

THE WATER SITUATION IN THE WORLD AND WAYS OF IMPROVING IT

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WATER SUPPLY AND PURIFICATION

BY LARS ESPEN KNOOP

All people have a need for water, clean water. Here in the rich countries, we automatically take potable water for granted. But even here in the west, and naturally in all other parts of the world as well, a great deal of planning and very many hours of work has been put down, and is still being put down, to give households a reliable and clean, preferably drinkable water. In this article I will discuss different ways of providing water from different sources, and I will also go into different ways of purifying it.

The source of water to be used in an area has to be decided on account of several factors. The geographical position naturally plays a great part, if a large river runs nearby, it is natural to use the river as a source of water. Other factors that have to be taken in account are the economic, the political and also the socio-economic situation. If a country has enough money, it is possible to get water to virtually anywhere. If the country has large debts, which is the case for many African countries, even only moderately difficult and expensive sources can be impossible to use.

Different sources of water include rainwater from roofs, which can either be collected in private or common reservoirs, streams, lakes, rivers, ground water and salt water. Using rainwater has both its advantages and its disadvantages. Rainwater is usually free from organic material, turgidity and clay, but it may have a pH value quite far below 7, often around 5-6. Rainwater is also not a completely reliable source. It should only be used at locations where the rainfall is fairly evenly spread throughout the year, but dry periods can still occur, where one has to have a fairly large reservoir from which to get water.



Rainwater



Dams are used to create artificial lakes

Streams, rivers and lakes have since the dawn of time been the most used source of water, because of its availability. If a lake is to be used as water supply, it is a great advantage if the lake is at an uphill location, as gravity is much cheaper and more efficient than mechanical pumping stations. It is preferable to use a source that never dries out during the year, but it is also possible to, by building a dam, to control the flow of water so that it is possible to get an even supply all year round. A dam can also help controlling

floods, as is the case with the dam over the Yang-Tse River in China.

In areas where there are no lakes or rivers, and with little rain, ground water can be the only available source of water. This is especially used in deserts, where it may rain only a few times each year. The concept of ground water is that on any place on earth, if you dig deep enough, you will reach water. The depth of this varies greatly, but it can be anything from just a few to over 30 metres. In order to get to this water, one obviously has to dig a hole. This hole is what is called a well.

A well is, as mentioned, a hole in the ground that leads to the ground water.



A well can be a source of water in deserts

They are most common in desert areas, but can also be found other places. I actually have a well in the basement (it's true). Wells can be dug by hand or using machines, they can have a large diameter hole, or they can be small, made by drilling. The depth of the well is decided on behalf of how deep the ground water level in that area is. In most cases, the shaft of the well should be lined with concrete or similar material. This is not necessary if the well is made into rock. In order to increase the intake and refilling rate of the well, it is possible to increase the area of well beneath ground water level by widening the hole at the bottom, or drilling horizontal extension shafts. These cavities are most commonly filled with fairly coarse gravel, in order to prevent collapsing. Wells are a fairly reliable source, as long as they are not over-used. If too much water is drawn from a well,

seawater will seep in to replace the ground water, and thus the water drawn from the well will be seawater.

Salt water can also be used for drinking water if it goes through a cleaning process. UN has said that drinking water should have only 500 ppm (parts per million) minerals, such as NaCl, which is common salt. Seawater contains between 33 000 and 36 000 ppm of it. I will later get back to how this cleaning process takes place. This process is fairly expensive, and lots of electricity has to be used. But, 97,5 % of the water on this planet is seawater, so it is there, the problem is just using it.

It is essential that the water supplied is as clean as possible, and in nearly all water supplies the water goes through a cleaning process. In supplies used for providing water, the water is mostly safe to drink; the amount of organisms in it is usually under danger level. Nevertheless, as a guard against bacteria and diseases, a small amount of chlorine is added to the water. The chlorine serves to kill any living organisms in the water. It is also poisonous for humans, but the concentration of chlorine has to be much higher for it to be dangerous.

