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Аннотация

ОСОБЕННОСТИ ЭРГОНОМИЧЕСКОГО ПРОЕКТИРОВАНИЯ РАБОЧИХ МЕСТ МАШИН ЛЕСОТЕХНИЧЕСКИЙ ОТРАСЛИ
Дяченко В.Ю.

В работе представлены теоретические и практические основы проектирования рабочих мест машин лесотехнической отрасли, позволяющих создавать оптимальный рабочее пространство для работающего оператора и позволяли бы ему выполнять все необходимые движения и перемещения при эксплуатации и техническом обслуживании машин и механизмов.

Abstract

DESIGN FEATURES ERGONOMIC JOBS OF MACHINES FORESTRY
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The paper presents theoretical and practical basis for designing jobs Forestry machines industry, which would allow to create optimal work space for the operator and worker would allow it to perform all the necessary movements and moving the operation and maintenance of machines and mechanisms.

CARBON DIOXIDE, FORESTS, AND THE KYOTO-PROCESS

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The questions and tasks of IPCC was considered in order to review all available scientific, technical and socio-information pertinent to the topic of climatic change

Actuality. A possible fast climatic change has become an important issue of scientific discussion (e.g. Anonymous 2012a, Kohl & Kühr 2014). In view of the very complex interactions between the anthropogenic emissions and the climate of the world and in order to avoid too much controversial discussions within the scientific community and to provide solid information for the necessary political decisions, the WMO (World Meteorological Organization) and the UNEP (United Nations Environment Programme) established in 1988 the IPCC (Intergovermental Panel on Climate Change; http://www.ipcc.ch/index.html).

Research purpose. The task of the IPCC is to review all available scientific, technical and socio- economical information pertinent to the topic "climatic change" which is lished in the peer-reviewed literature and to reveal the results in form of reports. The first report appeared in 1990 (Houghton et al. 1990, Tegart et al. 1990) and served as the scientific basis for the Rio-Conference in 1992 where the Agenda 21 was passed by the governments of the world. There is now an almost unanimous agreement in the scientific community that the increase in carbon dioxide concentration of the atmosphere is mainly responsible for the observed global increase in the temperature of the earth and that the global warming has to be reduced or at least the increase to be stopped (Forrest 2015).

Exposition of basic material. The Rio-Conference was followed up by several other conferences in which special problems were discussed. The conference in Kyoto (1997) focused on the greenhouse gas, especially the carbon dioxide problem. In the Kyoto-Protocol, the governments of the world agreed upon a massive reduction of the present greenhouse gas emissions. This protocol is now ratified by most of the governments of the world, except the USA, Australia and a few other countries. It is now in force as a law in the European Union (http://unfccc.int/essential_background/kyoto_protocol/items/3145.php).

The monoethanol aminecarbon dioxide complex, which is formed during this reaction, is then processed in such a way that the monoethanol amine is regenerated and the carbon dioxide is recovered. After the chemical isolation, the CO_2 is liquefied under a pressure of 110 bars (Anonymous 2003a).

The capacity of a typical power plant is about 600 MW. It produces about 500 t carbon dioxide per hour. For the absorption of this amount of carbon dioxide, about 16,000 m^3 of monoethanol amine have to be circulated. The carbon dioxide absorption reduces the efficiency of the power plant by 10-15 percent points (which in a modern plant with an efficiency of 50% corresponds to a reduction in the electricity production of 30%). The carbon dioxide absorption requires a doubling of the investment costs. The cost of the carbon dioxide production under such conditions is estimated to be in the range of 45 $/t CO_2 - this price has been declared as the target for a R&D (Research & Development) project on sequestering CO_2 from flue gases that is carried out at present by the Lurgi AG, Frankfurt, Germany (Plass 2014).

To summarise this concept of CO_2-reduction strategies, two points are very clear:

This option is pretty expensive. Howard Herzog from the MIT (Massachusetts Institute of Technology) in his closing words of the conference of the National Research Council of the National Academies of the USA in 2012 discussed final prices in the range between 100 and 200 $ per ton of sequestered carbon or 30 – 60 $ per ton of carbon dioxide (Herzog 2016).

The best what can happen to the sequestered carbon dioxide is that it stays at the place where it is finally stored. It will be not useful for anything else.

