and diameter class wise, from all the identified sample plots of 0.1 ha and recorded in the PLOT ENUMERATION FORM (Annexure IV). Trees, the stems of which touch the north and west border lines of the plot (called border line trees) will be enumerated. However, trees, the stems of which touch the east and south border lines of the plot will be treated as "out trees" and will not be enumerated. In and out trees would be similarly decided and treated. Trees below 10 cm diameter at breast height over bark will not be enumerated. Enumeration of trees will start from the NE corner of the plot and will proceed in clockwise direction. The same procedure should be followed for all the sample plots. For, average diameter of the clump will be measured and number of green culms of different age class (up to 5 years, 5-10 years and above 20 years) and dry & damaged culms in the given clump will be recorded. Also the height of the trees, at least from the central plot should be measured and recorded for ascertaining the site quality. The data of shrubs, climbers and regeneration status from all 4 quadrates of 3 m x 3m laid at the center of the plots is to be collected and recorded in the PLOT ENUMERATION FORM. The data of herbs from all nested quadrates of 1 m x 1m laid within each quadrate of 3 m x 3m at the center is to be collected and recorded in the PLOT ENUMERATION FORM.

10.18 GROWING STOCK ESTIMATION

From the enumeration/field data, species wise distribution of trees in each diameter class will be generated for compartment/village/any other management unit. Ratio method of estimation will be used for estimating the growing stock of important trees species using local volume table developed with the collaboration of PFI and the table used under previous plan. Adding the growing stock of all compartment, the growing stock of the block will be estimated, which will be again integrated up to range level and further at divisional level. Stratification developed by PFI based on forest type, density, land use using GIS can be used for increasing the precision of the estimates. Any gap in research results with respect to estimation of growing stock must be brought out clearly.

10.19 CARBON STOCK ESTIMATION

The total carbon stocked in the forest is divided into different pools and the changes in carbon stocks in these carbon pools are estimated as per Good

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Practices Guidance (GPC) developed by Inter-governmental Panel on Climate Change (IPCC). Changes in Carbon stock based on inventory data may be measured using Stock-Difference method based on tier 2 and tier 3 approach of IPCC guideline. Gaps in information, if any, should be explicitly highlighted.

A detailed protocol for the forest carbon stock assessment has been developed and is given in Chapter 16.



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CHAPTER 11
SOCIO-ECONOMIC SURVEY AND ASSESSMENT

It is necessary to assess the dependence of villagers on the forests for their livelihood needs. It is also important in the context of preparation of village plans for Joint Forest Management and forest fringe management. Information on socioeconomic status of the people living in forest fringe villages should be collected and assessed to bring forth the role of forest products and ecosystem services in their lifestyle. This is necessary to formulate suitable management strategies to improve their socio-economic status particularly that of tribal and economically backward communities living in fringe villages and partially or wholly dependent on forests for their livelihood. Socio economic survey shall include dependency on timber, fuel wood, fodder, grazing, other NWFPs and livelihood aspects. Since this is also a very important aspect of forestry, it has to be done with all seriousness; and help of Sociologist/Economists/Socio-economists /Research Institutes may be taken. The detailed survey is not required to be undertaken by WPO during the revision of working plan. The data on socio-economic survey from the secondary sources such as published literature and observations made/ recorded under PRA of that area may be used.



Socio-economic survey shall entail collecting information on socio-economic status of the people leaving in and around the forest and their dependence on the forests for their livelihood needs. The villages lying within the limit of 3Km from the forest will be considered as forest fringe villages for the assessment. Stratified multistage random sampling will be employed for the socio-economic survey. The first stage sampling units will be the fringe villages and the second stage sampling units will be the households. The first stage sampling units i.e. fringe villages within the division will be stratified based on the population of the villages, their distance from the road and market, range, block etc. Representative fringe villages will be randomly selected from each stratum of the division. In the selected fringe villages, the households will be categorized in three groups based on their economic status viz. 'affluent', 'less affluent' and 'others.' as defined. A household is classified as "Affluent" if the household owns any of the items like motorcar/jeep, tractor, truck/van/bus, large business, spacious pucca house in good condition or any two of the items like color TV, cell phone, Dish TV, washing machine, refrigerator, microwave oven, two wheeler (automobile) or owns land/livestock in excess of certain limits (7.0 ha. cultivable land /3.5 ha. irrigated land or at least 10 heads of cattle and buffaloes or at least 30 sheep/goats.). A household is classified as "Less Affluent" if the household does not own above items and owns land/livestock less than the above mentioned limits and more than 0.4 ha Land area or at least 2 heads of cattle and buffaloes or 5 sheep/goats. A household is classified as "others" if the household does not own any items mentioned above and the land area less than 0.4 ha. Or less than 2 cattle and buffaloes or less than five sheep/goats. Thereafter twelve households in each selected fringe village will be selected randomly for the survey (Two, five and five households from 'affluent', 'less-affluent' and 'other' class respectively). Total number of households should be twelve, the shortfall in the first category i.e. affluent will be compensated from less-affluent class

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failing which 'other' class will be considered and the shortfall in less-affluent class will be compensated from affluent failing which from 'other' class. Others class will be compensated from affluent class failing which from less-affluent' class. The data will be collected by visiting the selected houses in each selected fringe villages. These data will be collected at household level through the detailed questionnaire. The questionnaire shall generally contain information on fuel wood, fodder (includes grazing, stall feeding kg per day or week etc.), NWFP (including MAPs etc.



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CHAPTER 12
WRITING UP THE FOREST MANAGEMENT PLAN

12.1 CONTENTS OF THE PLAN (To be written by WPO)

The standard working plan headings are reproduced in the table given below:

Chapters	TITLE / SUB-TITLE	EXPLANATION
PART- I SUMMARY OF FACTS ON WHICH PROPOSALS ARE MADE		
1	The Tract Dealt with	Description about the Tract Dealt with is given.
1.1	Name and situation	Name of the division and its geographical location, demographic and administrative details. (Details regarding ranges, beats, their headquarters and area; list of rest houses, other forest building, forest roads, fire lines etc. are to be provided in the appendix. To be provided by concerned DFO to the WPO).
1.2	Configuration of the ground	It may be categorized as flat, gently rolling, hilly, very hilly, undulating foothills including description of slope, aspect etc.
1.3	Geology, rock and soil	Describe the geological and rock formation, soil types in particular along with Geological Survey of Paldstan (GSP) references. As far as possible, GIS maps may be provided.
1.4	Climatic Parameters	Data on rainfall and temperature: yearly and month-wise maximum, minimum, and average temperature for a few representative stations is given. This information can be obtained from Meteorological Department. Relevant GIS maps along with historical data may be provided.
1.5	Soil and water conservation	Soil and water situation and conservation measures are discussed.
1.5.1	Water resources	Duration of water flow in the selected seasonal rivers, streams, nallas; wetlands in forest areas; water level in the wells and ponds in the vicinity, (up to 5 km) of forest area along with maps:
1.5.2	Soil erosion	Soil erosion status in the division

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1.5.3	Conservation measures	Area treated under soil and water conservation measures
1.6	Land Use, Land Use Change and Forestry (LULUCF)	Land Use, Land Use Change and Forestry situation is discussed.
1.6.1	Land use and land cover,	Range wise land use for the division may be categorized as closed forests, dense forest, open forests, scrub, bamboo brakes, shifting cultivation, young plantations of forestry species, tree in line, forest roads, grass lands, barren, agricultural land without trees in surround, agricultural land with trees in surround, non-forestry plantations, habitation, water bodies etc. along GIS based maps.
1.6.2	Forest Distribution and its area	Details of range wise area of RF, PF, Un-classed Forest, other types of areas; distribution of different forest types along with GIS map.
1.6.3	Land use change	Details will come in divisional area statement, including list of area (range wise / beat wise) diverted, under FCA, FRA, Non forest Land/ Degraded Forest given for compensatory afforestation under FCA, encroachments and with special mention of change in area of forest cover with respect to base year should be given along with map using modern tools of GIS and remote sensing. Summary of changes occurred during last plan period may be given.
1.7	Status of forest boundaries	This refers to state of forest boundaries, a general note on the state of existing boundaries and boundary pillars, noting specially on the status of demarcation and need to have demarcation may be described. Locations of the boundary pillars should be shown on the map with latitude/longitude with the help of most appropriate methods on village map or such other map of convenient scale. The analysis may be made of fresh encroachments

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1.8	Legal position	Area of the forest under different legal classes (Protected Forests and Private Forests) along with number and date of notification for creation of Protected Forest and Private Forests is given; and mention is made of various forest settlements. Pending forest settlement work is also quantified.
1.9	Rights and Concessions	A brief account of the rights and concessions, their extent, nature, etc., which are to be regulated or met under working plan prescriptions should be given. (details are to be given in the appendix).
2	Flora and Fauna	Description of Flora and Fauna of the area is given.
2.1	Forest Flora	Forest Flora Description is given.
2.1.1	Forest Composition and Distribution	Based on the vegetation survey & forest inventory and compartment descriptions, a summary of important trees and other species occurring in the area with their floristic composition and condition (age class, health, and quality of the trees) is given. The effect of geology and soil; and climatic parameters (rainfall and temperature) on the distribution of forest types, specific composition (sub types), ecological relations; distribution of species; unique and specific vegetation etc. may be explored and described. Help of experts on Species Distribution Models may be taken.
2.1.2	Biodiversity Assessment	Biodiversity assessment in terms of density, frequency, total basal cover, dominance, IVI etc. should be given. Efforts should be made to make a base year documented species diversity status for future reference using GIS tools. As far as possible status of the species prone to over exploitation and destructive harvesting should be given.
2.1.3	Status of invasive species	Details to be given of forest areas infested by different invasive species.
2.1.4	The Growing Stock, Biomass and Carbon Stock	Description of the Growing Stock, Biomass and Carbon Stock of the area are given.

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2.1.4.1	General description of the growing stock and forest resource productivity	Growing stock of wood with respect to base year; growing stock; increment in volume of identified species of wood in terms of MAI with respect to base year and enhancement of forest productivity through quality plantation activities and eco-restoration of forests land.
2.1.4.2	Biomass	Biomass estimates are given here.
2.1.4.3	Carbon stock	Details of biomass carbon stock assessment may be given based on the forest types and land use.
2.1.5	Status of natural regeneration	This should be described in detail for all principal plant species including trees, shrubs,, canes, medicinal plants, other NWFPs (and RET species) based on regeneration survey.
2.1.6	Status of plantations	Details to be given based on survey and assessment of areas under the plantation.
2.1.7	Injuries to the crop	Practically necessary details of different kind of injuries such as Area affected by forest fire; area damaged by natural calamities (flood, frost, drought, erosion, etc.); area protected from grazing; and incidences of pest and diseases are provided. Scientific information with regard to attack of fungus and other insect pests should be mentioned, where it is of practical significance such as Ganoderma or Sal borer etc.
2.1.8	Forest degradation and its drivers	Details of drivers of forest degradation like fires, unregulated removals, encroachment, over grazing, mining, shifting cultivation, etc. along with the area description under different levels of degradation.
2.2	Forest Fauna	Forest Fauna is described here.
2.2.1	Fauna and their habitats	Give description of flagship wild species including mammals, birds, reptiles, amphibians, etc. along with their suitable habitats and micro habitats. This chapter may be vetted by NCCW and wildlife department of GB.

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2.2.2	Threats and Challenges to wildlife	Give details regarding habitat fragmentation/loss, illegal trade, road & rail networks, extended habitats in proximity to protected areas for rare and endangered species; man animal conflict.
2.2.3	Protection and Management of fauna	Details of measures taken for protection and management of fauna.
3	Forest Resource Utilization	Requirements of the local population, markets for the products from the forest, methods of exploitation and their costs, etc. are given here.
3.1	Demand and supply of Wood and wood products	Description of recorded removal for agricultural customs, local needs, market and marketable product and through any other agency may be given. Consumption of wood by wood based industries and other end users may also be given.
3.2	Removal of fuel wood	Information based on socio-economic survey and assessment will be provided here. Assessing and evolving mechanism for quantified data on recorded removals and sharing with the community may also be ensured.
3.4	Assessing removal and production of NWFP.	Assessment of demand and supply, sustainability and potentiality, Import and Export of NWFPs; A separate assessment may be made with respect to medicinal and aromatic plants (MAPs).
3.5.1	Removal of fodder	Description of cattle rearing community of forest dwellers with regard to removal of fodder
3.5.2	Assessment of grazing in forest	Number of livestock grazing in the forest, availability of palatable species and pasture land etc. to assess the grazing pressure and potential based on socio-economic survey and assessment and vegetation survey.
3.6	Valuation of forest products	Including past and current prices of different forest products with price trend.
3.7	Other Dependency of local people on forests	Other dependency which is not mentioned above.
4	Social, cultural, traditional and spiritual aspects	Social, cultural, traditional and spiritual aspects of the area are discussed here.
4.1	Constitution of JFM committees and area(s) protected by them	Details have to be given along with the map

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4.2	Status of empowerment of JFMCs	Aspects related to regular meetings at the Community level and representation and participation of members belonging to different categories in JFMCs and their role in functioning of the Forest Department may be given to indicate the status of empowerment.
4.3	Labor welfare	Details of Welfare measures along with direct employment in forestry activities
4.4	Status of compliance of Forest rights and concessions of the local people	Status of registration of all the claims and settlement of the genuine claims along with list of individuals and communities to whom forest area is allotted, enlistment of those locations whom physical possession has been handed over on ground and its position on the forest map with latitude/longitude, status of forest management of areas given to allottee
4.5	Respect for traditional knowledge	Documentation of the Indigenous Traditional Knowledge and incorporation of the same in the village plans and other prescriptions of the plan
4.6	Extent of cultural/ sacred groves	Details of cultural and sacred groves and interventions to conserve them.
4.7	Social customs	Prevalent social customs relevant to forests.
4.8	Other aspects	Other aspects which are not mentioned above.
5	Five Year Plans	WPO has to describe the activities taken up under preceding Five-year plan, (plan wise and scheme wise) and make summary suggestions for future based on details prescriptions provided in the various chapters of the plan.
6	Staff and labor supply	The details of sanctioned, permanent, temporary, and seasonal posts are given. It should also include number of filled and vacant posts on a particular date when the working plan is under revision. The requirement of daily wage/contractual man power may also be mentioned in this chapter. The usual rates of wages, past and present, are also mentioned.

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7	Past System of Management	Past System of Management is discussed.
7.1	General history of the forests	The historical back ground of the management of forests is given for as early period as possible with mention of sources of information. Compartment history can be an important source of such information.
7.2	Past system of management and their results	The system of management which has been followed in the past will be briefly discussed, with a view to prevent repetition of such mistakes as might have been made, and also to understand and appreciate the present condition of the crop. In general the account given in the expiring plan will be adopted and updated unless there are definite reasons of revising it. Further, there should be specific mention of status of Joint Forest Management, Community involvement and functioning of the Forest Department in the division along with the change matrix analysis
7.3	Special works of improvement taken	A brief summary and results of works such as fire-protection, improvement in communication, interface activities, amenities to staff, etc. will be given.
7.4	Past yield, revenue, and expenditure	This is given year-wise in a tabular form. The average during past working plans and details for each year during the plan under revision are generally given along with critical analysis.
8.	Statistics of Growth and Yield	Statistics and Growth and Yield of the forest is discussed.
8.1	Statistics of growth and yield	WPO has to assess the availability of volume/ yield tables for the main timber species, which have been prescribed for felling in the various working circle for calculation of yield. If such tables are not available, then the possibility of stem and stump analysis for such species may be examined and implemented if possible for preparation of local volume table. In case, this is also not feasible, then standard volume tables / regression equations developed by PFI or other institutes may be recorded and used. Research gap with respect to availability of data must be brought out clearly.

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8.2	Statistics of forest carbon stock	Default values used with respect to estimating forest carbon stock must be brought clearly so that specific values can be developed through experimentation and research.
PART II **CHOICE AND ADOPTION OF FOREST MANAGEMENT ALTERNATIVES**		
9.	Basis of proposals	Objectives, methods of treatment, division into working circles, analysis and valuation of the crop, period of the plan.
9.1	Objectives of management	It should include short and long term objectives of sustainable management of forest as enshrined in Forest Policy encompassing the ecological, economic and social dimensions in a division and provide broad strategy for attaining the objectives. The objectives of the forest management plan may be organized around the following major elements for sustainable management of forests: (I) ***Dynamics of Forests and Stands:*** With the objective to increase productivity of the forest ecosystem and maintain the vitality. (II) ***Forests and Soil:*** With objective of reducing soil erosion, enhancing fertility of the soil and ensuring stability of the forest ecosystem. (III) ***Forests and Water:*** With the objective of conserving water sources, enhancing water conservation capacity of the forest ecosystem and assisting in regulating the flow of water from its catchment. (IV) ***Forest Biodiversity:*** With the objective of conserving genetic resources (both floral and faunal including micro-organisms) and their sustainable use. (V) ***Climate and Forests:*** With objective of reducing GHG emissions, enhancing mitigation/carbon sequestration capacity of the forests and finding ways for adaptation with change in climate.

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		(VI) ***Socioeconomic considerations and generation of forest based employment opportunities and livelihood options:*** With the objectives of meeting the fuel wood, fodder and timber requirements of the local communities, enhancing livelihood and employment opportunities, ensuring usufruct/ benefit sharing and protection of their traditional knowledge and traditional/cultural practices, etc. (VII) ***Tool for integrated development:*** Management Plan must act as a tool for integrated development of the district/forest division. Performance indicators may be identified for different objectives of management.
9.2	Method of treatment to be adopted	A brief account is given of the ecological and silvicultural requirements for sustainable management of different identified forests or crops keeping in view the stakeholder's requirements, biotic factors aspects, legal aspects, drivers of un-sustainability, etc.
9.3	Constitution of Working Circles	Mapping and Listing of different Working Circles (including overlapping ones), their area, and distribution regarding justification for their constitution amongst various options for sustainable management of forests.
9.4	Period of working plan and necessity for intermediate revision	Generally the period of working plan will be for 10 years. A midterm review of WP should be undertaken for mid-course correction by the consultative committee under the Chairmanship of CCF with representation from Conservator of Forests Working Plans Forest Circle and Territorial Conservators of Forests, as well as other members of the Consultative Committee. Similarly, based on the performance of the WP prescriptions the plan period may be extended up to 5 years beyond the stipulated plan period by the competent authority on the recommendation of a standing consultative committee authorized for this purpose.
10	CHAPTER 2 to last CHAPTER viz., N	These are Chapters for the different working circles

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10.1	(Name of) Working Circle (Clearly marked on GIS based maps(1: 50,000)	There will be a separate chapter for each Working Circle including the overlapping ones. Last chapter identified with a Working Circle is presumed as N (last in row) which has a numerical value like 15, 16, 17, etc.
10.2	General Constitution of Working Circle	Mapping and Summarization of Working Circle area statement by ranges, blocks, and compartments included in the Working Circle. Gross area and showing forest type and density classes (as adopted GB Forest Department or by (PFI).
10.3	General character of vegetation	Concentrate on aspects of vegetation pertinent to management objectives outlined for the Working Circle, e.g., composition, age class, distribution, density, growing stock, status of regeneration, special problems like menace of weeds and invasive species growth etc.
10.4	Felling Series; cutting sections and JFM areas;	Name them and give the reasons for their constitution. JFM areas may be described as per existing village level JFM committees/village plans.
10.5	Blocks, compartments and JFM area;(marked on GIS based maps)	In a tabular form Felling Series, Cutting Section, Range, Block, Compartment, Quality, and Area in hectares. JFM areas may be described as per existing village level JFM committees.
10.6	Special objectives of management	These are enlisted in order of priority.
10.6.1	Analysis of the crop (where volume table of main tree species is not available the regression equation may be used	Stock maps, range and mean of quality and age class distribution, selection of sample units, type of enumeration, assessment of NWFP bearing species, status of regeneration, comparison with previous data, and special features, if any, are to be described.
10.6.2	Silvicultural system	Define the silvicultural system and give reasons for its adoption.
10.6.3	Rotation Period	The growth and other data on which the rotation is based are discussed. Full reasons are also given for adopting a particular period. If there is a change from the previous plan, then its possible effect on age class distribution is analyzed. The yield calculation formula adopted for sustainable harvesting should be indicated.

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10.6.4	Harvestable diameters	These are prescribed and also justified for different species from crop potential and future perspective.
10.6.5	Reducing Factors and reduced Areas	In general, reducing factors are used for quality and density for species for which yield tables are available. When enumerations have been done, the basal area is used for density reduction.
10.6.6	Felling Cycle	Wherever applicable, it is fixed and reasons given. In the diffused systems it generally corresponds to the period of the plan, i.e., 10, 15, 25 or 30 years.
10.6.7	Division into Periods and allotment to Periodic Blocks (PBs)	This is done for the shelter wood systems. It is also necessary to monitor the progress of Regeneration. A tabular statement is prepared showing block, compartment, sub-compartment area in hectares; PB allotment in previous plan, year of main felling, status of regeneration, allotment to PB in current plan, reasons of allotment.
10.6.8	Calculation of the yield	It is regulated by volume. If it is by area, there must a volume check. There must be provision for adjustment of extra ordinary felling against future yields. The yield calculation method adopted for sustainable harvesting may be indicated.
10.6.9	Table of felling	Felling is tabulated year-wise by ranges, blocks, compartments, and sub-compartments for each Felling Series; village level JFMC areas.
10.6.10	Method of executing the felling	Guiding principles (general marking rules) are given. It should be simple to understand and to implement.
10.6.11	Subsidiary silvicultural operations like cleaning and thinning	Good practice guide for silvicultural operations including thinning and its grades etc., should be given.
10.6.12	Regeneration	Methods of assisted natural regeneration based on status of natural regeneration may be prescribed. Keeping in view the objective of multiproduct forestry a multi-tier canopy shall be ensured while prescribing silvicultural and follow up cultural activities.

