ILTER Ecosystem Service Initiative for LTER Region Lake Päijänne (Finland)

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Narrative

Introduction

Päijänne is a 119 km long lake located in Central Finland between the major cities of Jyväskylä and Lahti. It is one of the three Finnish lakes with an area larger than 1000 km^2. Its Ristinselkä basin is deepest (94 m) among the Finnish lakes. Consequently, by volume Päijänne is the largest lake in Finland.

During the period between the Second World War and the 1980s the lake was heavily polluted by municipal and industrial waste waters. Since the 1940s municipal sewage handling systems were converted from predominantly solid based waste to liquid based waste, using lakes and rivers as recipients. Further, the expansion of pulp and paper industry in central (Jämsä cluster) and northern (Äänekoski) parts of Lake Päijänne led to rapid deterioration of water quality. After the settlement of Water Law in the early 1960s point source waste waters were gradually taken under control and by the middle of the 1970s the major municipalities had adequate sewage treatment plants. Somewhat later, at the end of the 1980s, the pulp and paper industry reduced its waste discharge to Lake Päijänne and the remaining fraction of effluents was purified. The improvement of water quality was also catalyzed by the interest of the Helsinki capital area to fulfill its rising demand of high quality drinking water with water from Lake Päijänne. While at the end of the 1960s the lake was in really bad condition at Jämsä and Jyväskylä districts and almost everywhere else only in satisfactory condition, now those previously worst areas are in satisfactory condition and 2/3 of the lake area can be considered to have excellent quality. Thus, although there are many urban areas on the shore of Lake Päijänne, it is to a great extent a recovering wilderness area with high recreational and other potential.

However, in spite of decreasing sewage load the lake recovered more slowly than what could be estimated from the reduction of loading. Further, there are other large scale water quality issues deserving attention. For example, diffuse sources of nutrients have a proportionally increasing effect on water quality and in large parts of the lake fish communities and fisheries are still far from natural condition. Consequently the lake still deserves the utmost care and high investment in monitoring and research. While monitoring can reveal the present status of the lake, research is needed to predict the future development of the lake ecosystem and ascertain sustainable use of lake resources.

Lake Päijänne has extraordinary socio-economic importance. First of all it supplies drinking water for over one million people in the capital area and hence can be considered to be the single most important lake in Finland. Secondly, the Päijänne district accommodates the important pulp and paper industry which both provides work to a large

number of people and loads the lake. Thirdly, the lake has been harnessed for significant electricity production along the downstream River Kymijoki. A further less striking, but not unimportant, economic feature is its significant potential in fisheries, recreation and tourism. In the neighborhood of the lake there are living over 300 000 habitants. In L. Päijänne there is also large national park with an area of 14 km^2.

Ecosystem Services and Natural Resource Management

Water

The most important single provisioning ES is fresh water in L. Päijänne, because it is fundamental for many other ES (fisheries production, socio-cultural sercices). Moreover, over million people in Helsinki capital area use water from L. Päijänne as their drinking water. Annually about 98 million m^3 water from L. Päijänne is used for this purpose.

The quality of water is monitored intensively. Due to effective water protection water quality is good. In the future, the diffuse load from catchment area and climate change together are possible threats to water quality.

Water of L. Päijänne is also used for electric power purposes in river Kymijoki. Thus, the water level is regulated which affects to lake ecosystem.

Fisheries production

Fish stocks and fisheries offer provisioning ES simply as a food resource. They are also important as cultural ES in recreational fishing. In the whole lake scale, the most important fish species for professional fisheries are vendace and whitefish. For recreational fisheries the most important species are perch, pikeperch and brown trout.

Fish stocks, their composition, economical value and utilization differ between northern and southern parts of the lake. Water quality in northern part of the lake is mesotrophic and thus fish community is dominated by percids (perch, pikeperch) and cyprinids (roach, bream). A fishery is mainly recreational and focused on multispecies. In southern part lake is oligotrophic and thus fish community is Coregonids (vendace, whitefish) dominated. In this area professional fishing produce higher catches than recreational fishing.

In recreational fisheries active fishing methods are widely used but also gill nets and traps are used. Contrary professional fishing is based on mainly trawling, trap nets and winter seining.

