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Forest Resources Monitoring for Proper Management in Ethiopia

Wondie Mebrat
Department of Biology, Adigrat University, Ethiopia
Email: wondiemebrat@yahoo.com

Abstract
Ethiopia is considered as the center of origin with many forests richest in species diversity. These Forests are one of Ethiopian greatest natural assets. They play an indispensible role in protection of environment, regulating climate, controlling water runoff, maintaining ecological balance and producing valuable materials. However, these forest resources are highly declined due to rapid and continuous deforestation activities; agricultural expansion and settlement. To minimize the risk, there are increasing needs to measure and monitor the extent and condition of Ethiopian forests for management purposes. Monitoring is an essential tool in ecological and biodiversity management. It improves the manager's ability to make proper decisions through a wide range of forest data collection by agencies including Federal and State and Territory governments. These are often collected using different methods and are not always consistent across boundaries making national compilations difficult. Monitoring indicates changing methods of forest mapping over time also poses problems for assessing trends in forest extent and condition.
Keywords: Forest, assessments, ecology, monitoring, management

1. INTRODUCTION

Forests cover about 25 to 30% of the earth's land surface; an area between 3.3 to 3.9 billion hectares which harbor about two-third of the known terrestrial species, have among the highest species diversity and endemism of many ecosystems as well as the highest number of threatened species (World Bank, 2004). Particularly tropical forests are the richest and most divers terrestrial ecosystems on earth. Although they now occupy less than 10% of the earth's land surface, these forests are thought to contain more than two-third of all plant biomass and at one-half of all plant, animal and microbial species in the world (Cunnigham and Saigo, 1995).

Especially Ethiopia is a mountainous country with great geographic diversity like rugged mountains, flat topped plateaus and deep gorges incised river valleys and rolling plains (Tewoldeberhan, 1988). These diversified topographic features made the country to be covered by the richest flora in tropical Africa (Tolera *et al.,* 2008). Thus, Ethiopia is considered as the center of origin and the richest in plant species diversity (Mesfin, 2004). They are used to meet the basic need of the forest dependent communities (Murthy *et al*., 2002). These resources help to maintain the fertility of agricultural land, used as habitat for wild life, protect water resources and reduce the risk of natural disasters such as land slide and flooding (World Bank, 2004).
However, these rich forest resources are highly declined due to rapid and continuous deforestation activities. Changes in land use mainly through the conversion of natural vegetation to agricultural lands and settlement are the main causes for this rapid deterioration of forest covered areas in the country (Eyayu *et al*., 2009). For instance, some reports in the country indicated that at the beginning of the 20th century, 40 percent of the country was covered with a natural forest. This larger sized forest cover declined to 16 percent in the 1950s and to less than 3 percent at the end of the century (Mesfin, 2004). To measure the change rate species diversity is one of the most important indices used for evaluating the sustainability of forest communities (Ray *et al*., 2009). Especially plant diversity often used as a measurement of health of biological system. Rapid and continuous change in plant diversity shows problems in the system or environment, which should be carefully assessed and paid quick attention. Those species are excellent gauges for measuring the system of nature and human indices pressure on the environment (Kumari, 2009).

This information helps to increasing agencies and public perception for forest management practices, such as clear cut and harvesting. Especially diversity indices allow objective assessment for ecological measurement, whether ecosystems are adversely affected by various management practices such as herbicide use, reduction, season of harvest, etc. Forest management practices may indeed impact size; it helps to identify negative and positive trends for plant diversity (TFIC, 2003).

To do the management practice, monitoring is a powerful tool for identifying problems at early stages, before they become dramatically obvious or crises. If identified early, problems can be addressed while cost effective solutions are available. Particularly, an invasive species that threatens plant population is much easier to control at the initial stages of invasion, compared to eradicate after it is well established (Elzinga *et al*., 1994). So, monitoring of vegetation diversity on an environment is a repeated measurement of some aspects of environment to detect change over time. It is necessary for adaptive management approach and successful implementation of ecosystem management (Gaines *et al*., 1999). Applied system of

management and conservation of forests is an immediate concern for the present and future generation. Such a study is useful to know the type of plant community development through succession under single stand management system (Singh and Gupta, 2009). So, the objective of this review is to assess vegetation health and to identify the main challenges for the vegetation diversity decline. In addition it provides information on the management actions to conserve vegetation resources.

