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Comparative study of water resource management policies between China and Denmark

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Abstract

This paper compares water resource management policies between China and Denmark at the planning level. It takes two vulnerable freshwater bodies as a case study: Baiyangdian wetland in China and Mariager fjord in Denmark. It explores the commons and differences between the two ecosystems from the characteristics of the ecosystems, historical and cultural background of the society, the technologies affect the way the common is used, how the common is seen at different times, the existence of property rights through time and their development process. It also compares the environmental regulations and its impact on both water bodies. The analysis shows that both in Denmark and in China it can be expected that goals, once they are decided, will be implemented. But in reality it seems to be much easier to accomplish in Denmark than in China, probably due to the complicated administrative structure in China and clearer goals and better resources in Denmark. Denmark has also accomplished a large degree of environmental policy integration (EPI). But China has opened up the gate to the whole world and shows a positive attitude to participating in international affairs and environmental protection as well as sustainability.

Keywords: Comparative analysis, Water resource management, Denmark, China

1. Introduction

For many years humans have caused impacts on and transformed wetlands, lakes and rivers in order to make them fit their own needs, are it for agriculture, waste-water discharge, navigation or fishing. In recent centuries these changes have been particularly dramatic, especially those caused by population increase and the industrialisation of

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production. In recent decades this has led to increased interest in restoring these often vulnerable ecosystems. After adopting environmental legislation, especially after the United Nations Stockholm conference in 1972, many countries have launched such policies.

In Denmark nature protection has been an issue for many years, the first Law on Nature Conservancy was passed in 1916. In the 1970s a range of laws were passed that were designed to protect the environment from pollution. In the 1980s the focus was on agricultural production and a range of action plans were proposed to protect the aquatic environment. At the end of the 1980s a growing focus on nature restoration was established. Since the EU directives on protection of birds (1979) and later on protection of habitat (1992) have formed a new basis for protecting and restoring the environment, establishing the Natura 2000 network of the EU as well as the parallel efforts of the Water Framework Directive. The overall policies are now that the decline in biodiversity should be stopped by 2010 and that good ecological conditions should be found in all natural water bodies by 2015.

In China there is also a long history of protecting the environment. As early as 1929, the Fishery Law clearly stated that 'anyone engaged in aquaculture should protect the water eco-environment, scientifically determine the feeding density, fertilization and use of drugs [and] should not pollute the water' (Fishery Law, 1929). The Environmental Protection Law of the People's Republic of China (1989) is now the basis for environmental protection activities. After its adoption the protection of the environment developed fast, and especially in the last 10 years a series of laws have been established covering, for example, ocean protection and prevention of water pollution. The Chinese government and the public now pay great attention to environmental protection. Still, China is undergoing a challenging period, with rapid economic development, so resolving the contradictions between economic development and environmental protection remains a challenge.

In this article we compare the environmental policies and practices in Denmark and China. The main interest is to describe the different water policies in the two countries and how they have developed since the 1970s, especially influencing two particular water ecosystems. Special emphasis is put on developments at the planning level. Our main interest is thus to analyse how the two different sets of developing political frameworks contribute to the restoration of the environment.

Theoretical background for the comparisons

Back in 1968 the American ecologist Garret Hardin framed the problem of wise resource use through a simple parable of the 'tragedy of the commons' (Hardin, 1968). The pivotal question in determining the fate of the resource, for Hardin, is the ownership of the resource (Hardin, 1968). Common resources have a tendency to become overexploited and the answer to this problem is normally seen as private property. A great deal of recent research on how resources are used shows that it is determined by many factors other than just ownership (Ostrom, 1999). It is often shown that the wise use of the commons is regulated in a much more intricate fashion than just being a choice between private property and state regulation. A variety of different forms of rules, duties and customs also regulate the use of the common resource (Ostrom, 1999).

In practice resource management is governed by a complicated relationship between the kind of resources in question, the kind of property regime related to this (be it private, state or common), and the duties and routines as well as the conceptions generally institutionalised between the parties sharing in the use of the resource (Hanna & Munasinghe, 1995; Ostrom et al., 1999). Today resource use cannot be seen as a simple relation between property owners and free riders overexploiting the resource. It is a complicated relationship between the physical characteristics of the resource in question and the technologies affecting it (Commoner, 1971), as well as the functioning forms of duties and obligations for its use as they are developed in the fabric of society (Costanza & Folke, 1996).

The character of the ecosystem or the resource is an important factor. The differences between commons are enormous as the climate system, the fish resources of the sea, biodiversity and groundwater resources cannot be treated alike. Whether the resources are renewable, and how they are affected by external disturbances are relevant. Our cognitive understanding of common resources often changes over time as scientific knowledge and relevant basic ideas develop. These pictures of the resource change gradually and sometimes radically if paradigmatic shifts occur (Kuhn, 1962; Commoner, 1971).

The relationship between humans and nature is also affected by the technology used which intentionally or unintentionally transforms the common. Technology plays a role in the exploitation of resources, but technology also plays a role in creating new commons that were not available before, for example, by giving access to groundwater.

It is characteristic of a common (or 'common pool resources') that they were once free, in the sense that actors from a local community had free access to the common and that one actor's use of the resource normally diminishes the possibilities for other people's use (Ostrom et al., 1999). The use of resources, in the positive cases, is governed by a set of institutionalised rights and duties. This includes property rights, the right to use resources, schemes for when and where to use the resource and also rules for monitoring and controlling use of the common. These rules can be based on private property or state regulation but can also include a wide range of community based rules and institutions. Besides the regulative aspects of institutions, normative and cognitive aspects should also be taken into consideration when investigating the institutional field affecting the actors involved in rule-setting activities (DiMaggio & Powell, 1983; Scott, 2001). During the last 40 years a growing pressure on states, bureaucracies and industries has emanated from the UN and other international bodies (March & Olsen, 1989; Meyer, 1994), so that there is now constant pressure for environmental change. Often the response is similar, creating isomorphy by uniform responses to the pressures be they regulatory, normative or cognitive (Scott, 2001). In recent years it has been realised that this is not only due to a passive reception of signals from the environment of the organisations, but that bureaucracies and companies often take in external pressures and mould them in accordance with their history and culture (Thelen & Steinmo, 1992; Yesilkagit & Christensen, 2009) or strategic interests (Oliver, 1991; Røvik, 1998; Lehmann et al., 2005).

In our description of the common we will focus on answering the following questions:

- What are the characteristics of the ecosystem?
- What is the historical and cultural background of the society?
- Which technologies affect the way the common is used?
- How is the common seen at different times?
- Which property rights exist through time and how do they develop?

By answering these questions we can see more clearly how a specific common is being used or overused and changed through time and how the wider society has reacted to this, creating new legal frameworks and new rules for the use of the common. We will make a comparison between two vulnerable ecosystems in China and Denmark respectively. At the beginning, we will introduce the ecology of the systems and we will sketch some of the developments taking place in these areas related to the use of the common and how they came to a point where measures had to be taken to restore the ecosystems. We then thoroughly describe how rules and regulations have developed vis-à-vis the situation, in order to see how new sets of institutional bindings are created that hopefully contribute to a more sustainable use of these commons.

2. The two study areas: Baiyangdian (China) and Mariager fjord (Denmark)

2.1 Study area in China: Baiyangdian wetland

Baiyangdian is the last residue of numerous wetlands in the Haihe River Basin. Today Baiyangdian is the largest freshwater body in northern China and is often called 'the Pearl of North China'. The area of the wetland is 366 km2 (Figure 1) and the average water depth is 1.5–2.0 m. Normally, the volume of water is 4×108 m3. The area of the wetland changes according to the hydrological conditions. The optimum water level is 7.74–8.86 m above sea level (Zhong et al., 2005). The annual precipitation is 350–750 mm and annual evaporation is 1750 mm. As a consequence of global warming, precipitation has decreased gradually while evaporation has increased, resulting in an unbalanced water ecosystem. Human impact from population growth and industrilization has intensified this trend (Liu et al., 2007).

