

# Preservation of Selected Ecosystem Services in the Floodplains of the Naryn River (Kyrgyzstan): Introducing the ÖkoFlussPlan Project

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The floodplain ecosystems along the Naryn River in Kyrgyzstan still show largely natural dynamics and represent a regional hotspot of biodiversity. For the local population, they provide important ecosystem services, such as the provision of firewood and pasture land, areas for recreation and protection against erosion. However, the intensive use of the forests endangers their persistence. In addition, several hydropower plants are a threat to the natural dynamics of the river system and its biodiversity. There is thus a conflict between energy supply for the local population, the development of the country through the expansion of hydropower, and the preservation of natural ecosystems and their biodiversity. Preserving the riparian forests along the Naryn River and creating sustainable alternatives for energy supply is the aim of the *ÖkoFlussPlan* project, which is funded by the Federal Ministry of Education and Research. This article summarizes the current situation in the Naryn region and gives an overview of the *ÖkoFlussPlan* project and its broader context.

## 1. Current situation in the Naryn Basin

In Central Asia, rivers and their floodplains are of great importance as they represent an important regional hotspot of biodiversity and provide relevant ecosystem services in the semi-arid to arid climate (Figure 1b). At present, the Naryn upstream from the Toktogul reservoir still has a completely natural discharge regime over a length of more than 600 km,

which ensures a high level of dynamics in the floodplain ecosystems (Figure 1a). This dynamic leads to a high biodiversity and a natural renewal of these ecosystems. Riparian forests provide the local population with relevant ecosystem services such as the provision of firewood or grazing land or protection against erosion (Unger-Shayesteh et al. 2013; Karthe et al. 2015; Betz et al. 2015). In the villages of the Naryn catchment, farmers have sheep,