2. Forest Monitoring

Monitoring is a continuing function that aims primarily to provide the management and evaluate the main stakeholders of an ongoing intervention with early indications of progress, or lack thereof, in the achievement of results. An ongoing intervention might be a project, programme or other kind of support to an outcome (Diabre, 2002). It is the process of under taking periodical assessments or surveys, recording results, periodically comparing and evaluating them to determine the effectiveness of actions or processes (Brodie, 2001). For proper management of diversity, Forest Health Monitoring (FHM) is a multiagency national program in United States designed to measure status, changes and trends of forest conditions annually. It can measure change in species composition, forest structure, age, and relative dominance of all trees on a particular site. FHM also describes the condition of individual trees through assessing growth, mortality, regeneration, damages and estimates the crown conditions (Roger *et al*., 2001).

To manage an ecosystem, monitoring ecological change has considerable relevance at a time when humans are having an increasingly widespread and long-term impact on nature (Vaughan *et al*., 2001). Ecological monitoring is assessing of natural environment like vegetation composition of a certain area. This assessment includes both biological and physical monitoring techniques. Biological monitoring activities are evaluation of vegetation diversity, abundance and frequency of an environment through applying the Shannon Weiner diversity index, by this result vegetation cover of an area is evaluated or monitored. However, physical monitoring is assessment of vegetation diversity through observation in field trips (Hill and Wilkinson, 2004). Ecological monitoring is also the systematic measurement of variables and processes over time but assumes that there is a specific reason for that collection of data, such as ensuring that standards are being met (Vaughan *et al*., 2001).

2.1 Ways of Monitoring

Monitoring vegetation cover and recording of observations is an excellent method to document the long- term healthy of the range sites. This method is not appropriate for determining annual range utilization and production. The recorded observations will be most valuable when you compare the results from year to year. For example, over time your recorded observation may reveal that the percentage of bare ground is decreasing. These methods of monitoring vegetation diversity help the researcher document change from year to year in abundance of desirable plants (Barry, 1996). Emphasis in this review is placed on the methods and procedures for carrying out field monitoring, impact, or other ecological studies once the goals and overall design have been determined (Murray *et al*., 2002).

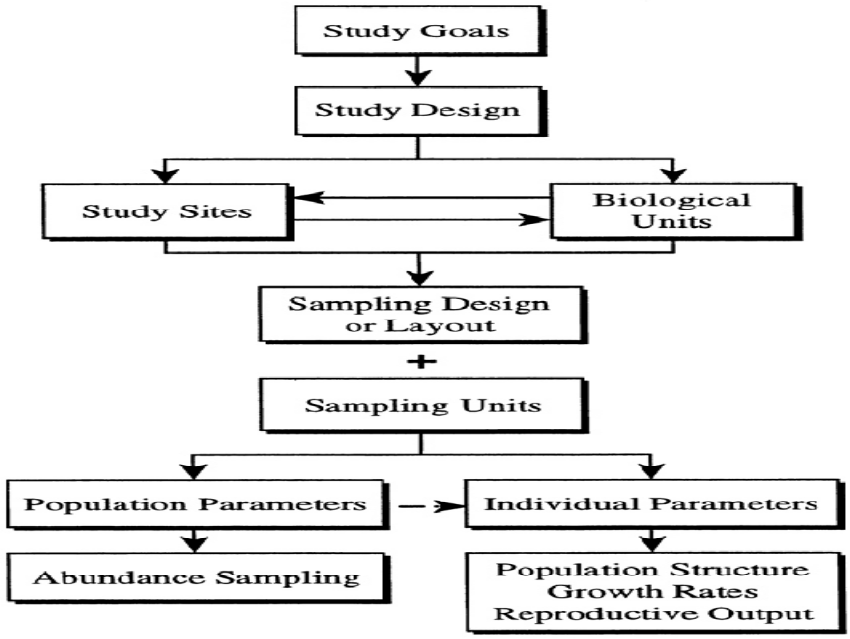

Figure 1: Method and procedures for field monitoring (Murray *et al*., 2002)

Estimating sampling plots or quadrants is an essential component of ecological monitoring and

research. Within this plots, count data of specific vegetation matrices are collected to estimate the physical and biotic components of the restoration. Monitoring efforts involve regularly collecting quantitative and/or qualitative data from established sampling plots (Guilfoyle and Fischer, 2006). In general for implementing ecological monitoring 6 steps used as illustrated in the figure below followed by the way of (Frode and Masara, 2007).

