

Role of ergonomics in reduction of occupational health hazards in forestry

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ABSTRACT

An intrinsic characteristic of forestry work is that it is an outdoor activity, exposing its workers to the prevailing climate conditions. The rate of occupational health hazards and postural discomfort is very high among forestry workers. The factors which reduce the physiological working capacity of worker are climatic factors and technical factors. This paper deals with the measures and techniques which are applicable to reduce the occupational health hazards and postural discomforts in forestry sectors by minimizing the adverse effects of climatic and technical factors. The improvement of safety, health, well-being and efficiency is a basic condition for prosperity, and ergonomics is a very important tool for this.

KEY WORDS : Ergonomics, Occupational health hazards, Postural discomfort, Forestry workers

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Working and living conditions for forest workers are generally poor in most countries all over the world, very often, work efficiency is also poor. Physical heavy work, inadequate working methods, working techniques and tools and equipments cause not only occupational accidents, diseases and unnecessary fatigue, but low productivity as well. In countries with available accident records, forestry appears to be one of the most hazardous occupations, with frequent and severe accidents and many diseases. The improvement of safety, health, well-being and efficiency is a basic condition for prosperity and ergonomics is a very important tool for this.

Forest is a community of trees, shrubs, herbs, and associated plants and organisms that cover a considerable area that use oxygen, water and soil nutrients as the community attains maturity and reproduces itself. Forestry is the art and science of managing forests, tree plantations, and related natural resources. The main goal of forestry is to create and implement systems that allow forests to continue a sustainable continuation of environmental supplies and services. The challenge of forestry is to create systems that are socially accepted while sustaining the resource and any other resources that might be affected.

Working conditions in the forestry sector:

Melemez and Tunay (2010) conducted an ergonomic evaluation on whole-body vibration of loading tractor in Turkish Forestry and reported that exposure to whole-body vibration during occupational operation of loading

tractor. Whole body vibration was analysed at the seat-operator interface using a tri-axial accelerometer at 145 forestry loading operations in Turkey. The mean total vibration value was found 1.38 ms⁻² at loading equipment mounted tractors and 1.06 ms⁻² at original loading machines. The regression analysis was performed in order to determine the most important factors that affect total vibration value transmitted to the tractor operator. The most important factors that affect the total vibration value were machine type, ground roughness condition, ground type, wheel pressure, seat condition and operator weight. In the region, the use of original loading machines should be encouraged. The operator seats having an automatic mass adjustment mechanism should be used. The roughness of the ground should be reduced by covering the ground of forest depots with stabilized material. According to the ILO (1999), the forestry sector's labour force comprises of 1 per cent of the world's total employment of which a large majority is working in developing countries. Annually they produce 1.5 milliard m³ of industrial round wood (FAO, 2001). Being a predominantly rural based sector, it provides employment in areas where other employment alternatives often are rare (ILO, 1999). In the industrialized countries, the number of forestry workers has decreased considerably due to mechanization and the ILO (1999) predicts that this decrease will continue. In Sweden for example, the number of forestry workers decreased from 65800 in 1970 to 17600 in 1998 (Anonymous 1999). In the developing countries however, the ILO (1999) predicts that the

number of forestry workers will increase in the near future due to a more intensive forest management and tree plantations.

According to a government survey for 2009-10 fiscal, agriculture, forestry and fisheries sectors continued to employ the largest workforce in the country. According to the first national-level household survey conducted by the Labour Bureau under the Labour and Employment Ministry (2010), out of 1,000 employed people, and 455 were working in agriculture, forestry and fisheries sectors during the period. Forestry work is in general physically demanding and, at times, dangerous. Additionally, high-energy food provision, health, medical and other services for forestry workers are often poor. All these, and many other deficiencies, point to the need for greater awareness, training, and extension in forest ergonomics.

Elements of ergonomics:

Ergonomics consists of two major elements, namely:

Technical part- concerning the practical aspects of optimizing workplaces, machines, tools, etc., often called 'Applied ergonomics'

Human part-concerning the description and knowledge of physical and psychological characteristics of man, e.g. in terms of measures, reactions, needs, capacities and limitations.

The main objective of all ergonomic efforts is to fit the forest work to man's needs, capacities and limitations by adjusting the technology and organization of work or to adjust man to the job, through proper training, information and the provision of adequate food, health services, etc. In evaluating whether or not a job task is acceptable from an ergonomic point of view, certain criteria have to be met. Examples of these criteria include:

- Safety (protection from being injured in a work-related accident);
- Health (absence of or protection from work-related diseases);
- Fatigue and discomfort (physical and mental workload should be adjusted to factors such as worker's age, sex, nutritional status and physical fitness);
- Security of employment;
- Work satisfaction (e.g. finding one's work useful or interesting; having opportunities to use and develop existing skills and to learn new skills on the job);
- Remuneration, social security and welfare;
- Efficiency (quantity and quality of output).