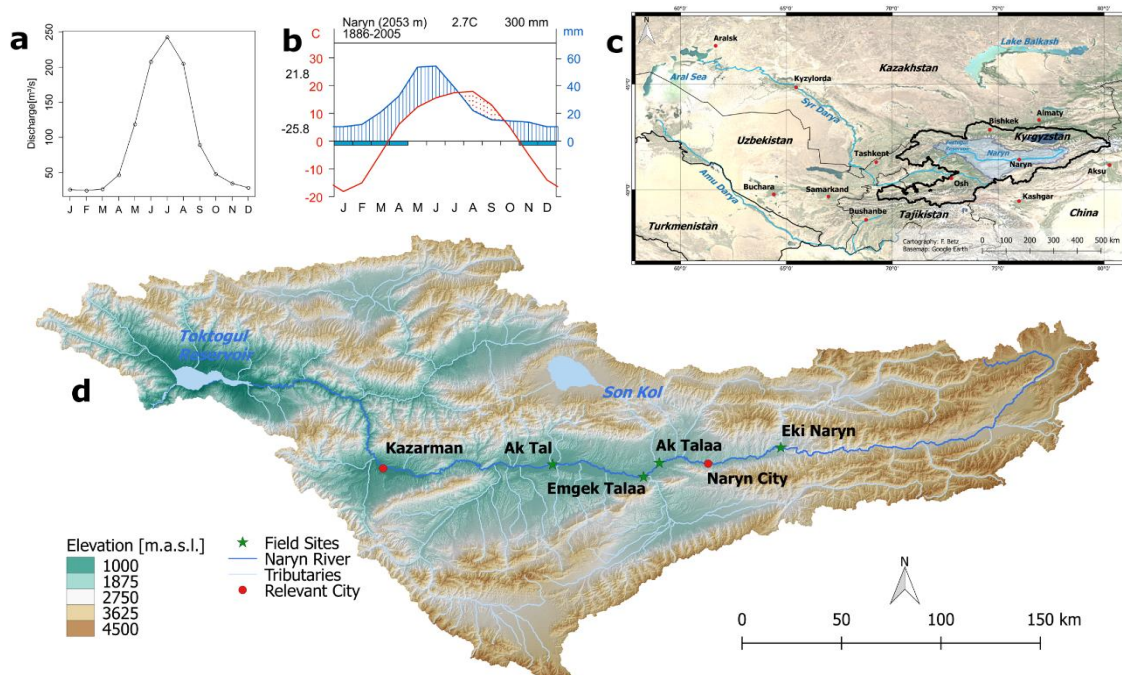


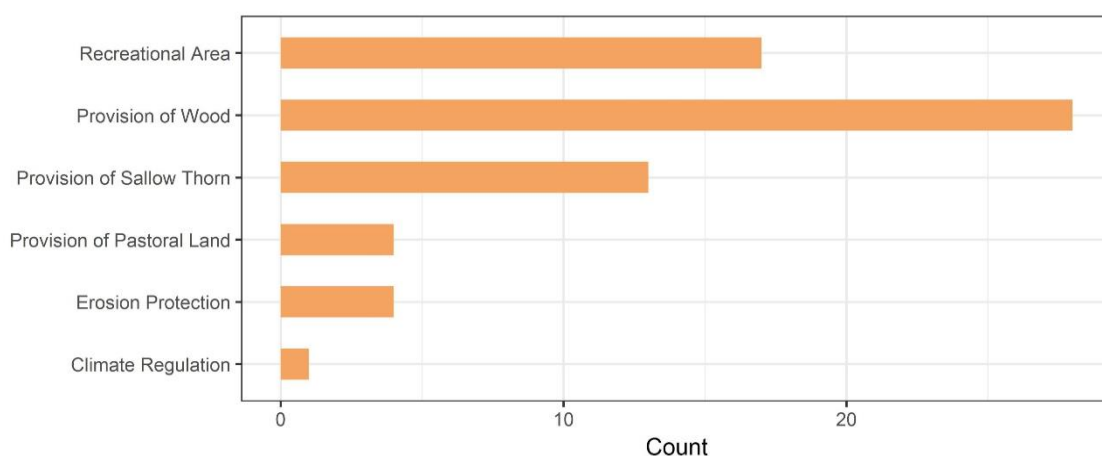
Fig. 1: The project region: the Naryn Basin in Kyrgyzstan.

cattle and horses for their own livelihood and as an important investment. Due to the high importance of livestock, large areas of pastoral land are required. The people themselves are also dependent on the natural resources of their immediate surroundings. The high level of dependency is mainly due to the transformation of economic and political conditions after the end of the Soviet Union (Schmidt 2014). With their rural character, the villages in the Naryn region are quite typical for Kyrgyzstan, a country where 66% of the population lives in rural areas (NSC 2018). Especially in these rural regions, people are existentially dependent on access to natural resources. Over 60% of the rural Kyrgyz population directly depend on natural resources for their livelihoods (UNICEF 2017). In a previous project<sup>1</sup>, the provision of ecosystem services by the Naryn riparian forests and their use by the local village population was analyzed. It was found that different services of the riparian forests are demanded by the local people. They collect the fruits of the willow thorn and use the forest areas as grazing grounds as well as for leisure activities. However, the provision of firewood for heating and cooking has a special role (Figure 2).

Although 99.8% of households in Kyrgyzstan have access to electricity, rural households primarily use non-sustainable biomass (firewood) and/or coal for heating, cooking and hot water preparation because of the low income, poverty and inconsistent electricity supply during winter (FAO 2016). The

cold climate is responsible for the long heating period of about six to nine months in the country. In that case, heating their homes is an essential need for the Kyrgyz population. The access to district heating is limited (19%) to the households of capital city Bishkek and a few urban areas. Instead, around 73% of rural households are dependent on traditional heating stoves that run on non-sustainable biomass or coal (Balabanyan et al. 2015). To save the heating fuel expenditure, rural households used to heat only one or two rooms during the winter season. Almost, 34% of rural population rely on solid fuels for cooking (United Nations Foundation 2018). The intensive use of these solid fuels for heating, cooking and hot water preparation contribute to indoor and outdoor air pollution (World Bank 2014). According to the Global Alliance for Clean Cooking Stoves, 1.9 million Kyrgyz people are affected by indoor air pollution. For this reason, about 4,500 people die annually in Kyrgyzstan (United Nations Foundation 2018). Consequently, the conventional use of firewood as an energy source must be classified as unsustainable from a social perspective as well.

In addition to these acute and health-damaging problems, the use of wood as firewood leads to a negative impact on the riparian forests. Studies have shown that natural forest regeneration takes place exclusively on sites with regular flooding (Rauschenberger 2016). There the high natural dynamics superimpose the human influence. However, the areas of the riparian forests where



**Fig. 2: Demand for ecosystem services in villages along the Naryn River, derived from the question "What do riparian forests mean to you?"**

Reference: unpublished result of F. Betz from EcoCAR<sup>1</sup> project.