Finnish fisheries system is based on local statutory fishery associations who own the fishing rights. The larger management units are fisheries regions which are organizations allowing for the co-operation of all persons and groups interested and involved in fisheries management. In L. Päijänne there are two large fisheries region. Over these

fisheries regions are fisheries administrative. Basic knowledge for management is produced by Finnish Game and Fisheries research Institute and universities.

Management of fisheries constitutes two main operation; stockings and fisheries recreations. Pikeperch, whitefish and pike are stocked as juveniles annually to L. Päijänne. Benefits of these stockings are not known. Brown trout stock is depending on stockings. Recreations are based on legal minimum size of certain species (pikeperch, brown trout) and mesh size of gill nets. Large carnivore species (brown trout, pikeperch) are suffering from overfishing. In contrast, perch and cyprinids stocks are underutilized. There are some conflicts between fisherman using traditional gill nets and ones fishing with rod fishing. In the future these conflicts are probably increasing. Management is mainly based on operations done by local fishing right owners. Some stockings are also based on compensation of water level regulation for electric power purposes.

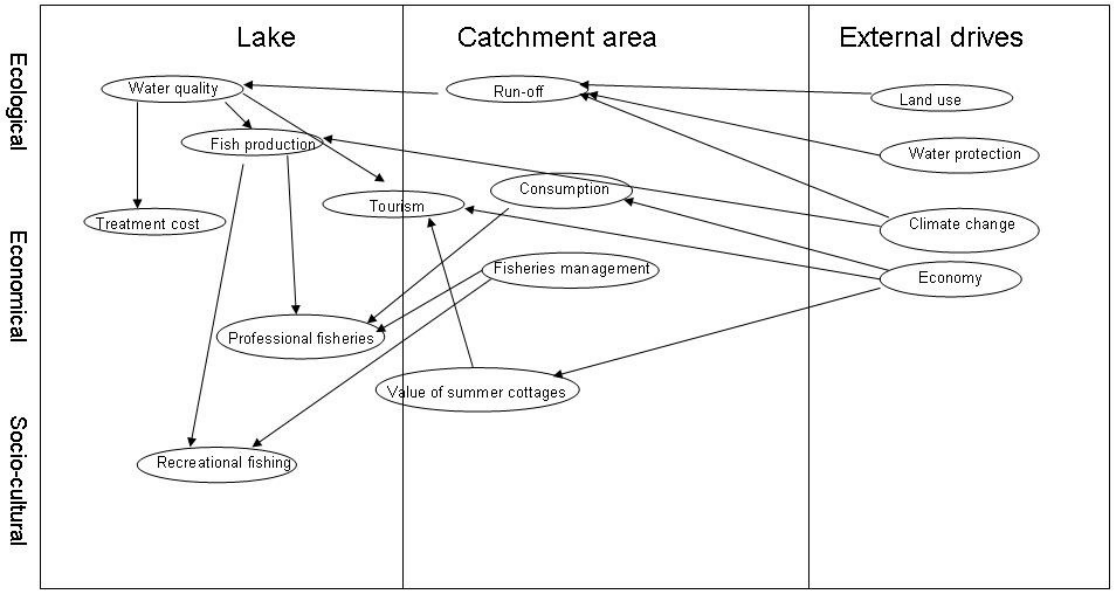

Fig. 1. Interactions of important components of the ecosystem services in the LTER-region Lake Päijänne over several scales

Critical Ecosystem Services

Ecosystem service	Specific services that are important at your site	Direction of change	Primary drivers of change	Public awareness of service	Institutions that manage service
Provisioning services					
Fresh water	Drinking water	degrading	Eutrophication, climate change	high	Water law, Helsinki Metropolitan Area Water Co
Food	fish	About the same	consumption	medium	Fishery administratives, local associations
Energy	waterpower	About the same	Price of electricity	medium	Owner, regulations from laws
Regulating services					
Water egulation		About the same	Climate change, land use	low	
Cultural services					
Recreation and tourism	fishing	improving	management	high	Fishery administratives, local and regional actions
	Summer cottages	improving	Increase of renting options	high	owners
	sailing	About the same		high	
Supporting services					
Primary production		improving	eutrophication	Low	
Nutrient cycling and retention		Slightly improving	Climate change	Low	
Water cycling		??		Medium	