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10.6.13	Other regulations	May cover control grazing, lopping schemes and regulated firewood removals; fire protection; forest protection from illicit felling, encroachment, illegal mining, etc.; soil and water conservation measures; restriction on felling along rivers, highways, hill slopes, etc., which are relevant to Working Circle
CHAPTER (N+1)	General Financial Forecast and Financial Plan of Operation	The WPO will give his assessment of expected revenue, estimated expenditure for implementation of the working plan prescriptions, and other normal plan and non-plan activities of the division. He will also indicate or identify the possible sources of funding taking cognizance of provisions in Five Year Plan, Non-Plan Budget, etc. This is necessary to ensure that working plan does not remain a theoretical document any more. This information should be given for the working plan period. Figures of past plan (to be provided by the concerned Territorial DFO) should also be given for comparison.
CHAPTER (N+2)	Miscellaneous Regulations	This chapter deals with various Miscellaneous Regulations given in the plan.
(N+2).1	Petty felling and extraction	Petty Felling and extraction for research and training needs should be allowed. It is necessary to emphasize the fact that experimental, preservation and sample plot; seed stand and their demarcated surrounds; etc. are excluded from all operations prescribed in the working plan. Special Grants in exceptional circumstances may be allowed which do not cause much deviation.
(N+2).2	The Control Forms	Control Forms should be clearly described and prescribed. Their details are given in the Chapter on Monitoring, Assessment and Reporting. Annual inspection of DFO office by CF/CCF and by DFO of Range office is mandatory within 3 month of completion of financial years so as to have checks on annual statements in Control Forms and Deviation Statements
(N+2).3	Records/Deviations	Maintenance of Other Records, such as Compartment History Files, Plantation Journals, etc. and the different Control Forms are meant help ensure conformity to the prescriptions of the working plan and

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		highlight any deviations and the reasons for those deviations.
(N+2).4	Rights and Concessions	These are to be dealt in detail: the quantity allowed, actually used, requirement of future demand, etc., are to be assessed and suitable guidelines/prescriptions given.
CHAPTER (N+3)	Science and Research	Reference should be made to all research articles/ outputs/ findings used in the preparation of the plan. All research gaps and constraints with respect to availability of the data and information required for writing of plan should be brought out clearly. However establishment, maintenance and up keep of the permanent plots must be provided in the plan.
(N+3).1	Preservation Plots	Sufficient number of representative preservation plots should be created and maintained for preserving examples of existing forests as far as possible in their present form, or preserving such selected forest plots from all forms of injury and so permit progression towards such climax form and to study and correlate vegetation change matrix with the impact of climate change.
(N+3).2	Sample Plot	Similarly establishment of representative sample plots of all ages, all species in different site quality along with revival of previous sample plots for growth studies; and separate sample plots for NTFP should be planned for more focused research aspects in this chapter. Even a time schedule for data collection should be provided so that sustainable management of forests can be prescribed on the basis of scientific analysis.
(N+3).3	Regeneration Plot	Regeneration plots may be established to study the regeneration status of important species. Data should be collected on population dynamics of seedlings, saplings and young trees. By marking them and monitoring their status periodically, finding out the conditions in which a species regenerates best and creating those conditions can make the working plan effective with regards to forest sustainability. While monitoring the marked seedlings,

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		causes of damage, effect of canopy gap, growth parameters, role of mycorrhizae and litter cover management should be considered.
(N+3).3	NTFP Plot	Permanent plots of suitable sizes may be laid for development of safe harvesting protocol and the optimum limit of the harvest should be standardized for assured regeneration of the species. The following harvesting regimes may be experimented to work out safe harvesting limit: 100 % harvest of the marketable parts (by removing the whole number) 75 % harvest of the marketable parts (by leaving 25 % of the whole number) 50 % harvest of the marketable parts (by leaving 50 % of the whole number) 25 % harvest of the marketable parts (by leaving 75 % of the whole number) The plots should be laid in triplicate. The plots so treated shall be visited after a gap of one year to enumerate the number of new recruits and the effect of above removal shall be calculated using standard mathematical formulae.
(N+3).4	Other Research and Experimental Plot	Status of seed orchards, clonal seed orchards and improved nurseries to generate quality seeds/ seedlings and planting stock; other experimental plots for growing stock development data and silvicultural system, etc.
CHAPTER (N+4)	Establishment and Manpower including Technical Skills	Suggestions may be made regarding increase or changes in the establishment and manpower if the current arrangements do not appear to be satisfactory based on the assessment of present and future work load. Training needs of staff at all levels should be assessed and provided here.
CHAPTER (N+4).1	Roads, Paths, Bridges, Building	Suggestions for new roads & buildings and other infra-structural facilities with full justification are given here.

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CHAPTER (N+5)	Summary of prescriptions	This is a brief resume of prescriptions and suggestions as per working circles. This is useful for senior officers who cannot go through the whole working plan document. It helps as a ready reference.
CHAPTER (N+6)	Trees Outside Forests	Include the present scenario and potential areas and efforts required to increase TOF so as to make forests sustainable and rural economy more revitalized

12. 2 CONSTITUTION OF WORKING CIRCLES

Working Circles are constituted in a working plan for the following reasons:

- Forest ecosystems provide a multitude of products and services. To be able to have maximum benefits from a given area, it will have to be managed from this multi-product and multi-service perspective. Since, the realization of these different products and services often requires different silvicultural treatments, therefore the forest management plan area is divided into different working circles for giving special treatments to a given forest area for the realization of the dominant forest objective in a given forest area.
- The total working plan area is usually large and has different forest types with different site and locality factors and other variations. To cater to this variation in the crop and site conditions, different silvicultural treatments will have to be proposed.

Given these reasons, the following working circles may be constituted. Working Circles are not necessarily exclusive and could be overlapping:

Name of the Working Circle	Major Objectives of the Working Circle
Multi-purpose Production Working Circle	Forests allotted to this working circle shall include those which are adequately stocked and hence will be managed for sustainable production of various forest products and services including timber production.
Forest Conservation and Development Working Circle	Management here is with the objective to develop and increase productivity of the forest ecosystem and maintain vitality of the forest. The working circle shall include areas which are currently unstocked or understocked and hence will be conserved, rehabilitated, restocked and developed through planting, enrichment planting, dibbling/seeding, etc.
Soil and Water Conservation Working Circle	Management objectives of this working circle includes reducing soil erosion, enhancing fertility of the soil, ensuring stability of the

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	forest ecosystem and conserving water sources, enhancing water conservation capacity of the forest ecosystem and assisting in regulating the flow of water from its catchment area. The working circle therefore includes areas which are vulnerable to soil erosion and where watershed management is important.
Biodiversity and Wildlife Conservation Working Circle	The management objective here is the conservation biodiversity at all three levels: ecosystems diversity, species diversity and genetic diversity. The aim is to conserve and sustainably use genetic resources, both floral and faunal including micro-organisms. Areas with rich biodiversity such as national parks and other protected areas will be allotted to this working circle.
Climate Change Management Working Circle	These forest areas are managed for climate change management through reducing GHG emissions and enhancement of forest carbon stocks under various climate change mitigation and adaptation mechanisms.
Community Use Working Circle	These forest areas are managed for socioeconomic considerations and generation of forest based employment opportunities and livelihood options. These are meant to meet the fuel wood, fodder and timber requirements of the local communities, enhancing livelihood and employment opportunities, ensuring usufruct/ benefit sharing and protection of their traditional knowledge and traditional/cultural practices, etc.
Non-Timber Forest Products (NTFP) Working Circle	These are those areas where Non-Timber Forest Products including Medicinal and Aromatic Plants are important. These areas will be generally managed through the development of Village Plans under the Village Land Use Planning (VLUP) Mechanism.

12.3 THE SUB DIVISION OF FOREST AREAS

There are four distinct and recognized sub-divisions of forest area as under:

S.No	Type of Sub Division	Name of Sub Division	Denotation
1.	Legal	Protected Forests	PRF
		Private Forests	PTF
		Village Forests	VF

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2.	Territorial	Block/Village	Local name
		Compartment	Arabic numbers. Thus 6
		Sub-Compartment	Compartment number and a small letter. Thus 6a.
3.	Administrative	Division, Range	Name
		Beat, Sub-beat	Name or number
4.	Management	Village	Local name
		Sub-compartment	Already explained above as 6a
		Cutting Section	-
		Felling Series	Mainly name sometimes even a Roman or Arabic numeral
		Working Circle	Name of Species or management system
		Periodic Block	By Roman numbers. Thus PB-I
		Coupes	By Roman numbers. Thus Coupe V

12.4 NUMBERING AND PAGING

Pages are numbered from the beginning of Part I, Chapter 1 and form a consecutive series right through the plan.

There should be one continuous sequence for the chapters of working plan including Part I & II. The chapter numbers should be in Arabic numerals.

There should be separate sequence for the paragraph numbers in the individual chapters. Each paragraph of a chapter should start with the index numbers of the chapter followed by the decimal point. Thereafter the paragraph number should be given as 1, 2, 3, ..., 57, 58, 59, ..., 99, 100, 101, etc. Thus paragraphs of Chapter 8 should be numbered as 8.1, 8.2, 8.3, ..., 8.9, ..., 8.99, 8.100, etc

If a paragraph has sub-para, the sub-para numbers should also be as 1, 2, 3, etc. The sub-para number should come after the main para number preceded by decimal point. For instance, in para 8.99, the sub para would bear number 8.99.1, 8.99.2, 8.99.3, etc.

Paragraphs and page numbers should be mentioned in cross-references. Dates should be typed as January 1, 2, 3, etc., and not January 1st, 2nd, 3rd, etc.

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12.5 WORKING SCHEMES OR WORKING PLAN FOR AREAS NOT UNDER THE MANAGEMENT OF FOREST DEPARTMENT

This will depend on the extent of the area for which the working scheme or working plan is to be prepared. General headings, in which the working plan can be written, can be as under; but there is no hard and fast rule. The local DFO, the Territorial Circle In charge, and the Head, Working Plan Organization can use their discretion. Following are sample headings for a working scheme:

PART-I
Area dealt with – location
Details of Forest Land – Legal, Boundaries, Area, Rights of others If any
Description of the Forest Crop
Analysis and valuation of the crop
Past management practices and changes required
PART – II
Basis of Proposals
Working Circle wise description
Necessary measures for protection of forest
Plantation measures
Estimated revenue and expenditure
Control and records

12.6 APPENDICES

All information and details, which are required for the elucidation of the plan, should be included in appendices as a separate volume. In order to make full use of the appendices, reference should invariably be indicated in the concerning paragraph of the plan. Similarly in the appendices also, the concerning paragraphs of the working plan should be indicated in brackets below the title of the appendix.

The following is the list of essential appendices. Additional may be added, if necessary, but effort should be made to keep them (i.e., appendices) to the minimum.

Appendix I – Divisional Area Statement

Block Range	Village/ Compartment Sub Comp Coupe	Composition by area	WC/FS/PB	Density	Site Quality	Growing Stock	Area	No. of cattle units permitted	Other Details	Remarks



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Order Alphabetical	Serially	Separate for important species	WC main or over-lapping indicate	As assessed by WPO	As assessed by WPO	As assessed by WPO	To be mentioned	Given if regulated	Anything Important	Important observation
1	2	3	4	5	6	7	8	9	10	11

Appendix IIA – Enumeration Results

Full details in compartment histories inclusive of major NTFP and an abstract are to be given in this appendix. The figures are detailed by Working Circles, Felling Series, Blocks and Compartments or/and Beat, Sub-beat and village; all are arranged alphabetically and serially. A summary of assessment of enumeration data should invariably be given together with estimated total growing stock, wherever necessary.

Appendix IIB- Biodiversity Assessment

The detailed report of biodiversity assessment will be annexed indicating biodiversity richness of the area as per the following table

Name of the species	Density (Tree/area)	Frequency (%)	Total Basal Area (m^2/ha)	IVI
Trees				
Shrubs				
Saplings				
Seedlings				
Climbers				
Herbs				
Grasses/ Sedges				

Appendix IIC -Regeneration Surveys

Regeneration survey data should be analyzed and should be reported in full wherever applicable.

Appendix IID- Socio-economic Survey Results

The detailed report of socio-economic survey will be annexed indicating dependence of people on forests

Appendix IIE- NTFP (including MAPs) Estimation

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Detailed estimated quantities along with type of plants, their part and its utility, area, species, etc. should be provided.

S.No	Scientific name	Local name	Type of plant	Part used	Location where found compartment no /beat/ Range)	Area in ha	Potential harvesting Quantity per hectare	Estimated harvested / hectare	Remark
1	2	3	4	5	6	7	8	9	10

Appendix III-Carbon Stock Assessment

A carbon stock assessment in relevant forest carbon pools will be done as per Protocol for Carbon Stock Assessment.

Appendix IV – Research Plots

A summary list of existing sample plots, linear increment plots, tree increment plots, preservation plots, protected trees, plus and elite trees, NTFP, seed orchards, etc., along with location description should be given.

Appendix V – Rights, Concessions, Grazing Regulations, etc.

All Government settlement reports, orders and notification should be reproduced in full.

Appendix VI – Schedule of Rates

The current schedule of rates of timber, NTFP and forestry works is to be given.

Appendix VII – Leases, Contracts, transfer etc.

Give details of leases, contracts, land transfer cases etc.

Appendix VIII – Ranges, Blocks and Beats, their headquarters and area

Constitution of ranges, blocks, beats, and compartments or coupes of ranges and beats (along with maps) should be given alphabetically.

Appendix IX – Buildings and Rest Houses

The list will be of all forest buildings, rest houses, location by latitude/longitude, number of suites, distance from road, and elevation (in hill areas), etc. (May visit and assess the ground level situation for general recommendation for improvement and alteration/addition required.)

Appendix X – Divisional Forest Officers

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List of Divisional Forest Officers is given right from the day of formation of the division; and the period of holding charge is also mentioned.

Appendix XI – JFM

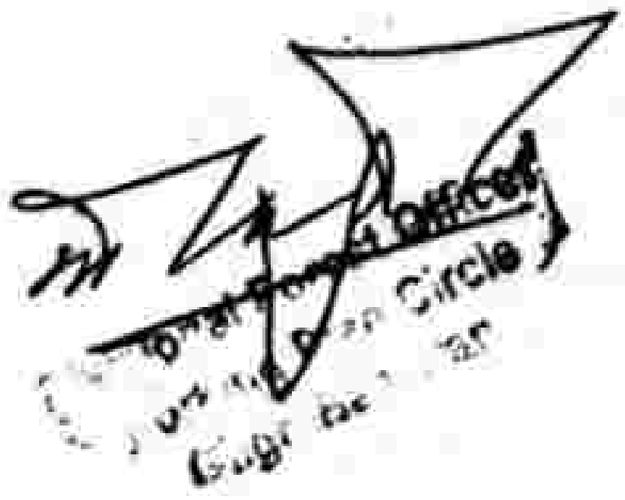
The details of JFM villages (Range wise) along with location by latitude/longitude, area allotted to JFM, status of village/micro plan should be given.

Appendix XII – FIRE

Details of all FIRE cases (Range wise) would be given, for at least past three years to identity fire prone areas along with specific remarks with regard to severity and burnt area.

Other appendices

Other Appendices which may be useful should also be given, such as, Roads and their status, Fire lines including the status of their maintenance, forest employees killed on duty, results of soil survey, etc.



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CHAPTER 13
PREPARATION OF WORKING PLAN MAPS BY WPO

13.1 MAP POLICY

Map making process has seen many changes over the years from the conventional techniques to switching over to the digital techniques. Now-a-days maps are available in both analogue and digital formats. Advent of satellite based techniques has brought in revolution in almost all the walks of life. Expectations for provision of higher order of accuracies and user oriented products have increased. One such free user friendly utility in the public domain is Google Earth, which is on World Geodetic Survey.

The use of modern technologies and tools which includes satellite remote sensing (RS), geographic information systems (GIS) and global positioning system (GPS) have become inevitable in preparation of working plans of forest divisions. For survey and acquiring latitude and longitude on the ground, GPS is to be set in Geographic Coordinate System (GCS) with WGS 84 datum for easy uploading data into the GIS software.

Remote sensing imageries help in mapping the land cover/land use of forest division and getting other details needed for preparation of stock maps.

Finer resolution (about 5.8 m or less) satellite imagery on other hand can help in mapping more details, classifying and stratifying forest into a larger number of density classes, conducting inventory and preparing stock map on 1:12500 scale with the essential 0.1ha mapping unit for forest management. The role of GIS is integrated into image analysis by digitizing the different layers of boundaries (divisional, range, block, compartment etc.) and working out area of each section/class of forests and providing attributes of each class. The use of GPS has been well pronounced in quick survey of the forest areas, both for demarcating the boundary and also for determining the area. It also helps in bringing cadastral maps into digital and computer compatible mode.

As a general rule, if the stock maps of previous working plan are available, they should only be checked with the new stock map and any serious deviation is to be recorded along with reason for the same. If stock maps do not already exist, they will have to be prepared on 1:12,500 scale or 1:50,000 scale depending on the available resolution of satellite images. One set will be for the territorial divisional office and the other for the Working Plan Officer. Normally a stock map shows the details of blank areas, crop composition, density, quality, age classes, and regeneration. Different colors and symbols may be used in the preparation of stock maps.

13.2 MANAGEMENT MAP

This is prepared on 1:50,000 scale cut and mounted. The WPO prepares sufficient number of master copies of the management map so as to provide them to all concerned including lower ranks like sub divisions, ranges of the division. This map will show divisional, range, block, compartment, and sub-compartment boundaries, and boundary pillars with their numbers.

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The most important aspects to be shown in color are: Working Circle, Felling Series, Periodic Blocks, and coupe numbers. Other important features like roads, transmission lines, railway lines, water bodies etc. may also be shown if possible, clearly.

13.3 WORKING PLAN MAP

These are prepared on 1:12,500 scale cut and mounted for each range. These are also like management maps, which in addition to silvicultural units- viz., Working Circle, Felling Series, and Periodic Blocks- show as many management, administrative, and physiographic features as possible.

13.4 REFERENCE MAP

When reading a working plan, it is inconvenient and unnecessary to have to refer a separate working plan/management map except when detailed information is required to be understood. Thus, each working plan will include a small reference map on the inside of the back cover on 1:1, 25,000. This map will be bound or attached to the printed volume in such a way that when it is unfolded it will be completely outside the volume. The map will be of such a convenient size as can be simply folded once or twice to the size of the printed volume. It should show the main boundaries, the forests, ranges, roads, canals, forest rest houses, neighboring towns and villages, and such other relevant features as can be shown without overcrowding it. The scale of map, which must be given, will, of course, depend on the size and shape of the division. Reference map is a miniature mix of working plan map and management map.

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CHAPTER 14
PREPARATION OF COMPARTMENT HISTORY FILES

This should be written by the WPO/DFO (Territorial) as his inspection of forests (in two sets, one each for range and the division) are used for writing the compartment history for each compartment or sub-compartment:

CH Form-1	Compartment description	To be filled by WPO
CH Form-2	Compartment enumeration	To be filled by WPO
CH Form-3	Biodiversity assessment	To be filled by WPO
CH Form-4	Management details	To be filled by WPO
CH Form-5	Details of NTFPs including MAPs	To be filled by DFO
CH Form-6	Trees marked for felling since last plan	To be filled by DFO
CH Form-7	Compartment out-turn	To be filled by DFO
CH Form-8	Harvesting of NTFP	To be filled by DFO
CH Form-9	Past events in the last plan in the compartment	To be filled by DFO

14.1 COMPARTMENT DESCRITPION: The format (CH Form – 1) is as under:

Identification

Division	Range	Block	Compartment

Management details

Working Plan Period			
Author WPO			
Working Circle			
Felling Series			
Periodic Block			
Sample/research plots/preservation plots			
Forest types			

Description

Title of description	Explanatory notes to write the description
Area (In Hectares)	Total as also under each species or type, blank unworkable, etc.
Situation	As accurate as possible with the help of GPS.

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Boundaries	N, S, E, W (mention boundary pillars, ridges, spurs, streams, etc.)
Altitude	In meters. In case of hilly areas give lower and upper limits.
Aspect	Main aspect and variations if any
Gradient	Precipitous, very steep, steep, moderate, gentle, etc.
Configuration	Rugged, undulating, flat, etc.
Rock	Mention main underlying rocks including alluvial deposits
Soil	Texture, depth, permeability, drainage, surface compaction, humus, etc.
Growing Stock	Natural, artificial, story-wise composition, age class quality, stocking density, regeneration of principal species, etc.
Quantitative analysis of vegetation	Name of the species, density, frequency, total basal cover, dominance, IVI etc.
Other information	The effect of biotic factors and any other information related to plantation, NTFP, medicinal and aromatic plants, bamboos and rattans, wildlife, invasive species etc., should be especially dealt with

The description will be signed and dated by the WPO. Each heading should commence in a separate paragraph. Details shall be based on information collected in plot approach form and plot description form for plots falling in the compartment/village.

14.2 COMPARTMENT ENUMERATION (based on enumeration of sample plots falling in the compartment): CH Form-2. The format is as under:

General Information

Block	Compartment	Sub Compartment	Total Area (Ha)	Area enumerated	Sampling method If partial	Year of Enumeration

Result of Enumeration (If any)

Species	Diameter class in cm. (Number in each class)									
	10-20	20-30	30-40	40-50	50-60	60-70	70-80	80-90	90& over	Total

14.3 BIODIVERSITY ASSESSMENT: CH Form-3

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Name of the species	Density (Tree/area)	Frequency (%)	Total Basal Area (m^2/ha)	IVI
Trees				
Shrubs				
Saplings				
Seedlings				
Climbers				
Herbs				
Grasses/ Sedges				

14.4 DESCRIPTION OF NTFPs including MAPs: CH Form-5

S. No.	Scientific name	Local name	Type of plant	Part used	Location where found (Compartment no./beat/ Range)	Area in ha	Potential harvesting Quantity per hectare	Estimated harvest/ hectare	Rem
1	2	3	4	5	6	7	8	9	10

14.5 TREES MARKED FOR FELLING: CH Form-6

This form is to be filled by the DFO from time to time as the markings take place. The format is as under:

Year	Area Ha.	Species	Diameter class in cm. (Number in each class)									
			10-20	20-30	30-40	40-50	50-60	60-70	70-80	80-90	90 & over	Total

14.6 COMPARTMENT OUTTURN: CH Form-7. The format is as under:

Year	Area Felled in hect.	Species	Round Timber	Sawn timber	Fuel wood	Miscellaneous	Remarks



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14.7 HARVESTING OF NTFPs: CH Form-8

Block	Compartment	Sub-Compartment	Species, Scientific name)	Harvesting time	Quantity harvested (Kg)						
					Roots	Flowers	Leaves	Bark	Stem	Twig	Wlepl t

14.8 COMPARTMENT HISTORY: CH Form-9

The format is as under:

Year	Event (since last plan)

Block..... Compartment.....

If compartment history with full entries already exists, past entries made by the DFO will be scrutinized by the WPO who may edit them if necessary. Usually no condensation should be necessary.
The DFO is responsible for recording current events as they occur and will make his entries on the separate sheet of the form and not on that prepared by the WPO. At the next revision of the plan, the WPO will scrutinize these entries and edit them if necessary.

The principal information, which the DFO should record, is as follows:

Felling, Subsidiary Silvicultural Operations, Slash Disposal with costs, Plantations, Control Burning with costs, Fire incidences and damage caused, Damage by other factors like Drought, Storm, Snow, Insect, Fungi, Grazing, etc., Remedial measures taken along with costs, Good seed or seedling years of important species.

The entries should be brief and concise; whole or part compartment that was involved should be made clear. For event timings- month or months- should be given. Any other activity if undertaken is mentioned along with cost.

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CHAPTER 15
MONITORING, ASSESSMENT AND REPORTING

15.1 CONTROL FORMS

General prescriptions of the working plan should be written in such a way that it is quite clear as to what constitutes a performance norm and the Control forms provide for performance parameters /targets/ annotations/ norms for all prescriptions/suggestions for every working circle to be monitored, assessed and reported on annual basis during the period of the working plan. Control forms should be prepared to include each of these prescriptions, as well as all definite suggestions regarding other operations left at the discretion of the territorial staff.

The WPO should prepare a draft set of control forms to control all the important operations prescribed and suggested in his working plan such as different types of felling, thinning, plantation works, subsidiary silvicultural operations, rotational lopping, soil and water conservation works, control grazing, fire protection, NTFP harvesting, MAPs harvesting, boundary pillars, spring recharge, weeds and invasive species eradication, reducing degradation, removal of firewood etc., These forms will then be submitted to the CCF, CF Working Plan for approval and preparation of final sets. There shall be separate set of control forms for each working circle.

Five permanent sets of these control forms will be prepared in the office of the Working Plan Officer and one set each is distributed to CCF, CF Working Plans, the CF Territorial Circle In charge, and the Divisional Forest Officer Territorial.

Following are examples of control forms:

- **Silvicultural Control Form** – For the control of all silvicultural operations such as fillings, subsidiary cultural operations, cleanings, thinning, burnings, etc., which may be prescribed or suggested to be carried out in a given management unit for the duration of the working plan.

- **Felling Control Form** – For controlling and maintaining the record of all trees marked for felling and trees retained.

- **NTFP Control Form** – For controlling and maintaining a record of all NTFPs harvested so as to make the removal/harvest of NTFPs remain sustainable.

15.2 FORMATS OF CONTROL FORMS

One example of each of the Three Types of Control Forms is given below:

Silvicultural Control Form



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The format of coupe control form is as under

Working Circle- Periodic Block-		Felling Series / Cutting Section	Localities Prescribed/ Localities Suggested As Carried Out				Coupe Control Form Coupe No. Excess +/Deficit		Page
Prescription in brief	W.P. para	Year due	Year	Block/ Compt:	Area	Volume	Area	Volume	Remarks and sanction
1	2	3	4	5	6	7	8	9	10

Felling Control Form: Format of the Felling Control Form is given below.