<sup>1</sup> Project between 2014 and 2017: EcoCAR – Ecosystem Assessment and Capacity Building for Sustainable Management of Floodplains along the Central Asian Rivers Tarim

(Xinjiang/China) and Naryn (Kyrgyzstan). For further information see <http://fordoc.ku-eichstaett.de/2046/>

timber collection and grazing are taking place are predominantly located in higher situated areas without regular flooding. At these sites no natural forest rejuvenation has been observed (Rauschenberger 2016). The combination of grazing and above all timber extraction therefore endangers the long-term persistence of the riparian forests. Particularly affected are the old parts of the forest not regularly flooded anymore because the site conditions there limit natural seed germination and thus rejuvenation. This development contrasts with Kyrgyzstan's forest policy, which aims to increase forest cover in the country in view of climate change (Zholdosheva 2010).

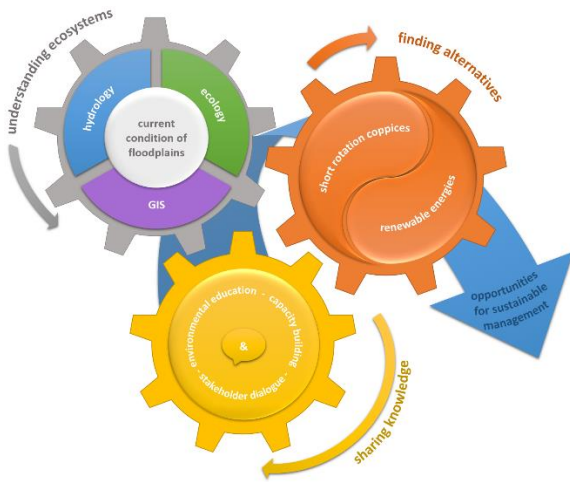
Despite the legal framework, the lack of availability and acceptance of alternative energy sources is causing further degradation of the riparian forests, contradicting the official objectives. Politicians are paying more and more attention to plantations of fast-growing trees, especially poplar trees, in order to relieve the remaining near-natural forests of the country and protect them from further firewood extraction by offering alternative fuelwood. At the beginning of 2018, a law was also passed to make it easier to rededicate less productive farmland. This change in the law allows the increased construction of plantations of fast-growing trees for short rotation forestry or as valuable timber plantations. In Central Asia, poplars are the most important agroforestry trees, especially in irrigated cultivation and in combination with vegetables and fruit growing. Research in recent years has shown that poplar windbreaks can reduce water consumption in irrigated agriculture (Thevs et al. 2017) and provide a significant source of income or resource as firewood for rural households. For this reason, poplars, especially in the south of Kyrgyzstan, are also increasingly cultivated in plantations.

To generate more electricity and to stimulate the economic development of Kyrgyzstan, the construction of a hydropower cascade of four new dams, already planned in Soviet times, has made progress in the last few years. It is expected that this cascade will significantly change the natural flow regime of the Naryn River. For optimal energy management, peak flows in summer will probably be reduced. On the contrary, during winter month, the natural low-water season, water will be discharged for power generation, resulting in peak flows even during the winter months. These changes are likely

to have negative impacts on natural floodplain vegetation, which is dependent on high dynamics (Poff and Zimmerman 2010). Due to the geological boundary conditions, just the section with the most extensive floodplain ecosystems would be affected by the modified discharge regime (Betz et al. 2016; Betz et al. 2018).

Currently, the construction of the cascade is suspended due to financing problems. However, due to the complex situation in Central Asia, the expansion of hydropower is a political goal of the Kyrgyz government. The completion of the Naryn cascade is therefore to be expected, even if the time horizon is currently uncertain. Recently, a private investor also started planning a hydropower plant in the central part of the Naryn Basin.

In the short term, riparian forests with their biodiversity and ecosystem services are under pressure from the overuse of wood resources. In the long term, the construction of the dams could cause further significant impairment. A solution for a comprehensive, sustainable management of the floodplain areas, considering ecological as well as economic and social sustainability, is not yet in sight. Although the experiences from the previous project show that Kyrgyz decision-makers have a keen interest in sustainable nature conservation, it is clear, particularly in the context of floodplains, that the highly sectoral nature of the Kyrgyz authorities is not able to offer comprehensive solutions. This sectoral character still characterizes the Kyrgyz science as well; accordingly, inter- or even transdisciplinary projects on the sustainable use of ecosystem services have hardly been carried out in Kyrgyzstan up to now (Shigaeva et al. 2013).