The different impurities that can cause problems are the following: disease-producing organisms, such as bacteria. They can carry diseases with them, such as typhus and cholera. The organisms also bring with them bad taste. They can most easily be removed by adding a disinfecting substance, like chlorine. Another problem can be toxic substances, which, as the name suggests, are poisonous for the human body. These toxic substances are not as easily removed.

Other impurities include colour, that the water is not clear. The colour comes mostly from swamps, water in swamps is very often not clear. The colour in itself is not really that dangerous, but it makes the water much less appealing, one wouldn't want to drink brown water. Also, if the water has colour, it may very well contain other substances as well. The same thing applies to turbidity, which in many cases comes from clay areas, the clay dissolves in water. Clay is not toxic, but it too adds colour and also taste to the water.

Organic material is also a common impurity to be found in water. This may come from dead plants or animals, or dead fish, if the dead material falls into water, and the rotting process continues there. Tiny bits and pieces will gradually come loose from the material, and will float around freely in the water. Organic material can also come from farms, if too much fertiliser is used on the fields. This will then be washed away, and will eventually end up in an aquifer. Another problem is algae. Algae are small plants that live in water. They feed off organic material, so there is a certain connection between high concentration of organic material and high concentration of algae.



Naturally filtered

Carbon dioxide, or CO_2 , is a problem, especially in rainwater. The reason for this is that the rainwater falls through the atmosphere. In the atmosphere there is a certain amount of CO_2 , and as the rain falls, a small amount of this goes into the water. The problem here is that water and carbon dioxide makes carbon acid. It is fairly common for rainwater to have a pH value of 5-6, instead of 7, which is common for water. Being an acid, rainwater can cause problems both with the environment, as acid dissolves non-soluble salts, such as CaCO_3 , which is a type of rock, and for people, as acids are not that healthy for the body, especially the teeth, but the rainwater is still potable.

So, now that the water is supplied, all that remains is to purify it. The simplest ways of doing this is letting nature herself handle the job. If the water is exposed to sunlight, the heat removes both colour and some disease-producing organisms. On the other hand, sunlight also increases the growth rate of for instance algae. Time, also, is a good purifier. With time, colour and turbidity will sink

to the bottom, algae will die and rot, and CO_2 in the water will come out as gas. These are the simplest means of filtration.

Another way nature filtrates water is through sand and rocks. This is called natural filtration. The sand or rock acts as a sieve, and removes organic material, algae, colour and turbidity. This natural filtration is used a lot for bottled water, they advertise with "natural mineral water". This name also shows that this water is not completely pure, it is not distilled water, but for drinking purposes, the body needs certain minerals in small amounts. Also, the human body is not designed around drinking distilled water, it is only during the last few decades that we have had access to it at all. Distilled water has less taste, and is not as healthy.

If natural filtration is not possible, for whatever reason, one has to do it artificially. There are two main ways of doing this, slow sand filters and rapid sand filters. Slow sand filters are, as the name implies, sand filters that work slowly. A slow sand filter is made by having a basin filled with sand, where the water enters at the top, and comes out at the bottom. The layer of sand is between 1 metre and 50 centimetres thick. Most of the impurities remain in the few upper centimetres of the sand, so after a while, when the sand starts getting dirty, only the top has to be scraped off. The top layer is scraped off, and when the layer gets below a certain thickness, the sand is refilled.

The rapid sand filter is, obviously, basically the same as a slow sand filter, just faster, but there are certain differences. The sand is often layered, so that the water passes through coarse sand first, then gradually finer grades. Also, prior to filtering, the water is treated with some kind of coagulant. This makes the impurities clump themselves together, so that they can be removed more easily and thus faster.

But, these filters do not remove salt from the water. As mentioned previously, the salt has to be removed for the water to be potable. The salt removing process is called *desalting*. There are two different approaches to this matter. One approach is to extract the water, and the other approach is to extract the salt. To extract water, it is most common to use thermal separation. This means that the water is brought to boil, either by increasing the temperature, lowering the pressure, or both. The steam that evaporates is collected, and guided into tanks, where it is cooled down so that it becomes liquid again. One is left with a tank of potable water, and salt crystals where the salt water used to be. Another name for this is *distilling*.