Since 1960 Baiyangdian has dried up several times (Liu et al., 2007). This has resulted in a decrease of water supply and an increase of water consumption. As a result, the wetland degraded and so did its biodiversity.

The catchment of Baiyangdian is mainly low-lying. The composition of the soil is mostly sandy (Wang et al., 1999). The dominant vegetation is reed (Phragmites australis var. Baiyangdiasis) with a height of roughly 3 m. Nymphoides peltatum and Lemna minor is distributed in the marginal waters around the reed community (Wang et al., 2002). The area of reedbeds is more than 80 km^2.

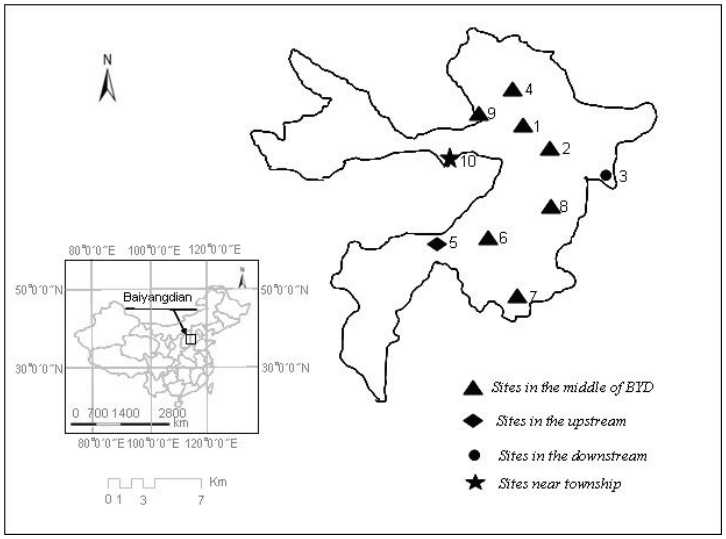

Figure 1. The location of Baiyangdian wetland

The main landscape of Baiyangdian differs from the wetlands of southern China as it is divided into 143 lakes and more than 3700 ditches. Around 100,000 people live on small islands in the wetland, so the ecological and

hydrological process is affected by severe disturbance from human activities. Contributing to this is the exploitation of water due to population growth and industrial activities in Baoding City which is located upstream of Baiyangdian.

From 1900 to the 1950s, the wetland was in a stable condition. From the 1960s, numerous reservoirs were constructed and exploitation of the water resource increased as well. With decreasing precipitation the wetland shrank significantly. In the 1950s, the surface area of water was 360 km^2, in the 1960s it had decreased to 206 km^2 and in the 1970s it was 109 km^2, reaching an all time low level in the 1980s at only 68 km^2. In the 1990s it was back at 170 km^2, dropping off again in 2000 to just 100 km^2 (Haihe River Water Conservancy Committee, 2004) (Figure 2).

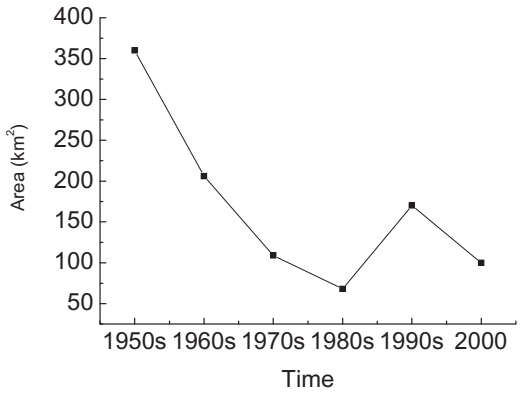

Figure 2. Water surface area change of Baiyangdian since 1950

In the 1920s, the annual water flow into Baiyangdian from its tributaries was 20.6×108 m3but in 1988 it decreased to 12.5×10^8 m^3 (see Fig. 3). In 2000 this volume dropped sharply to 0.24×10^8 m^3. From the 1950s to the 1970s, the amount of water entering the wetland was almost equal to the volume flowing out, so the water level remained stable. From the 1920s to the present, there have been seven occasions of the wetland drying up. From 1984 to 1988, it remained dry through all five years (Figure 3).

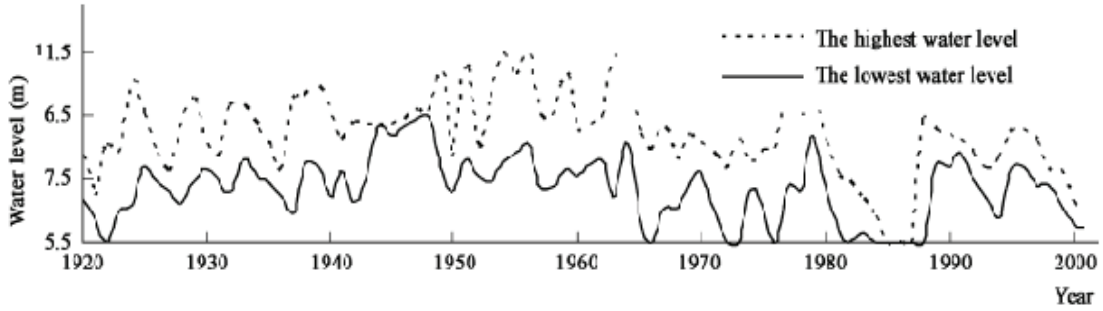

Figure 3. Highest and lowest water level measured, 1920–2000 (after Zhao X. et al., 2005)

Due to the high volume of water, before the 1950s the water in Baiyangdian was clear and transparent and there were more aquatic species than now. However, since the 1960s as runoff has dropped sharply (Figure 4) the water in Baiyangdian has become almost stagnant.

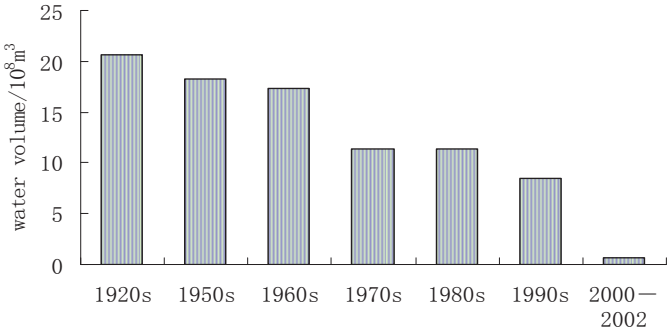

Figure 4. Runoff to Baiyangdian from 1920s to 2002

Large amounts of untreated sewage and agricultural irrigation water are discharged directly into the wetland. A large amount of nitrogen, phosphorus and other nutrients flow down the Fu River and the sewage enters the shallow water area of the wetland. This has accelerated the deterioration of water quality both in the wetland and the river and has led to events of ‘fish-deaths’ appearing at the outfall of the Fu River (Li et al., 2004).

In order to prevent the wetland from drying out again, on ten occasions since 1992 the State Ministry of Water Resources as well as other departments have transferred water from other river systems into Baiyangdian to get over the emergency. The total volume of water transferred has been 9×108 m3. At present, the main purpose of water importation is to dilute the pollutants in the lake, ensure the minimum level of the lake and use water for infiltration and evaporation. It is still unclear, however, how much water is needed and how to allocate the water to different ecological functions.