Working Circle- Periodic Block-		Felling Series / Cutting Section	Localities Prescribed/ Localities Suggested (with areas)				Coupe Control Form Coupe No.		Page
Range wise	Area	Species	Diameter class	Trees marked	Unit Factor	Volume marked	Tree retained	% Trees retained	Remarks and sanction
1	2	3	4	5	6	7	8	9	10

i. Offence reports- prosecuted, compounded, un-detected

ii. Removals under rights/concessions

iii. Forest lands marked for infrastructure development works, etc.-range, block area and compartment, etc.

iv. Forest lands allotted to community for enjoying of rights- range, block area and
compartment, mauza, status as per revenue records.

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NTFP Control Form: Format to incorporate the NTFPs:

Working Circle- Periodic Block-	Felling Series / Cutting Section/ Collection Area	Localities Prescribed/ Localities Suggested As Carried Out						Coupe Control Form Coupe No. Excess +/Deficit		Page -
Prescription in brief	W.P. para	Year due	Year	Block/ Compt:	Area	Name of NTFP with scientific name of species	Vol. / Qty *	Area	Volume	Remarks and sanction
1	2	3	4	5	6	7	8	9	10	11

*Quantity may be given in specified unit viz. number/weight/volume according to type of NTFP.

The DFO will annually make entries in his copy of the control forms and send them together with the deviation statement in triplicate to the Working Plan Officer through the Territorial Circle In-charge. After the entries have been checked and approved, the Working Plan Officer will first get his copy completed and then send the DFO's copy to the Territorial Circle In-charge. The later will then complete his copy and finally return the DFO's set for deposit in the later's office till next year. The Working Plan Officer will send four copies of deviation statement with appropriate justification to the CCF for sanction through the CF Working Plans. After the sanction, one copy each will be sent to the Working Plan Officer, Territorial Circle In-charge and the DFO for their record and the CCF, CF Working Plan or the head of working plan organization as the case may be, will retain the fourth copy for his set of control forms.

The control forms should be submitted by the DFO to the Territorial Circle In-charge on or before December 1st and the later should send them to the Working Plan Officer concerned on or before January each year.

15.3 DEVIATION STATEMENTS AND DEVIATION CONTROL FORM

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Any large and unusual operation, variation from yield and target for plantation/regeneration and or other activities provided in Control Forms of the working plan constitutes a deviation. These also should be spelt out. The check is through Control Forms and reporting is through Deviation Statements. Deviation beyond 20% of target is considered to constitute a major deviation. Following is the format of Deviation Statement.

STATEMENT SHOWING DEVIATIONS FROM WORKING PLAN PRESCRIPTIONS

Year..... Division.....

Serial No. of deviation	Control book name; form no. Page	Reference to *working plan*		Nature of deviation requiring sanction
		Paragraph	Nature of Prescription	

The DFO will forward through the Territorial Circle In-Charge, typed copies of this form in triplicate yearly with his copy of control forms. No explanatory remarks are required on this form, but these should be given in the forwarding letter. All minor deviations, which do not permanently alter the basis of management, may be approved and sanctioned by the Head, Working Plan Organization on behalf of the CCF provided he agrees with the necessity of these deviations. One copy of the statement will be returned to the DFO through the Territorial Circle In-Charge after the deviations have been sanctioned by the Head, Working Plan Organization and the other copy will be sent to WPO for record. All major deviations without altering the basis of management, the prior sanction of the CCF should have been obtained in advance; the sanction number and date should be quoted in the last column.

All deviations such as change in Silvicultural System; clear Felling of Natural Forest; formation of new Felling Series; large scale felling due to natural calamities; which cannot be adjusted against future yield, etc. which permanently alter the basis of management laid down in a working plan, will require prior sanction of the CCF. For all major deviations with respect to prescriptions where sanction of federal government is mandatory, an explanatory note along with request for regularization has to be sent by Territorial Conservators of Forests through the CF Working Plans to the Chief Conservator of Forests. In case where there is difference of opinion between the Territorial Conservators and Conservator of Forests Working Plans, the Chief Conservator of Forests will either decide the case at his level or refer it to the Secretary Forests, Government of GB whose decision shall be final in the matter. The CCF will countersign the deviation statement for reporting to the federal government, if there is need for such reporting to the federal government.

15.4 REGISTERS AND RECORDS

The following registers and records including spatial data will be maintained by the division:

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1. Compartment histories
2. Divisional notebook
3. Fire records and registers
4. Register of boundary pillars
5. Plantation journals (along with list of plantation raised area and location last five years)
6. Nursery register (location, permanent nursery)
7. Register of reserves
8. Register of rights and concessions
9. Record of forest produce harvested including any NTFPs and MAPs
10. Free grants
11. Register of leases
12. Register of land transferred to other departments or under FC act and FRA
13. Register of soil and water conservation works (along with list of plantation raised,
area and location last five years)
14. Register of rotational lopping's
15. Grassland management (last five years)
16. Wildlife management
17. Register of invasive species eradication e.g., *Lantana* eradication, etc.
18. Register of wildlife management may include detailed record of human-wildlife
conflicts that include data on human casualties and injuries, loss of domestic
animals and crop damage and compensation paid etc.
19. Register of government buildings that includes log of the repairs and addition (if
any) undertaken in the buildings.
20. Register of permit holder(s) in the division.
21. Register of places of special significance that has been historically been given
recognition (However, mention must be made of the fact that mere mention in the
register does not automatically give legal sanctity to the structure).
22. Register of registered saw-mills in the division.
23. Register of habitual and noxious forest offenders in the division.

Annual inspection of DFO territorial office by CF/CCF and range office by DFO territorial is
mandatory within three months of completion of financial year to have checks on annual
statements in control forms and deviation statements and maintenance of registers and records.

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Working Plan Circle
Gilgit

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CHAPTER 16
FOREST CARBON STOCK ASSESSMENT INVENTORIES METHODOLOGY

A number of methodologies for forest carbon stock assessment and investment inventories have been developed and successfully used in different parts of the world. The description given in the following section is based on one methodology that has been developed and used for participatory forest carbon stock assessment in community forests in Nepal. There are a number of other methodologies and protocols also developed elsewhere, which can be used in GB too.

The methodology and procedures used to estimate carbon stocks and their changes over time in forests are simple step-by-step procedures using standard carbon inventory principles and techniques. The procedures used emphasize the training of forest technicians and local resource persons (LRPs). Procedures are based on data collection and analysis of carbon accumulating in the above-ground biomass; below-ground biomass, litter, and soil carbon of forests using verifiable state-of-the-art methods.

The methodology is sequenced as per following major steps:

- Delineation of project boundaries
- Stratification and boundary mapping of stratum
- Pilot inventory for variance estimation
- Capacity building and orientation of the locals
- Field measurements in the permanent plots (Above Ground Biomass, Below Ground Biomass, soil carbon, dead wood, herbs& litter)
- Data analysis (calculation of carbon stock density)
- Leakage analysis belt and monitoring
- Report preparation

16.1 BOUNDARY MAPPING AND PILOT INVENTORY

The first step in forest carbon measurement is delineation of the project boundaries which is then followed by making a pilot inventory. Each activity is discussed in detail in the following and subsequent sub-sections.

16.1.1 Delineation of Project Boundaries

Spatial boundaries of the particular area need to be clearly defined to facilitate accurate measuring, monitoring, accounting and verification. A watershed might be a natural entity of a spatial project area. Spatial boundaries can take the form of permanent boundary markers, e.g., rivers and/or creeks, mountain ridges; spatially explicit boundaries (identified by global positioning system [GPS] apparatus); and/or other methods. Many tools are available for identifying and delineating project area boundaries; and these include remote sensing, e.g., satellite images from optical or radar sensor systems; aerial photos; GPS; topographic maps; and land records. Larger areas across the landscape can be defined by specific



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boundary descriptions using GPS-based coordinates on topographic maps or by using satellite images.

Software such as geographical information systems (GIS), ARC hydro extension of ARC GIS (ESRI software) or the BASINS extension tool for ARC view software are used to delineate watershed areas of spatial project boundaries. Contour lines and data on drainage networks are commonly available to define watershed boundaries of specific project areas. For this purpose, high resolution satellite images (e.g., Geo eye 0.5 m resolution) are extremely useful if they can be obtained. If these high resolution images were not available, then the available images with Pakistan Forst Institute and used in their study for Land Cover Analysis of Pakistan will be used.

GPS points are used for geo-referencing as required for increased accuracy and precision on satellite images and GIS data: available satellite images and global positioning systems (GPS Map 60CSx, Garmin) are used for verification.

16.1.2 Forest Boundary Delineation

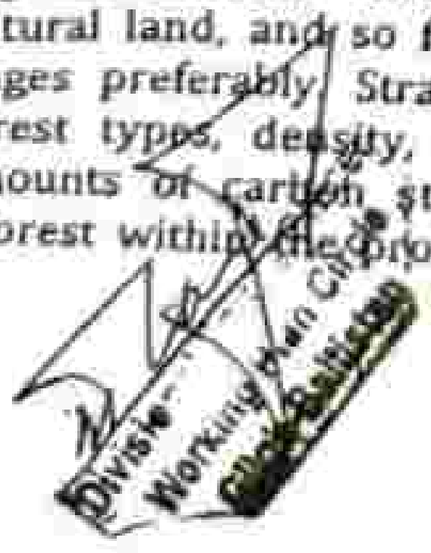
Individual forest blocks within the project area are mapped jointly by GIS experts, forest technicians, and members of community forest user groups (CFUGs) in a participatory way. High-resolution satellite images printed on a large scale are used to find the different land cover and natural boundaries and to trace individual forest blocks easily. GPS (GPS Map 60CSx, Garmin) tracking is carried out to delineate different management methods for forests in confusing areas, i.e., where the natural boundary cannot be clearly observed.

If high-resolution satellite images are unavailable, GPS tracking is the most accurate and efficient alternative method for boundary delineation, even if the process is time consuming. The standard procedures for marking current location and delineating the forest boundary using GPS will be made use of. Each forest block will be traced on to base maps first and then digitized on Arc View or ARC GIS software for data input. The data tracking from the GPS receiver is downloaded as a shape file, e.g., DNR Garmin software can be used. The areas of individual forest blocks are estimated after digitizing and editing the data downloaded.

16.1.3 Stratification of the Project Area

Once the project area has been delineated, it is essential to collect basic information on features such as land use and land cover as well as data on the vegetation and topography.

Data for the project area (e.g., watershed area) can be geo-referenced and traced on to a base map. A base map specifies the details of the project area by indicating the different land-use categories (forest, water bodies, open land, agricultural land, and so forth) and is developed with high-resolution satellite images preferably. Strata are areas distinctly different from each other in forest types, density, and species; and as such they will have different amounts of carbon stored. To make strata as homogeneous as possible, a forest within the project area is divided into different layers or



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blocks. Remote-sensing software (ERDAS Imagine, ENVI or ILWIS) is used for land-cover classification and forest stratification.

A preliminary field visit is organized within the entire study area to improve the accuracy and precision of the representation. Strata and sub-strata are identified using the expert knowledge of local foresters. The entire project area can be stratified into approximately homogeneous units on the basis of the following parameters.

Forest types – Montane Dry Temperate Coniferous Forest, Montane Dry Temperate Broadleaf Forest and Montane Dry Sub-Tropical Forest, Northern Scrub and Sub-Alpine are the major forest types in Gilgit-Baltistan.

Dominant tree species - Sites containing a dominant tree species are regarded as one stratum types.

Stocking density of trees - Within a dominant type, sites are separated further if they differ substantially in stocking density. Remote-sensing analysis is used to identify forest areas which differ in tree density. 'Sparse' and 'dense' can, for example, bc major types of forests.

Age of trees - Sites with distinct age classes are stratified further, as carbon sequestration differs markedly with the age of the stand.

Aspect and position of hill slopes - Within a dominant forest type, sites differing in aspect and position on a hill slope are also stratified further because the rate of carbon sequestration varies in relation to these factors. For example, a stand on the some given aspect would have far greater productivity than one on a north aspect.

Altitude - Forest blocks are selected within altitudinal ranges above mean sea level as vegetation types differ according to altitudinal variation. It is sensible to design elevation strata that represent forests within a 300-500m range in altitude.

Physical boundary - The boundary of the forest block is determined on the basis of easily visualized boundaries (i.e., rivers, roads, bridges, and so on).

Site quality - Site quality tells us how much timber a forest can potentially produce. The productivity of forest land is defined in terms of the maximum amount of volume that the land can produce over a given amount of time. Site quality is measured as an index related to this timber productivity.

16.1.4 Pilot Inventory for Variance Estimation

A preliminary inventory then needs to be completed to estimate the variance of the carbon stock in each forest stratum and to provide a basis for calculating the number of permanent plots required for the inventory. It is carried out by laying 10 to 15 circular plots randomly in each forest block and/or stratum within the project boundary. Random selection is important in order to cover the natural variability present within the different forest blocks and /or stratum. The plot size is dependent on tree density (MacDicken 1997). Possible plot sizes are presented in the following Table. The default plot dimension is 250 m2 with 8.92 m radius as this surface is suitable for moderate to dense vegetation (MacDicken 1997).

A carbon inventory is more complex to carry out than a traditional forest survey because a different variance may be associated with each carbon pool (MacDicken 1997). Therefore, all trees above and equal to 5 cm in diameter

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at breast height (DBH) within sample plots have to be measured and recorded on the data sheet.

Table: Plot Sizes and Tree Density

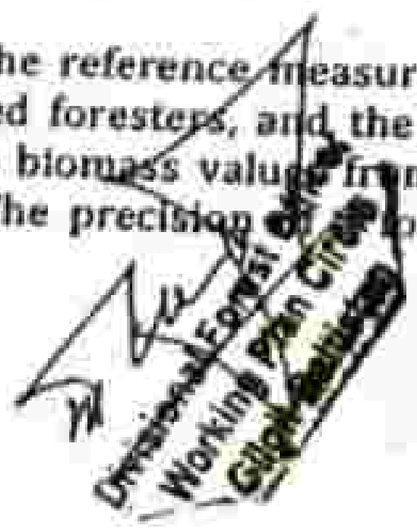
Plot Size [M²]	Plot Radius [M²]	Typical Area per Tree [M²]	Tree Density
100	5.64	0 to 15	Very dense vegetation, stands with large numbers of stems small in diameter, uniform distribution of larger stems
250	8.92	15 to 40	Moderately dense woody vegetation
500	12.62	40 to 70	Moderately sparse woody vegetation
666.7	14.56	70 to 100	Sparse woody vegetation
1000	17.84	More than 100	Very sparse vegetation

16.1.5 Calculation of Optimal Sampling Intensity and Number of Permanent Sample Plots

It is impossible to measure every tree within a forest. Statistical sampling theory explains how measuring only a fraction of the trees provides a measure of the biomass that is good enough to be used in carbon accounting. To quantify what 'good enough' means, it is important to distinguish between two concepts: accuracy and precision. Accuracy refers to how close a measured quantity is to its actual value, whereas precision expresses how reproducible a measurement is. Ideally, measuring biomass is both accurate and precise. One can imagine, however, a measurement technique that yields very different values every time a measurement is taken, but which provides accurate measurements when large numbers of individual measurements are averaged. Such a technique would be accurate but not precise. In contrast, a technique that continuously reproduces values within a narrow range but which are far from the actual values will be precise but not accurate. The measured values will be characterized by a systematic bias.

In classic sampling theory, the accuracy of a measurement system is established by setting a (often arbitrary) reference standard and repeatedly measuring this reference standard and calculating how far the measurements are to the set reference. The precision is usually quantified practically, using the width of the confidence interval around the mean, while the accuracy is quantified by the difference between the measured mean and the reference level.

For forest inventories, the reference measurement could be carried out by a team of truly experienced foresters, and the precision of a field crew can be tested by comparing the biomass values from the experienced foresters with that of the field crew. The precision of a forest inventory can be tested by



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performing multiple forest biomass inventories within the same forest stratum.

In other words, measurements that are 'good enough' are both accurate – meaning that measurements should be identical to measurements carried out by a team of truly experienced foresters – and precise – meaning that the width of the confidence interval around the mean should be sufficiently small. As a rule of thumb, one half of the width of the 95% confidence interval around the mean divided by the mean should be less than 10% within a stratum. If it is greater than that, more samples should be taken within that stratum, or the stratum should be split into two more homogeneous strata. The problem with this approach is that one needs to know the standard deviation of the measurements to know how many samples one needs, and, to know the standard deviation, one has to have carried out the measurements. In practice, it is best to adapt the sampling design and number of samples iteratively.

The sample plots will be established on a permanent basis to estimate changes in
the forest carbon stock, as using permanent plots is more accurate statistically for recording tree growth than resampling the forest blocks or strata every time. Permanent plots that are known to local managers, however, have the potential to be managed differently and may end up with more carbon stock than their surroundings. The existence of this possible bias can be checked by conducting comparative measurements in the surrounding area in subsequent evaluation. Permanent plots are also labelled inconspicuously to minimize the risk.

It is important to note that, by dividing the project area into relatively homogeneous strata, one can increase the accuracy and precision of measuring and estimating carbon. A stratified sampling design decreases the costs of monitoring because it diminishes the number of sampling plots required to acquire a set precision compared to a non-stratified sampling design. A stratified sampling design will allocate a greater number of plots in strata that have greater variability and, therefore, focus the sampling efforts in areas in which more accuracy is needed. A sampling design in which a single-stratum approach is used for every stratum will yield a greater number of plots than the multiple-strata sampling design. This is because a single-stratum sampling design for every stratum will result in the required precision on every stratum. On the other hand, the multiple stratum approach will result in the required precision only in the full area, which is a less stringent requirement.

The following procedure is carried out to calculate the sampling intensity (number of permanent sample plots) required for an above-ground forest biomass inventory.

Step 1. Identify the required precision level. A required precision with a value of 10% of the mean, calculated as the half-width of the 95% confidence interval, is frequently used.

Step 2. Select the location of the 10-15 preliminary sampling plots per forest stratum – the selection can be either completely random, or can be a random selection from a present rectangular grid of sampling plots. Plots

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can be laid out or distributed randomly within each stratum using a standard sampling method or software like Hawths' tool of ARC GIS.

Step 3. Estimate carbon stock per tree, per plot, per ha, and mean carbon stock per ha for each of the preliminary sampling plots.

Step 4. Calculate the standard deviation of carbon [Mg C ha-1] for all the plots.

Step 5. Calculate the number of plots required using the appropriate statistical equation.

Step 6. Visit the field to measure the biomass on the number of sample plots derived in step 5.

Step 7. Calculate the true relative half-width of the confidence interval around the mean for each stratum and compare these to the required values of 10%. If the required precision of 10% is not attained, either split or merge the strata or update the number of samples required to get the required precision based on the standard deviation from all the sampling plots.

Repeat steps 5-7 until the required precision is attained or by following the adaptive sampling design as described below.

16.1.6 Adaptive Sampling Design

Adaptive sampling is a strategy for maximizing the value of biomass inventory samples by continuously adapting the number of samples taken in each forest stratum. Adaptive sampling design works well when sampling individuals are spatially clustered, elusive, or hard to detect. Additionally, adaptive sampling is robust in situations where variability is difficult to estimate before sampling, and it is, therefore, an ideal sampling strategy for forest biomass inventories.

Adaptive sampling contrasts with conventional sampling techniques, such as stratified random sampling, in which all of the sample units are selected prior to the actual inventory. In adaptive sampling, an initial set of sampling units (plots) is selected, either randomly or through a systematic approach, but plot distribution over individual strata is continuously optimized. Plots are added repeatedly until the desired precision is attained. The basic steps for an adaptive sampling strategy are as follows.

1. Stratify the forest based on elevation classes, forest types, visible stocking (i.e., trees
per ha), and aspect. Select 3 to 5 forest strata.

2. Obtain information on variability. When no previous data from biomass inventories are available, the variability of the biomass stock density must be obtained from the literature or from a preliminary survey. When part of the inventory has been carried
out already, however, all plots sampled in previous iterations should be used for
calculating the number of sample plots required.

3. Use the procedure mentioned in these guidelines to obtain the number of plots required per stratum.

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4. In one iteration step, measure about 25% of the total plots required by the sampling design, evenly distributed over each stratum.

5. Estimate biomass stock, variability, and precision for the entire forest and for each individual stratum. Sampling precision can be obtained using the appropriate statistical formula.

6. If the desired precision is met, sampling can be finalized.
7. If the precision is relatively large in at least one stratum (e.g., precisions greater than 30%), revision of the stratification by splitting forest strata into more homogeneous sub-strata, or merging smaller strata to attain more samples within a stratum should be considered. Re-calculate the biomass stock, variability, and precision for the new strata as explained in step 4.

8. Re-calculate the plots required based on the empirically measured precision levels and the newest stratification following the procedures mentioned in these guidelines. Repeat steps 2 through 6 until the desired precision over every stratum is attained.

It is possible that steps 7 and 8 may result in either more, less, or the same number of plots allocated for one or more strata.

16.2 PERMANENT PLOT DISTRIBUTION AND LAYOUT

Establishing permanent plots with appropriate sizes and shapes is another task to be completed for forest carbon measurement.

16.2.1 Permanent Plots

The number of permanent sample plots is dependent on the size and types of forest stratum. Plots used must be of the same size as those used in the pilot survey. A base map is used to produce locations of random sample plots. Plots are laid out or distributed randomly within each stratum using standard sampling methods or software (e.g., Hawths' tool of Arc GIS). Coordinates of each plot are also generated. The plots' coordinates are then loaded into the GPS; e.g., using DNR Garmin software. Cemented or wooden pillars marked with permanent paint are used to fix the centre of each plot permanently. The marking in the centre of the plots has proved to be very valuable in annual monitoring as GPS alone could give a few meters of difference in locating the centre of the permanent plot for subsequent measurements.