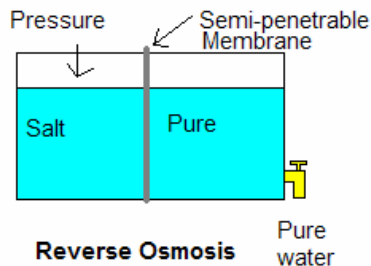
Sometimes, after distilling, a small amount of salts are added to the water, to give it more taste. The process of distilling works because H_2O (g) (steam)



Distilling water

cannot carry salts. Thermal separation can also be done by freezing the water. The ice will then be freshwater, and the saltwater will collect near the bottom.

In order to extract the salt, one has to use different methods. The two most common are *reverse osmosis* and *electrodialysis*. Electrodialysis is done by having an oblong basin, with the inlet and outlet centred on the longest side. In both ends of the basin, one inserts electrodes. One of them should be



positive (+), and the other one should be negative (-). Because of the electrical charge in salts, such as for instance NaCl, the positively charged ion, in this case sodium (Na^+) will collect at the negative electrode, and the negatively charged ion, which here is chlorine (Cl^-) will collect at the positive electrode. The water left in the basin will then be free from salts.

All these methods have their positive and negative aspects, and thus their different places of use. Boiling uses a lot of energy, but it is a fairly simple process, with not that many things that can go wrong. Because of this, almost exclusively boiling is used aboard ships, where one has a large engine that supplies plenty of energy. Freezing, although it might seem simpler, is more likely to go wrong, there are more parts involved that may fail. Electrodialysis uses an amount of current and energy that is proportional to the saline content, the amount of salt in the water. It is also a fairly complicated and expensive process.



Finally, here are a few prices, to put this all in perspective. All prices are taken from US, but they do not vary much from country to country.

Drinking water supply:	330 USD per person served
Water purification:	18,50 USD per 1 000 000 litres.
Desalting:	0,26 USD per 1 000 litres.





THE IMPORTANCE OF WATER

BY JØRGEN AASEN BERGET

I have chosen to write about why it is so important with safe drinking water, and the consequences that occur when the water available is contaminated, or if there is little or no water at all. I chose this topic because I wanted to find out more about the world's water situation today. I believe that here in Norway we take so many parts of life for granted, and this has started to irritate me. E.g.: I complain about writing this essay on water, instead of being thankful that I am allowed to learn more about the world's situation. Or, if you look at it from a different angle, here in Norway we all shower every morning in a liquid that is too cold, and sometimes take a sip of it. Well, it is not that easy all over our planet. Our brothers and sister are dying. They are dying because they have to drink unsafe waters, while we forget how lucky we are. I want to make you all more aware of this gigantic problem, and that it is up to us to do something about it.



All living organisms on this earth are made up of 50-90% water. All life is dependent on this source. The planet we live on is covered with 70% water; where as 97% is salty, and less than 1% is usable fresh water, as you see there is not a lot of fresh water compared to the amount of salt water, so we should take care of it. Water is recycled. From the sea it evaporates into the clouds, and from the clouds it rains down on the earth, where organisms use it. Water is then returned to the sea or ground waters. And the cycle is repeated. The plants need water to do photosynthesis, and as you probably know all food chains start with plants so, without plants there would not be life.