.2.2 Study area in Denmark: Mariager fjord

Mariager fjord is the longest of the eight fjords on the east side of the Jutland peninsula in Denmark. The fjord is 42 km long and it is a 'threshold' fjord situated in a tunnel valley created during the Ice Ages. The water in the inner part of the fjord is up to 30 m deep while the outer part is as shallow as 0–2 m. The watershed surrounding the fjord is 572 km2 of which 66% is agriculture, 17% is forest, 9% is built up areas and 8% is wetlands, lakes and other natural habitats (Århus amt & Nordjyllands amt, 1998b). The soil mainly consists of chalk with a thin layer of most often sandy soils on the top.

In the deeper part of the inner fjord, water circulation is slow (up to 3 years) often causing oxygen depletion. The bottom layer of water is also salty (1.8–2.4 %), being influenced by salt water intruding from the Kattegat. The upper layer of water is exchanged within a few months, also being very much influenced by the run-off from the many watercourses, so the resulting salinity is rather brackish (1.2–1.7 %). The halocline is located at a depth of 10 m. The water in the inner fjord below 5–6 m is found to be depleted of oxygen almost every year.

Approximately two-thirds of the water in the fjord comes from Kattegat while one-third is fresh water from watercourses and groundwater. The two largest watercourses in the catchment of Mariager fjord are Villestrup Å and Kastberg Å which cover 22% and 17% of the watershed respectively (Nordjyllands amt & Århus amt, 2002).

The level of nitrogen and phosphorus in the fjord is higher than in any other Danish fjord. In the upper layer of water the content of tot-N is above 2000 μg/L while tot-P is above 110 μg/L. In the summer these levels decrease to 1200 and 80 μg/L respectively (Århus amt & Nordjyllands amt, 1998b)

The input of nutrients comes from the influx of saltwater from Kattegat, from industries and urban waste-water treatment plants, from aquaculture and from agriculture. These human activities have been increasing throughout the last 200 years and have contributed to the declining environmental quality.

The research was conducted in Zinc Industrial Complex (36° 66' N, 48° 48' E). The Zinc Specialized Industrial Complex was established in 1996, with a current consumption of about one million tons of raw ore and a production of 0.19 million tons of Zn per year. The tailings from the industrial complex estimated to be about 2.5 million tons by now is containing a variety of toxic elements, are damped in the vicinity of the complex and are exposed to wind and rains, contributing to soil, surface and ground water contamination.

3. The history of increasing impact

3.1 History of increasing impact in Baiyangdian

The Baiyangdian wetland has undergone a complicated historical development since 265 BC, when there was far more water resource than now. After AD 1368, the content of sand in the water increased and some of the river watercourses were silted up. The rivers changed course several times because of this. In recent years, as a consequence of rapid development and population increase, the water consumption and discharge of sewage is also increasing.

In the 1950s, the Haihe River Basin, where Baiyangdian is located, suffered severely from flooding which washed away houses, damaged farmlands, and killed livestock. In the 1960s, Chairman Mao decided to implement management of the Haihe River Basin and in 1979 the Haihe River Water Conservancy Committee was founded, which is responsible for making water use plans, flood prevention control and water quality monitoring. The regular monitoring of Baiyangdian started from this point.

The concentrations of nitrogen and phosphorus discharge to Baiyangdian in recent years are shown in Table 1. From 2006 to 2009, the water quality of Baiyangdian was either Ⅳ level or Ⅴ level. The main contribution to the water quality is ticked in the table. Though the 2006, 2008 and 2009 were the same quality level, the main contribution for quality was different. In 2006 were COD, sulphide and total Hg, but in 2008, only COD and sulphide were the key factor. In 2009, COD, sulphide and total Hg were not the problem but BOD is the main contribution. This indicate though the water quality were same, the composition changed in the past 4 years.

Table 1. Water quality changes of Baiyangdian from 2006 to 2009. The water quality is based on Environmental Quality Standards for Surface Water in China (MEPC & SAQSIQ, 2002). (Source: Haihe River Water Resources Commission, 2006; Haihe River Water Resources Commission, 2007; Haihe River Water Resources Commissio, 2008; Haihe River Water Resources Commission, 2009).

Time	COD	BOD	Sulphide	Total Hg	Water quality
2006	√		√	√	Ⅳ
2007	√		√		Ⅴ
2008	√		√		Ⅳ
2009		√			Ⅳ

Since 1980 several hydrological projects have been carried out. The upstream reservoirs supply drinking water for the cities and regulate the flow of water into Baiyangdian. However this interference with the natural flow of the river minimises annual fluctuations and occasionally the wetland downstream will also be short of water.

One of the reasons for the water area decreasing is that local people have filled in the wetlands to create agricultural land. From an investigation in 1982 (Zhao et al., 2005), it was concluded that the water body area had decreased by10% because of this. Upstream at the Baiyangdian watershed, the annual soil erosion is $1.6\times10^7 m^3$. After pouring into Baiyangdian the channel grows wider and the water velocity slows down, so sand is deposited. This is another reason for the shrinking of the wetland. From 1955 to 1979, it is estimated that deposition of sand caused a decrease of the water body area by 34.8% (Zhao et al., 2005).

In recent years, a lot of studies have taken place in order to improve the water environment of Baiyangdian. This research is related to assessment of the potential ecological risk of heavy metals in sediment (Yang et al., 2005), or the use of protozoan communities to assess the water quality (Li et al., 2005), but there are few studies on water policies as well as on the whole watershed.

Nitrogen and phosphorus influence the growth and reproduction of algae, so they are the main factors controlling eutrophication. Particularly nitrogen (NH_4-N, NO_2-N and NO_3-N) and soluble phosphorus, which can be directly absorbed by aquatic plants, play a crucial role in eutrophication.

The main source of pollution of Baiyangdian is Baoding City and Anxin County, which are located upstream. The pollution from industry has caused fish and shrimp to die. The number of fish species decreases and good quality fishes become younger and smaller. The sewage and garbage from local people pour directly into the lake. The motor vessels, the use of fertilizers and pesticides in agriculture speeds up the deterioration of the water quality.

Baoding City's population is now around 600,000. With the rising of living standards, the use of washing machines and phosphorus-containing detergents are rapidly increasing so the urban waste-water emissions of nitrogen and phosphorus have been increasing in recent years (Zhang & Li, 2007).

3.2 History of increasing impact in Mariager fjord

Even before humans made an impact on the Mariager fjord it probably frequently suffered from oxygen depletion at least in the inner, deeper part of the fjord. During the last 100 years the fjord has been recorded to be 'dead', i.e. smelling of FeS_2 and having dead fish at least in 1933, 1947 and 1970 (Århus amt & Nordjyllands amt, 1998b). The latest incidence of 'total death' was recorded in 1997. This event, which is described in more detail below, spurred a lot of activity and led to the adoption of the second action plan for the aquatic environment being launched in 1998 (cf. section 4).

Estimations of the total impacts on the fjord are only available after the 1970s as the first law on environmental protection was passed in 1974, also implying that monitoring more or less started at this point.

Prior to 1997 some investigations had taken place on the distribution of eel-grass (Zostéra marina L.). These indicated that the eel-grass had been shadowed away by the increased content of plankton in the water caused by the increase in nutrients. The pollution also led to a decrease in the distribution of the mussel Mytilus edulis, which in the 1930s could be found down to 12–14 m, while in 1997 it only covered the floor of the fjord down to 7–10 m.