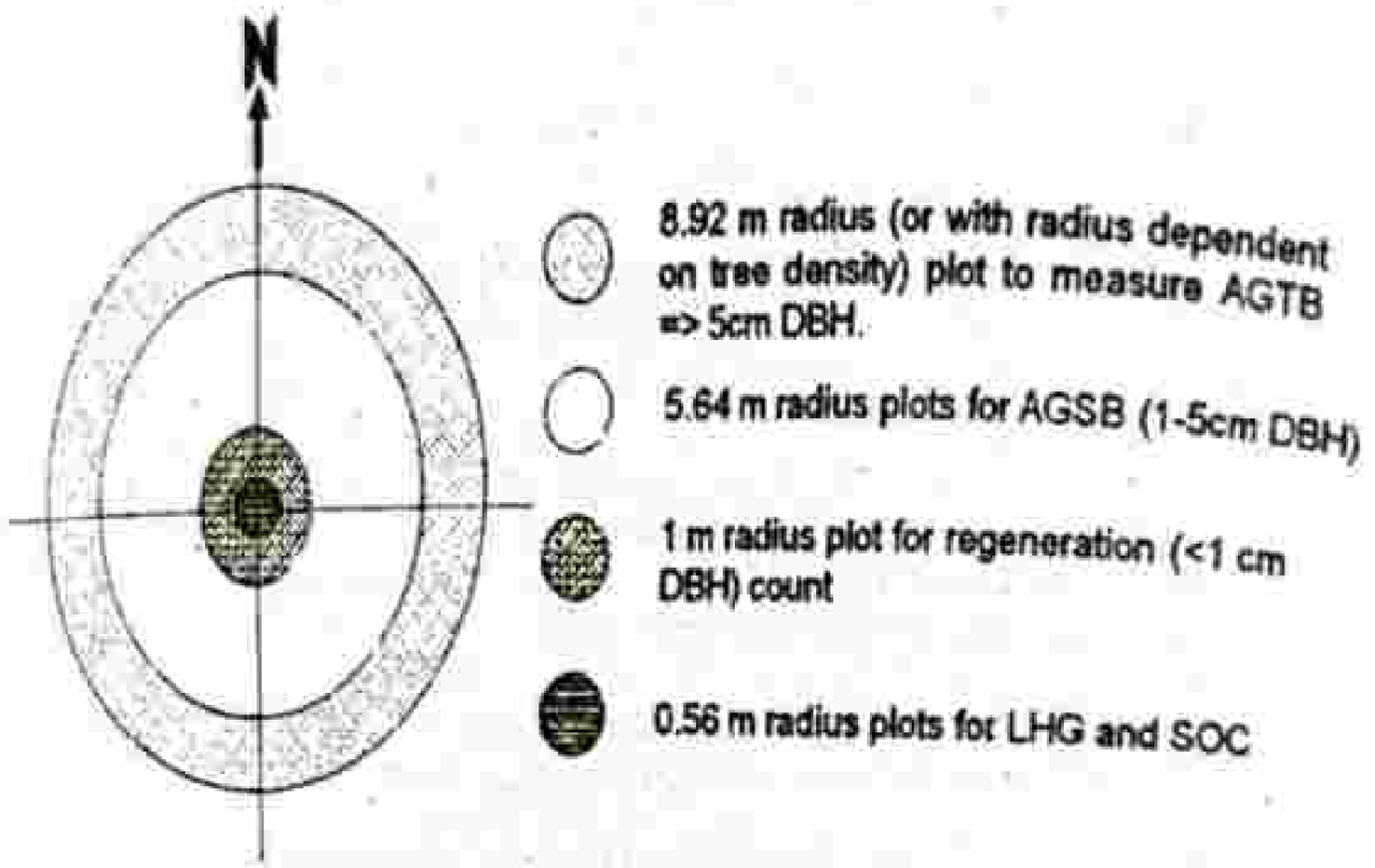


16.2.2 Size and Shape of Sample Plots

Forest carbon measurement can be carried out in both rectangular and circular plots. Nevertheless, circular samples are recommended for the study because they are relatively easy to establish. The radius of each plot is dependent on the density of the forest, the default being an 8.92 m radius for moderately dense vegetation. Several sub plots are established within each plot for specific purposes: inside of the 8.92 m radius plot, a sub plot with a 5.64 m radius is established for saplings; a sub-plot with a 1 m

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radius is established for counting regeneration; and a sub plot with a 0.56 m radius is established for sampling leaf litter, herbs, grass, and soil.



16.2.3 Carbon Pools to Measure

The following carbons pools will be measured in forest carbon estimation.

a) Above-ground tree biomass (AGTB)
b) Above-ground sapling biomass (AGSB)
c) Below-ground biomass (BB)
d) Soil organic carbon (SOC)
e) Leaf litter, herbs, and grass (LHG)
f) Dead wood and fallen stumps (DW)

If the neuromas portion of the carbon pool is not significant in the area due to frequent removal of dead wood for use as fuel by local communities, this pool should not be measured.

16.3 PLANNING AND PREPARATION OF FIELD MEASUREMENT

Thorough planning is imperative for efficient fieldwork: it helps to avoid mistakes, to recognize hidden opportunities, and, more generally, to ensure that operations run as smoothly as possible. A good planning process also enables the working group to understand more clearly what they have to accomplish and when they are expected to accomplish it. Before going to the field to establish plots on a new site, field teams will be formed, instruments and materials will have to be procured, responsibilities be delegated, field work will be scheduled, appointments will be made with the communities, forms for recording field data will be photocopied, and maps will be printed. These activities are explained in detail in the paragraphs below.

16.3.1 Gathering and Organization of Equipment

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Gathering the materials required before moving to the field is crucial. All instruments and pieces of equipment will be collected early enough so that they can be prepared, checked, and calibrated in advance. The operational team has to ensure that every instrument is functioning, so that field work can take place without any disturbance. A complete checklist will be prepared so that no materials are left behind: this checklist will also be useful during field work as the team moves from one location to the other.

16.3.2 Human Resource Management

After gathering all the equipment and materials required for forest carbon measurement, another important element is team formation and training-cum-orientation. Forest carbon measurement will be carried out with care to ensure the collection of complete data. Once the data collecting team leaves one location, it is not practical to revisit the area at a later date to collect missing data. Hence, a well-trained and well-managed team is needed. The participation of local persons is also a must since building the capacity of and transferring knowledge to local and indigenous communities are an intrinsic part of REDD in order to make it efficient and effective. The following paragraphs describe the formation and training of a good data collection team.

16.3.2.1 Teams Formation

Good teams will be formed and trained well in advance of their first field operation to ensure a satisfactory standard for data collection. Generally, each field team will have 3-5 members for the pilot inventory and 6-8 members for the detailed inventory; and one of them will be a person who knows the details of the methodology; has read these guidelines thoroughly; is able to operate all the equipment properly; takes a copy of the guidelines along to the site; and comprehends the importance of even the tiniest detail of the work described here. Teams should include at least one forest technician who has a thorough knowledge of carbon measurement; and two is the ideal because a second forest technician in the team helps to speed up operations. The remaining crew members would be local resource persons. The local resource persons taking part in forest carbon measurement will have primary-level education at least; more educated team members would further ease the measurement process.

16.3.2.2 Orientation Program

Data collection has to be good enough and no compromises can be made. For that all the crew members taking part in forest carbon measurement should understand the basic ideas behind forest carbon measurement and how to use all the materials and equipment. To train the team properly, a one-day orientation program will be organized. Orientation will be carried out in two sessions, a theoretical one and a practical one in the field. Major activities to be carried out during the orientation program include: introduction to forest carbon measurement; importance of forest carbon measurement; forest carbon measurement procedures; demonstration and use of equipment and materials; and field demonstration.

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16.3.2.3 Detailed Field Measurement Planning

After all the equipment and materials have been gathered and the team given orientation on field measurement, the next key step is preparing a detailed action plan for field measurement activities. Planning will be carried out in a participatory manner. Date, meeting points, contact person, and target communities are agreed during the planning.

16.4 PERMANENT PLOT NAVIGATION AND FIELD MEASUREMENT

After the team is properly oriented and ready to carry out measurement activities, it has to navigate to the place where the permanent plot has been established. As soon as the team reaches the plot, it will collect data about the different carbon pools.

16.4.1 Permanent Plot Navigation

After loading sample plot locations on to the GPS receiver, sample plots will be navigated to in the field by using a GPS receiver. Proximity will be set up so that the centre point of the sample plot for every waypoint can be approached. A base map is helpful for field placement of plot locations on a map or image and will therefore be used. If the location of the permanent sample plot lies on inaccessible and impractical terrain such as cliffs, roads, rivers, or cultivated land, the position of the plot canter will be relocated according to the compass bearing.

16.4.2 Centre Plot Marking and Referencing

Centre points of all plots will be marked permanently in the field using marks such as concrete pillars, metal rods, pipes, or stone poles. No matter what object is used for marking the canter, there is always a risk that it will be moved or removed. Therefore, the distances and bearing between the canter and at least 3-4 permanent reference points (stones or trees) will be recorded. The references will be distributed around the canter.

The sketch of the plot canter references, their distances, and bearings to the canter will be recorded and shown on the inventory form. Besides showing the location of such references, the plot layout sketch will also indicate the geographical orientation of the plot. In addition, easily recognizable landmarks will be marked on a sketch of the plot layout.

16.4.3 Slope Correction

The next step after determining the canter of a plot is to delineate its boundary. While placing a permanent sample plot, care will be taken to do a correction for any slopes in the area. A Clinometer can be used to measure slope angles. Most standard forestry compasses also contain a slope measure. A calculator can be used in the field to make the simple trigonometric calculation (distance on the sloping ground is equal to the cosine of the angle of the slope divided by the desired radius) necessary to determine the slope. Alternatively, a chart with horizontal distances calculated according to the slope angle could be taken to the field.

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16.4.4 Forest Carbon Stock Measurement

After slope correction, the major work of carbon measurement starts. Here, leaf litter, herbs, and grass; above-ground sapling biomass, and regeneration; dead wood and stumps; soil organic carbon; and above-ground tree biomass are measured. Detailed methods are explained under the following sub-headings.

16.4.4.1 Leaf Litter, Herbs and Grasses (LHG)

One circular sub plot of 1 square meter (0.56 m radius) in size is established at the canter of each nested plot. All the litter (dead leaves, twigs, and so forth) within the 1 m2 sub plots are collected and weighed. Approximately 100 g of evenly mixed sub-samples are brought to the laboratory to determine moisture content, from which total dry mass can then be calculated. Likewise, herbs and grass (all non woody plants) within the plots are collected by clipping all the vegetation down to ground level, weighing it, placing in a sample weighing bag and bringing it to the laboratory to determine the oven dry weight of the biomass.

16.4.4.2 Above-ground Sapling Biomass and Regeneration (AGSB)

The goal of quantifying regeneration data is to analyse the regeneration status of the project area. This helps to plan processes for further forest enhancement and sustainable management practices.

Nested sub plots having a 5.64 m radius inside larger plots are established for sapling measurement. Smaller nested sub plots having a 1 m radius inside the larger nested plots are established for assessing regeneration. Saplings with diameters of > 1 cm to < 5 cm are measured at 1.3 m above ground level, while saplings smaller than 1 cm in diameter at 1.3 m above ground level are counted as regeneration.

Divisional Forest Officer Working Plan Circle Gugi Kalichan

16.4.4.3 Deadwood and Stumps (DWS)

In most cases dead wood is less abundant than live trees. Standing dead trees, fallen stems, and fallen branches with a diameter at breast height (DBH) and/or diameter ≥ 5 cm should be measured within the whole 250 m2 plot, branches with diameters of 2-4 cm should be measured within the 100 m2 plot, and thinner branches should only be measured within the 1 m2 plot.

Separate procedures will be adopted for logged trees, standing dead trees, and downed and dead wood.

16.4.4.4 Soil Organic Carbon (SOC)

Soil organic carbon will be determined through samples collected from the default depth prescribed by the IPCC (2006). Near the canter of all plots

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and/or sub-plots a single pit of up to 30 cm in depth is dug to best represent forest types in terms of slope, aspect, vegetation, density, and cover. The location of the hole is decided based on foresters' knowledge of the area. For the purpose of estimating bulk density, three individual soil samples of approximately 100 or 300 cm3, one each from three depths (0-10 cm, 10-20 cm, and 20-30 cm) are collected with the help of a standardized 100 or 300 cm3 metal soil sampling corer. Similarly, one composite sample is collected mixing soils from all the three layers in order to determine concentrations of organic carbon and then weighed at a precision of 0.1 g. Around 100 g of composite sample are collected from one plot.

It is important not to modify the soil bulk density in any way during sampling. For this, a trench can be dug with a spade and a sample collected sideways. The following steps can serve as a guide for collecting soil samples.

- Dig a trench with a spade or other similar equipment.
- Orient yourself to the surface dug.
- Wood or plastic planks can be used to smoothen the exposed surface.
- Use a fine brush to remove any material from the exposed soil surface.
- Insert a core at three subsequent depths.
- Once the soil corer has been inserted into the soil to the desired depth, it is removed from the ground by pulling it outwards.
- The top and bottom (or bottom only depending on the coring tool used) of the core should be trimmed to be even with the rims. When taking cores for measurements of bulk density, care should be taken to avoid any loss of soil from the cores; if any material is lost, resampling will be needed.

All material collected in the corners and composite soil samples should be placed into sample bags which are labelled appropriately. All samples should be then transported to the laboratory for further analysis.

In addition, it is highly recommended to use a soil standard to quantify the analytical errors made by the soil laboratory. This 'standard soil' should be considered as a reference when multiple labs, technicians, and time periods are involved in soil carbon analysis. A large volume of 'standard soil' sample must be collected from random forest soil. The volume of soil collected must be sufficient so that small 'check samples' can be included every time soil samples are sent to the lab for the whole duration of the project. As a rule of thumb, one 'check sample' should be included for every 10 true samples. For example, if 300 plots are measured every year of a 50-year project, and one soil sample of 100 g is send to the lab for every plot, in total 0.10 x 300 x 50 x 100 = 150 kg of 'standard soil' is necessary. Including losses through handling, about 300 kg of standard soil must be collected.

After collection of the 300 kg of standard soil, the standard soil should be well mixed, possibly by using a mechanical mixer such as a cement mixer. If a mixer is not available or cannot be rented, manual mixing can be done, but it should be done very thoroughly and in small batches that are constantly mixed together and split again. To check the homogeneity of

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mixing, 10-20 samples of the standard soil should be sent to the laboratory in one batch.

16.4.4.5 Above-ground Tree Biomass (AGTB)

The DBH (at 1.3m) and height of individual trees greater than or equal to 5cm DBH are measured in each permanent circular 250 m2 plot that is 8.92 m in radius using diameter tape, clinometers and linear tape, starting from the edge and working inwards, and marking each tree to prevent accidentally counting it twice. Highly sensitive equipment such as Vertex IV and Transponder can also be used to measure tree height directly. Each tree is recorded individually, together with its species' name if identification is possible. Trees on the border must be included if > 50% of their basal area falls within the plot and excluded if < 50% of their basal area falls outside the plot. Trees overhanging into the plot are excluded, but trees with their trunks inside the sampling plot and branches outside are included. For trees of an unusual shape, a standard forestry practice will be adopted before all sampling operations and applied to all plots.

Diameter at breast height (DBH) is the basic measurement standard for trees. This measurement is recorded for all trees. For stems that fork from the ground, each individual stem is measured separately: to indicate that they are part of the same tree, however, they are numbered by adding a letter suffix.

16.5 DATA ANALYSIS

Soon after the data collection is completed, data analysis of various carbon pools measured in the forests is yet another major task to be accomplished. Analysis of all the carbon pools is explained in the following sub-sections.

16.5.1 Above-ground Tree Biomass (AGTB)

An allometric equation is a statistical relationship between key characteristic dimension(s) of trees that are fairly easy to measure, such as DBH or height, and other properties that are more difficult to assess, such as above-ground biomass. Allometric equations are established in a purely empirical way on the basis of exact measurements from a relatively large sample of typical trees. They permit an estimate of quantities that are difficult or costly to measure on the basis of a single (or at most a few) measurement.

The selection of the appropriate allometric equation is a crucial step in estimating aboveground tree biomass (AGTB). Allometric equations for biomass usually include information on trunk diameter at breast height *DBH* (in cm), total tree height *H* (in m), and wood-specific gravity ϕ (in g/cm3). Baker et al. (2004) have shown that ignoring variations in wood density results in poor overall prediction of the stand (AGB). Therefore, wood-specific gravity is an important predictive variable in the regression model.

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Direct wood density measurements are seldom available for trees in permanent forest stands. As a consequence, either a specific-level average (Brown et al. 1989; Nelson et al. 1999; Chave et al. 2005), or, if detailed floristic information is unavailable, a stand-level average (Baker et al. 2004) is recommended. The use of tree height as a predictive variable also improves the quality of the allometric equation. Hence, the allometric equation enables AGTB to be easily estimated, provided that diameter, total height and wood specific gravity of a tree are
available, irrespective of the tree species and of the location of the stand. The unit of the AGB estimated from the allometric equation is the kilogram (kg).

The following equation is best for dry stands, which are found in Gilgit-Baltistan:

$$AGTB = 0.112 * (\rho D^2 H)^{0.916}$$

where,
AGTB = above-ground tree biomass [kg];
ρ = wood specific gravity [g cm-3];
D = tree diameter at breast height [cm]; and
H= tree height [m].

After taking the sum of all the individual weights (in kg) of a sampling plot and dividing it by the area of a sampling plot (250 m2), the biomass stock density is attained in kg m-2. This value can be converted to t ha-1 by multiplying it by 10. Since the pilot areas are part of the dry temperate and sub-tropical region, the biomass stock density of a sampling plot will be converted to carbon stock densities after multiplication with the IPCC (2006) default carbon fraction of 0.47.

16.5.2 Above-ground Sapling Biomass (AGSB)

To determine the above-ground sapling biomass (AGSB) (<5cm DBH), relevant allometric biomass tables will be used. If the allometric biomass tables did not
contain all species present in Gilgit-Baltistan, values for related or similar species may be used. The biomass values of saplings include foliage, branch, and stem compartments. The following regression model is used for an assortment of species to calculate biomass.

$$\log(AGSB) = a + b (\log D)$$

Where,
log = natural log [dimensionless];
AGSB = above-ground sapling biomass [kg];
a = intercept of allometric relationship for saplings [dimensionless];
b = slope allometric relationship for saplings [dimensionless]; and
D = over bark diameter at breast height (measured at 1.3 m above ground) [cm].
Biomass stock densities will be converted to carbon stock densities using the IPCC (2006) default carbon fraction of 0.47.

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16.5.3 Leaf Litter, Herbs and Grasses (LHG)

To determine the biomass of leaf litter, herbs, and grass (LHG), samples are taken destructively in the field within a small area of 1 m2. Fresh samples are weighed in the field with a 0.1 g precision; and a well-mixed sub-sample is then placed in a marked bag. The sub-sample is used to determine an oven-dry-to-wet mass ratio that is used to convert the total wet mass to oven dry mass. A sub-sample is taken to the laboratory and oven dried until constant weight to determine water content. For the forest floor (herbs, grass, and litter), the amount of biomass per unit area is given by:

$$LHG = (W_{field}/A) * (W_{subsample\ dry}/W_{subsample\ wet}) * (1/10000)$$

where,

LHG = biomass of leaf litter, herbs, and grass [t ha-1];
W_{field}= weight of the fresh field sample of leaf litter, herbs, and grass, destructively sampled within an area of size A [g];
A = size of the area in which leaf litter, herbs, and grass were collected [ha];
$W_{subsample\ dry}$= weight of the oven-dry sub-sample of leaf litter, herbs, and grass taken
to the laboratory to determine moisture content [g]; and
$W_{subsample\ wet}$= weight of the fresh sub-sample of leaf litter, herbs, and grass taken to
the laboratory to determine moisture content [g].

The carbon content in LHG, C(LHG), is calculated by multiplying LHG with the IPCC (2006) default carbon fraction of 0.47.

16.5.4 Soil Organic Carbon (SOC)



Soil samples are collected at 0-10, 10-20, and 20-30 cm depths. Samples of exactly 100 cm3 are taken and transferred to pre-weighed sampling bags. Wet weights of soils are determined in the field with 0.1 g precision. Subsequently, samples are transported to the laboratory and oven dried (70° C) until constant weight to determine water content. Samples from each of the three depths are composted and well-mixed per sampling plot and then prepared for carbon measurement by removing stones and plant residue > 2mm as well as by grinding. The carbon stock density of soil organic carbon is calculated as (Pearson et al 2007):

$$SOC = p * d * \%C$$

where,
SOC = soil organic carbon stock per unit area [t ha-1],
p = soil bulk density [g cm-3],
d = the total depth at which the sample was taken [cm], and
%C = carbon concentration [%].

16.5.5 Below-ground Biomass (BB)

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One of the most common descriptors of the relationship between root (below-ground) and shoot (above-ground) biomass is the root-to-shoot ratio, which has become the standard method for estimating root biomass from the more easily measured shoot biomass. Belowground biomass estimation is much more difficult and time consuming than estimating aboveground biomass. Measurements of root biomass are indeed highly uncertain, and the lack of empirical values for this type of biomass has for decades been a major weakness in ecosystem models (Geider et al 2001). To simplify the process for estimating below-ground biomass, it is recommended that MacDicken (1997) root-to-shoot ratio value of 1:5 is used; that is, to estimate below-ground biomass as 20% of above-ground tree biomass.

16.5.6 Total Carbon Stock Density

The carbon stock density is calculated by summing the carbon stock densities of the individual carbon pools of that stratum using the following formula. It should be noted that any individual carbon pool of the given formula can be ignored if it does not contribute significantly to the total carbon stock.

Carbon stock density of a stratum:

$$C(LU) = C(AGTB) + C(AGSB) + C(BB) + C(LHG) + C(DWS) + SOC$$

where,
C(LU) = carbon stock density for a land-use category [Mg C ha-1],
C(AGTB) = carbon in above-ground tree biomass [Mg C ha-1],
C(AGSB) = carbon in above-ground sapling biomass [Mg C ha-1],
C(BB) = carbon in below-ground biomass [Mg C ha-1],
C(LHG) = carbon in litter, herb & grass [Mg C ha-1],
C(DWS) = carbon in dead wood and stumps [Mg C ha-1], and
SOC = soil organic carbon [Mg C ha-1]

The total carbon stock is then converted to tons of CO2 equivalent by multiplying it by 44/12, or 3.67 (Pearson et al. 2007).

16.6 LEAKAGE ANALYSIS

Leakage is defined as an increase in greenhouse gas (GHG) emissions outside of the project area but directly attributable to the REDD project activities implemented inside of the project area. A distinction is made between primary leakage, when the emissions are directly attributable to the deforestation agents, and secondary leakage when the emissions are not directly attributable to the deforestation agents but rather to other actors through effects on prices and markets (Aukland et al. 2003). In our study we will focus on activity-shifting leakage.

Any activity that reduces deforestation within a certain area may increase deforestation in an area outside of the project area. For example, the

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protection of forest land from grazing inside the project area can lead to the conversion of forest land into grazing land outside the project area. Similarly, closing down a forest for the collection of fuelwood can increase fuelwood collection in the immediate vicinity of the project area. A third example relates to logging: if under the baseline scenario logging was occurring within the project area, project actions can lead to displacement outside of the project area. The existence of leakage reduces the GHG benefits from increases in forest stocks or reductions in deforestation. Mitigating and preventing leakage is crucial for ensuring that REDD and forest projects actually reduce carbon emissions.

Leakage is caused because a forest resource, such as timber, fodder, or firewood, is not available anymore in the protected area without direct substitution. Therefore, leakage can be minimized by (1) reducing the consumption of this resource through more efficient use, (2) continuing to harvest the resource in the protected forest but in a sustainable way, or (3) providing a substitute for the resource such as substituting fodder collected in the forest by grass collected outside the forest.

In other words, the potential for leakage is directly related to the difference between resource consumption (RC) and resource extraction (RE). The RE can originate from community-based forests engaged in the REDD program, an individual's agricultural land, or private uncultivated land. If RC=RE, all the resources that are consumed can be produced within the community forests or on agricultural land and there is no possibility of leakage.

Leakage can be quantified by monitoring deforestation, forest degradation rates, and resource consumption in leakage belts, i.e., the area adjacent to the project area. The size and location of the leakage belts can be identified beforehand by GIS analysis.

16.6.1 Determining the Size and Location of the Leakage Belts

Local communities are the main agents of deforestation. Therefore, leakages will remain close to the project areas. The geographical area in which leakages are monitored must be determined and fixed before the project starts. A correct demarcation of each leakage belt is crucial to account accurately for the GHG benefits of the REDD project since it is an area where leakages will be monitored and deducted from the actual NERs. The size and location of the leakage belts are determined using a cost-of-transportation-based GIS approach and participatory rural appraisals. The following steps are followed:

- Determine the average 'cost' to move across a forest stratum, landscape class, or road and/or track. The relative costs must be calculated by reciprocating the maximum speed for every class or road category and the relevant mode of transportation. The speeds therefore represent the fastest time it takes to cross a set distance.
- Using a GIS, a raster map of the watershed is created in which every grid cell contains the cost to cross this pixel based on the class or roads and/or tracks that are present within the cell. The cost to cross areas that are not accessible to deforestation agents must be set to an

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arbitrary large value. Examples of inaccessible areas include protected areas, national parks, economic land concessions, and large plantations.