**Fig. 3: Transdisciplinary approach to elaborate integrated solutions that will provide opportunities for sustainable management of natural riparian forests.**

Previous projects also showed that Kyrgyz scientist are very interested in modern approaches in research on human-environmental relations. However, it also became apparent that further work would require the generation of broad basic data from both the socio-economic and ecological fields. In addition, the training of (junior) scientists is crucial for the sustainable implementation of management recommendations and the monitoring of their effects on environmental development.

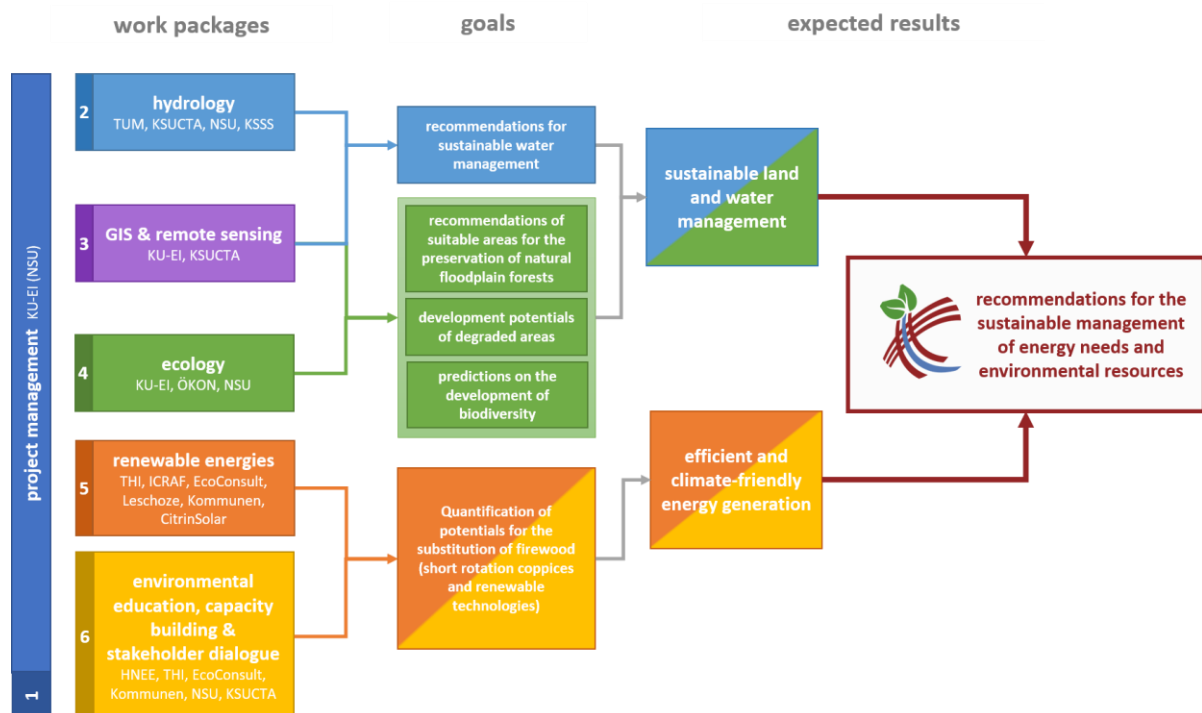
The ÖkoFlussPlan project addresses the existing

deficits and uses a transdisciplinary approach to find comprehensive solutions for the sustainable protection of the riparian forests along the Naryn River, taking into account the ecology as well as the well-being of the local population and economic development. Such a comprehensive approach has not yet been developed for the Naryn region. In particular, the interlinked view on energy production and the protection of ecosystems has not yet been realized despite the close connection of these topics. Another innovative aspect is the focus on renewable energies and efficient energy use beyond hydropower, which, although CO<sub>2</sub>-neutral, is a significant disturbance of natural riparian forests. Therefore, the proposed transdisciplinary approach formulated in the framework of the project ÖkoFlussPlan can significantly contribute to the research gap.

## 2. ÖkoFlussPlan Project

The project is divided into three major areas and six work packages (Figure 3). The overall objective is to preserve the riparian forests along the Naryn River and to offer and implement sustainable solutions for the local population.