ISSE Feedback Loop Model

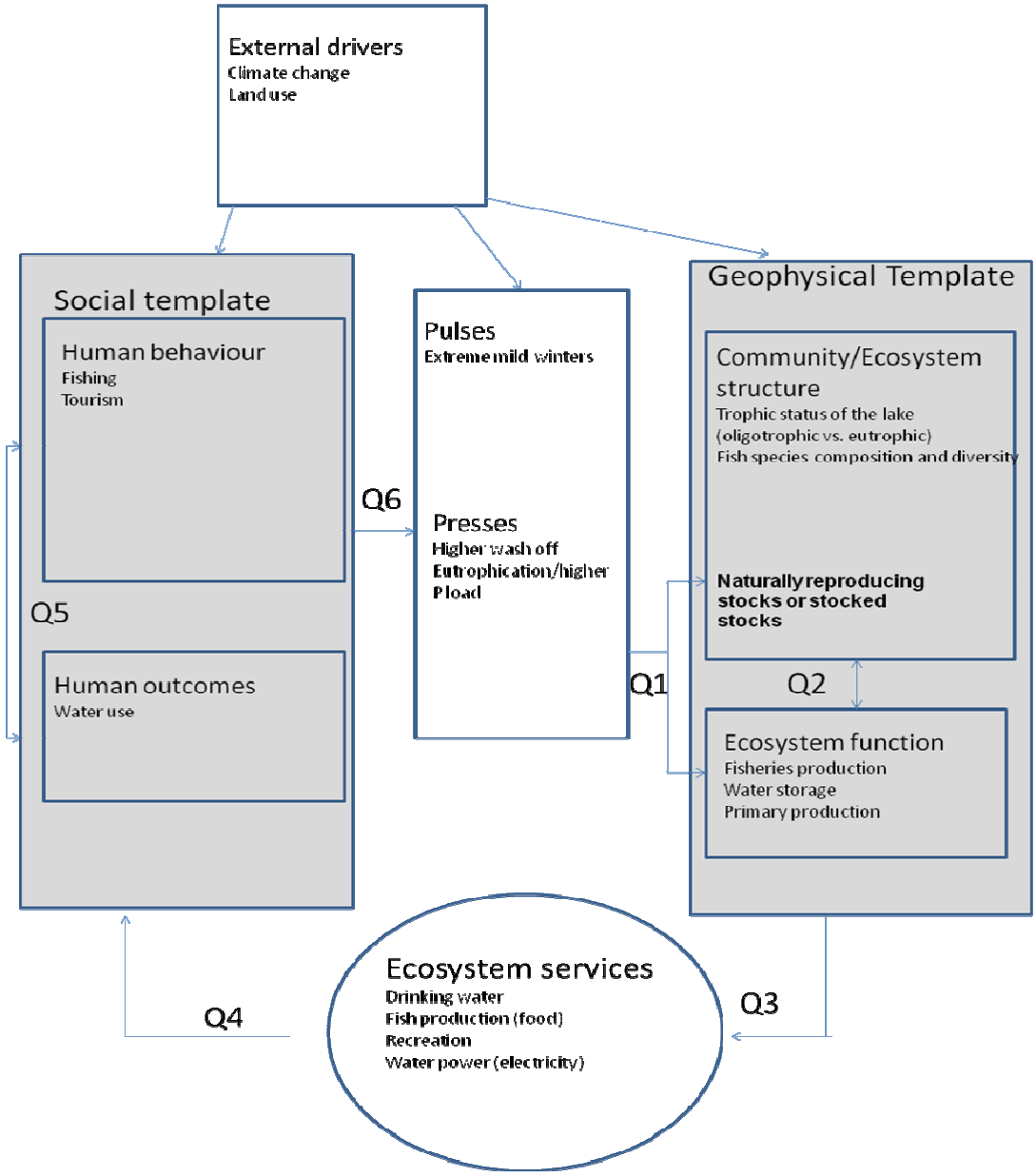

Figure Fehler! Kein Text mit angegebener Formatvorlage im Dokument.**: Regional level socio-ecological system, LAKE PÄIJÄNNE LTER Site**

Q1: How do long-term press disturbances and short-term pulse disturbances
Q2: How can biotic structure be both a *cause and consequence of ecological fluxes of energy & matter?*
Q3: How do altered ecosystem dynamics affect ecosystem services?
Q4: How do changes in vital ecosystem services alter human outcomes?
Q5: How do perceptions and outcomes affect human behavior?

Q6: Which human actions influence the frequency, magnitude, or form of press and pulse disturbance regimes across ecosystems, and what determines these human actions?