There is no doubt that the discharges of polluting substances have been on the increase during the last 100 years. Back in the late 1800s it was recorded that several industries like dairies, slaughterhouses, breweries etc. were located in Hobro, the largest city at the bottom of the fjord. Many of these closed down during the last century as a consequence of concentration of this kind of industry, leaving behind just one large dairy today. The population within the watershed has risen slowly to approximately 35,000 inhabitants today, most of them living in Hobro and the towns of Mariager and Hadsund. After the oxygen depletion in 1970, Mariager and Hadsund constructed mechanical/chemical waste-water treatment plants and Hobro and Havndal constructed mechanical/biological plants. These waste-water treatment plants treated roughly 92,000 PE (person equivalents) of waste water from households and industries.

Aquaculture was introduced to the area of Mariager fjord in the 1940s. In 1950 it was recorded that there were six fish farms, the number rose to 17 in 1983, but later on declined to 16 in 1996. From 1997 to 2002 this number

declined to 11 (Nordjyllands amt & Århus amt, 2002) and recently it has dropped to eight (Nordjyllands amt & Århus amt, 2004). The facilities were small at the time, having a production of 300–400 tonnes of fish (trout) rising to 815 tonnes of fish produced in 1983. All of the facilities were located along the watercourses that fed into the fjord. From 1960 to 1978 it was common to use raw fish as feed, but this was banned in 1978. At this point in time the discharge of nitrogen and phosphorus from aquaculture reached 68 tonnes/year and 16.8 tonnes /year respectively (Nordjyllands amt & Århus amt, 2002). In 1983, after the ban on using raw fish, the discharge of nitrogen and phosphorus was 40 tonnes/year and 10 tonnes /year (Nordjyllands amtskommune, 1986). Later on aquaculture was regulated by requiring a lower content of phosphorus in the feed. At the time of the 'dead fjord' in 1997 discharge was estimated to be 34 tonnes of nitrogen and 2.1 tonnes of phosphorus per year. As part of the action plan to save the fjord, this was later decreased to 22 tonnes of nitrogen and 1.9 tonnes of phosphorus per year (Nordjyllands amt & Århus amt, 2002).

Agriculture has covered two-thirds of the catchment probably over the whole period. Earlier, before the mid 1800s, a large part of this area was uncultivated heath land, meadows and commons with very poor soil, thus contributing little to the leaching of nutrients. The discharge of nutrients from agriculture rose dramatically throughout the twentieth century after most of the marginal land was turned into intensive farming land through the late 1800s. As can be seen from Figure 5, the use of manure and fertilizers has grown since 1900, and especially after the end of World War II it accelerated as fertilizers became cheaper. The increased use of nitrogen continued until environmental protection policies started to address these problems in the 1980s and since the mid 1990s it has been declining.

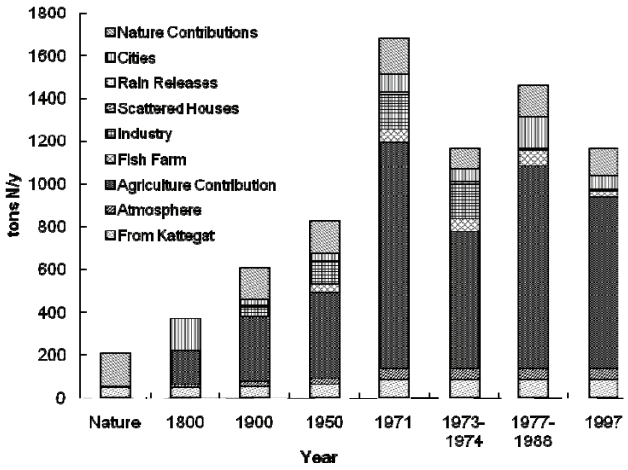

Figure 5 Discharge of nutrient to Mariager fjord from 1800 to 1997

In September 1997 Mariager fjord 'died' when a massive incident of oxygen depletion took place. All the fish in the inner fjord died and most of the mussels (Mytilis edulis L.) and eel-grass (Zostéra marina L.) disappeared. This was more or less a national catastrophe. The national politicians reacted by framing yet another new policy, 'Action plan for the aquatic environment no. II' increased the demands on agriculture in Denmark. At the county level the two responsible counties, Århus and Nordjyllands, initiated a process whereby a local action plan should be launched.

The total discharge of nitrogen and phosphorus to the fjord in 2000 was 1247 tonnes and 22.2 tonnes respectively (Nordjyllands amt & Århus amt, 2002) (Table 2). The goals put forward in the action plan for Mariager fjord (Nordjyllands amt & Århus amt, 2004) stipulated that the discharges of nitrogen (TN) and phosphorus (TP) should be 550–620 tonnes and 16–20 tonnes, respectively. A working group focusing on the implementation of the Water Framework Directive suggested that the goals should be a reduction to between 200 and 400 tonnes of nitrogen and between 6 and 8 tonnes of phosphorus (DMU, 2008) by 2015.

Table 2. The nitrogen and phosphorus discharges to Mariager fjord in 2000 (Nordjyllands amt & Århus amt, 2002).

	Nitrogen (N)	Phosphorus (P)
Aquaculture	22	1.9
Waste-water treatment plants	49	1.9
Urban run-off	11	3.0
Industry	0.3	0.0
Solitary houses	8	1.9
Background contribution	160	7.0
Agriculture	940	6.0
Atmosphere	57	0.5
Total	1247	22.2

If 1247 tonnes of N runs off into the fjord every year, this means that every hectare of the fjord receives 266 kg N/year, which is more than Danish agriculture uses per hectare of farm land! So eutrophication is indeed a problem.

The national action plans for the aquatic environment (no. I and II) generally reduced the emissions of nitrogen from agriculture by 30% in the period 1990–2002. This decrease is not visible in Mariager fjord probably because 75% of the effluent water goes to the groundwater aquifers (Nordjyllands amt & Århus amt, 2002). This means that it will take 20–30 years before the reduction of leaching N realized from the topsoil will appear in the watercourses and the fjord.

So far the national action plans (no. I and II) as well as the local one for Mariager fjord have only been partially successful, mainly because the regulatory provisions that should be used were not in place. For run-off of phosphorus and urban discharges, a decline was already evident as the result of prior action plans. As for the rest of Denmark, however, it is a matter of waiting to see the results of the new regulations on husbandry as well as waiting for the implementation of the Water Framework Directive which should be implemented before 2015. Presently the situation of the fjord is not very positive. A report from 2005 stated that the Secchi depth was decreasing and the goal put forward in the regional plan was far from being met (Nordjyllands amt & Århus amt, 2005), but hopefully the implementation of the Water Plans launched in the spring of 2010 can make substantial progress before 2015 as stipulated in the Water Framework Directive.

4. The development of environmental regulation and its impact on the two water bodies

4.1 Environmental regulation and its impact on Baiyangdian

In China, the history of protecting the environment started with the Fishery Law in 1929, later on came more laws and the Environmental Protection Law of the People's Republic of China (1989) is now the basis for environmental protection activities in China.

Before 1949, agriculture played a dominant role in China and industry was underdeveloped. The government did not pay much attention to environmental protection, so there were only sporadic environmental laws, such as the Fishery Law in 1929 and the Water Act in 1942. In the 1950s and 1960s, China was under an economic restructuring, starting with the Great Leap Forward (1958–60) and ending with the Cultural Revolution (1966–1976). After a period of recovery, Deng Xiao Ping started the opening of the Chinese economy which has progressed ever since. Pollution from industry was not so heavy earlier but during the 1990s it became clear that China was also facing severe problems.

The Environmental Protection Law was first formulated in 1979 but was amended and re-enacted in 1989. It is a comprehensive statute which provides the basic principles and systems for environmental protection in China. It

requires environmental protection content in national economic and social development plans. It focuses on prevention and control (Act 13), and establishes comprehensive management principles as well as Environmental Impact Assessment.

