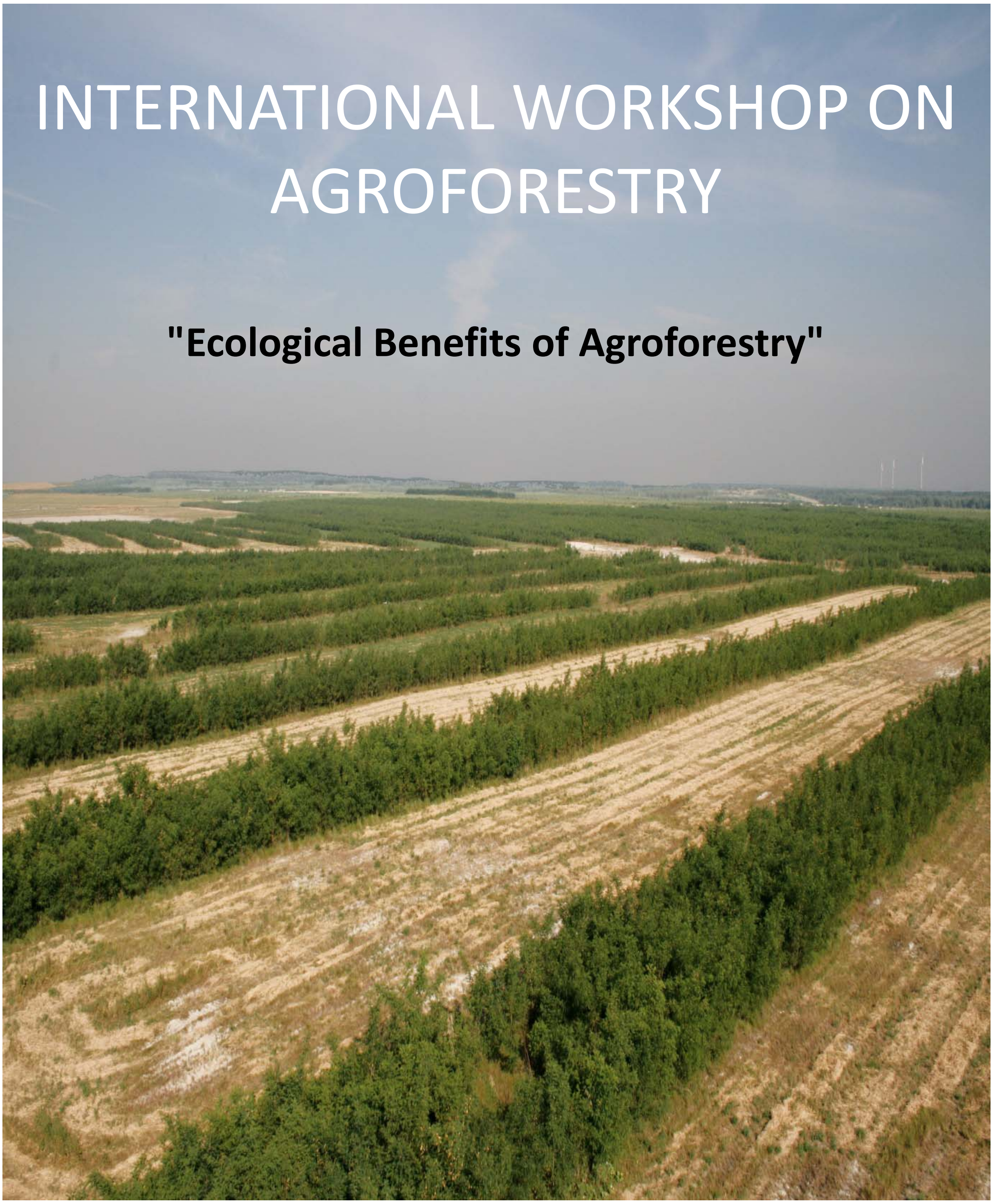
INTERNATIONAL WORKSHOP ON AGROFORESTRY

"Ecological Benefits of Agroforestry"



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Yield-transpiration relations of bioenergy crops:
How can we optimize water use in agroforestry systems under climate variability?

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Climate variability and drought periods will increase in the next decades as a result of climate change. In southern Brandenburg the cultivation of short-rotation plantation and and new bioenergy crop for biomass production will be an alternative land-use for marginal lands. The area is characterized by recultivated former open-cast mining with low nutrient content and limited ground water resources. As the availability of water influences also the biomass production significantly, a central role is played by the optimisation of these processes through the species selection. As an early successional and nitrogen-fixing tree species black locust (*Robina pseudoacacia*) has been already successfully used for land reclamation and biomass production in southern Brandenburg. The Giant Knotweed, Fallopia *sachalinensis.)* is a new bioenergy crop and is characterized by a high annual biomass production and can be harvested 2-3 times during the growing season.

Under water limitation the understanding of the governing processes of an efficient water use in agroforestry systems is important to develop a growth models for predictions of biomass production under various water regimes. For the determination of yield-transpiration relations at whole plant level we developed a new wick lysimeter system, which allows us to study plant growth under controlled water regimes (well-watered, moderate, drought). The lysimeters are filled with sandy loam. Water is supplied by an automatic drip irrigation system and water amounts are controlled by the actual evapotranspiration and water demand of the plants. Transpiration is calculated on the basis of water input, storage and drainage in daily intervals.

Photosynthesis is the essential process for biomass productivity. CO2 uptake and water loss is controlled by the stomata on the leaf level. Environmental stress effects this physiological process. Therefore, the ecophysiological response of the plants to different soil water availability will be investigated by using a portable gas exchange system with a minicuvette system.

The soil-plant-atmosphere processes as well as the ecophysiological plant performance obtained from the experimental water balance and the gas-exchange measurements will be integrated into a physical-based ecological model (CoupModel). After the model calibration and validation, yield crop modelling under different environmental scenarios will be performed.