

SURUMER - Sustainable Rubber Cultivation in the Mekong Region Development of an integrative land use concept in the Chinese province Yunnan

Sub-project 3: Development and implementation of a strategic water management system for a rubber dominated catchment area

Rubber monocultures have various impacts on the water quality of rivers and streams. In rubber plantations, the undergrowth between trees is regularly removed, either manually, mechanically or by the application of herbicides. This results in increased erosion, in comparison to forested areas, allowing top soil, fertilizer and pesticides to be washed into surface water bodies. Rubber tree fertilization is age specific and pesticide use is handled on a seasonal and case specific basis. Nutrients and pesticides can also reach surface waters via groundwater.

Intensive rubber cultivation also has a direct impact on peoples' lives. With regards to surface waters, some ecosystem services that are affected include, for example, drinking water supply (negatively influenced by fertilizer and pesticide use) and fisheries (habitats are damaged due to increased erosion). A management scheme focused solely on rubber cultivation to directly ameliorate ecosystem services falls short of the mark: Settlements in which the plantation workers live, usually established in the vicinity of the surface waters, and the associated activities such as agriculture, livestock farming, fisheries and wastewater disposal result in further impacts on the ecosystem services.

Surface water management based on clear goal formulation for the desired ecological status and obtained through environmental evaluation methods and checklists and on the evaluation of specific criteria of the surface water quality will result in the water quality and living situation being more purposefully, more effectively and more sustainably controlled than with the current management methods.

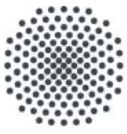
The objective of the sub-projects is to develop a water management system that supports local decision makers, in both the collection and evaluation of the current surface water status and its link to ecosystem services as well as to evaluate measures and their expected impact on water quality and the associated ecosystem services. For this purpose a monitoring station in the catchment area will be established which will monitor the condition of the waters and ecosystem services. Various mathematical models will be used to represent and evaluate their statuses. Measures, with potential impacts on the water quality, will be cataloged and assessed with mathematical models. Checklists support the decision maker with the selection of measures. The true efficacy of the measures can be verified by monitoring and the model can be calibrated with the results, and the checklists updated. The management system will be designed so

that the checklists support the decision-making. The mathematical models will be used by experts to evaluate additional measures, such as alternative land uses or cultivation methods. In the framework of this research project, the focus is on ecosystem services which have a direct link to surface waters and are influenced by rubber cultivation.

The investigation area in the south Chinese province of Xishuangbannah/Yunnan is characterized by a multitude of diverse land uses. Tropical secondary forest is situated beside rubber monocultures, rice, tea, banana, corn, pineapple and other crops. The cultivation of such diverse crops naturally leads to the application of various pesticides as well as fertilizers. A monitoring system shall be installed in the investigation area to monitor register the condition of the surface waters. The installed online-monitoring system will guarantee reliable monitoring of the various parameters 24 hours per day, 365 days a year. The online- monitoring system is supplemented with random sampling and measurement campaigns in which, among other things, the concentration of various pesticides is analyzed. A highly resolved monitoring system is necessary in the Naban catchment area in order to obtain accurate measurements around concentration peaks due to rain and other events, such as the flooding of rice fields to investigate if these short, intensive impact loads are possibly responsible for the majority of the water pollution.



Figure 1: Water monitoring in the study area
(Photo: Manuel Krauß)



In the investigation area the existing ecosystem services, which are influenced by rubber cultivation in connection with surface waters, will be determined. The ecosystem services will be non-monetarily assessed with help from the model results.

Based on various models, the status of the water will be represented and assessed. The evaluation is compared against reference waters that are not affected by rubber cultivation.

Part of the water management system is a catalog of measures. This includes not only measures on the rubber plantations, but also measures which could result in changes to the water quality and/or ecosystem services.



Figure 2: Land use in the study area. Rice terraces in the foreground - rubber plantations in the background (Photo: Manuel Krauß)

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