For this purpose, the riparian forests are mapped and their condition assessed in order to identify areas especially worthy of protection and to identify potentials for development. In order to reduce the threats to the forests, alternatives for timber



**Fig. 4: The work packages with partner institutions, goals and expected results.**

extraction from the riparian forests are also being developed. For this purpose, short-rotation plantations are established, which can substitute the wood from the forests. The preservation of the natural forests through the plantations will also contribute to a reduction of CO<sub>2</sub> emissions. On the other hand, modern renewable technologies (i.e. solar thermal system, solar PV system etc.) are used for the sustainable energy production and efficient energy use. A close dialogue with the local population should ensure that, on the one hand, existing local knowledge is integrated from the beginning and, on the other hand, that the results of the project are communicated. In addition, an intensive exchange with local decision-makers is being targeted and existing projects of the Kyrgyz authorities for the protection of the riparian forests and for the efficient use of energy in the villages are being linked up. In addition, training of young scientists in modern methods of environmental analysis aims to encourage long-term monitoring of the development of the riparian forests along the Naryn River. The results of the overall cooperation are thus the implementation of short-rotation plantations and the installation of demonstration systems for the production and use of renewable energies. In addition, the development of management recommendations for a comprehensive, sustainable management of environmental resources and energy needs is a further result of the overall project (Figure 4).

### Fast facts on the project

**Project title:** ÖkoFlussPlan – Preservation of Selected Ecosystem Services in the Floodplains of the Naryn River (Kyrgyzstan)

**Project duration:** 01.08.2019 – 31.07.2022

**Funding:** Federal Ministry of Education and Research (BMBF), Germany - CLIENT II – International Partnerships for Sustainable Innovations

**Project lead:** Catholic University Eichstaett-Ingolstadt, Applied Physical Geography and Floodplain Institute

#### Partners:

- Technical University Munich
- Ingolstadt University of Applied Sciences
- Eberswalde University for Sustainable Development
- ÖKON Ltd. – Association for Landscape Ecology, Limnology, and Environmental Planning and Hydrobiology, Kallmünz
- CitrinSolar Ltd. - Technology for Energy and Environment, Moosburg

#### Partners in Kyrgyzstan:

- Naryn State University, Naryn
- Kyrgyz State University for Construction, Transport and Architecture, Bishkek
- World Agroforestry Centre, Central Asia Office, Bishkek
- Eco-Consult LTD, Naryn
- Kyrgyz Soil Science Society, Bishkek
- Kommunen Aktal und Emgek-Talaa
- Forstverwaltungen Naryn und Aktalaa

#### Website:

[www.bmbf-client.de/projekte/OekoFlussPlan](http://www.bmbf-client.de/projekte/OekoFlussPlan)

### 3. Outlook

Livestock will continue to play an important role as an investment and for livelihood in Kyrgyzstan in the foreseeable future. If livestock farming is oriented on traditional nomadism, it can function in harmony with nature and can thus represent a sustainable way of farming. This type of husbandry also has the advantage that it could be adapted to climatic changes relatively short-term if Kyrgyz pasture management is focused on that issue. As a result, the traditional way of life of the nomads could even regain importance for Kyrgyzstan in the future, as it is more flexible than fixed and intensive forms of agriculture. With an increase in animal populations, however, large pastures are required, which must provide sufficient biomass for the livestock.



To this end, the pastures must be examined for their resilience to changes to ensure that they can be used in the long term. Changes can be triggered not only by climate change, but also by increased land requirements due to increasing animal numbers. This could result in a land use conflict due to a variety of land requirements, for example between more and/or better grazing land and afforestation areas.

Climate change, with rising temperatures and declining precipitation, may further deepen this conflict. The vegetation cover of areas that are already sparse today could decrease to such an extent that they could become useless as pasture. In this case, seasonal migration of animals becomes more challenging and an increase in grazing in the floodplains could be expected. To prevent this development, an inventory of the quality and resilience of pastures and forest areas is of central relevance.

International and transdisciplinary projects can implement approaches with modern methods and can contribute to overcome the still strongly sectoral structures of authorities and science. The area of conflict between economic development and the energy production required for it and environmental development is a particularly relevant topic in this context.

The expansion of hydropower and the dams required for it is likely to irreversibly destroy Kyrgyzstan's free-flowing rivers with their high biodiversity – also with financial participation of international institutions. Against the background of the Water Framework Directive, European development aid in particular should ensure that free-flowing rivers are preserved. In order to cover the growing energy demand sustainably in Kyrgyzstan, other renewable energies (e.g. solar power) besides hydropower should be seriously considered to protect these globally threatened ecosystems.

The ÖkoFlussPlan project can develop the first fundamentals for sustainable development of the region along the Naryn River. The joint efforts of all those involved are the basis for strengthening and expanding the initial approaches towards greater sustainability.

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