- Using the cost map, generate a cost-distance map of the watershed in which every grid cell contains the cost (time) to reach the nearest point of the community forest areas that are participating in the REDD program.
- For every agent of deforestation and/or degradation, estimate the extra time this agent is willing to take to move their deforestation activities from the project area to the nearest accessible forest.
- Select the area in the cost-distance map that is accessible from the boundary of the project area within the maximum time determined in the previous step. Therefore, when different agents and drivers of deforestation are active, the **most mobile deforestation agent** shall determine the size of a leakage belt. Note that the leakage area should be fully encompassed within the reference region. Increase the size of the reference region if necessary to accommodate the leakage belts defined.

16.6.2 Leakage Monitoring

Certain variables are monitored within the project area and leakage belts during project implementation:

The number of head loads of firewood and fodder extracted from the forest will be counted for 3-4 consecutive days in each collection period. Counts should be carried out separately for male adults, female adults, and children younger than 13 years.

The weight of the head loads is determined per category and season.

The number of domestic animals, the related fodder requirements, the grazing
period, the amount of crop residue fed to animals, and the firewood consumption
are determined through questionnaires. Around 20-30% of the households representing all social categories should be interviewed every collection season.

The daily fodder consumption is measured by isolating 3-5 individuals in a stall and weighing the fodder consumed by them. The moisture content of the fodder is determined separately by comparing the moist weight of a sample with the weight of the sample after oven drying. Separate measurements are taken for different livestock species such as cows, buffalos, and others. Fodder consumption is measured in 3-4 different seasons.

16.6.3 Leakage Reduction Measures

A number of measures can be implemented to reduce the potential for leakage.



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- Fodder production can be established on open land which has no forest or woody biomass.
- Existing and new fodder production can be optimized through improved sowing, fire control, and by avoiding the collection of fodder before plants reach maturity.
- Community members can be educated on the importance of not using tree leaves as fodder due to their adverse effect on animal growth.
- Priority can be given to collecting fallen wood from forests for timber and fuelwood so that the pressure on live trees is minimized.
- Woodlots in which firewood species are growing can be established next to crop fields and homesteads.
- Fuel-efficient, improved wood-burning stoves and bio-gas digester plants can be promoted.
- The total number of trees and households can be counted to calculate the availability of tree resources per household. The rate of sequestration may vary because of these factors.

All the measures the communities take to conserve the forest are recorded during community meetings.

16.7 QUALITY ASSURANCE AND QUALITY CONTROL

Provisions for quality assurance (QA) and quality control (QC) will be implemented to ensure that the carbon stocks and credits reported are reliable and meet minimum measurement standards. The QA/QC provisions are an integral part of standard operation procedures and include procedures for: (1) collecting reliable field measurements; (2) verifying laboratory procedures; (3) verifying data entry and analysis techniques; (4) checking data completeness and consistency; and (5) maintaining and archiving data.

16.7.1 Field Measurements

Rigorous standard operating procedures (guidelines) will be developed to detail all steps taken in the field. Guidelines ensure that measurements executed by different teams or at different times are consistent and comparable. Once the guidelines are developed, those responsible for carbon measurement will be trained extensively according to the guidelines so as to be fully cognizant of all procedures and the importance of collecting accurate data.

During every field visit, a document will be produced and filed with documents proving that all steps from the guidelines have been followed; similarly, all deviations from the guidelines, if any, must be listed. The guidelines may be updated officially if significant issues arise with the procedures.

An audit program for field measurement and sampling will be established. A typical audit program consists of three types of checks. During a *hot check*,

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auditors (technical experts) observe members of the field crew during data collection on a field plot (this is primarily for training purposes). *Cold checks* occur when field crews are not present for the audit. *Blind checks* represent the complete re-measurement of a plot by the auditors. Hot checks allow for the correction of errors in techniques, while blind checks allow for calculation of measurement
variance.

When field work is completed, about 10% of the plots will be checked independently. Field data collected at this stage will be compared with the original data, and errors will be corrected and recorded. To provide an estimate of the measurement errors, errors can be expressed as a percentage of all plots that have been rechecked.

16.7.2 Laboratory Measurements

Guidelines for laboratory measurements will be prepared by the laboratory staff and be followed for each part of the analysis. If an external laboratory performs the analysis, a record of the procedure(s) will be obtained. A typical crucial step for laboratory measurements is, for example, the calibration of combustion instruments for measuring total carbon or carbon forms using commercially available and certified carbon standards. Similarly, all balances for measuring dry weights will be calibrated periodically against known weights and fine-scale balances will be calibrated by the manufacturer. Where possible, 10 to 20 per cent of the samples will be re-analysed and /or re-weighed to produce an error estimate.

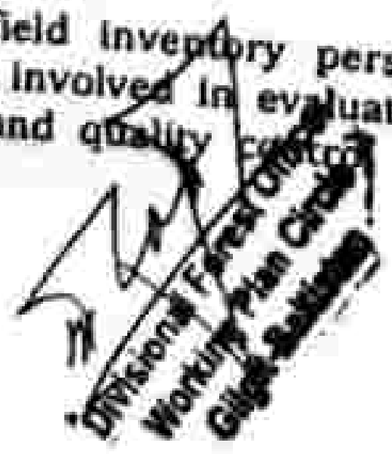
16.7.3 Data Entry

Data entry can be done immediately in the field using laptop computers. In most cases, however, measurements are written down in the field and must be entered manually on to spreadsheets and/or datasheets. Data entry on to spreadsheets and/or a database is often a significant source of error. Ongoing communication between all personnel involved in measuring and analysing data is critical for resolving apparent anomalies before final analysis.

Special attention will be paid to units used in the field. Typical mistakes are confusion between diameters or circumferences if trees are measured, or the length unit (mm, cm, and inches). All measurements contained in spreadsheets and/or datasheets must have their unit clearly indicated. Errors can be reduced by spot checks of the data entered by independent personnel. In addition, outliers can be identified by checking whether each value is within an expected range. If during spot checks or range checks a significant number of errors is found, all data will be re-checked by independent personnel. If there are anomalies that cannot be resolved, the plot will not be used in the analysis.

16.7.4 Data Completeness and Consistency Checks

To assist field inventory personal, data analysts and individuals and institutions involved in evaluating the quality of analytical data, quality assurance and quality control (QA/QC) procedures are developed. The



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QA/QC procedures include specific criteria to evaluate the quality of the analytical data that have been gathered. These QA/QC procedures will promote the acceptance of the analytical data in the marketplace for carbon credits and reduce the need for additional sampling and analysis to support and/or confirm the analytical data and the professional decisions. The QA/QC procedures are therefore an absolutely essential part of any sampling operation. These QA/QC procedures evaluate (a) data completeness and (b) data consistency.

a. Completeness check

One of the important steps related to QA/QC is to ensure that the data gathered are complete and stored correctly. A thorough evaluation of the data completeness should be carried out as soon as possible after the field work, so that missing data can be retrieved in a reasonable time.

Completeness of files

- Are all the digital pictures and electronic scans of the sample sheets available and named correctly?
- Are digital pictures of the GPS screen indicating the position of a sampling plot available and named correctly?
- Are all the scanned packages of each of the data sheets complete and in the correct order? Once all the electronic data files are checked, the individual elements within the data files will be checked for completeness.

Completeness of data within the electronic files

- *Data cover sheet*

Are data for all the plots requested present?
Are all plot IDs named correctly?
Are all coordinates for the plot centers available?
Are preliminary inventory data and results reflecting sample design present?
Does the number of plots required in the preliminary inventory match the number of plots in the actual inventory?

- *Plot information*

Are data present for all the plots requested?
Is a strata name/number given for each plot?
Is the naming convention of the plot ID followed?

- *Above-ground live trees*

Are data present for all the plots requested?
Is the naming convention of the plot ID followed?
Are all tree species' names provided?
Are all tree tag numbers provided?
Are all DBH measurements greater than 5 cm?
Are there any unusually large DBH measurements?

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o *Canopy cover percentage*

Are data for all plots requested present?
Is the naming convention of the plot ID followed?
Are the total square counts equal to 24 per reading?
Are 4 separate readings per plot recorded?

o *Standing dead wood*

Is the naming convention of the plot ID followed?
Are decomposition classes 1, 2, or 3 assigned to each standing dead tree?

o *Fallen dead wood*

Is the naming convention of the plot ID followed?
Are decomposition classes 1, 2, or 3 assigned to each piece of deadwood?

o *Logged tree stumps*

Is the naming convention of the plot ID followed?
Are all height/diameter readings present?
Are decomposition classes 1, 2, 3, or 4 assigned to each piece of deadwood?

b. Consistency check

The QA/QC procedures should ensure that the data measured are consistent throughout the scope of the project so that the same analytical approach can be implemented.

Data cover sheet

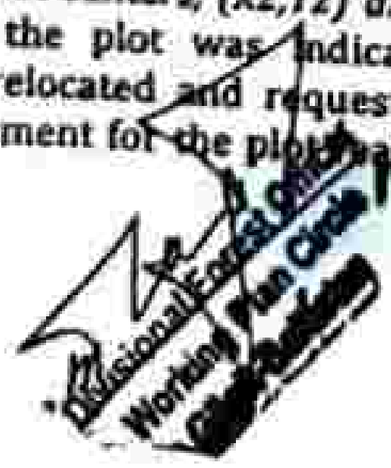
o In a spot check with the pictures showing the GPS coordinates on the GPSs creens were at least 50 coordinates correct?

o In a spot check with scanned datasheets were 10 randomly-selected values of coordinates correct?

o If the plot was not indicated to be 'relocated', are the actual coordinates of the plot canter equal to the coordinates requested?

Calculate the distance between the actual plot canter and relocated plot. This distance must be less than 20 m using the distance method; i.e.,

D = square root of (X2 – X1) + (Y2 – Y1) where, *D is the distance in meter(s) between two plot canters, (X2,Y2) and(X1,Y1) UTM coordinate pairs of two plot canters.* o If the plot was indicated to be 'relocated', was the distance between the relocated and requested coordinates smaller than 300 m? o Is slope measurement for the plot realistic; i.e., within 0-60 degrees? (If over 60



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degrees check the crown cover and tree density for possible error, since high crowns usually will give greater tree density in sloping terrain.)

Above-ground live trees

o Are all tree tags unique within one plot?

o In a spot check with scanned datasheets were 10 randomly-selected values, correct?

o Are minimum and maximum of the DBH within each plot realistic?
o Is the correct unit of measurement employed in all information recorded?
o Are counts of trees within each plot realistic? Is the biomass calculated per plot realistic? - Use any allometric equation available or any local literature on the region previously studied to spot the error and/or outliers.

16.7.5 Canopy cover percentage

o Are the number of sky squares + number of canopy squares everywhere equal
to 24 for each plot? Are there 4 densiometer measurements per plot? o Is the average canopy cover larger than 0 and smaller than 100? In a spot check with scanned datasheets were 10 randomly selected values, correct? Is the correlation between canopy cover and above-ground live trees realistic?

Standing dead wood

o Conduct a spot check with scanned datasheets for 10 values o Are minimum and maximum of the DBH within each plot realistic?
Are the carbon density values calculated realistic?

Downed dead wood

o Conduct a spot check with scanned datasheets for 10 values o Are the minimum and maximum of the inner and outer DBH within each plot present and realistic? Are the carbon density values calculated realistic?

Logged tree stumps o Are the numbers of logged tree stumps recorded realistic given the tree density in the forest? Conduct a spot check with scanned datasheets for 10 values? o Are the carbon density values calculated realistic?

16.7.6 Data naming conventions

Ensure that all database files are named correctly. The efficiency of data analysis as well as error checking can be enhanced by rigorously following a strict naming convention.

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16.7.7 Data Archiving

Because of the relatively long-term nature of forestry activities, data archiving and storage are important and should include the following steps.

- Original copies of the field measurement (data sheets or electronic files) and
- laboratory data should be maintained, entered in electronic media, and stored in a secure location.

- Copies of all data analyses, models, final estimates of the amount of carbon sequestered, GIS products, as well as a copy of the measuring and monitoring reports should all be stored in a secure location (preferably offsite).

- Given the period for reporting and the pace of production of software updates and of new hardware for storing data, electronic copies of the data and report should be updated periodically or converted to a format that can be accessed by new or updated software.

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ANNEXURE-1
SPATIAL DATABASE IN GIS

Geomatics offer very effective tools for an exercise like working plan (WP) preparation, which involves analysis of several spatial layers and parameters in relation to forests for prescribing management practices. The techniques and methods based on geomatics add to the precision, objectivity and scientific analysis into the process and also lead to significant saving of cost and time. A spatial database on forest in GIS is a set of geo-referenced layers of spatial data of an area in which each layer is devoted to a particular theme or an entity on the ground e.g. administrative boundaries, road network, forest cover, forest types, altitude, etc. A layer can be either in vector or raster format. In vector format, features are shown by point, line or polygons, whereas, in raster, the layer appears as an image and is made of pixels. In each spatial layer (vector), attribute data with every feature appearing as point, line or polygon (e.g. a forest patch, compartment, village, plantation, etc.) can be attached for analysing management alternatives, creating scenarios, building queries or general database applications. A set of layers on different themes relevant to forest management of a given division makes the spatial database in GIS. Spatial database of a forest division with spatial layers indicated in the list given at annexure I will be of immense use in preparation of working plan and later in day-to-day forest management decisions of the forest division.

Creation of spatial database of the division should be undertaken as an exercise towards preparation of working plan and not only to create an end product, as the spatial database itself would provide a scientific basis for collecting data on various parameters, stratification and for efficiently storing/compiling the data for each compartment, block or range. The spatial database would be of immense use in analysis and creating different scenarios for identifying working circles and writing prescriptions for n anagement of forests. Creation of spatial database should be accomplished in first four months of working plan preparation exercise.

Creating spatial database

(i) Suitable GIS software along with a high-end PC or workstation can be used for creating spatial database of the division in GIS.

(ii) The spatial database will comprise layers on different themes and in each layer, attribute data will be attached with the features in attribute table, wherever applicable pictures should also be part of the attached data.

(iii) On screen digitization for creating various layers should be done on sufficiently large scale1:25,000 or higher.

(iv) A common projection parameters, as given below should be followed for the spatial database

Projection system – UTM
Datum – WGS 84
Spheroid – WGS84 / Everest

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(v) An indicative list of the layers for the spatial database with possible sources is given in the table below. Mandatory layers have been indicated, other layers can be according to the specific planning and management needs of the division.

(vi) For creating layers from the satellite images, images with spatial resolution 5.8m or higher only should be used.

(vii) Discrepancy in the area of forest appearing in the records and that which is measured through IS tools in the spatial database is always possible because of various reasons. For the purpose of spatial database, an attribute of forest area according to the government records should beaded in the attribute table (PAT).

An indicative list of various layers in the Spatial Database in GIS is given as under which are to be provided to the WPO by the GIS Lab of the department or any such designated source to be used in preparation in working plans.

Indicative list of layers in the Spatial Database In GIS

S.No.	Layers in the Spatial Database	Possible source(s)
1.	Division boundary*	Maps in the division/ department
2.	Range boundary*	Maps in the division/ department
3.	PRF and PTF boundary*	Maps in the division/department
4.	National parks and wildlife sanctuaries*	Maps in the division/ department
5.	Beat boundary*	Maps in the division/ department
6.	Block boundary*	Maps in the division/ department
7.	Compartment boundary*	Maps in the division/ department
8.	Location of all the offices*	Maps in the division/ department/GPS
9.	Village locations*	SOP toposheets /Census
10.	Road network*	SOP toposheets /Google Earth
11.	Telecommunication network	SOP toposheets /Google Earth
12.	Forest check posts*	Maps in the division / department /GPS
13.	Rest houses	Maps in the division / department /GPS
14.	Stream network*	SOP toposheets /Satellite Image/ASTER DEM
15.	Nurseries*	Maps in the division / department/GPS
16.	High resolution satellite imagery*	SUPARCO
17.	Forest cover*	PFI or other GIS Lab
18.	Forest type/stock map*	PFI/ maps in the division/ department
19.	Police station/chowkis	SOP Toposheets/ Police Department's Map

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20.	JFMCs*	GPS
21.	Plantation locations in the last 15/20 years	Maps in the division/ department/GPS
22.	Forest depots	Maps in the division/ department/GPS
23.	Fire locations recorded in the last 5 years	Department files and conversion of the same in to digital point coverage
24.	Parent geology	Maps from Geological Survey of Pakistan
25.	Protected areas*	Maps in the division/ department/ WWF/IUUCN
26.	Wildlife corridors	Maps in the division/ department/ WWF/IUCN
27.	Eco-tourism spots	Maps in the division/ department /GPS
28.	Soil type	SoP Land Use Planning map on 1:250,000 scale
29.	Altitude zones*	ASTER DEM
30.	Slope	ASTER DEM
31.	Aspect	ASTER DEM
32.	Fire affected area	Burnt area mapping using IRS P6 LISS III data
33.	Fire sensitive spots	Grid analysis using department's forest fire spots data
34.	Encroachment*	Existing map in the division / remote sensing based
35.	Management areas and working Circles	To be identified/created in GIS in the course of preparing WP
36.	Location of saw mills	Existing maps/GPS survey
37.	Mining areas	Existing maps/GPS survey
38.	Grid layer of rainfall	Meteorological Department
39.	Grid layer of temperature	Meteorological Department
40.	Forest research plots	GPS
41.	Seed production areas/Plustrees/Seed Orchards	GPS

* indicates mandatory layers

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ANNEXURE- II
FOREST RESOURCE ASSESSMENT METHODOLOGY

Natural populations have peculiarities of spatial auto-correlation and spatial heterogeneity, more so in case of forest resources. Therefore, for forest resource assessment of large forest area like a division, systematic sampling gives quite precise estimates of population parameters. The precision of estimate may further be improved using post-stratification technique. Post-stratification may be carried out using field survey or using GIS tools or using GIS tools in conjunction with classified maps based on remotely sensed satellite data.

Forest resource assessment requires sampling of plots of optimum area (area sampling) for various parameters. For assessment of growing stock, volume or number of stems, 0.1 ha plot is optimum. Similarly for assessment of regeneration status 2mx2m or 3mx3m plot is optimum. For assessment of soil organic carbon, a 3-dimentional plot (pit) of 30cmx30cmx30cm is optimum. For ecological study of trees, shrubs and herbs plots of sizes 10mx10m, 3mx3m and 1mx1m respectively are optimum. It means that if the plot size is increased, it will not increase the precision of estimate of the corresponding parameter, though it will increase the sampling intensity. Therefore, for area sampling situation, sampling intensity is not very relevant but just indicative. The optimum sample size i.e. optimum number of plots to be included in the sample which may provide the estimate of population parameter within prescribed limit of error is more important. Instead of prescribing sampling intensity, the allowable level of error in the estimate at division/range level say, ± 5% at95% probability level is fixed.

Determination of optimum sample size is a crucial decision in any sample survey design. The size of sample depends on the variability of main characteristic in the population (say, volume/ha),allowable error in the estimate and time and cost factors. Generally, time and cost are not considered in the calculation. It is the variability of the population parameter (characteristic/attribute) allowable error that decides the sample size. A general formula for calculation of optimum sample size is givens –

$$n = \{t^2_v (CV/AE)^2)\}/(1+1/N(CV/AE)^2)$$

Where,
n = sample size,
CV = Coefficient of variation of the main characteristic/attribute (which can be calculated through past or pilot survey or using correlated variable. In absence of any these it can be asked from PFI from similar nearby area of that forest type),
AE = allowable error (%),
t_v = value of t-statistic with v degrees of freedom and 5% significance level

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N total number of plots of optimum size of main characteristic in the population
(division/Range etc.)

Generally, the N is very-very large in forest resource assessment making denominator
approximately one and for that reason and brevity the numerator becomes the formula for sample size calculation.

Having calculated the sample size, the sample plots may be laid out following systematic
sampling scheme. The systematic sampling may be based on the system of grids of latitude and longitude or distance, say 1kmx1km, basis. The size of grid can be ascertained using area of the concerned division and optimum sample size and sample grids be selected. It may be all grids of25''X25''size (approximately one plot per 0.56 km2 , assuming that at the centre of GB on an average 2.5'X2.5' covers an area of 20 km2) or alternate grids of 25''X25'' size (approximately one plot per 1.11 km2) or all grids of 50''X50'' size (approximately one plot per 2.22 km2) or alternate grids of 50''X50'' size size(approximately one plot per 4.44 km2) all grids of 1.25'X1.25' be merged with existing grids of Sop. At the centre of grids plots of optimum sizes may be laid out. For the purpose of assessing attributes like growing stock, NTFPs, etc. of a compartment/ village/ management unit, provision of lateral(side) sample plots at a fixed distance from the centre of the grid in addition to the central plot may be provided depending upon the requirement of the sample size. To increase the precision of estimate, the data may be processed using post stratification techniques on the basis of canopy density /forest type, etc. as being done in most of the developed countries.

LAYING OUT GRIDS ON THE TOPOSHEET AND SAMPLE PLOTS

For forest resource assessment in the working plan, sample plots are systematically laid out
in the forest area which is indicated on the Survey of Pakistan topographic sheet (toposheet) on the scale of at least 1:50,000. The grids are laid out by dividing the toposheets of 1:50,000 scale (size 15'X 15' i.e. 15 minute latitude and 15 minute longitude) falling within the division/district boundary into 144 grids of 1 ¼ 1 ¼ . To carryout forest resource assessment, each of these 1 ¼ 1 ¼ grids are further sub-divided into 9 grids (or as per the requirement of sample size) thus forming the basic sampling frame of 1296 (144 X 9) grids, each of size 25 25 (each grid of twenty five seconds latitude and twenty five seconds longitude representing approximately 56 ha area on the ground).The latitude and longitudes of the intersection of diagonals of grid will be identified as the centre of the grid. These latitude and longitudes will be used for reaching the centre of the grid by using GPS.The grids are conveniently serial numbered by WPO.

DESCRIPTIVE WORK WHILE REACHING SAMPLE PLOTS

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The recent version of satellite imagery in digital form may also be used to determine the
possible accessibility, land use, land use change and forest cover change. The land use may be classified into closed forest, dense forest, open forest, scrub, young plantations of forest species, tree in line (Avenue plantation), forest roads, grass lands, barren lands, agricultural land without trees in surround, agricultural land with trees in surround, barren lands, habitation, water bodies, etc. as per the description given in Land Cover Atlas of Pakistan or some other Land Cover/Land Use Classification being used by SUPARCO or some other relevant organization with a GIS Lab.

After earmarking the grids to be surveyed, the survey team leader should find a nearest
convenient route to reach the sample plot i.e. centre of the grid from minimum traverse by vehicle or on foot. After arriving at a nearby location of the plot, the next task would be to search a reference point, which can be identified on the map as well as can be located on the ground. The grid centre is reached after covering the desired distance and tracking the bearing from the reference point. The reference point selected on a map should not be a temporary structure. The possible reference points may be village tri-junction points, bridges and culverts, mosques, road, river, streams, ponds and wells, milestone or kilometre stone
or prominent trees, etc. The location of reference points and its correct description, recorded in the form is very important to re-visit the sample plot in future.
While approaching the sample plot, stock assessment and mapping (earmarking the stocked
area on the map), ground truthing of remote sensing data should be done by traversing the forests(compartment/village /any other management unit); so as to cover the entire area making observational assessment of site quality, tree species composition, its health (including injury to the tree crop), density and crop age, etc. Changes at all locations should be described in 'plot approach form' (Form I) and depicted/delineated on the map. Presence of special features within the compartment/village/other management unit, namely grassy patches, scattered trees, plantations raised, etc., should also be described in 'plot approach form' (Form I) and depicted on the stock map, as per the standard set of conventional signs, symbols and colours as adopted and in use. Regeneration status of main species should also be observed. As regards the site quality (SQ), the criteria for determination of site quality as given by PFI will be followed uniformly across the country.