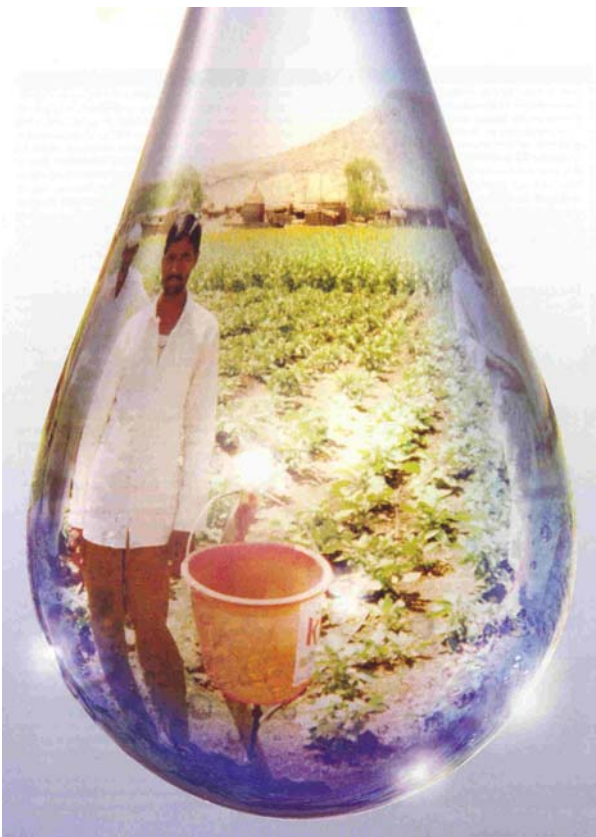
Humans consist of 2/3 water. Our brain is 95% water, our blood 82% and our lungs 90%. Like a car is in need of gasoline, humans are in need of water. Without water we will die faster than, without of food. For humans water is important as a dissolvent in our bodies. It transports food and oxygen to all cells, and takes part in a lot of chemical reactions. Saliva is mostly made up of water. The joint fluids where bones meet contain water, and water works like an air-conditioning system in by controlling the temperature. It is vital for our digestive system and it transports wastes out of our bodies. Water can prevent diseases, and it is recommended to drink at least 8 glasses a day.

When all life is dependent on this source, the result is not good when water is contaminated, or if there is a lack of water. It will cause illness and death. Water can dissolve many substances in large amounts, and this means both substances that are good for our health and that are dangerous. Water is

rarely found in a pure state, and this can be a problem in many parts of the world when there is not any possibility to purify it.

Not everyone is so lucky that they have fresh clean drinking water, when ever they want it. Many places in the world the water is contaminated, but even so people drink it. The result is sad. Other countries or places there might be too little or no water at all, and that is just as big of a problem. In 2002 there were 1.1 billion people who did not have access to safe drinking water, and 2.4 billion who did not have access to sanitation that is up to human standards. More than 2.2 million people in developing countries died because of in some way the unsafe drinking water had affected them. It might have been through some organisms that breed in water, it could be some waterborne disease. It might be directly that they drank the water, or indirectly that they got the water through foods. Most of these 2.2 million people were children. If you stop for a second while reading this text please, and count to 15, then one person has died because of a lack of unclean drinking water. With water and sanitation up to human standards the death and illness could drop as much as 75%.

Often it is the weakest link that you have to say good bye to, like we learned in science that it is only the strongest who survive. In the world it is often the poor who are the weakest, and of the poor it is their children. The children often have bad nutrition and when their bodies are not fully grown, it is not as strong as the adult's. It gets worse when it is common with poor hygiene, there are bad sanitary facilities, and contaminated water resources.



Ground waters in some countries contain fluoride and arsenic. Especially children are affected by this, resulting in a disorder. It attacks their teeth and bones, and make them weak. Weak as if they were old people. It is unfair really, why children, who are supposed to play, and laugh, end up dead. Selenium is also a substance, you sometimes find in groundwater. Like fluoride it is healthy in small amounts, but when the amounts grow bigger, it is toxic.

But these are not the worst or the most deadly diseases, no the worst are the diarrhoeal infections. These are carried by water, like small devils. Every year 1.5 million die of these infections. The contaminations can both be biological diseases and chemical pollution. Children who are feed with a bottle as a baby have a greater

chance of being effected of contaminated water, then children who are breast feed. But it is often hard to understand how people get infected by diseases like these, and find ways to protect. The best thing is just to try to stop preventing exposure. But it is said at least is that if these people got safe water, better hygiene and sanitation. Diarrhoea could be reduced with 25% and deaths could be reduced with as much as 65%.

It is extremely hard to live without a safe water source. To live in pain, without access to clean good water. There was woman in a small country called Suriname in the north of Brazil with this problem, they had to go far away only to fetch polluted water. The country is rich in fresh water, but even so in this district called Commewijne they were suffering from highly critical water shortage. Life was very hard for her, she had to go and fetch everyday. Sometimes the water was so disgusting that you would puke just by drinking it. It was hard for her when she had her period, she could not wash herself, and she had to walk long hard trips everyday. Their sanitation was poor, but they fought for their rights, it was a hard fight. At last they got their safe crystal clear water. No longer did you have to become sick, no longer did you have to be worried. Before old people had to pay others, to fetch water, and they did not have too much water. Oh, heavens how blessed they were now, the liquid gold had arrived.