The most important of the above-mentioned criteria are safety, health and fatigue.

Affecting factors in forestry sectors:

Basically, there are two important factors which mainly affect the work performance of forest workers and productivity. (1) Biological and physical factors and (2) Technological and organizational factors.

Biological and physical factors:

In the category of biological and physical factors, which mainly affect the health of forest workers are climate (humidity, rain, snow, heat, cold, wind etc.), flora (trees and plants), fauna (animal and insect), microorganisms (fungi, bacteria, and virus), topography (altitude, slope and distance etc).

With these climate factors different hazards such as heat cramps, heat exhaustion, heat stroke, vibration white finger (also known as hand-arm vibration syndrome and dead finger), increased energy expenditure etc. occur which decline the work performance of forestry workers.

A large number of injuries also occur by harmful plants and woods such as itching, redness, rash, headaches and fever. Some times blisters and swelling will occur. With these, very common types of injuries among forestry workers are cuts, puncture, wounds, scratches or abrasions, due to touching or handling stinging plants, or plants which break into sharp splinters and edges or have thorns.

A number of animals are used in forestry for dragging and carrying loads, e.g. horses, mules, donkeys, camels, oxen, buffaloes and elephants. There is a great risk of accidents occurring if the animals are not treated with care. Only patient and calm persons with experience should be employed to take care of and work with animals. Even well- trained and good- tempered animals can be spoiled in a short time if treated badly by a nervous and unbalanced person, and may thus create dangerous situations.

Wild animals such as monkeys and apes can sometimes be dangerous, and their behavior is often unpredictable. They give nasty bites if irritated. There is a risk of infection in all animal bites, and there is also a risk of tetanus and rabies. Bites from even the most venomous snakes do not usually results in death. The mortality has been estimated at less than 10 per cent, mainly because the snake is very seldom able to inject the full dose of venom. Venoms from different snakes affect the victim indifferent ways, such as effect on the nervous system, on the circulatory system, destruction of RBC and disturbances of blood clotting. Snake bites normally occurs the limbs, especially on the feet and legs. Scorpions rarely cause death, nausea, vomiting, abdominal pain, shock, convulsions and sometimes coma.

Technological and organizational factors:

Second factor is technical and organizational factors such as machines, tools, equipment, material, methods, techniques, organization, management, noise vibration, gas, smoke, chemical solvents, lighting, ventilation drought, workload supervision etc. which generally produces pollution, whole body vibration, increased heart rates, hearing impairments, hearing loss, raised blood pressure, increased pulse rate, Constriction of capillary blood vessels, increased muscular tension and dilation of pulse rate, irritation etc. Some types of harmful substances such as smoke, dust, chemical solvents etc. produce allergic reaction, toxic effects, respiratory diseases and cancer.

Harmful effect on the forestry workers:

Occupational injuries, infective diseases, fatigue, discomforts, low motivation, mental stress are major hazards which are produced in forestry workers.

Costly effects on production:

Accidents, labor turnover, inefficiency, low productivity are the result of biological and technical factors in forestry sector's production.

Measures at the national and enterprise level to reduce occupational health hazards in forestry sector.

To promote and facilitate daily occupational health and safety at work and the application of the ergonomic concept, measures have to be taken by a number of concerned parties and institutions. They must be taken both at the enterprise and the national level, as well as the international level.

Measures at the national level:

At the national level, the measures to be discussed are those which are planned and controlled by parties or institutions outside the enterprise and which have a general function in the society, such as laws and regulations, institutions for education, training, research and extension, governmental bodies e.g. Ministry of Labour, Ministry of Health, health and safety inspection services, trade unions and safety associations.

Formulation of laws and regulation:

Laws and regulations should provide a foundation and framework for preventive measures against occupational accidents and diseases. Examples are mandatory prescriptions concerning such matters as general working conditions, the design, construction, maintenance, inspection, testing and operation of machines and equipment, the duties of employers. Inspection systems will also be necessary for the

enforcement of mandatory laws and regulations.