The potential of afforestations for carbon dioxide sequestration is presented in Table 1. Under European conditions, fast growing tree species like willow (Christersson 1986), poplar (Heilman & Stettler 1984) or grand fir (Kramer 1984), produce about fifteen to twenty tons of round timber per ha. This amount of timber is equivalent to 27-36 tons of carbon dioxide. In addition to this sequestration in the form of timber, a stand absorbs much more carbon in the form of leaves, twigs and humus. A balance of the total carbon dioxide binding was made for an afforestation project financed by the World Bank in the frame of the Prototype Carbon Fund (Brown et al. 2002). From these data it is obvious that an afforestation with fast growing tree species has a much higher efficiency in carbon dioxide sequestration than annual agricultural crop plants could ever have (see also Chapter 4 of this book). The question which then arises is: How much land would be available for such afforestations without impeding the production of food and fodder?

At present, about 26 billion tons carbon dioxide annually are worldwide emitted. To sequester this amount by afforestation, one would need 480 million ha tropical dry forest or 3 billion ha desert area, given the present values of biomass production for the different regions. In the last century alone, about 1 billion ha of land has been severely degraded by converting tropical forests into not very fertile agricultural soils which eventually lost their fertility. During the same time, the Sahara desert has spread by about 100 km to the south which converted an area of about 520 million ha land into a desert. In addition, massive soil degradation has taken place owing to inadequate agricultural techniques which afflicts about.

1.1 billion ha land (Lal 2015) in view of the modern afforestation techniques, which will be outlined below, there is no reason to believe that these degraded soils cannot eventually be afforested again (see also Chapters 3 and 4 of this book). Although the success of Keren Kayemeth LeIsrael with regard to desert afforestation is really stunning, not all stands are suitable for the techniques the Israelis are using. Also, not for every stand a suitable novel tree can be found which is able to grow on it right away. However, we discovered that stands where trees fail to grow in many cases can be afforested with the help of hydrogels

Hydrogels in general are by now an almost integral part of our modern culture. They are the ”miracle substances” in the diapers which keep the babies dry for the whole night. Hydrogels are crosslinked polyacrylates of very high molecular weights. These substances very fast bind water, up to 400 times their weight. This rapid and reversible absorption of water will take place also when the hydrogel is dispersed in soil. When the soil starts to dry out, the water which is stored in the hydrogels is helping the plant to survive the drought (Hüttermann et al. 2015)

The most comprehensive field experiments with hydrogels so far have been conducted by Prof. Ma Huancheng, Southwest Forestry College Kunming, in the eroded areas of the drainage basin of the upper Jangtze river in Yunnan, China. The survival of the plants treated with hydrogels was twice as high as of the plants cultivated without the hydrogel. An amendment of the soil in the plant hole with 40 g hydrogel was enough for the survival of the trees. These results were confirmed in the meantime for other tree species in other parts of the hot dry valleys (Ma & Nelles-Schwelm 2016 Based on the results of the afforestations employed so far, it is now planned to until 2010 afforestate several hundred thousand hectars of degraded lands all over China (Ma, personal communication).

The Kyoto-Protocol includes afforestation and the subsequent use of the wood as a sink for reducing the carbon dioxide content of the atmosphere. Thus, a "pure" afforestation could lead to a profit, if the carbon dioxide which is bound in the standing timber could be certified and these certificates sold accordingly.

Fig. 1 shows that the price for the ton of carbon dioxide sequestered by afforestation is a clear function of time. The longer the forest is allowed to grow, the lower the price for carbon dioxide sequestration will be. This is true, however, only for the first 20 years of stand age. Owing to the imputed interest – in this calculation set to 5% - the prices increase again after 20 years.

A comparison between the development of the price for carbon dioxide and the net discounted revenues for afforestations reveals that only under Chinese economical conditions it will be possible to grow forests exclusively for the purpose of carbon dioxide sequestration.