In China there are four administrative levels in the regulatory system dealing with the environment, (Figure 6). At the first level is the Constitution of the People's Republic of China. In the Constitution the goal of sustainable development is formulated. The Constitution forms the basis and guidance for environmental laws in China.

Below the Constitution are four levels of regulations. The first level is the international environmental treaties which China has ratified. The second level is the basic laws on the environment, such as the Environmental Protection Law. They formulate the environmental policies, give guidance on environmental protection, and formulate principles and measures. These laws are the foundation for the third level containing special laws and regulations, such as those implementing the Water Pollution Prevention and Control Law. At this level the regulations are established by the Standing Committee of the National People's Congress. Finally at the local level there are environmental regulations established by the provinces or autonomous regions and cities with direct jurisdiction. Furthermore at the local level there are also administrative bodies defined by their geographical nature, as in the case of Baiyangdian. In Baiyangdian, there are three relevant regulations on protection of the water body, of which two were formulated by the Haihe River Management Commission (HRMC) and one was formulated by the provincial government (Table 3).

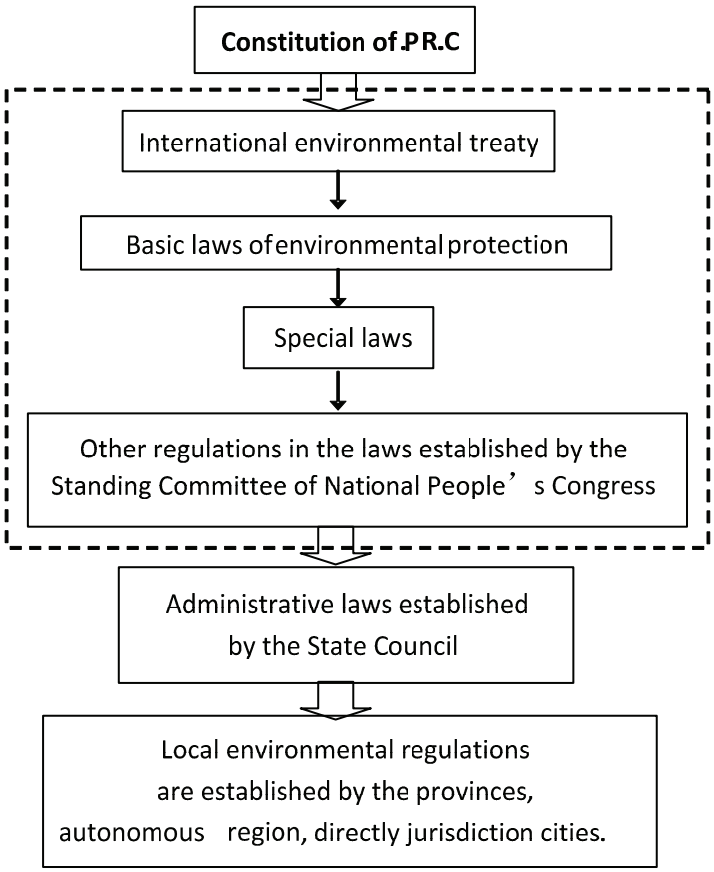

Figure 6. The hierarchy of environmental laws and regulations in China

The regulations for the management of Baiyangdian water body environment protection, which was issued by Hebei Province government, is the only set of regulations focusing solely on Baiyangdian at present.

It became effective on 2 May 1995. It defines three levels of protection zones. The first level protection zone is the area inside the Baiyangdian levee. The second level protection zone starts from the Baiyangdian levee, and extend 5 miles around it and 10 miles up the river. The third level protection zone includes the rivers and their tributaries flowing into Baiyangdian beyond the first and second protection zones. This could be a very powerful and clear regulation on the protection of Baiyangdian but there are still several deficiencies in its implementation.

Table 3 Regulations at the local level by Hebei Province and Haihe River Management Commission (HRMC).

Regulations	Responsible organization	Effective date
Regulations on the management of Baiyangdian water body environmental protection .	Hebei Province Government	22.04.1995
Detailed rules for the implementation of a 'Water Permit System' in Haihe River Basin	HRMC	30.05.1995
Examination and monitoring regulation on flood and drought prevention and control in Haihe River Basin	HRMC	23.03. 2006.

In the regulations for the first and second level protection zones, there is a range of prohibitions. It is forbidden to:

- *build any enterprise that could bring pollution to the water body;*
- *discharge any poisonous and nocuous fluid, industry waste or municipal solid waste;*
- *clean any vehicles, vessels and containers if petrol, pesticides and other poisonous pollutants are present;*
- *use high risk pesticides;*
- *pour surplus oil and waste oil into the water body;*
- *discharge solid waste from households and tourist facilities, or manure, into the water body.*

For the second level protection zone, it is forbidden to:

- *build or expand heavy pollutant enterprises related to paper pulp production, printing and dyeing, plating and other enterprises that could cause severe environmental pollution;*
- *use high risk pesticides.*

The protection of the Baiyangdian is suffering because the regulations are not enforced. Although it is forbidden to pour solid waste and manure into the water body, when the authors visited the area in April 2009 we found that at some places solid waste was piled on the bank of the water body. Furthermore there were several toilets and refuse dumps located next to the bank. Some villagers poured solid waste directly into the wetland. On our visit we also found some vessels discharging oil into the water while under way. Also, while it is forbidden to build or expand a range of enterprises that could cause severe environmental pollution, there is no clear definition of what is meant by severe pollution. In China, the water quality is divided into five different levels (Table 4) (MEPC & AQSIQ, 2002) so when the water quality declines below these levels it should be called 'severe`. In the regulations it is underlined that projects that discharge sewage into Baiyangdian should comply with relevant regulations at national or provincial level; but it is not clearly stated what is meant by relevant regulations. Furthermore already existing enterprises that discharge pollutants into Baiyangdian should pay a sewage charge, so if they can afford to pay, they can pollute at will without protecting the environment!

Table 4. Environmental Quality Standards for Surface Water in China (MEPC & SAQSIQ, 2002)

Items		Classification				
		Ⅰ	Ⅱ	Ⅲ	Ⅳ	Ⅴ
Temperature (°C)		Environmental changes in water temperature by human beings should be limited to: maximum temperature rise of per week ≤1 maximum temperature drop of per week ≥2				
pH		6–9				
DO	≥	Saturation rate (90%)	6	5	3	2
COD	≤	15	15	20	30	40
BOD_5	≤	3	3	4	6	10
NH_3-N	≤	0.15	0.5	1.0	1.5	2.0
Total N	≤	0.2	0.5	1.0	1.5	2.0
Total P	≤	0.02 (lake and reservoir 0.01)	0.1(lake and reservoir 0.025)	0.2 (lake and reservoir 0.05)	0.3(lake and reservoir 0.1)	0.4 (lake and reservoir 0.2)

The Department responsible for the protection of the environment in Baiyangdian is the Coordinating Management Committee of Development and Construction. This committee belongs to the environmental protection department of Hebei province. It is in charge of the detailed management as well as coordination

There is no doubt that the Regulations on the management of Baiyangdian water body environment protection has played a very important role in the protection of Baiyangdian. But still, there are several points that could be improved.

- The whole ecosystem has experienced great change over the last ten years, but the regulations basically have remained the same.
- The area of Baiyangdian varies each year; but the protection zone is the same.
- In China, decisions are made according to administrative lines of responsibility as well as according to watershed management organizations. Baiyangdian is the responsibility of the Haihe River Management Commission but it is also to the responsibility of the Hebei provincial government administration. The two departments have unclear and possibly even conflicting responsibilities.
- The enforcement of the law should generally be improved.
- The government gives high priority to enforcement and penalties but should also encourage collection and reuse of the different kinds of waste.

