

WOODLAND BELTS AS A SOLUTION TO MITIGATE THE CLIMATE CHANGE**G. Babur-Caratelli¹, O.A. Pasko²**¹ *University of the Netherlands;*² *National Research Tomsk Polytechnic University, Tomsk Russia***Introduction**

The climate change that we experience nowadays is mainly caused by humanity's massive use of the primary energy sources, which we call fossil fuels. When we burn coal, oil and gas to move vehicles, heat buildings and produce electricity, the combustion process produces the greenhouse gas –carbon dioxide (CO₂) that is emitted into the atmosphere. The rising concentration of CO₂ in the atmosphere is the main, though not the only, source of human-induced climate change [7]. The humanity is causing changes that are large, serious and highly disruptive.

Climate change affects every part of the planet, and there is no escaping from its severity and threat. The solutions on climate change are inherently complex. There is no one action, one technology, which would solve the problem by now. Therefore, the solution also should be complex. The reduction of human caused greenhouse gas emissions should go along with development of technologies for CO₂ recycling and practical solutions, which could forward the natural vital processes to reduce the excess of carbon dioxide in the atmosphere.

The challenge we met in our work is to align existing anthropogenic systems (sources of large volumes of carbon dioxide) with other systems in the web of life. The later intends the circular "breath of life" (metabolism), when waste from one system becomes food for another system and so on. In any case, our long-term survival is possible only on support and cooperation with nature [5].

The large "customers" of atmospheric carbon dioxide are forests. The famous international agreement on climate change, the Kyoto protocol [9], supports replanting trees or establishing new forests [6]. Yet we are losing forests. Over the past 50 years, about half the world's original forest cover has been lost.

In our work, we propose as easy and flexible alternative to new forests, which for one reason or another cannot be planted. We propose to plant woodland belts, which, together with existing forests, will help to mitigate the climate change on our planet.

"Breath of Life" of Live Systems

All live and dead organisms in nature have so-called "breath of life" (metabolism) through the network of chemical reactions. This provides the continuous flow of energy. All systems produce waste, which becomes food for other systems. Building ecologically sustainable societies is possible, when material and social structures do not interfere with nature's inherent ability to sustain life.

We cannot imagine our life without technology. The anthroposphere (sometimes also referred as technosphere) became a part of the environment made or modified by humans for use in human activities and human habitats. "Breath of life" of modern people is not limited by the breathing and digestion processes of human-beings. The "breath of life" of anthropogenic systems includes "exhalation" of large volumes of CO₂ due to the fossil fuel use etc. The anthropogenic waste (carbon dioxide) is used for metabolism of other systems (for example, by forests, swamps, oceans); any growing biomass absorbs carbon dioxide. The problem is that the amount of CO₂ emissions produced by anthropogenic systems are so large that it cannot be completely digested by other systems and, therefore, accumulates in the atmosphere. The result is known: it is the climate change with all the consequences.

The direct solution for decreasing CO₂ in the atmosphere is the increase of biomass (plant or plant-based materials). And the most natural effort for the biomass increase is planting trees, because trees absorb carbon dioxide and emit oxygen. The opposite process (oxygen absorption and carbon dioxide emission by trees), is much more imperceptible.

On planting trees there might be two obstacles. The first is the popular statement that once trees die, almost all the carbon that they stored up in their bodies is released again into the atmosphere. In principle, it is true, if trees are burned. However, wood burning is not a natural process, not all trees are burnt. A more natural process is when wood decays into organic substances, which are fertilizing new plant. As an example, many trees are dying in swamps, but swamps are famous as a carbon sink. In addition, it is revealing that the map of forests on our planet is highly correlated with the maps of CO₂ distribution in the atmosphere. The higher density of forests, generally, corresponds to the lower concentration of CO₂.

The second obstacle limiting planting large amounts of trees (forests) is that the anthroposphere tends to take land from nature for its own use in agriculture, industry, as habitat etc., but not to give it back to nature. However, the solution exists. Our paper proposes an easy alternating for forests, which can be embedded and successively used in the anthropogenic structures. This alternative is called woodland belts.

Woodland Belts

Woodland belts (forest belts) are protective forest plantations, consisting of two or more rows of trees and shrubs, situated among croplands, pastures, orchards, along roads, irrigation and navigation canals, railways, on the slopes of ravines etc. [5]. When woodland belts are designed, first of all, less valuable land is selected.

Russia has ratified the Kyoto Protocol and received the new economic mechanisms. Due to this, woodland belts reveal two important functions:

1. Binding of CO₂ for reduction of the greenhouse effect.
2. Compensation of the industrial CO₂ emissions.