To give people water you first need a source. If this source is not clean, you will need a purifying unit to clean it. Then you will need a system that can move this water about among all people in need of it. Often in many developing countries or industrial countries a lot of water goes to waste. Up to 50% of water is lost, due to leakage, hook ups and vandalism. And this is not a good thing. The problem is often that the countries do not have money to fix their water systems, and to maintain them in a good condition. The worst part, is when the pipes and the systems are so ruined, that people become sick, because of some chemical released for the pipes. Then it is no longer a system to give people the water of life, but it is the water of illness, which is horrible.

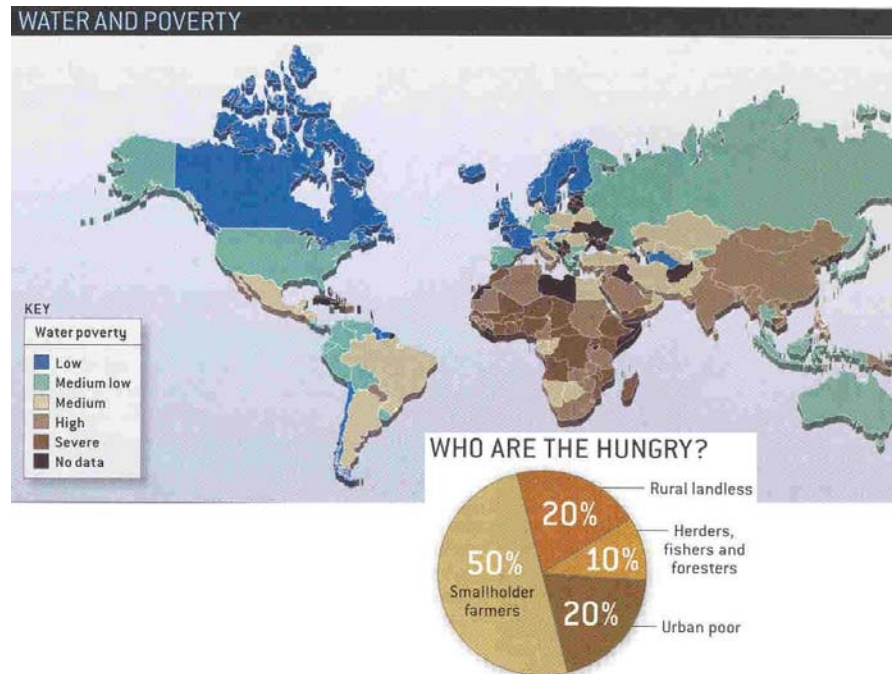
There are also places where only the rich have enough money to get water from these systems, while the poor end up drinking unclean water. Or maybe they have to buy it from salesmen who take harsh prices pr. litre, this making the poor become even poorer. In some countries they do not afford water systems. Then it is the women who have to do the job. Many long walks in the dazzling heat per day, to supply their family with water that might not even be clean. The UN has found out that approximately per year the women/females of earth walk 10 million person years to fetch water. And that is a lot! These humans also suffer from illness in backs and necks that occur to be very painful, for it is not exactly comfortable job carrying tens of litres on top of your skull.

“The world is going towards a food crisis, and can not use any more water for irrigation.”

Of all the fresh water we as humans have on this earth, 70% of it is used for irrigating of agriculture/plants. In dry countries it is even up to the level of 90%. Compared to the remaining 30% that is equally divided by industrial needs, and households. But often the irrigation is not effective in areas where there is little water, as it should be. This is because 60% of the water tends to

evaporate or return to surface waters or ground waters. Leaving only a 40% to reach the plants themselves, and this is a waste! Sometimes farmers over irrigate ruining good land, and leaving water standing still. This is a source for malaria.