4.2 Environmental regulation and its impact on Mariager fjord

Environmental protection in Denmark started out with some media specific laws on watercourses, in 1880 and nature conservation in 1916 (Christensen, 2000). These laws primarily reflected the fact that the impacts from industrialization and urbanisation had started to influence the natural environment in Denmark. After the World War II, not only industry but also agriculture began to develop rapidly. Like most other countries Denmark experienced severe environmental problems in the 1960s leading to the formation of environmental NGOs, increased focus on ecological sciences and increased political acceptance of new legislation. This was heralded by the UN Stockholm conference in 1972 (Jamieson, 2001) which inspired most countries to adopt environmental legislation. This was also the case for Denmark. In 1974 a new law of environmental protection was launched together with the establishment of a new planning system that required counties as well as municipalities to make regional plans and municipal plans respectively.

The new law of environmental protection included two strong regulatory instruments. First of all, the law included old provisions for giving waste-water licences to industries, as well as requirements for municipal waste-water treatment plants. The issuing of licences should now be seen in connection with the goals established in the regional plans especially related to water quality planning.

Another feature of the law of environmental protection was that now larger, newly established industries should obtain an environmental permit before starting new production or expanding existing facilities. The tie between the law on environmental protection and on regional planning was already very strong from the outset in the early 1980s. In the first regional plan of 1981 no goals were formulated for the quality of Mariager fjord but in the regional plan of 1985 there was now formulated a very brief goal stating that '…these areas should function as habitats for animal and plant life, and should be able to be used for fishery, bathing and other recreational purposes' (Nordjyllands amtskommune, 1986). In the first water quality plan for Nordjyllands amt from 1986 a goal was set that aimed at a Secchi depth of greater than 3 m and a content of nitrogen and phosphorus as presented in Table 5 (Nordjyllands amtskommune, 1986).

Table 5. Goals for Mariager fjord as stipulated by the first water quality plan form 1986 (Nordjyllands amtskommmune, 1986).

Goal in water quality plan 1986	Inner part of Mariager fjord	Outer part of Mariager fjord
Sommersigtdybde	> 3 m	> 3 m
Tot-N, winter	< 4 mg/l	< 2.5 mg/l
Tot-P, winter	< 15 µg/l	< 10 µg/l

At this point it was already clear that the condition of the fjord was not acceptable. As the consequence of the goals formulated in the regional plan the municipalities around the fjord were obliged to improve their waste-water treatment facilities. The separate water quality plan of 1986 was integrated into the regional plan of 1989 adopting the same measures as presented in Table 5, and the only difference was that it was now underlined that not only should 'it function as habitats for animal and plant life' but 'for a versatile animal and plant life' (Nordjyllands amt, 1990).

In the regional plan of 1993 the goals were the same once more, but now the conditions had changed. While nitrogen was regulated in the mid 1980s as a result of the action plan for the aquatic environment, now new demands were put on the discharge of phosphorus (Nordjyllands amt, 1994). While the action plan for the aquatic environment generally set a threshold on 1 mg per litre of waste water it was within the discretionary power of the counties to set lower threshold values. In the regional plan of 1993, Hobro waste-water treatment plant accordingly had a threshold value of 0.4 mg P/l while the remaining waste water treatment plants could continue with 1.0 mg P/l.

In the regional plan of 1997 major changes occurred as the goals for Mariager fjord were reformulated and strengthened. The general goal was that the fjord '…shall function as habitats for a natural animal and plant life, and therefore have the best possible quality.' This happens through a weighing with other demands on the use of the water body' (Nordjyllands amt, 1997). The inner fjord should live up to this goal (from Hobro to Hadsund) while

the outer fjord should meet more rigorous demands, meaning a 'condition with a versatile animal and plant life, that only is vaguely impacted by human activities. The composition of animal and plant life is determined by the natural conditions, and the water has a good aesthetic and hygienic quality' (Nordjylland amt, 1997). The reason for the more rigorous demands for the outer fjord is that this area was now also designated as a Natura 2000 site. Only briefly is it mentioned in the plan that the fjord died in September that same year.

In the regional plan of 2001 the goals are more or less the same as in the previous plan but now more quantitative measures are formulated as well (Table 6).

Table 6. Goals for Mariager fjord as stipulated by the regional plan 2001 and 2005 (Nordjyllands amt, 2005).

Goal in water quality plan 2001 and 2005	Inner part of Mariager Fjord	Outer part of Mariager Fjord
Secchi depth	> 4 m	> 4 m
Eel-gras (*Zostéra* sp.)	> 3 m	> 2 m

The linkage of regional planning and environmental protection had some weaknesses already from the outset, however. This is especially clear from some of the activities that were not regulated by the plans. Especially for agriculture the counties did not have the authority to regulate the leaching of nitrogen and phosphorus. This control was not introduced until the first action plan for the aquatic environment in 1987. The new instruments established in the action plans functioned more or less as general demands established at the national level, so the counties could actually regulate these activities in just a few cases. The achievement of the goals in the regional plans therefore was dependent on other regulatory activities formulated by other government bodies. That is why agricultural pollution is not very often mentioned in the regional plans.

In the 1970s and 1980s aquaculture were not required to have an environmental permit as all of the fish farms were established prior to 1974. Since the late 1980s they have been regulated by general requirements on what kind of feed can be used and especially of its phosphorus content.

Also agriculture was not part of the environmental law of protection from 1974. In the summer of 1981 there was a series of oxygen depletion events in the coastal waters of Denmark. This continued for several years and in 1985 the government passed a law on agricultural production that for the first time placed limits on the use of nutrients in agriculture.Another severe incident of oxygen depletion was reported in October 1986 from Kattegat. It paved the way for yet another political initiative in 1987 called the 'Action Plan for the Aquatic Environment'. This action plan set the goal to reduce the loss of nitrogen from Danish agriculture by 50% This reduction target was to be met before 1989, primarily using general regulations aimed at all farmers. By the late 1980s it became clear that this goal would not be met. In the mid-1990s, a new modelling exercise estimated that the target would still not be met, and this together with the 'death' of Mariager fjord in 1997 paved the way for the 'Action Plan for the Aquatic Environment II' in 1998. In this plan the reduction was to be ensured through two types of measures. First, higher demands in terms of how efficiently manure should be managed, and secondly, more emphasis was given to subsidy schemes for nitrate-sensitive areas, afforestation and organic farming.

In the first action plan for the aquatic environment of 1987, new rules were also established for waste-water treatment plants. Until then it was the counties that decided the threshold values put on each facility depending on the nature of the recipient water bodies and the political goals for its use and quality. From 1987, though, the government demanded uniform low threshold values for every large waste-water treatment plant. Now they should meet the standard of 8 mg N/l and 1 mg P/l. For phosphorus the counties could use their discretionary power to set lower threshold values where there was discharge to vulnerable water bodies.

After than 20 years of debate and research on the nitrogen and phosphorus cycles of Danish agriculture, tremendous efforts have been made to reduce the losses of nitrogen and phosphorus. Today, the objectives of the first two action plans seem to have been met. This has spurred a new discussion of how much further it is necessary to go, as it seems obvious that the first 50% reduction of nitrogen loss was not enough. The Danish government decided in the current 'Action Plan for aquatic environment III' (2003) that a further reduction of 13% is necessary. However, it has now become clear that Denmark will not live up to the demands in the EU Water Framework

Directive which demands that 'good ecological conditions' should be met by 2015. In the latest action plan, called 'Green Groth', decided upon in 2009, goals are now set for yet another decrease of 33% of nitrogen discharged to the marine environment. This means approximately that after the first 50% reduction decided on in 1986, it has now been decided that almost a further halving of the nitrogen in the coastal waters should be the goal.