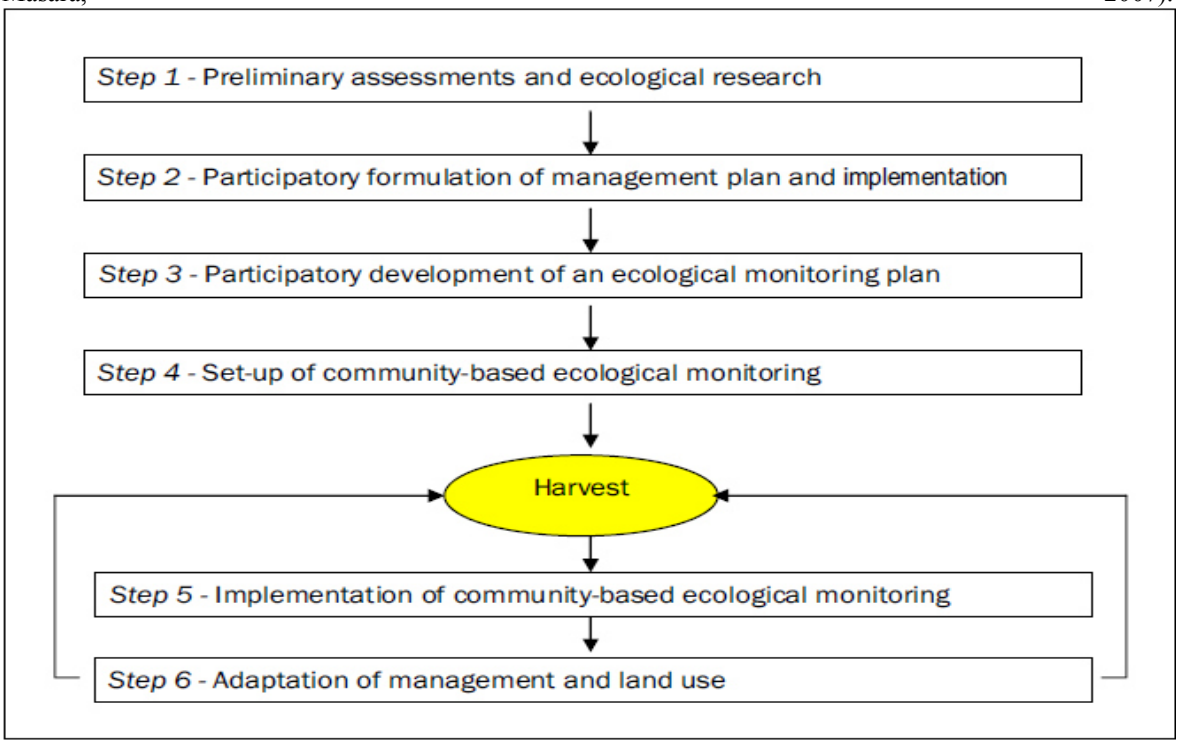

Figure 2: Ecological monitoring steps (Frode and Masara, 2007).

2.2 Significance of Monitoring

Ecological monitoring of vegetation diversity can be introduced in to development projects for the following reasons: to gain a clear understanding about impact of resource use on ecosystems and populations of specific plants, to support long-term maintenance and growth of productivity and yield of plant resources and maintenance of vegetation diversity, to be able to plan and implement projects in order to enhance productivity and ecosystem health and to detect negative side effects of resources at an early point and to plan for corrective action (Frode and Masara, 2007). In addition to these according to Vaughan *et al*., (2001) ecological monitoring has to be resourced and financed. There may be long-term resourcing implications and some ecological monitoring can be relatively expensive. It provides roles as follows:

1. The processes of many ecosystems have not been well researched and monitoring programmes could provide basic ecological knowledge about those processes.
2. Management of ecosystems, if it is to be effective, requires a baseline, which can only come from ecosystem monitoring.
3. Anthropogenic perturbations on the world's ecosystems have long-term effects, some synergistic and some cumulative: therefore, it follows that long-term studies are required.
4. The data from long-term studies can be a basis for early detection of potentially harmful effects on components of ecosystems.
5. With the ever-increasing loss of species, loss of habitats and damage to biological communities, ecological monitoring is needed to identify the implications of these losses and damage.

Ecological monitoring of vegetation diversity can help to recorded changes over time and also relate these changes to climate, environment, and management events (Brodie, 2001). It can show up a problem when it is still small. In addition vegetation monitoring can document the effectiveness of management actions, extent and severity of extreme events, develop a bench mark, against which future performance can be measured, use the information again to determine managements actions and developing a better understanding cause and effect in managing vegetation (Brodie, 2001).

Conclusion

Plant species cover a wide area of the earth's land surface and used to meet the basic need of forest dependent communities. Vegetation diversity was very crucial for human beings and animals through

maintaining fertility of agricultural land and protects water resource and reduces risk of natural disasters such as flooding and land slide. However these valuable resources were highly declined through time as a result of anthropogenic disturbances that were caused by human activities in a variety of ways. So to conserve such natural beauty assessment of diversity and measurement vegetation healthy through applying monitoring techniques are an appropriate way to identify environmental threats for the vegetation diversity for a better resource management and conservation.

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