Plot approach form also contains general observational information on undergrowth –
climbers, important herbs, grasses, shrubs, MAPs, bamboo and rattans, NTFP yielding species, intensity of invasive species, flagship faunal species and their traces, ecotourism potential areas, *special wildlife* habitats and their interface with humans, biotic factors and any other thing or special treatment required should find a mention here.

Drivers of forest degradation, forest resource utilization, dependence of local people on

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forest and their social, cultural and spiritual aspects may be explored. The notes prepared by theWPO and his team during the field visit are very important as they form the basis of the description of compartment/village/other management unit, which again form the basis of future management. Notes are taken under the headings mentioned in the 'plot approach form' (Form I). An effort should be made by the WPO and his team to use GPS tract facility to make the above observational information, spatial as far as possible and develop fully functional GIS based maps as an integral part of working plan exercise and train the staff to use the same in the collection of data and preparation of reports. Stock mapping in sample plots may be done on 1:12,500 or higher scale. However, all the classes on the map should be shown in the form of polygons digitized on the basis of field observations.

LAYOUT OF SAMPLE PLOTS IN THE FIELD

After reaching the sampling plot i.e., the centre of the grid, a square plot of 0.1 ha (main
plot) will be laid out by measuring 22.36 m horizontal distance i.e., half of the diagonal in all the four directions at 450 in north-east, at 1350 in south-east, at 2250 in south-west, and at 3150 in north-west corners of the plot from true north. Check the dimensions of the plot i.e. all sides should measure31.62 m horizontal distance. Care should be taken for laying out the proper dimensions of the plot. Nested quadrates of size 3m 3m and 1m 1m will be laid out at a distance of 30 metres from the centre of the central plot in all four directions along diagonals in non-hilly area and along trails in hilly areas for the enumeration of shrubs (including regeneration status) and herbs/grasses respectively. Selected grids must contain one central plot of 0.1 ha (31.62m X 31.62m).

GENERAL PLOT VARIABLES TO BE RECORDED

General information related to land use, physiographical features like altitude, aspect, slope,
soil and water resources, crop composition, regeneration status, injury to the crop, fire incidence, grazing incidence, presence of weeds, presence of grasses, plantation status, distance from water course, drivers of degradation, etc. should be recorded for every sampling unit of 2 (two) hectare area in the 'plot description form' (Form II). This information along with the general observations made in 'plot approach form' will be used for writing the compartment description. General definition and description of terms not specifically mentioned here may be taken from the Land Cover Atlas of Pakistan PFI, 2012).

PLOT ENUMERATION

The sample plot, which cannot be laid out due to steep slope or other conditions, may be left
out of enumeration and its conditions of inaccessibility need to be mentioned in 'plot enumeration form' (Form III). All trees having diameter 10 cm and above will be enumerated, species wise and diameter class wise from all the identified sample plots of 0.1 ha and recorded in the 'plot

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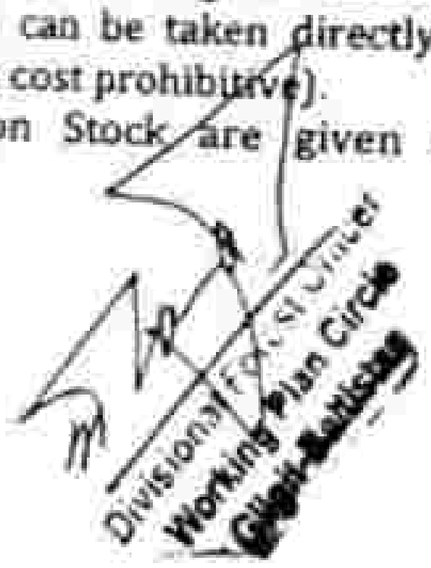
enumeration form' . Trees, the stems of which touch the north and west border lines of the plot(called border line trees) will be enumerated. However, trees, the stems of which touch the east and south border lines of the plot will be treated as "out trees" and will not be enumerated. Trees below 10 cm diameter at breast height over
bark will not to be enumerated. Enumeration of trees/bamboo will start from the NE corner of the plot and will proceed in clockwise direction. The same procedure should be followed for all the sample plots. Also the height of the trees, at least from the central plot should
be measured and recorded for ascertaining the site quality.

The data of shrubs, climbers and regeneration status from all 4 quadrats of 3 X 3m laid out at a distance of 30 meters from the centre of the main plot of 0.1 ha. is to be collected and recorded in the 'plot enumeration form'. The data of herbs from all nested quadrates of 1m X 1m laid within each quadrate of 3m X 3m is to be collected and recorded in the 'plot enumeration form'.

CARBON STOCK ESTIMATION

The total carbon stocked in the forest is divided into different pools and the changes in carbon
stocks in these carbon pools are estimated as per Good Practices Guidance (GPC) developed binder-governmental Panel on Climate Change (IPCC). Changes in carbon stock based on inventory data may be measured using Stock-Difference method based on tier 2 and tier 3 approach of IPCC guideline. Gaps in the information collected and further research needs should be explicitly highlighted.

Along with the nested quadrates of size 3 3m and 1 1m, one more quadrate of size 5 5m at
NE and SW direction, may be laid out in the selected grid for the estimation of carbon stock subject to availability of resources and funds. In 5 5m plot, all the dead wood above 5cm diameter would be collected, weighed and recorded. In 3 3m, all the woody litter, that is all branches below Scmdiameter, would be collected, weighed and recorded. All shrubs and climbers in 3 3m plots would be up-rooted, weighed and recorded. For trees, allocation of carbon in root, stem, branch, twigs and leaves may be obtained separately. In 1 1m plot, all the herbs/grasses including leaf litter would be collected, weighed and recorded. Dry biomass would be converted into carbon stock. For collecting data on humus and soil carbon, forest floor of 1 1m plot at the NE and SW corner of the main plot would be swept and materials thus collected, would be weighed and a portion of the same would be kept for the carbon analysis. After that a pit of 30 30 30cm would be dug at the centre of these1 X 1m plots and a composite sample of soil weighing 200gm would be kept for organic carbon analysis
(This information can be taken directly from PFI Carbon Stock Assessment Project if survey is cost prohibitive).
Details of Carbon Stock are given in the Chapter on Carbon Stock Assessment.



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Form I
PLOT APPROACH FORM

Name of Division (DD/MM/YYYY)

S. No	Heading	Description
1	Range	Name of the Range.
2	Block and or Beat	Name of the Block and or Beat.
3	Comptt.	Compartment No. or name of Village or any Management Unit in practice.
4	Grid and Sub Grid	The grids of 1' 15"X 1' 15"and sub grids of 25"X 25" are conveniently serial numbered for each compartment or Village or any Management Unit in practice.
5	Latitude.	Using GPS Plot (sub grid) center is located and latitude recorded.
6	Longitude	Using GPS Plot (sub grid) center is located and longitude recorded.
7	Journey/Approach to the plot	All the details of journey by vehicle and on foot including the lats and longs of various places or prominent reference points and the distances in between these places or prominent reference points will be recorded sequentially so that the plot can be revisited easily in future.
8	Ocular Stock Assessment	While approaching the plot general assessment of the forest crop and stock is done ocularly and mapping of the same is done accordingly.
9	General observational information	Information on tract, configuration of the ground, aspect, slope and drainage; geology, rock, soil and water resources; under wood – proportion of species, density; undergrowth – climbers, weeds, grasses, regeneration of principal species; mention of important herbs, shrubs medicinal and aromatic plants (MAP); bamboo and rattans; NTFP yielding species; intensity of invasive species; flagship faunal species, their special habitats and their interface with humans, biotic factors, drivers of forest degradation; resource utilization; dependence of local people on forest; and their social, cultural and spiritual aspects etc. may be observed and noted.
	Conspicuous features	Brief description of conspicuous features pertaining to the terrain and forest like grassy patches, scattered trees, plantations raised etc. observed during the journey by vehicle to the Plot (sub grid) are recorded so as to make use of the same while writing the description of the compartment.
11	Removal of fuel wood and fodder	Estimating number of head loads of fuelwood and fodder and their quantity

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Form-2

PLOT DESCRIPTION FORM

A separate description form will be filled up for every Plot of 0.1 ha for various parameters pertaining to the Plot including location, land use, topography, aspect, rock, soil, crop, regeneration, fire, grazing etc. and qualitatively described.

DD/MM/YYYY:

Name of Division:

S. No	Description	Remarks
1	Range	Name of the Range.
2	Block and or Beat	Name of the Block and or Beat.
3	Comptt.	Compartment No. or name of Village or any Management Unit in practice.
4	Grid and Sub Grid	The grids of 1' 15"X 1' 15"and sub grids of 25"X 25" are conveniently serial numbered for each compartment or name of Village or any Management Unit in practice.
5	Latitude	Using GPS Plot (sub grid) center is located and latitude recorded.
6	Longitude	Using GPS Plot (sub grid) center is located and longitude recorded.
7	Altitude	Altitude of plot center is measured and recorded in meters.
8	Legal status	Legal status of the forest may be as reserve forest, protected forest, un-classed forest, national park, private forest, private land with tree owned by Government and undetermined.
9	Land Use	The land use type of the plot may be categorized as closed forests, dense forest, open forests, scrub, bamboo brakes, shifting cultivation, young plantations of forestry species, tree in line, forest roads, grass lands, barren, agricultural land without trees in surround, agricultural land with trees in surround, non-forestry plantations, habitation, water bodies.
10	General Topography	The topography of the area around the center of the plot may be determined from the toposheets and the same may be confirmed by field observation. It may be categorized as flat, gently rolling, hilly, and very hilly.
11	Slope	By standing at the center of the plot the average slope of the area may be measured and recorded as up to 3°, 4° - 15°, 16°-40° & 41° and above respectively.

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12	Aspect	The direction of the slope may be recorded as Northern, North-Eastern, Eastern, South-Eastern, Southern, Southwestern, Western, North- Western and no aspect.
13	Rock & geology	Type of rock including alluvial deposits
14	Soil Data	Mention of texture, depth, permeability
15	Soil Erosion	Heavy/ Moderate/ Mild/ No erosion
16	Crop Composition	Mention of major tree spp. predominant in the Plot and extent of their representation in terms of percentage may Be made.
17	Regeneration status	Regeneration status may be observed and recorded as Adequate/ Moderate/Poor/Absent for major tree spp.
18	Injury/ Damage to crop, if any	Insect attack, fungal infestation, leaf defoliator, top drying, girdling, scarring, lopping, damage by natural calamities/ wildlife/fire may be observed assessed and recorded.
19	Grazing incidence	Depending upon the pressure of grazing exerted on the forest by livestock the incidence of grazing may be categorized Heavy/ Moderate/ Light/ None.
20	Presence of Bamboos	If yes, brief description of Bamboo density, Bamboo quality, Bamboo regeneration and Bamboo description may be made.
21	Presence of grasses	Ground cover on an area of about 2 ha around the Plot (sub grid) center may be intensively observed to classify the area for grasses as very dense, dense, moderate, scanty and absent.
22	Presence of Weeds	Ground cover on an area of about 2 ha around the Plot (sub grid) center may be intensively observed to classify the area for presence of weeds as very dense, dense, moderate, scanty and absent.
23	Plantation status	If a plantation is in an existence in a Plot (sub grid) area fully or partially, the details of the plantation with regard to its area, year of plantation, species, spacemen, general growth conditions, average crop diameter, any specific events or happenings related to plantations may be observed, assessed and recorded.
24	water bodies	Name, Type, Extent, Seasonality of the water body may be explored and recorded. Portability i.e. safe enough for drinking has to be ascertained.

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25	Drivers of degradation	Biotic: Brief account of degradation sources may be given and on the basis of various factors of degradation like grazing, browsing, fire, lopping, girdling, illicit felling, mining, encroachment etc. the intensity of degradation may be categorized as heavily degraded, moderately degraded, mildly degraded and not degraded. Natural calamities: Degradation due to calamities such as landslides, avalanches, floods, frost, cyclones, droughts may be categorized as heavily degraded, moderately degraded, mildly degraded and no calamities.
26	Faunal sighting, if any	The flagship species including mammals, birds, reptiles, amphibians, plants etc. which may be very significant to the area may be identified. Suitable habitats and microhabitats for such key faunal species may be identified and recorded so as to prescribe appropriate measures needed to conserve and improve.
27	Faunal Traces of flagship spp.	The entire 2 ha area around the center of plot (sub grid) may be scanned for any faunal traces of flagship species. If found the details of the same may be observed and recorded.

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Form-3

PLOT ENUMERATION FORM – A. (31.62m X 31.62m Plot)

This form is used to record data of all the trees and bamboos measured in the sample plots of 0.1 ha. Separate form will be used for each of the sample plot. All trees with 10cm and above diameter at breast height are measured and recorded. Diameter of bamboo clumps will be measured at its base.

Compartment No..... Block /Village .....
Beat ..... Range ..... Division.....
Grid No..... Sub Grid No. ..... (DD/MM/YYYY)
LAT..... LONG..... ALT.....

S. No	Species Name	Local Name	DBH (OB) in cm	Height of selected dominant trees	Remarks, if any, about the tree condition

PLOT ENUMERATION FORM – B. (3m X 3m Plots)

This form is used to record data of all shrubs and saplings measured in the 3m X 3m quadrants. Separate form will be used for each of the quadrant. All individuals with 2 to 9.9 cm collar diameter at the base will be measured and recorded.

S. No	Species Name	Local Name	Collar Dia at base in cm	NTFP utility		Remarks, if any, about the condition of shrub vegetation
				Part of the Plant body	Approx. Weight and or no.	

PLOT ENUMERATION FORM – C. (1m X 1m Plots)

This form is used to record data of all the herbs including medicinal and aromatic plants counted in the 1m X 1m quadrants. Separate form will be used for each of the quadrant. All individuals below 2 cm collar diameter at the base, will be measured and recorded.

S. No	Species Name	Local Name	NTFP utility		Remarks, if any, about the condition of herbal vegetation
			Part of the Plant body	Approx. Weight and or no.	

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Information collected in Plot Approach Form and Plot Description Form along with
Compartment History may be used to update information under different subheads.

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ANNEXURE III
PREPARATION OF VILLAGE PLANS FOR ENSURING REGENERATION AND REHABILITATION OF FORESTS AND MANAGEMENT OF NTFPs AND MAPs

It is the joint responsibility of the WPO and Territorial DFO to develop village plans to regenerate gaps and blanks in the track so that regeneration activity could be carried out in the worked forests which could be established over the period of 25 years (felling cycle). Guidelines issued by the federal cabinet with regard to regeneration and rehabilitation of gaps be kept in view. Sufficient funds from FRF be allocated so that these activities could be accomplished and monitored by WPO.

1.1 Preparation of village plan in JFM areas

In case of new working plans a Community Use/JFM exclusive or overlapping working circle should be provided to incorporate broad provisions for village plans. To achieve these flexible guidelines should be evolved for preparation of local need based village plans. For this purpose, the working plan officer will work with the territorial DFO and CF for finalization of the prescriptions of the JFM overlapping working circle. The village plans should be prepared by the Forest Officers and Village Development CommitteesValley Conservation Committee/Joint Forest Management Committees after detailed PRA exercise and should reflect the consumption and livelihood needs of the local communities as well as provisions for meeting the same sustainably. It should utilize locally available knowledge as well as aim to strengthen the local institution. It should also take into account marketing linkages for better return of NTFPs/MAPs to the gatherers and should also reflect the needs of local industries market. This should be done with due regards to the environmental functions and productive potential of the forests and their carrying capacity as also their conservation and biodiversity values.

In areas where existing plans are in force (till their revision in future), for incorporation of village plans in the working plans, a special order may be issued by the Chief Conservator of Forests for implementation of the village plan which should aim at ensuring a multi-product and more NTFPs/MAPs oriented approach. Without changing the basic principles of silviculture, deviations may be approved in the existing working plans if necessary. To ensure this, the concerned DFO and Conservator of Forests should dovetail the requirements of village plans with the working plans.

The village plan should also take into consideration and provide suitable advice for areas planted/ to be planted on community lands and other Government lands outside the notified forest areas.

Infrastructure/ Eco-development under village plan should form a separate entity for funding it through concerned development agencies.

1.2 Extension of JFM in good forest areas

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There has to be a circular on this topic. This circular is to envisage that the JFM program should cover both the degraded as well as good forests (except the protected area network). The village plan or microplan or treatment plan and memorandum of understanding should be different for degraded forests and good forests (crown density above 40%). In good forest areas, the JFM activities would concentrate on NTFPs/MAPs management and no alteration should be permitted in the basic silvicultural prescription prescribed in the Working Plan but to promote regeneration, development and sustainable harvesting of NTFP/MAPs which need to be managed under the Insternational Standards for Sustainable Collection of MAPs (I SSC-MAPs) which set principles and criteria for their wild collection. A benefit sharing mechanism will be devised for both timber as well as NTFPs including MAPs as per prevailing tenure arrangements and rights and concessions agreements into between the local communities and Forest Department/Government of Gilgit-Baltistan. The JFM committees will be eligible for any additional benefit sharing for timber or other forest produce, only if they have satisfactorily protected the forests and NTFPs/MAPs for a minimum period specified to with them under the agreement. The felling of trees and harvesting of timber will be as per the provisions of the working plan. A certain percentage of revenue from final harvest should be ploughed back in the silviculture and management of the forests. The extent of forest areas to be allowed under JFM will depend upon the number of village households and their forest protection and management capacity. The area allowed under JFM may be gradually increased once both the communities as well as Forest Department staff gain experience in implementing collaborative forest management practices. Thisphased implementation of JFM will help in gaining and documenting experiences and thus in revising the collaborative management approaches and practices The pilot areas may be monitored closely for a few years and based on the feedback and success achieved the program can be extended further in consultation with the Government. Before allowing the good forests on a large-scale basis for JFM, all the degraded forests of that locality should be covered simultaneously.

1.3 Relationship with community elders

The relationship between community elders and JFM Committees should be such that the JFM Committees take advantage of the administrative and financial position and organizational capacity of the community elders for the management of the forest resources. However, the unique and separate non-political identity of the JFM Committees as 'guardian of forests' should be maintained and ensured. The benefits accrued from NTFPs/MAPs sales should be shared with all the members of the community including the JFM committees. In order to achieve a better coordination with community institutions, a committee may be constituted at the district level under the chairmanship of the Deputy Commissioner of the district on the recommendations of the concerned DFO with representation from community and other district level officers of relevant departments as members.

1.4 Memorandum of Understanding (MoU)/Terms of Partnerships (ToPs)

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To ensure smooth working relationship between the forest department and the JFM Committees and also to bring in a sense of empowerment and accountability, a Memorandum of Understanding (MoU) or Terms of Partnerships (ToPs) should be signed between the forest department and the JFM committees outlining the short term and long term roles and responsibilities, implementation of work program, pattern of sharing of usufructs and conflict resolution. In the MoU or ToPs, JFM Committees should form the basic Forest Management Units to provide them a feeling of empowerment and enable them to effectively protect and conserve the forest resources. The MoU/ToP for each committee shall have location specific work program based on site- vegetation profile and mutual understanding. The MoU/ToP should reflect the consumption and livelihood needs of the forest dependent communities, plan for restoration of vegetation and clearly spell out the roles, responsibilities and powers.

The MoU/ToP should define the procedure for necessary transparent accounting of all types of forest produce (seasonal, annual and periodical) accrued from the forests as per the working plans and village plan prescriptions. All JFM Committees should be assigned specific roles for boundary demarcation, fire prevention and control of grazing, encroachments and illicit felling as well as ensure sustainable non-destructive harvesting of NTFPs including medicinal plants and for this, the Committees should be given authority to protect the resource as per legal provisions of the law/rules besides any monetary and other incentives as genuine stakeholders. A provision to assist the JFM Committees has been made in the Forest Act of Gilgit-Baltistan as well as the NTFPs/MAPs Rules framed under the Forest Act. Similar provisions should also be made for other JFM activities as well. A GIS based map of the JFM area along with village boundaries may be prepared every two years to monitor the performance and to ascertain the status of vegetation. Similarly, the socioeconomic changes brought about by JFM should also be monitored by obtaining regular feedback from the committee members. The action program should also be linked with the Forest Working Plan activities in order to make JFM integral to the overall forestry activities including afforestation on all types of lands. The MoU/ToP should also include planning and development of grasslands, other common lands, and agroforestry and water bodies as a reflection of people's voluntary action for holistic land use planning and management. Agroforestry models developed in other parts of Pakistan or elsewhere in the world under different conditions should be studied and adopted if found applicable.

2.1. PLANNING

Preparing a village plan for a village requires groundwork before actually taking up of collection of data. It is important for planners to know the village in details to understand the problems and available resources in the reference village. An in-depth understanding of issues, time spent in consulting local people to understand their needs and rational approach to their requirement are all very important in village level planning. The planning stage is important and can be divided into 3 steps

Step – I – Village Identification

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Step – II – Methodology
Step – III- Implementation

3.1 Village Identification

3.1.1 The village: - Brief introduction of the village.
3.1.2 The Village Plan: - A brief description about the general understanding of the villagers
and the frontline staff of village plan.
3.1.3 Details of the village: - It will describe about all the natural / created resources of the
village as well as requirements and the problems faced by villagers.

3.1.4 Justification for selection of village: - It will describe the reasons for selection of the
village for program implementation.

3.1.5 Methodology: - It will deal with the Procedures for preparation of village plan, and
approaches to people's participation in the village planning process.

4.1 Methodology

4.1.1 Description of the village

This chapter will deal with the details of the village, such as: -

Geographical / political location: - This section will include the details of location of village

Communication facilities:- This section will deal with the infrastructure for communication and transportation facility.

Natural and created Resources: - It will deal with the available natural resource and other manmade structures created in the past for the villagers.

Climate:-This will include the distribution of rainfall temperature and humidity condition of the villages.

Population structure: - This will deal with the details of male and female population, population growth rate, age structure, employment rate, child mortality etc.

Land use patterns: - It will deal with the different types of land uses and their status.

Socio - Economic status: - This will deal about the social setup, economic condition, land holdings their earnings and Livestock status etc.

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The outcome of the above exercise will be accompanied by the Preparation of (i) village map (ii) village social map (iii) village resource map.

4.1.2 Plan Preparation Activities

To prepare a village plan, various steps are needed to be executed in a systematic manner and through an accepted methodology. The whole process can be accomplished in following steps.

Secondary data: - In the primary stage authentic secondary data of the village is collected through published or unpublished records. Published data are usually available in census reports, village, union council and tehsil records and from different government offices and unpublished data may be found in official reports, official records and in their communications.

Primary data: - The collection of primary data will depend on kind of data. The primary data required for village level micro planning can be categorized into two broad categories

Bio-physical data:-This includes biological and physical components of the village.

Socio economic data: - This includes socio-cultural, political and economic components.

Data Analysis: - The collected data is required to be processed and analyzed before being put to further use. The analysis means editing, coding computation, classification and tabulation of collected data so that it can be analyzed for rational conclusion and recommendations.

Recommendations: - After the systematic and complete analysis of all the collected data, conclusions are made and recommendation are drawn for future management and developmental activities and these activities are listed and prioritized for implementation in the target village.

5.1 Implementation of the village plan

The recommendation given in the village plan are to be implemented judiciously as per the availability of funds and importance of the activities, therefore, it is important to give details of the followings items in the village plan

Budget: - Based on the recommendation, various management activities which have been finalized needs funds for implementation. Therefore, it is important to link the activities with the source of funding and available funds. The various activities should be prioritized as per the funds position.

Monitoring and Evaluation: - This will deal with the indicators for continuous timely monitoring of the project and its evaluation, to keep the project on track.