Establishment of safety associations and accident insurance institutions:

Safety associations are examples of institutions outside a company. These could handle ergonomic and safety matters that are of general interest to the industry, but which are expensive or difficult for a small enterprise to handle as regards standard and number, such as training resources, information material, etc. The safety associations could be financed, for example, from membership fees or through deduction of a percentage from compulsory accident insurance. Accident insurance institutions can play the role of motivator and financial body of safety and health measures.

Establishment of manufacturers, dealers and testing institutions:

Manufacturers, dealers and testing institutions of forest machines, tools and equipment should be mentioned as parties with a major impact on ergonomic conditions in forestry practice. Their involvement in ergonomic activities and projects has given very good results in some industrialized countries. Safety and comfort standards for tractors and chainsaws and the development of personal protective equipment have, for instance, improved considerably.

Provision of education, vocational training and extension:

Basically, education, training and extension are channels for sharing knowledge which is necessary to spread existing ideas, and also to generate new knowledge through research. The relatively rapid return on investment is a good reason for giving high priority to training in ergonomics.

The following broad levels of basic education are usually distinguished:

Vocational level:

practical training of forest workers, machine operators and forest farmers - at vocational schools and in special courses for foremen and other people directly organizing and leading others.

Technical level:

training of rangers, technicians and supervisors at technical schools and in courses.

University level:

professional education and postgraduate studies for

people to be engaged in teaching, research, administration, design or management work, with responsibility e.g. developing and organizing practical work in large enterprises and organizations at universities and colleges.

A factor to be considered in the training is the influence that the students will have, in their future occupations, on essential factors in their own and other people's working environment.

In many industrialized countries, a considerable amount of ergonomic research has been carried out in various forestry activities for a long time. New legislation and stronger demands from employers as well as workers have further increased the amount and quality of ergonomic research and the application of its results. Examples of ergonomic problems where research efforts have been particularly significant are: causes of occupational accidents and their prevention in terms of technical measures (tool and machine design and function, personal protective equipment, etc.), organizational and administrative measures (payment systems, job rotation, etc.) and behavioral measures (training, information, motivation, etc.) chainsaw-related problems (noise, vibration, exhaust emission, etc.), epidemiological studies on specific occupational health problems, and rehabilitation and prevention of occupational diseases.

Examples of research carried out in various disciplines are:

- Technical research including investigations into the properties and characteristics of harmful materials, machine guards, design of machines etc.
- Medical research including, in particular, investigations of the physiological and pathological effects of environmental and technological factors and physical circumstances conducive to accidents.
- Psychological research, *i.e.* investigations of psychological patterns conducive to accidents, motivational aspects, stress reactions, etc.
- Statistical research concerning occupational accidents.

Measures at the enterprise level:

Technical measures:

There are a number of alternative or supplementary measures which may be taken when facing an ergonomic problem in production:

- Take away the danger from man.
- Take man away from the danger.
- Enclose or isolate the danger.
- Enclose or isolate the worker.

Appropriate technology:

During the last 10-15 years expressions such as "basic technology" and "appropriate technology" have become common in discussions regarding choice of technology for different forestry operations, particularly in developing countries. In particular, the transfer of a too-sophisticated and capital-intensive technology from the industrialized countries has been criticized.

According to a (FAO, 1982) document, "the technology should be 'appropriate' with regard to local conditions and to the combined effect on: production, quantity and quality, employment, ergonomics, occupational safety and health, socio-economic conditions, ecology, energy, availability of tools and equipment."

Personal protective equipment (PPE):

When all possible efforts to eliminate or control safety and health hazards at work have failed, the use of PPE must be considered. PPE plays an important role, particularly in the forest.

Behavioural approach:

Propaganda and persuasion:

Motivational campaigns, competitions, posters, etc. are examples of approaches to safety which are frequently used. As with all propaganda, it is difficult to assess how long the effects will last. Usually there will be a decrease in the rate of accidents, but the improvement may only be temporary. This does not mean, of course, that the method is unimportant - quite the contrary. A motivational campaign must, however, go beyond simply telling the worker to work safely - for example, by ensuring safer work practice and activating the workers so that they make proposals as to how to improve the working environment.

When using the approach of propaganda and persuasion, it is necessary to do so on a continuous basis. Old, faded, dusty posters on safety matters may have the opposite effect on the workers as they realize that safety is not given much attention by the management.

Organizational measures:

Organizational measures concern, for example, production planning, remuneration system, supervision, inspection and enforcement of mandatory regulations.