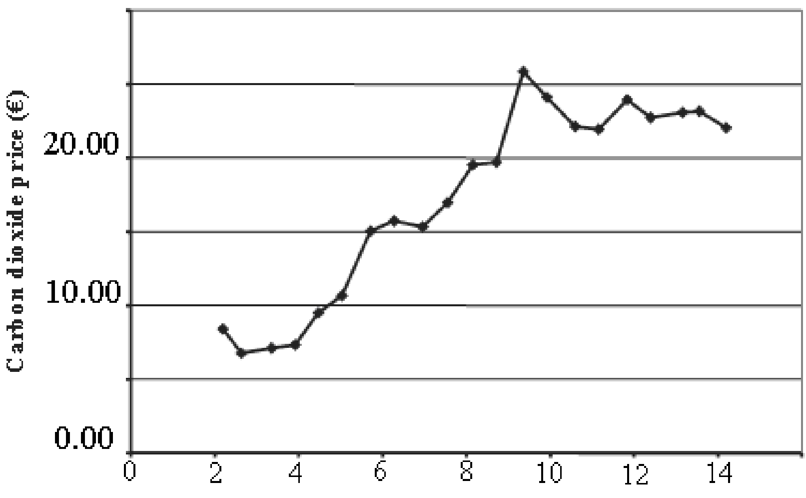

Figure 1 – Development of the price for carbon dioxide at the European Energy Exchange, Leipzig

(http://www.eurexchange.com/about/company_info/subsidiaries/sub_eex.html)

For “Third World” countries, meaningful participation in the Kyoto-Process would be to establish a sink for carbon dioxide via afforestation with subsequent conversion of the biomass to electrical energy and/or liquid fuel.

This approach would indeed result into a double income from the produced timber: first from the sale of the product and second for the carbon dioxide sequestration. The return of such a venture would be about 240% annually with regard to the invested capital (Fig. 2).

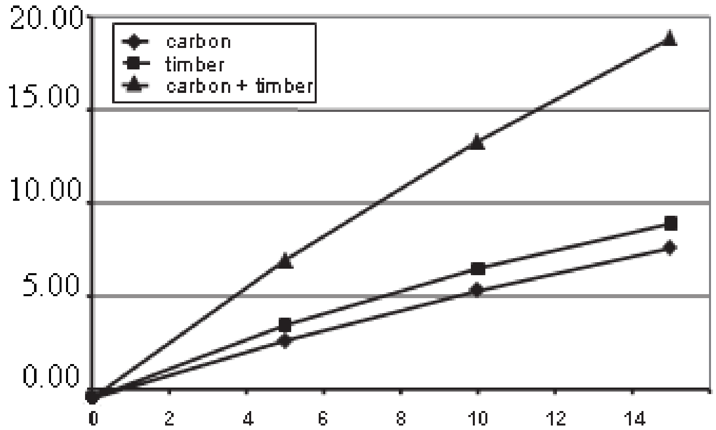

Figure 2 – The following options exist for utilising the such produced timber in a way that is compatible with the Kyoto-Protocol and certifying process.

Conversion of the wood to charcoal: In the Prototype Carbon Fund project: “Plantar Sequestration and Biomass Use” (De Ferranti et al. 2002), it is planned to plant in Brazil 23,000 ha of high yield clones of *Eucalyptus* spec. in order to produce charcoal for the pig iron manufacture.

Conversion of biomass to chemical feedstock and synthetic fuels: The conversion of wood to diesel or methanol is the most efficient way to produce chemical fuels from biomass. A small plant would require about 300,000 t of timber per year to produce 150,000 tons of methanol or 75,000 tons of diesel oil (Plass & Reimelt 2007; see Chapter 6 of this book)

Burning at high temperatures in high-tech furnaces to process either cement, lime, tiles, ceramics, or ore: An average German cement plant needs about 1.4 x 106 GJ energy per year. To supply this energy via afforestations, one has to produce about 366,000 t of dry woody biomass per year (Marton & Alwast 2002).

Conclusions

An afforestation in “Third World” countries as depicted above with subsequent conversion of the major part of the biomass to fuel would be beneficial to the world in several ways:

Carbon dioxide would be removed from the atmosphere.

Fossil fuel would be substituted with commodities from renewable resources.

The project would be a model for a sustainable economy. It would show that it could be possible to establish a sustainable world economy without drastically changes in the machinery which is needed for our present way of life.

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Анотація

ПРОБЛЕМА ВУГЛЕКИСЛОГО ГАЗУ ТА ЛІСНИХ МАСИВІВ В КОНТЕКСТІ КІОТСЬКОГО ПРОТОКОЛУ

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В статті розкриваються проблеми кліматичних змін, на яку опирається програма дослідження оточуючого середовища ООН 2016 року та Кіотський протокол а також проблеми регуляції вуглекислоти в лісних масивах Європи та Північної Америки.