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Rights and responsibilities: - The resources created and benefits accrued are needed to be rationally used by the stakeholders. Therefore it is important to clearly mention arrangements for access to resources and assets created and for this a written agreement between Forest Department and Village Development Committee/Valley Conservation Committee/JFMC is required, which will clearly state the obligations of both parties. These inter alis should cover both the qualitative and quantitative information about the following:

- Grazing/fodder collection
- Fuelwood collection
- Timber and small wood collection
- Thatching/fencing/other building construction and agricultural implements materials collection
- Collection of NTFPs /MAPs

Other resources and forests and forestry dependent occupations: Here all the occupations based on raw materials drawn from the forests, the number of families involved, various khels/ tribes involved, whether full time or part time, estimated incomes and seasonality of such occupations should be discussed.

Problem analysis: This section would include the major problems and identification of the root causes of these problems. This should be done after a joint problem analysis exercise.

Strategies and activities to solve problems: This section should contain various strategies to solve each problem. The strategies should also explain various other processes like generation of people's participation, ways to integrate the programs of other departments/agencies, cost sharing between the people and the department, fund raising mechanisms, awareness and environmental education, etc. From the strategies, should emerge different activities for each problem. Linkages with the village and village organizations should be made clear while deciding the strategies.

Feasibility analysis of proposed activities: The proposed activities have to be tested for various feasibilities. This includes environmental feasibility, social feasibility, financial/market feasibility, technical feasibility as well as administrative/legal feasibility. The results of the feasibility analysis could be presented in the form of a table.

Agreed activities and their details: This section would include the activities agreed upon after the feasibility analysis along with the man power requirements, intended beneficiaries and financial requirements for carrying out these activities (with unit costs). This section would also include cost sharing arrangements among the communities and the department, other line agencies or project management authorities in case the activity is done under a project. Sometimes the contribution of the village communities may not be in financial terms, but in physical terms. This should also be clearly spelt out. The agreed responsibilities of the various line agencies if any, should also be laid down along with the activities and time frame. Ultimately, the entire village plan can be presented in a simplified logical

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framework, so that all the problems, outcomes, outputs, activities, monitoring mechanisms and indicators and assumptions can be seen clearly along with the linkages of these components, by the villagers.

Annual physical and financial targets: This section would be the gist of year wise physical and financial targets for the period. This should also mention about the amount of common fund expected from these activities and the strategies to manage and enhance this common fund.

Monitoring and evaluation: This will give details about different indicators which will be monitored to see if the implementation of the village plan and its various programs is going on in the right direction. This will also clearly mention who will be responsible for monitoring, what will be monitored, where it will be monitored and how frequently it will be monitored. Evaluation will also be done to see the long-term impacts and suggestions for improvements in future planning and strategies.

For the successful implementation of the village plans/micro plans, two supporting components are important which are:

Capacity building – the JFMC members may be new to many of the responsibilities they will be undertaking and will require training and other forms of capacity building before they can take independent charge of resource development and livelihood improvement activities.

Institutional development - For systematic execution of the plan, there will be need for proper institutional development of the responsible organizations. Therefore, institutional development of village development committees (VDCs)/Valley Conservation Committees/JFMCs and Women Organizations (WOs)will be required and the Forest Department will support this strengthening and attention to building their systems are properly designed and operate as per intended spirit of collaborative forests and renewable natural resources management.

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ANNEXURE-IV
GLOSSARY OF WORKING PLANS, FOREST INVENTORY AND ANALYSIS AND RELATED TERMS

TERM	DEFINITION/DESCRIPTION OF THE TERM
Access and Benefit Sharing	Abbreviated as ABS, Access and Benefit Sharing means access to genetic resources and benefit sharing and is an acronym used to refer to access to genetic resources and the fair and equitable sharing of benefits arising from their utilization as set out in of the Convention on Biological Diversity (CBD) or any other convention, agreement, Terms of Partnerships, Memorandum of Understanding, etc.
Accretion	"Accretion" means the growth on all surviving trees plus the growth on trees that were cut or died and were utilized between two measurements.
Accuracy	'Accuracy' means and describes agreement or closeness of a measurement or estimate to the true value. For any forest measurement including timber volume estimation, carbon accounting, etc. this specifically refers to repeated measured observations or estimations of a quantity relevant for quantitative estimates of the relevant forest measures and carbon stocks and flows, etc..
Activity	'Activity' in the context of carbon accounting means a practice or ensemble of practices that take place on a delineated area over a given period of time.
Activity Data	'Activity data' in the context of carbon accounting means data on the magnitude of human activity (i.e., land use and land use changes related to forests) resulting in emissions or removals taking place during a given period of time.
Adaptation	'Adaptation' means (a) in the context of United Nations Framework Convention on Climate Change (UNFCCC) actions taken to help communities and ecosystems cope with changing climate conditions; or (b) in the context of United Nations Convention on Biological Diversity (UNCBD) genetically determined characteristic that enhances the ability of an organism to cope with its environment.
Additionality	'Additionality' means (a) funding principle envisaged to ensure that Global Environmental Facility (GEF) funds do not substitute for existing development finance but provide new and additional funding to produce agreed global environmental benefits; or (b) approval test for projects under the Clean Development Mechanism (CDM) of the Kyoto Protocol (KP) or Reducing Emissions from Deforestation and Degradation of Forest (REDD+) of UNFCCC. CDM and REDD projects are considered additional if they would not have taken place in the absence of the CDM or REDD+ project.

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Aerial photograph	"Aerial photograph" means a photograph of the Earth's surface taken from airborne equipment.
Afforestation	'Afforestation' means the direct human-induced conversion of a non—forest land to forested land through planting and/or seeding.
Age-Class Distribution, Normal	"Age-Class Distribution, Normal" means a complete series of age-classes in such proportion as will permit equal volume from annual or periodic filings under the given rotation and Silvicultural System.
Age Gradation	"Age Gradation" means an age class with one year as the interval.
Alien Species	'Alien Species' means species occurring in an area outside of its historically known natural range as a result of intentional or accidental dispersal by human activities. Alien species are not necessarily invasive species.
Anamorphic curves	"Anamorphic curves" means a series of curves or equations scaled so that each is a constant times the base curve.
Animal	'Animal' means any kind of vertebrate and invertebrate animal and the young and egg thereof and as defined in the Gilgit-Baltistan Forest Act and Wildlife Act.
Animal-unit-month	"Animal-unit-month" abbreviated as AUM means the amount of oven dry forage required by one animal unit for a standardized period of 30 animal-unit-days.
Area change matrix	"Area change matrix" means the area of the intersection of all combinations of initial and terminal condition classes between two points in time, compiled for a microplot, subplot, microplot, or plot.
Aspect	"Aspect" means the predominant direction of slope of the land.
Attribute	"Attribute" means a discrete or continuous variable, usually associated with the classification or measurement of area or vegetation.
Azimuth	"Azimuth" means a horizontal angle, measured clockwise from the north.
Basal area	"Basal area" means the cross-sectional area of a single tree stem, including bark, measured at breast height, or the sum of the cross-sectional areas of all stems in a stand measured at breast height and expressed per unit of land area.
Bearing	"Bearing" means a horizontal angle referenced to a quadrant, namely NE, SE, SW or NW, measured from north or south to east or west.
Bench mark	"Bench mark" means a surveyed point of known position and elevation.
Bi-areal plot	"Bi-areal plot" means a plot design that incorporates two different plot sizes at each sample location for the purpose of measuring trees in two different diameter ranges.
Bias	"Bias" means a systematic distortion that is introduced

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	through sampling, measurement, or estimation processes.
Biodiversity	'Biodiversity' is shorthand for biological diversity and means variability among living organisms from all sources including terrestrial, marine and other aquatic ecosystems, and the ecological complexes of which they are a part; this includes diversity within species, between species and of ecosystems.
Bioindicator	"Bioindicator" means the use of a biological entity's condition, frequency, and abundance as an indicator of ecosystem quality.
Biological resources	'Biological resources' means genetic resources, organisms or parts thereof, populations, or any other biotic component of ecosystems with actual or potential use or value for humanity.
Biomass	'Biomass' means the total amount of live and inert organic matter above and below ground expressed in tonnes of dry matter per unit area.
Biomass fuels	"Biomass fuels' means energy sources that are renewable as long as the vegetation producing them is maintained or replanted such as firewood from forests.
Bio-prospecting	"Bio prospecting' means exploration of biodiversity for commercially, scientifically, or culturally valuable genetic and biochemical resources.
Biosafety	"Biosafety: means set of measures or actions addressing the safety aspects related to the application of biotechnologies and to the release into the environment of transgenic plants and other organisms, particularly microorganisms, that could negatively affect plant genetic resources, plant, animal or human health, or the environment.
Biosafety protocol	'Biosafety protocol' means the protocol to the Convention on Biological Diversity. It is also referred to as the Cartagena Protocol and regulates the trans boundary movement, transit, handling and use of living modified organisms that may have an adverse effect on the conservation and sustainable use of biodiversity taking also into account human health.
Biosphere reserves	"Biosphere reserves' means sites recognized under UNESCO's Man and Biosphere Programme which innovate and demonstrate approaches to conservation and sustainable development.
Biotechnology	"Biotechnology" means any technological application that uses biological systems, living organisms, or derivatives thereof, to make or modify products or processes for specific use.
Board foot	"Board foot" means the amount of wood contained in a board 1 inch thick, 12 inches long, and 1 inch wide.
Board of Revenue	"Board of Revenue" means the Board of Revenue, Gilgit-Baltistan, established under the West Pakistan Board of Revenue Act, 1957 (W.P. Act XI of 1957).

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Bonn Guidelines	"Bonn Guidelines" is shorthand for and means the Bonn Guidelines on Access to Genetic Resources and Fair and Equitable Sharing of the Benefits Arising out of their Utilization.
Bottom-up approach	"Bottom-up approach" means approach based on the participation of relevant stakeholders, particularly those at the local levels.
Boundary (condition class)	"Boundary (condition class)" means the border between two distinctly different condition classes.
"Boundary (population)	"Boundary (population)" means the border of a population or subpopulation.
Breast height	"Breast height" means the standardized point for measuring tree diameter and defined as 4.5 feet above ground in Pakistan, or 1.3 meters above ground in most countries utilizing metric units.
"Browse	"Browse" means the parts of shrubs, woody vines, and trees suitable for animal consumption.
Brush	"Brush" means shrubby vegetation that is not suitable for commercial timber.
Brushwood	'Brushwood' includes all woody plants, bushes, shrubs and small trees growing on Wastelands, Protected Lands, Private Forests and Protected Forests, with the exception of fruit and nut trees, that is almonds, apples, apricots, cherries, citruses, figs, grapevines, guavas, litchis, other fruit vines, peaches, pears, persimmons, pistachios, plums, and walnuts.
Buffer strip	"Buffer strip" means a strip of vegetation left intact along a watercourse or other sensitive area
Canopy	"Canopy" means the foliar cover in a forest stand and may consist of one or several layers.
Cant	"Cant" means a piece of lumber made from a log by removing two or more sides by sawing.
Census water	"Census water" means areas of permanent water > 4.5 acres or > 200 feet wide.
Chain	"Chain" means a unit of length equal to 66 feet and composed of 100 links.
Chain of custody	"Chain of custody" means the channel through which products are distributed from their origin in the forest to their end-use
Chemicals	"Chemicals" mean the range of fertilizers, insecticides, fungicides, and hormones which are used in forest management.
Classified satellite imagery	"Classified satellite imagery" means a map (satellite image) that defines and displays the spatial arrangement of each classified stratum on a pixel basis.
Clear Felling System	"Clear Felling System" means a Silvicultural System in which equal or equi-productive areas are successively clear-felled in one operation to be regenerated , most frequently, artificially but sometimes naturally also.
Components of	"Components of change" means the different

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change	subdivisions of the changes that can occur to a tree between measurements, such as growth, mortality, and removals.
Compartment	"Compartment" means Territorial Units of a forest permanently defined for purposes of administration and record, preferably designated by Arabic numerals 1,2, 3, etc. It is the smallest permanent Working Plan unit of management, location of works and records; as such, its boundaries are carefully chosen on the ground and marked on the map. The boundaries are formed either by natural features such as ridges, valley bottoms, streams or artificial lines such as fire lines, roads, etc. The size of a compartment depends on the intensity of management. Smaller the compartment, easier it is to include areas homogeneous in site factors and forest types in it.
Condition class (or condition)	"Condition class (or condition)" means the combination of discrete attributes that describe the area associated with a plot. These attributes include condition status (land use), forest type, stand origin, stand size, owner group, protected status, and stand density, as well as other ancillary and computed attributes.
Contrasting condition	"Contrasting condition" means the condition class that differs from the condition class located at the subplot centre (for boundaries on the subplot or microplot) or at the microplot centre (for boundaries on the microplot), i.e., the condition class present on the other side of the boundary.
Cord	"Cord" means a stack of wood that measures 4x4x8 feet that is 128 cubic feet including wood, bark, and air spaces within the stack.
Coupe	"Coupe" means annual felling areas, equal to the number of years in the rotation, say R, size of each coupe being equal to the area of the Felling Series (or Working Circle as the case may be), say A hectares, divided by R, i.e., A/R hectares. A Felling area, usually one of an annual series unless otherwise stated. Preferably numbered with Roman numerals I, II, III, etc.
Criterion	"Criterion (pl. Criteria)" is a means of judging whether or not a Principle (of forest sustainability or forest stewardship)has been fulfilled.
Crown ratio	"Crown ratio" means the ratio of length of live crown to total tree height.
Cruise	"Cruise" means a forest inventory conducted to estimate the quantity of timber on a given area according to species, size, quality, and other characteristics.

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Cunit	"Cunit" means a unit of volume, generally applied to pulpwood, consisting of 100 cubic feet of solid wood.
Current annual increment	"Current annual increment" abbreviated as CAI means the growth observed in a tree or stand in a specific one-year period.
Cutting cycle	"Cutting cycle" means the interval between partial harvests in uneven-aged stands or the number of years between successive harvests on an area of forest.
Customary rights	"Customary rights" mean rights which result from a long series of habitual or customary actions, constantly repeated, which have, by such repetition and by uninterrupted acquiescence, acquired the force of a law within a geographical or sociological unit.
Cutting Section	"Cutting section" means a sub-division of a Felling Series formed with the object of regulating cuttings in some specified manner: a planned separation of fillings in successive years.
Cycle	"Cycle" means one sequential and complete set of panels.
Cycle length	"Cycle length" means the period of time required to measure a complete set of panels (synonymous with measurement cycle).
Declination magnetic	"Declination, magnetic" means the angle between true north and magnetic north.
Dendrometer	"Dendrometer" means a device for measuring the diameter of tree stems.
Diameter at breast height	"Diameter at breast height" abbreviated as d.b.h. and means tree diameter measured outside bark at 4.5 feet above ground level on the uphill side of a tree, or 1.3 meters above ground on the uphill side of a tree in countries using metric measurement system. The point of diameter measurement may vary on abnormally formed trees.
Diameter at root collar	"Diameter at root collar" abbreviated as drc means the diameter of a shrub-like "woodland" tree species, measured outside bark at the ground line or stem root collar.
Digitizing	"Digitizing" means the process of converting or encoding map data that are represented in analogue form into digital information of x and y coordinates.
Directional felling	"Directional felling" means predetermining on a predefined set of criteria the preferred direction of fall of a tree.
Domain	"Domain" means a class (or combination of classes) for which a population estimate is made for some attribute of interest. Domains are typically the row and column margins of tabular output tables (e.g., saw timber stands on publicly owned timberland).
Double sampling for stratification	"Double sampling for stratification" means a sampling method whereby a large sample of plots are stratified in Phase 1, then a subsample are measured for all

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	attributes in Phase 2. When the strata are homogeneous with respect to the attribute, then the estimators are more accurate versus simple random sampling.
Down woody material	"Down woody material" dead pieces of wood > 3.0 inches in diameter. Down woody material includes downed, dead tree and shrub boles, large limbs, and other woody pieces that are severed from their original source of growth or are leaning more than 45 degrees from vertical.
Eastings	"Eastings" means the x coordinates in a plane coordinate system.
Ecology	"Ecology" means the study of the interrelationships or organisms with their environment.
Ecosystem	"Ecosystem" means a community of all plants and animals and their physical environment, functioning together as an interdependent unit.
Edge Effect	"Edge effect" means the modified environmental conditions or habitat along the margins or edges of forest stands or patches;
Ecology	"Endangered species" means any species which is in danger of extinction throughout all or a significant portion of its range.
Ephemeris	"Ephemeris" means prediction of the current position of a GPS satellite that are transmitted in the GPS data message;
Even aged	"Even aged" means a forest stand composed of trees of the same, or approximately the same, age. Difference up to 25% of the rotation age may be allowed in cases where a stand is not harvested for 100 or more years.
Felling Series	"Felling Series" means a forest area forming the whole or part of a Working Circle and delimited so as to distribute felling and regeneration to suit local conditions and to maintain or create a normal distribution of age-classes. The yield is calculated separately for each Felling Series which should have an independent representation of age-classes. Each Felling Series is a self-contained unit of management with a separate calculation of yield and a separate series of silvicultural operations. Division of a Working Circle into several Felling Series enables effective control and distribution of work in different ranges. When a Working Circle is not divided it is, of course, one Felling Series.
Forage	"Forage" means the browse and herbage that is available and may provide food for grazing animals or may be harvested for feeding.
Forest	"Forest" means a land spanning at least 0.05 hectares with trees higher than 5 meters and a canopy cover of 10 or more than 10 percent, or trees able to reach

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	these thresholds *in situ*. It does not include land that is predominantly under agricultural or urban land use.
Forest integrity	"Forest integrity" means the composition, dynamics, functions and structural attributes of a natural forest.
Forest Management	Forest management is the practical application of the scientific, technical, economic, social and management principles of forestry for achieving the set objectives. Alternatively Forest Management may be defined as the set of activities and processes (including planning and decision making, organizing, leading, and controlling) directed at the biophysical, human, material, financial and knowledge/information resources of a forest organization aimed at achieving the set organizational goals in an efficient and effective manner.
Forest manager	"Forest management/manager" means the people responsible for the operational management of the forest resource and of the enterprise, as well as the management system and structure, and the planning and field operations.
Forest management unit	"Forest management unit (FMU)" means a clearly defined forest area with mapped boundaries, managed by a single managerial body to a set of explicit objectives which are expressed in a self-contained multi-year management plan.
Forest Organization/ Classification	Forests are classified into various categories for purposes of description, administration, management and record. These sub-divisions are: Geographical and Climatic (or Ecological); Functional; Legal or Statutory; Territorial; Administrative or Organizational; and Management or Silvicultural. As per Ecological Classification, forests may be classified into Tropical, Sub-tropical, Temperate and Boreal Forests. As per Functional Classification, forests may be classified into Production Forests, Protection Forests and Community Use or Village Forests. As per Legal Classification, forests may be classified into Protected Forests, Private Forests, etc. As per Territorial Classification, forests may be divided into Forest Regions, Forest Circles, Forest Divisions, Forest Sub-Divisions, Forest Ranges, Forest Blocks, Forest Beats, Forest Compartments and Forest Sub-Compartments. As per Administrative or Organizational Classification, forests may be classified as those under the administrative control of Federal Government and

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	those under the Regional/Provincial Governments. At the Federal level, the administrative head is the Inspector General of Forests and at the Provincial level the administrative head is the Chief Conservator of Forests, who heads a Forest Region. The administrative head of a Forest Circle is the Conservator of Forests, the Forest Division is administered by a Divisional Forest Officer, a Forest Sub-Division is administered by Sub-Divisional Forest Officer, a Forest Range is administered by a Range Forest Officer, a Forest Block is administered by a Block Officer or a Forester, and a Forest Beat is administered by a Beat Guard or Forest Guard. From the point of view of Silvicultural Management, forests are classified into Working Circles, Felling Series, Cutting Sections, Coupes and Periodic Blocks.
Forest stewardship	"Forest stewardship" means forest management which, in conformity with the Forest Stewardship Council (FSC) Principles and Criteria for Forest Stewardship, is environmentally responsible, socially beneficial, and economically viable.
Geographic Information System	"Geographic information system" abbreviated as GIS means an information management system that accommodates the entry, storage, manipulation, retrieval, and display of spatial data.
Global Positioning System	"Global Positioning System" abbreviated as GPS means a satellite based positioning system that gives a user's position anywhere on Earth.
Graze	"Graze" means the consumption of standing forage by livestock or wildlife.
Ground Datum	"Ground datum" means a point on the Earth's surface used as reference for measuring the height of aerial photography and for calculating photo scale.
Ground Truth	"Ground truth" means measurements or observations made on the ground for the purpose of verifying interpretations made from aerial photography or remote sensing.
Growing Stock	"Growing Stock" means the sum (by number or volume) of all trees growing in the forest or a specified part of it.
Growth	"Growth" means change in size of an individual or a stand of trees over a specified period.
Habitat	"Habitat" means the place, including the climate, food, water and cover, where an animal, plant, or population lives and develops.
Herb	"Herb" means any flowering plant except those developing persistent woody stems.
High Conservation Value Forests	High Conservation Value Forests mean forests that possess one or more of the following attributes: (a) Forest areas containing globally, regionally or

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	nationally significant :concentrations of biodiversity values (e.g. endemism, endangered species, refugia); and/or large landscape level forests, contained within, or containing the management unit, where viable populations of most if not all naturally occurring species exist in natural patterns of distribution and abundance (b) Forest areas that are in or contain rare, threatened or endangered ecosystems (c) Forest areas that provide basic services of nature in critical situations(e.g. watershed protection, erosion control) (d) Forest areas fundamental to meeting basic needs of local communities(e.g. subsistence, health) and/or critical to local communities' traditional cultural identity (areas of cultural, ecological, economic or religious significance identified in cooperation with such local communities).
Home range	"Home range" means the area over which an animal normally travels.
Hybrid classification	"Hybrid classification" means a combination of supervised and unsupervised classification (e.g., guided classification).
Hypsometer	"Hypsometer" means an instrument, based on geometric or trigonometric principles, for measuring tree heights.
Indicator	"Indicator" means a quantitative or qualitative variable which can be measured or described, and which provides a means of judging whether a forest management unit complies with the requirements of an FSC Criterion. Indicators and the associated thresholds thereby define the requirements for responsible forest management at the level of the forest management unit and are the primary basis of forest evaluation
Indicator function	"Indicator function" means a variable with a value of 0 or 1 that is used to specify attributes of interest (e.g., blue pine growing-stock volume), and domains of interest (e.g., moist temperate coniferous forest types) in the estimation process.
Indicator species	"Indicator species" means any plant that by its presence, frequency, or vigour, indicates any particular property of the site.
Ingrowth	"Ingrowth" means the volume of those trees that grew into the lowest inventoried size class between two measurements.
Ionosphere	Ionosphere" means the outer part of the Earth's atmosphere, consisting of heavily ionized molecules.
Latitude	"Latitude" also called parallels means the angular

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	distance measured north or south of the Earth's equator. The equator has latitude 0 degrees, the south pole -90 degrees and the north pole +90 degrees.
Log rule	"Log rule" means a formula or table for estimating the volume, usually in board foot, of lumber that may be sawed from logs of different sizes.
Longitude	"Longitude" also called meridians means the angular distance measure east or west from a reference meridian (Greenwich, England) which is 0 degrees on the Earth' surface. Longitudes range from -180 (180 degrees west) to +180 degrees (180 degrees east).
Macroplot	"Macroplot" means a circular area with a fixed horizontal radius of 58.9 feet (1/4 acre). Macroplot centres are co-located with subplot canters. Macroplots are used in the optional tri-areal design, primarily for sampling relatively rare events.
Mapped plot	"Mapped plot" means a plot that has been partitioned into unique and distinct classes by establishing the boundaries between them.
Mapped projection	"Map projection" means a mathematical model for converting locations on the Earth' surface from spherical to planar coordinates.
Mean	"Mean" may refer to Arithmetic Mean, Geometric Mean or Quadratic Mean. Arithmetic mean means the average of a set of observations, obtained by dividing the algebraic sum of all observations in the set by the total number of observations. Geometric mean means and is calculated as the *n*th root of the product of *n* values. Quadratic mean means the square root of the arithmetic average of the squared values of a set of observations.
Mean annual increment	"Mean annual increment" abbreviated as MAI means the total growth of a tree or stand up to a given age divided by that age.
Median	"Median" means the middle observation in a set of ranked data; if the set consists of an even number of observations, the median is the average of the two middle observations.
Microplot	"Microplot" means a circular area with a fixed horizontal radius of 6.8 feet (1/300 acre), primarily used to sample trees less than 5.0 inches at d.b.h./d.r.c.
Mode	"Mode" means the value occurring most frequently in a set of data.
Money Yield Table	"Money Yield Table" means a table constructed from a Volume Yield Table in which yields are expressed in terms of money instead of volume.
Mortality	"Mortality" in general terms means trees dying from natural causes. Mortality with reference to sequential inventories means the volume of trees initially measured that died during a growth period and were

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	not utilized.
Moving average	"Moving average" means a weighted average of the estimates for distinct panels.
Mult-aged	"Multi-aged" means a forest stand that has more than one distinct age class arising from specific disturbance and regeneration events at various times.
Multipath error	"Multipath error" means the error caused by the interference of a signal that has reached a GPS receiver antenna by two or more different paths and is usually caused by one path being bounced or reflected.
Non-census water	"Non-census water" means bodies of water from 1 to 4.5 acres in size and water courses from 30 feet to 200 feet in width.
Non-forest	"Non-forest" means areas defined as nanoforest land, census water, or non-census water.
Non-forest land	"Non-forest land" means land that does not support, or has never supported, forests, and lands formerly forested where use for timber management is precluded by development for other uses. Includes areas used for crops, improved pasture, residential areas, city parks, improved roads of any width and adjoining rights-of-way, power line clearings of any width, and nonsenses water. If intermingled in forest areas, unimproved roads and no forest strips must be more than 120 feet wide, and clearings, etc., more than 1 acre in size, to qualify as non-forest land.
Non-timber forest products	"Non-timber forest products" mean all forest products except timber, including other materials obtained from trees such as resins and leaves, as well as any other plant and animal products.
Northings	"Northings" means the y-coordinates in a plane coordinate system.
Other forest land	"Other forest land" means forest land other than timberland and protected forest land. It includes available and reserved low-productivity forest land, which is incapable of producing 20 cubic feet of growing stock per acre annually under natural conditions because of adverse site conditions such as sterile soil, dry climate, poor drainage, high elevation, steepness, or rockiness
Oven dry weight	"Oven dry weight" means the weight of a substance after it has been dried in an oven at a specific temperature to equilibrium.
Over run	"Over run" means results when the mill tally is greater than the log rule.
Panel	"Panel" means a sample in which the same elements are measured on two or more occasions. Generally, Forest Inventories divide plots into five panels that can be used to independently sample the population.
Parallax	"Parallax" means the apparent displacement of an object, caused by a change in the point of observation.