After the death of Mariager fjord, the local politicians in Århus and Nordjyllands counties decided to make a local action plan for the fjord. In February 1998 an 'idea catalogue' was formulated discussing many of the technological and regulatory possibilities for 'saving the fjord' (Århus amt & Nordjyllands amt, 1998a). Many of these ideas were rather unrealistic, like artificial oxygenation of the fjord water or removal of sludge from the bottom of the fjord. After these initial discussions, the next four years were more or less used to document the status of the fjord in a long series of reports covering different aspects of the fjord ecosystem, with topics like; hydrogen sulphide in the fjord (1998), sedimentation processes and nutrient exchange in the fjord (2000), primary production of the fjord (2000), fishery investigations (2001), mezzo plankton in the fjord (2001), bottom vegetation (2001) and many more (Trelle Christiansen, 2007). Finally in 2002 the counties invited the public to take part in a discussion on the future of the fjord (Nordjyllands amt and Århus amt, 2002). In a leaflet published in 2002 the counties underlined that the national policy, the 'Action plan for the aquatic environment II' was not sufficient to safeguard the fjord to a level that was sustainable, or to use the words of the EU Water Framework Directive, improve the conditions so that a 'a good ecological condition' could be attained. The debate regarding this local action plan was intended to materialise as a plan for the fjord that could form the basis for a supplement to the regional plans formulated by the two counties in 2005. This never happened. Instead it was substituted by the implementation of the Water Framework Directive according to which Water Plans should be made for 23 larger watersheds in Denmark, which included Mariager fjord. As mentioned above, the first draft of this plan was launched in January 2010 promising that substantial progress would be made before 2015.

5. Comparison of environmental capacity in China and Denmark

In comparing the two case studies we will take our point of departure in the five questions that we pointed to as vital for understanding the two cases and the differences between them:

- What are the characteristics of the ecosystem?
- What is the historical and cultural background of the society?
- Which technologies affect the way the common is used?
- How is the common seen at different times?
- Which property rights exist through time and how do they develop?

5.1 What are the characteristics of the ecosystem?

The two cases share some common features but there are also wider differences among them. Denmark is a small country with not that many different ecosystems. The temperate Atlantic climate and its position at the northern part of continental Europe bring Denmark a beautiful and mild environment and the country is lush and green. China's land area is almost 240 times greater than that of Denmark, so naturally it is richer in different climates and has a broader variety of natural habitats, ranging from temperate climates like in Denmark to tropical regions at the southernmost part to arid and desert areas in the northern part of the country. The case study areas are in many respects alike, both having a temperate climate and being lakes/fjords that face problems with eutrophication. In both areas there are human settlements, industries and farmland that impact on the ecological balance. In Baiyangdian the hydrological balance is also disturbed due to excessive use of water in some of the watersheds feeding in to Baiyangdian. All in all we conclude that it is fair to make a comparison between the two cases.

5.2 What is the historical and cultural background of the society?

Looking at the two countries in a broader historical and cultural perspective unveils some dramatic differences but also some striking similarities. Denmark as a member of the EU is among the richest countries in the world

(GDP US$ 37,400). China is still a developing country and although it has had fabulous growth rates for many years it has not yet caught up in GDP, which is now US$ 6000 per capita.

As a small country Denmark has few administrative levels and thus it is simpler to implement legislation and policies while China has more levels of bureaucracy. But behind that story is also the fact that China always has been more bureaucratic due to its cultural background as well as recent history. While Danish society is based on market economy and democracy, China is a Socialist country based on a one-party system. In a certain sense, however, Denmark and China have common features when it comes to collectivistic behaviour; working and acting as a group or in co-operation with other. Even today this is the backbone in the two societies; in China entailing collective behaviour and loyalty (Toh, 2010 in prep.) and in Denmark a certain degree of collectivism paired with individualism. In both countries there is a high degree of trust in and loyalty to government and legislation. For the Danish, the reason for this trust is the participative democracy that evolved from the folk high school movement and the Cooperative movement (Bjørn, 1998). Whereas for the Chinese, the trust stems from the notion of loyalty to those in leadership; and it dates back from the days of Confucius and Imperial China (Toh, 2010 in prep).

Denmark has experienced a modernization period while China has been hindered by its troubled socio-political situation. It resulted in Danish society taking up capitalism much earlier (1848) than China (1980) and thus transforming itself into being more individualistic when it comes to economy, but still retaining much of its collectivistic attitude, as can still be seen in the Danish welfare state as of today.

5.3 Which technologies affect the way the common is used?

The technologies that causes problems are normally introduced through population growth and changes in the technologies used in industries.

The area around Mariager was industrialised at an early date, with several large industries in Hobro and the other cities along the fjord. For agriculture, a wave of land reclamation was initiated after the defeat by Germany in the war of 1864, when Denmark lost the southern part of Jutland. Under the motto ‘What is lost outside must be regained internally’, heath land was turned into farmland and marginal soils were afforested. Later on, industrialisation of farming took place, especially after World War II when tractors and artificial fertilizers and later on pesticides were introduced.

Since 1970 a range of new technologies have been introduced to combat pollution. First it dealt with waste-water treatment for cities and polluting industries together with landfill. Later on in the 1980s and 1990s cleaner technologies were introduced, especially for industries, but at that time many companies closed or moved to other places with less strict environmental regulations. Many companies also became connected to municipal waste-water treatment plants which from 1990 onwards were required to have modern highly advanced treatment facilities. Agriculture faced environmental regulations from 1987, and a lot of new technologies have been introduced to minimise pollution. Aquaculture grew from the 1920s to 1990. Since then this industry has been regulated and requirement put on feed. Many have been closed in order to protect the flow of water in the watercourses, while new ‘full recirculation’ aqua farms have been developed.

For Baiyangdian our knowledge of how technologies play a role is scarcer. We know for sure that the population has increased in the recent years and that the comforts of the population are growing, as just like people in the western world, they want washing machines and other appliances. We also know that several companies have established themselves in Baoding and continue to cause problems in that there is little environmental regulation and the technologies are probably somewhat old fashioned and probably not aiming at pollution prevention. Agriculture also thrives in the area but also here the technologies are fairly old-fashioned, some of the even so old that, unlike many farming practices in the industrial world, they do not cause much pollution. However, that also means that an increase in agricultural production will have a price to pay in the form of increasing losses of nitrogen and phosphorus to Baiyangdian. Finally it should be underlined that Baiyangdian is also affected by hydrological projects like dams and reservoirs that store water for supply to the local residents and for regulating the flow of water through Baiyangdian.

Pollution abatement and prevention is not as prevalent in the Baiyangdian area as around Mariager fjord. On our visits to the two places we noticed a marked difference, for example, where waste was piling up along parts of the

shores of Baiyangdian which indicates that the lack of technological means to prevent pollution is the order of the day in many places around Baiyangdian.