Prevention of accident risks through organizational measures is not effective if not well planned. In Sweden, for instance, the introduction of new safety regulations on felling, prohibiting the workers from using some very dangerous methods (e.g. methods of taking down hung-up trees), did not significantly increase the use of less

hazardous methods. A study showed that the main reason for this result was that the forbidden methods were considered to be faster and demanded less physical effort. Saving time was equated with better earnings, because at that time the piece rate system was applied. The accident rate decreased, however, when a new wage system was introduced based on time worked, which encouraged the workers to use safer working methods and to help each other in hazardous situations, e.g. when taking down hung-up trees.

The traditional approach of accident prevention has been focused merely on the worker himself, overlooking the importance of all the other contributing factors in the working environment.

Occupational health and safety organization:

Safety measures in any enterprise should, as a principle, be part and parcel of the normal operations and should therefore not be handled as something separate.

Objectives of occupational health and safety work:

The overall objective is to promote and maintain the workers' health, safety and well-being. To succeed in this, it will be necessary:

- To identify the hazardous factors in the working environment which constitute a threat to the workers' safety and health.
- To analyze the hazardous factors, how the workers are affected and how to prevent the effects;
- To analyze the preventive measures to be taken to ensure that no new risks are introduced;
- To implement the needed improvements;
- To inform all concerned about risks and prevention; and
- To check thereafter that the measures taken have had the intended effect.

Occupational health services:

It is important, particularly in the forestry sector, for workers to have access to a company health service as they work in areas usually without (or with very poor) medical services.

The following broad functions may be mentioned:

Surveillance of the working environment, which also implies that the occupational health services should:

- Carry out monitoring of workers' exposure to special health hazards, when necessary;
- Supervise sanitary installations and other facilities for the workers, such as drinking water, canteens and living accommodations, when provided by the

employer;

- Advice on the possible impact on the workers' health of the use of technologies;
- Participate in and advise on the selection of the equipments necessary for the personal protection of the workers against occupational hazards;
- Collaborate in job analysis and in the study of organization and methods of work with a view to securing a better adaptation of work to the workers;
- Participate in the analysis of occupational accidents occupational diseases and in accident prevention programmes.

Surveillance of the workers health, which may include:

- Health assessment of workers before their assignment to specific tasks which may involve a danger to their health or that of others. The physical and mental capacity of the worker should be compared with the job requirements so as to facilitate a successful placement of the worker.
- Health assessment at periodic intervals during employment which involves exposure to a particular hazard to health, for example regarding loss of hearing, lung symptoms or other diseases related to the job in question. Very young and old workers should be examined more frequently;
- Health assessment on resumption of work after a prolonged absence for health reasons for the purpose of: determining its possible occupational causes; recommending appropriate action to protect the workers; determining the worker's suitability for the job; needs for reassignment and rehabilitation; and
- Health assessment on and after the termination of assignments involving hazards which might cause or contribute to future health impairment.

Conclusion:

From the above review, it is evident that some work must be done prior to the implementation of ergonomics standards. Because of the general lack of knowledge regarding the benefits of ergonomic intervention, certain efforts must be made even prior to ergonomics legislation being passed. The public must be aware of ergonomic principles, and following these principles must become everyday activities both at work and at home. Health care professionals need to make patients aware of how ergonomics affect quality of life. Appropriate epidemiological monitoring should be performed, and the public should be kept aware of the magnitude of the problem.

Prevention of occupational health hazards in forestry sectors can be achieved by engineering controls and appropriate organizational arrangements. The first-mentioned aspect involves the whole working environment and deals with the ergonomic design of tools, workplace and equipment. The latter concentrates upon factors such as training, instruction and work schedule. The primary aim of ergonomic work design is the adaptation of the working conditions to the capacity of the worker. It is supplemented by a secondary way, which is based on the development of the person's capacity to the working requirements by training and vocational adjustments.

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REFERENCES

- Anonymous** (1999). *Statistical yearbook of forestry*. Official Statistics of Sweden, National Board of Forestry, Jönköping. ISBN 91-88462-40-4.
- Bostrand, Lisbet** and Frykman B. (1992). Introduction to ergonomics in forestry in developing countries, FAO Forestry Paper (100).
- ILO** (1999). Forestry, wood, pulp and paper. International Labour Office, Sectorial Activities Programme, Geneva, Switzerland.
- FAO** (2001). FAOSTAT Forestry Data. FAO Statistical Databases, Rome, Italy.
- Melemez, K.** and Tunay, M. (2010). An ergonomic evaluation on whole-body vibration of loading tractors in Turkish Forestry. Forest Engineering: Meeting the Needs of the Society and the Environment July 11 – 14, 2010, Padova, Italy.

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