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Parameter	"Parameter" means a characteristic, generally in numeric form, that describes a specific aspect of a population.
Periodic annual increment	"Periodic annual increment" abbreviated as PAI means the growth of a tree or stand observed over a specific time period divided by the length of the period.
Periodic Block	"Periodic Block" abbreviated as P.B. means the part or parts of forest set aside to be regenerated, or otherwise treated , during a specified period. The regeneration block is called "Floating" or "Single" when it is the only Period Block allotted at each Working Plan revision. When all P.Bs. are allotted and retain their territorial identity at Working Plan revision, they are termed "Fixed" or "Permanent".
Periodic survey	"Periodic survey" means a non-continuous inventory system. A survey strategy whereby a set of inventory panels is measured simultaneously over a short time frame, often 1 to 3 years in the case of Forest Inventories, and there is a time lag, often many years, before the panels are re-measured.
Phase 1	"Phase 1" with reference to Forest Inventory means forest inventory activities related to remote-sensing, the primary purpose of which is to obtain strata weights for population estimates.
Phase 2	"Phase 2" with reference to Forest Inventory means forest inventory activities conducted on the network of ground plots. The primary purpose is to obtain field data that enable classification and summarization of area, tree, and other attributes associated with forest land uses.
Phase 3	"Phase 3" with reference to Forest Inventory means a sub-set of plots where additional attributes related to forest health are measured.
Photogrammetry	"Photogrammetry" means measurement made from aerial photographs, including area measurements, distance, direction, height, of differences in elevation or slope.
Photointerpretation	"Photointerpretation" means the art and science of identifying objects and conditions from photographs.
Photo scale	"Photo scale" also called representative fraction (RF) means the ratio of the distance measured on the photograph to the distance measured at the ground datum (measurements must be in the same units).
Pixel	"Pixel" or picture elements means the elements of a digitized picture. The resolution of a pixel is dependent on the size and number of elements of which it consists.
Plot	"Plot" means a cluster of 4 points arranged such that point 1 is central, with points 2, 3, and 4 located 120 feet from point 1 at azimuths of 360, 120, and 240 degrees, respectively. Each point includes a microplot,

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	a subplot, and an optional macroplot.
Polymorphic curves	"Polymorphic curves" means a series of curves of different shapes.
Population	"Population" means the aggregate of all units forming the subject of study and may be finite or infinite. In case of forest inventory a basic building block of land area for which the number of plots and the land area being sampled are known.
Precision	"Precision" means the closeness of a series of measurements or estimates to their own average.
Principle	"Principle" means an essential rule or element; in FSC's case, of forest stewardship
Pseudorange	"Pseudorange" means the distance between a GPS satellite and receiver based on the correlation of a satellite-transmitted code and the local receiver's reference code, which has not been corrected for synchronization between the transmitter's clock and the receiver's clock. "Range" in statistical terms means the difference between the largest and the smallest value in a set of observations.
Rangeland	"Rangeland" means land on which the indigenous vegetation is predominantly grasses, forbs, or shrubs.
Ratio of means	"Ratio of means" means an estimator which is computed as the ratio of the means of two random variates (attributes), such as the volume per acre of forested land.
Recreational area	"Recreational area" means a developed or undeveloped land area reserved and managed for recreational purposes.
Regeneration Period	"Regeneration Period" means the period required to regenerate the whole of a Periodic Block.
Regular Shelterwood or Uniform System	"Regular Shelterwood or Uniform System" means a kind of Shelterwood System aiming at concentrated regeneration in which the canopy is uniformly opened up over the whole area of a compartment to obtain uniform regeneration.
Remote sensing	"Remote sensing" means the measurement of an object or phenomenon by a recording device that is not in physical contact with the object or phenomenon under study, and often involves aerial photography or satellite imagery.
Rotation	"Rotation" means the period between regeneration and final cutting in even-aged stands. Rotation is an important factor in regulation of yield and proper management of a forest as a whole. It depends mainly on objects of management. Various types of rotations recognized in forestry are: Physical Rotation Silvicultural Rotation

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	Technical Rotation Rotation of Maximum Volume Production Rotation of Highest Income Financial Rotation
Sample	"Sample" means a part of a population assessed to estimate characteristics of the whole population.
Sampling unit	"Sampling unit" means a basic unit of selection and observation. All forest inventory units are the centre-point of the 4-point cluster of sub-plots as the primary sampling unit.
Section	"Section" means a land survey subdivision of one square mile or 640 acres or 259 hectares.
Sediment	"Sediment" means fragments of rock, soil, and organic material transported and deposited in bed by water, wind or other natural phenomena.
Selection Forest	"Selection Forest" means an uneven-aged forest crop containing many, theoretically all, age classes or gradations. Or it is a forest managed under Selection System of Management.
Silviculture	"Silviculture" means the art and science of producing and tending a forest by manipulating its establishment, composition and growth to best fulfil the objectives of the owner. This may, or may not, include timber production.
Simple random sample	"Simple random sample" means a method of selecting n units out of the N such that every one of the samples has an equal chance of being chosen.
Site index	"Site index" means the total average height that dominant and codominant trees in fully stocked, even-aged stand will obtain at a specified reference age, usually 25 or 50 years.
Site productivity class or site class	"Site productivity class or site class" means the maximum mean annual increment in cubic feet per acre that can be expected in fully stocked, natural even-aged stands.
Sliver	"Sliver" means a condition class that occupies less than 25 percent of a plot (less than one full subplot and not encountered on other subplots).
Soil Expectation Value	"Soil Expectation Value" means the discounted present value of all future returns from a forest property minus the discounted present value of all future expenses necessary to earn these returns, the discounting done at a given rate of interest at compound interest.
Stand	"Stand" means a contiguous group of trees sufficiently uniform in age class distribution, composition, and structure, and growing on a site of sufficiently uniform quality to be a distinguishable unit.
Stand density	"Stand density" means a quantitative measure of stem crowding within a stocked area.
Stand table	"Stand table" means a tabulation of the total number of stems or average number of stems per acre or

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	hectare) in a stand or compartment by d.b.h. classes and species.
	"Standard deviation" means a measure of the dispersion about the mean of a population or a sample and is computed as the square root of the variance.
State plane	"State plane" means a coordinate system commonly used in surveying applications and based on zones drawn on transverse Mercator and Lambert projections.
Stocking	"Stocking" means the adequacy of a given stand density to meet some management objective. At the tree level, stocking is the density value assigned to a sampled tree, usually in terms of numbers of trees or basal area per acre, expressed as a percent of the total tree density required to fully utilize the growth potential of the land. At the stand level, stocking refers to the sum of the stocking values of all trees sampled;
Stock table	"Stock table" means a tabulation of the total volume of stems (or average volume per acre or per hectare) in a stand or compartment by d.b.h. classes and species.
Strata	"Strata" means the nonoverlapping subdivisions of the population such that each primary sampling unit is assigned to one and only one subdivision (or stratum). The relative sizes of these strata are used to compute strata weights.
Stratification	"Stratification" means a statistical tool used to reduce the variance of the attributes of interest by partitioning the population into homogenous strata. It may also involve partitioning a highly variable but small portion of the population.
Stratified estimation	"Stratified estimation" means estimation of population attributes using the total area of the population, strata means, and known strata weights. Strata means and weights are obtained from the stratification of the population either before or after the selection of sampling units.
Stumpage value	"Stumpage value" means the sale value of standing timber.
Sub-Compartment	"Sub-Compartment" means a sub-division of a Compartment. Generally (but not necessarily) of a temporary nature, differentiated for special description and silvicultural treatment (preferably designated by smaller letters, a, b, c, etc.). The sub-division may be revoked when the crops have been brought into condition when they do not require different treatments.
Subplot	"Subplot" means a circular area with a fixed horizontal radius of 24.0 feet (1/24 acre), primarily used to sample trees at least 5.0 inches at d.b.h./d.r.c.
Subpopulation	"Subpopulation" means a subdivision of a population

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	for which the area sampled is known and controlled for, such as the area within a county in national forest ownership. Sub-populations are not necessarily a subset of one single population.
Supervised classification	"Supervised classification" means training sites with known properties are used to extract spectral statistics from an image data set by interactively identifying sites in the image. These statistics are used to establish starting values for cluster means, and a clustering algorithm is used to classify the image.
Sustained Yield	"Sustained Yield" is defined and expressed variously as: 1. The yield of timber or other forest produce from a forest which is managed in such a way as to permit the removal of approximately equal volume or quantity of timber or other forest produce annually or periodically in perpetuity. 2. The regular, continuous supply of the desired produce to the full capacity of the forest 3. The material that a forest can yield annually (or periodically) in perpetuity. 4. As applied to policy, method or plan of management (Sustained Yield Management), it implies continuous production with the aim of achieving at the earliest practical time at the highest practical level an approximate balance between net growth and harvest by annual or somewhat longer periods. Sustained Yield may be annual or periodic, depending on whether a complete series of age-gradations (or ages mixed together) is maintained or only an incomplete series. Periodic Yield is also considered as sustained, provided the period is short.
Systematic sample	"Systematic sample" means a method of selecting n units out of the N such that restrictions are placed on the samples chance of being chosen.
Taper	"Taper" means the decrease in diameter of a tree stem of log from the base upwards or from the larger diameter end to the smaller end in logs.
Tenure	"Tenure" means socially defined agreements held by individuals or groups, recognized by legal statutes or customary practice, regarding the "bundle of rights and duties" of ownership, holding access and/or usage of a particular land unit or the associated resources there within (such as individual trees, plant species, water, minerals, etc).
Threatened species	"Threatened species" means any species which is likely to become endangered within the foreseeable future throughout all or a significant portion of its range.

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Timberland	"Timberland" means Forest land that is producing or capable of producing in excess of 20 cubic feet per acre per year of wood at culmination of mean annual increment (MAI). Timberland excludes forest lands reserved for biodiversity or other conservation purposes.
Township	"Township" means a land survey subdivision of 6 x 6 miles, consisting of 36 sections (23,040 acres, or 9,238 hectares).
Tree	"Tree" means a wood perennial plant that has a defined crown shape and reaches a mature height of at least 16 feet (5 meters).
	"Trend" means the direction of change in an attribute as observed over time.
Tri-areal plot	"Tri-areal plot" means a plot design that incorporates three different plot sizes at each sample location for the purpose of measuring trees in three different tree-diameter ranges.
Type mapping	"Type mapping" means the process of delineating soil, vegetation, or site quality types on an aerial photograph or on a base map.
Under-run	"Under-run" means results when the mill tally is than the log scale.
Uneven-aged	"Uneven-aged" means a forest stand composed of an intermingling of trees that differ markedly in age.
Universal Transverse Mercator	"Universal Transverse Mercator" abbreviated as UTM means a planar coordinate system, extending from 84 degrees north to 80 degrees south latitude and based on a specialized application of the transverse Mercator projection.
Unsupervised classification	"Unsupervised classification" means radiance values of an image data set are used in a statistical clustering algorithm. The clusters are labelled after the classification.
Up-growth	"Up-growth" means trees that grow into large diameter class between two measurements.
User rights	"Use rights" means rights for the use of forest resources that can be defined by local custom, mutual agreements, or prescribed by other entities holding access rights. These rights may restrict the use of particular resources to specific levels of consumption or particular harvesting techniques
Variance	"Variance" means a statistical measure of the dispersion of individual observations about their arithmetic mean.
Volume equation	"Volume equation" means a mathematical expression used to estimate the volume of trees from measures of diameter and height, and occasionally form.
Watershed	"Watershed" means a land area drained by a single stream, river, or drainage network.
Weir	"Weir" means a notch in a levee, dam, or other barrier

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	across or bordering a stream, through which the flow of water is measured or regulated.
Yield	"Yield" means the volume of an individual or a stand of trees at various ages.
Yield Table	"Yield Table" means a tabular statement which summarizes on a unit area (acre/hectare) all the essential data relating to the development of a fully stocked and regularly thinned even-aged crop at periodic intervals covering the greater part of its useful life.
Working Circle	"Working Circle" means a forest area, forming the whole or part of a Working Plan Area, organized with a particular object and subject to one and the same silvicultural system and the same set of Working Plan prescriptions. In certain circumstances, Working Circles may overlap.
Working Plan	"Working Plan" is used synonymously with Forest Management Plan and means a written scheme of forest management aiming at continuity of policy and action controlling the treatment of a forest. It is a means of enforcing systematic, obligatory and mandatory regulations for continuous management of a given forest property. It is not confined to silvicultural and management aspects of the forest only, but it also covers other activities such as general administration, grazing, watershed management, biodiversity management, permanent improvement, protection and conservation of environment including climate change regulation, forest production, soil and water conservation and various other functions for which forests are managed. It is thus a complete forest management plan for the next Working Plan period.
Working Plan Area	"Working Plan Area" means the total forest area covered by a particular Working Plan. Since the entire Working Plan Area is usually large and heterogeneous in site conditions and crop composition, different silvicultural systems may have to be given (i.e., different Silvicultural Systems prescribed) in different parts of the Working Plan Area and different working rules, called prescriptions, drawn up for different parts. Such parts are known as the Working Circles.

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[redacted] HELD ON [redacted]

The 26th meeting of the Gilgit-Baltistan Cabinet was held on 11th December 2022 at 4:00 PM under the Chairmanship of the Honorable Chief Minister Gilgit-Baltistan in Gilgit-Baltistan House Islamabad. However, some ministers have been joined through video link from Chief Minister Conference Hall Gilgit and Commissioner Office Baltistan Region Skardu. The meeting started with the recitation from the Holy Quran.

2. During the meeting the following agenda points were discussed in detail and decisions were made as recorded against each point:

S #	Agenda	Brief/Decision	Action by
1	**Approval for direct/negotiated contracting for hiring of legal/technical experts for vetting of draft power purchase agreement and implementation agreement for installation of 180 MW dual fuel for plants in GB**	The Secretary W&P Department GB briefed the Cabinet about the different aspects of the Power Purchase Agreement (PPA) and Implementation Agreement (IA). It was briefed that the CPI Uk has a vast experience in undertaking similar projects across the globe including Egypt, Algeria, Greece, and Angola. The equipment to be provided has the following salient features: - • GE based TM-2500 units	Secretary W&P

	Supply and Install Equipment:
1	Transformers
1.1	40MVA Generator Step Up Transformer (configured
1.2	Tx connection box and FSU
1.3	2000A, 11kV Generator Circuit Breakers (In TM
1.4	2 MVA, 11/0.4kV, ONAN YNd11
2	30kV indoor site substation (3150A/25kA)
2.1	MV Switchgear
2.1.1	GSU incomer (1500A)
2.1.2	Outgoing feeder (1500A)
2.1.3	Bus coupler (3150A)
2.2	Control and Protection: 30kV scheme
2.2.1	Feeder
2.2.2	Gen Transformer
2.2.3	Bus Coupler
2.2.4	HMI, SCADA
2.2.5	Setting Study

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3	Electrical BOP
3.1	Cabling MV Cables
3.1.1	630mm2 XLPE PVC 11kV Unarmoured
3.1.2	300mm2 XLPE 11kV SWA 3 Core
3.1.3	95mm2 XLPE 11kV SWA 3 Core
3.1.4	Control Cable
3.2	Terminations (MV)
3.2.1	630mm2 XLPE 11kV Indoor
3.2.2	630mm2 XLPE 11kV Outdoor
3.2.3	300mm2 XLPE 11kV Indoor, Outdoor Set.
3.2.4	95mm2 XLPE 11kV Indoor, Outdoor Set.
3.3	LV Distribution and BSDG
3.3.1	BSDG (1000kVA)
3.3.2	Standby switch board
3.3.3	MDB 2 Section incl c/o
3.3.4	LV Cabling (per GT)
3.3.5	LV Cabling (BOP and BSDG)
3.3.6	LSP panels
3.3.7	MCCs
3.4	Lighting Masts
3.4.1	21m Lighting Mast
3.4.2	400W HPS
3.4.3	Cabling
3.5	UPS and Batteries
3.5.1	DCS UPS system 20kVA
3.5.2	Admin UPS system 20kVA
3.6	Station earthing and CPS
3.6.1	Station earthing system
3.6.2	Cathodic Protection System
3.7	Security, Comms, Fire Detection and BOP DCS
3.7.1	Telephone System
3.7.2	Admin LAN
3.7.3	Satellite Connection (Assumed not required)
3.7.4	Fibre Optic and Comms Cabling
3.7.5	Security and Access Control System
3.7.6	Surveillance CCTV System
3.7.7	Intercom System (Assumed not required)
3.7.8	Fire/Smoke Detection System
3.7.9	BOP DCS including cabling and marshalling boxes
4	Mechanical BOP
4.1	Service and Instrument air
4.1.1	Compressors, dryers, receivers
4.1.2	Distribution per GT

Section Officer
Energy (Power Wing)
Cabinet Division

SECTION OFFICER
Cabinet GB

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		xvi. in the event GoGB does not elect to acquire the project or fails to pay the compensation amounts in accordance with the terms of the IA due to its earlier Termination, the Company shall be entitled to re-export the plant, machinery and equipment; xvii. Any dispute between the GoGB/W&PDGB and the Company shall be amicably resolved. If not so resolved dispute shall be resolved through expert meditation for technical and financial matters. Alternatively, the parties shall have recourse to the arbitration under Arbitration Act 1940 of Pakistan; xviii. IA and the PPA shall be governed by the laws of Gilgit Baltistan; and xix. Project will be transferred to the GoGB on notional value of Rs. 1 at the end of the term of fifteen (15) years. **Decision:** After detailed deliberation the Gilgit-Baltistan Cabinet took the following decisions: (i) Authorized the department to proceed with the IA and PPA as per PPRA. (ii) Authorized the Secretary W&PDGB to sign IA and the Chief Engineer W&PDGB to sign PPA; and (iii) Authorized the W&PDGB to make and approve any project specific changes without increase in the obligations or liabilities of the GoGB / W&PDGB. (iv) The W&PDGB shall engage a legal firm adopting alternative methods of bidding through the same legal firm to verify financial documents/term sheets etc before accepting the terms and conditions of the Financial Closing in order to determine its obligations and liabilities under the IA and the PPA.	
2	**Forest Working Plan Diamer**	The Secretary Forest Department GB briefed the Cabinet that Working Plan is a scientific harvesting mechanism which describes logging of around 40.000 million cft timber from 06 forest ranges of Diamer district over the period of next 30 years with an average annual cutting of 1.300 million cft timber- around 22000 trees annually. It was approved by the Prime Minister of Pakistan in 2017 conditionally- the leftover timber shall be disposed of before commencement of the Working Plan. With the promulgation of GB Order 2018, the subject rests with the Provincial Govt. The document includes the regeneration plan-reforestation (ANR), social forestry & community development (100 plants for every felled tree). The further described the a summary was submitted to Honorable CM GB during September 2021 with certain technical observations and recommendations. The Honorable CM constituted the Forest Working Plan Committee under the chairmanship of	Secretary Forest

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Minister Forest GB with set ToRs. The committee after through discussion and consultation with Jirga, finalized its recommendations and accordingly submitted to Chief Secretary GB. The Chief Secretary GB directed the Department to come up with clear Road Map for Implementation of Working Plan. The department has submitted the same and solicits the approval of the following policy/decisions from the Cabinet GB.

During the discussion forum pointed out that if the marking and cutting process would not be started simultaneously then a sufficient time would be required, making it difficult to implement the working plan. Hence, it is required to constitute a Monitoring Team headed by Secretary Forest, Wildlife & Environment GB and comprising some Secretaries and Commissioner Diamer to over sight the activities and to report to the Provincial Government.

Decision: After detailed deliberation the Cabinet approved the following recommendations of the Forest Department GB:

i. Recommendations of the Working Plan Committee
ii. Initiation of marking subject to endorsement of the Technical Committee
iii. [redacted]
iv. Creation of Working Plan Circle on regular basis
v. Road Map including Budgetary requirements from FWF
vi. New rates of Royalty-as prescribed in the summary for different species
vii. Retention of 7% Syndicate timber for local use on subsidiary rates in GB as per provision of Section-50 of GB Forest Act 2019.
viii. Monitoring Team to over sight constitution of the activities mentioned in the Road Map.
ix. The Cabinet further directed the department to initiate summary for amendments under section-6 in the GB Forest Act (Amended) 2020 to replace the word destruction into disposal. However, no amnesty scheme shall be allowed for such illegally extracted timber expect for government uses with explicit approval of the authority concerned.
x. Implementation of mega regeneration/reforestation project from 1% Climate Fund under the prescriptions of Working Plan.
xi. A Secretary level monitoring committee shall monitor the marking and cutting process and will submit monthly report to Cabinet. CS office will notify the secretary's committee.

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Cabinet GB

DIVISIONAL FOREST OFFICER,
Working Plan Circle
Gilgit-Baltistan.

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