5.4 How is the common seen at different times?

Both water bodies have today a special place in the heart of people living there as well as visitors. Baiyangdian is called 'the pearl of Northern China' owing to its rich resources of lakes and lotus flowers. Likewise Mariager fjord is well known for its beauty and many people have sailing boats in one of the many local 'marinas' (leisure boat harbours). Also during the incident known as the 'death of the fjord' it became clear that a lot of feelings were attached to the place and what happened was genuinely seen as a catastrophe. Besides this, the two areas have been regarded as places to make a living, and more specifically as places that could digest and transform sewage and run-off from the farmland. They have been seen as robust recipients for many years – and maybe they were so. But now – as a result of increasing pollution – this notion of self-cleaning capacity is on its way out. Now the two areas are seen as fragile environments that should be protected and even 'restored' back to a condition where the balance between human use of the environment and its protection for non-production purposes strikes a new balance. This happens at different times for different categories of people and this process has definitely come further in Denmark than in China, and also among ordinary Danish citizens as opposed to Danish farmers who still cling to the view that farmland is first and foremost for production. This balance between production and non-production (protecting) is of course not formulated the same way in the two countries as this process has moved faster and gone wider concerning Mariager fjord than concerning Baiyangdian. In that respect China is also, as or technologies, 'lagging behind' the situation in Denmark and their way forward is more bumpy, meeting more resistance, than is the case for Denmark.

5.5 Which property rights exist through time and how do they develop?

The comparison of laws and regulations between China and Denmark definitely showed some marked differences. Although both countries introduced some 'environmental laws' many years ago, it was first after the UN conference in Stockholm formulated modern legislation that targeting industrial pollution. Both countries have consecutively formulated new and additional laws and regulations that look fine on paper. In reality the legislation in China has not been fully implemented. There might be several reasons for this. One could be the rather complicated administrative structure, where several levels of jurisdiction can be responsible for the areas in question, and that of course can create confusion and create barriers to change.

H. Xiao and colleagues (2006a, 2006b) have claimed that there is already a very complete set of legislation that could be used for protection of the Baiyangdian wetland. The key issue now is how to coordinate the national legislation with the local regulations so that the legislation can be put into practice.

In Denmark there is also a complicated legislative structure around the Mariager fjord. Prior to 2007 there were counties were the main authorities responsible for planning related to nature and environment. The two counties of Nordjylland and Århus succeeded in working together to create a joint vision and a common action plan. After 2007, a new slightly more complicated structure was established consisting of the municipalities as well as seven new State Environmental Centres. According to the EU Water Framework Directive and its implementation in Danish law, 'water plans' should be formulated by the national centres, and then the municipalities in the watershed of the fjord are obliged to execute these visions by making municipal action plans covering the whole watershed. The first generation of these plans are currently being drafted and from the first draft it seems reasonable to assume that if it is implemented before 2015, as stipulated by the EU Water Framework Directive, Mariager fjord will be close to the natural conditions prevailing before industrialisation.

In China many levels of government are involved in the management of the wetland, a situation that contains many conflicts. For example, Baiyangdian is the responsibility of the Haihe River Water Resources Commission, which is the affiliate of the Ministry of Water Resources. It is also regulated by the local government of Hebei province. The rights and obligations of these two management departments are overlapping and possibly also conflicting.

In some cases, people living beside the wetland are still filling the lake with soil to reclaim it for farmland. This is supported by the Land Department but is opposed by the environmental protection departments because it threatens the wetland ecosystem. Another case is aquaculture, which is supported by the Fishery Department, but is of concern to the environmental protection departments because fish farms cause eutrophication which causes fish-deaths and decrease of bio-diversity (Sang, 2006).

In China it must be realized that many plans are not implemented well. Some laws are implemented but not very stringently. Besides it is also often found that the law is violated but no one reacts to this fact simply because measures for enforcement are not in place. In Denmark enforcement is rather strict, so that is not to blame. Instead, the reason for vision and goals not being implemented must be the lack of appropriate regulations.

New laws are formulated in both countries. In China the environmental legislation appears unable to stop the environmental degradation. Contrary to this, the situation in Denmark in relation to water bodies is constantly improving, but discussed above, this has demanded clear goals that are pursued for many years as well as strict limits being placed on polluting activities. This has been done through six consecutive 'Action Plans' for reducing the pollution from agriculture, or in other words one new action plan" every three years. This demands clear visions from the politicians and a constant will to implement the necessary rules and regulations.

In Denmark pollution was very severe in the 1970s but the national government has succeeded in establishing a meticulous net of regulations that are implemented well and that can be used to reduce pollution step by step. The visionary goals of creating freshwater and marine habitats that live up to the goal of achieving 'good ecological condition' as stipulated by the EU seems to be a realistic goal for the coming decade. But it has also taken more than 30 years to realise the need for it and provide the proper knowledge of the ecological conditions, formulate appropriate visions and goals and implement these in strict regulations that are effective to curb the growth in pollution and to restore the ecosystem.

In China too visions are now formulated that could be helpful in restoring Baiyangdian. Presently, Baiyangdian has been divided into 3 zones of protection as discussed in the previous text: an experiment zone, a buffer zone and a core zone. This division into different zones is not in accordance with ' The Nature Reserve Ordinance of People's Republic of China'(1994), which clearly stipulates that in the core zone, access is forbidden, in the buffer zone, only scientific research and making observations is allowed, while in the experimental zone, there could be both scientific research as well as exploitation.

The sources of pollutants should be strictly controlled. The factories upstream which discharge sewage should be closed down or made to install proper treatment facilities as soon as possible. All factories, new as well as old, should strictly control their sewage. Waste water that does not meet the required standard is prohibited in the wetland and its tributaries. People should also be educated in eco-agriculture and how to use manure instead of fertilizer and pesticide.

6. Conclusion

Comparing the two wetlands – the Baiyangdian in China and Mariager fjord in Denmark – clearly paints a picture of differences between the two countries. In many ways a cultural-cognitive comparison clearly shows that both in Denmark and in China it can be expected that goals, once they are decided, will be implemented. But in reality it seems to be much easier to accomplish in Denmark than in China, probably due to the complicated administrative structure in China and clearer goals and better resources in Denmark. Due to its level of economic development Denmark started out earlier, building up an effective environmental administration. China also started early after the Stockholm conference in 1972 but did not succeed in making effective legislation as happened in Denmark during the 1980s. In this period Denmark strengthened its environmental regulation by demanding more efficient waste-water treatment and that companies improved their environmental performance through the use of cleaner technologies. These kinds of visions first found their way into Chinese regulations in the mid 1990s and for the Baiyangdian area it presumably has not been implemented yet in detail just as is found for the zoning activities also formulated in the same period. The reason is presumably the complicated administrative structure in China, leaving room for many problems of implementation to arise, but also that China has recently have put the environment on the top of the agenda, realising that the balance between economic growth and environmental protection should be reconsidered.

Also for the environmental regulation of agriculture Denmark has been a frontrunner and after more than 25 years of debate and struggle agricultural pollution is now on the decline and an effective system of planning and regulation is now being implemented due to the EU Water Framework Directive. In the case of Baiyangdian, we have not found any clue that environmental legislation on agricultural production has found its way into the rules pertaining to this watershed.

The whole concept of sustainability is integrated into the activities of the municipalities in Denmark which entails that they set aside a lot of resources to work with the problems related to wetlands and water bodies. Recently they have also focused on a wider range of climate change related activities. Although sustainability is formulated in the Constitution of the People's Republic of China (but not of Denmark) it seems that Denmark has accomplished a large degree of environmental policy integration (EPI). As part of the concept of sustainability, the public should take part in changing society in a more sustainable direction. Due to its culture and recent history since 1949 as a one-party system this has not yet been fully implemented in China. But China has opened up the gate to the whole world, from the Olympic Games to President Wen Jiabao's visit to Europe. The whole country shows a positive attitude to participating in international affairs and environmental protection and sustainability as part of this. In 20 years from now, we anticipate the comparison of these two water bodies will be on a more equal footing.

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