Often this is a large problem for farmers in developing countries because water is expensive/ valuable for them it is not just something you can waste. One farmer once said, "I need control of water for crops at a price I can afford." That is why this is one important problem the world is facing, because if you manage use the water better you will have more food. If poor people get more food, then there will be less poverty. It is not only trade for aid poor countries need. They also need water. Water for life. In some countries they use a drip system , which is a hose with holes in it. This making water reach the plants more effectively, and less water goes to waste. And there is also a system that a Norwegian man made for pumping up groundwater, which is cheap and very good. It is a lot used in Madagascar, and is called the treadle pump. In poor countries they need the access to better tools, which have to be cheap and excellent in the same way. It is not always easy but the help is on the way.



The water use is increasing faster than the population, and that is a problem. This problem has occurred because of all the technologies in houses today that are in need of water. Since 1940 the world's population has doubled, but the world's water use has increased four times of what it was. If the population and use will increase in the same way in the years to come, the earth will basically go dry, in the middle of the 20th century. The problem also gets worse as more and more people urbanise, making it difficult to supply everyone with clean water and good enough sanitation systems.

The question remains: *Is there enough water?* The answer will be no, if the population gets as big as the calculation tells us, and if we do not do something dramatic with our polluting of all the earth's fresh water resources. But the story can become different if we manage to control our use and pollution of the water in a better way. There is a long way to go, and be on our guard because that is something we often have forgotten.

“Man has lost the capacity to foresee and to forestall. He will end by destroying the earth.” By Albert Schweitzer.

The UN has made some millennium goals concerning water. The goal is to halve the proportion of people who lack safe drinking water and good enough



sanitation by 2015. Goals are important in life, very important if you want to achieve something. Then another 1.6 billion people will need access to safe drinking water, infrastructure and services. 2.2. billion people will need improved sanitation systems and awareness of hygiene. The awareness is also very important, in schools e.g. This is because,

if we do not as small children see what is right and wrong, it is a lot harder to see it later. Now the level of money given to water and water infrastructure is 16\$ billion pr. year, to reach the goals it is needed 23\$ billion pr. year. There is needed 180\$ billion in a total. And pre investments there is needed 70-80\$ billion. All these numbers probably do not say you much but it is a lot of money, if you think that one dollar is 7 kroner.

Also there a need for people who can mobilize the resources, infrastructure and services. There is a need for people with high intelligence, and the projects have to be followed up so the money is not taken by corruption, so the world can become a better place, and people in need of clean water can get it. Also it is vital to find a balance between the ecological systems' needs, humans' needs, industrial needs and agricultural needs. This is because always there has to be a perfect balance in nature.

The year 2003 was a year were the UN worked with AWARENESS. They wanted more people to become aware of the world's situation. And I do truly believe, that is what I have achieved by doing this project on water. And I hope you as a reader, also have become more aware, through reading my essay.

Water so precious, for life, it is not shared equally between countries. It is different from land to land, and season to season. I do understand that there are conflicts about water around the world, because something that vital to life is worth fighting for. But we should try to see each other, try to see what gift water is, and not destroy it. I do believe that it is a luck that we live in a country, a so rich country. But I also believe that it is our mission, to help each other. We should try to think, how we would feel if we lived down in Africa, and had to drink water you got sick of everyday, but you drank it

anyway cause if not you would die of dehydration. How would that feel? Know that there were people out there with so much more than they actually needed, but they did not care. They just wanted more, and more them selves. How would that feel?

My point is that many drops will in the end make a sea, your hand can make a difference. It might be for just one life, for just one human being, but that is a huge different. This is because all humans are worth so, so much, and that I want you to think a bit about. You only have one shoot, there is not always one tomorrow for everybody. So our help has to come today, now. So in the end I would like to refer to a verse from the bible that says this:

“Love your neighbour as yourself”





THE WATER SITUATION IN THE WORLD

EUROPE

BY ANDREA SÆTRE

The European continent is the western part of the Eurasian continent. Europe is the second smallest continent in the world, with Oceania behind it. It covers about 1/14 of the world's total area. Today it consists of 45 independent states. Europe has ever since the industrial revolution been the leading continent together with USA in economy and industry.

The European climate is relatively mild. The European summers are usually warm, and there is also a lot of rainfall in this season. The winters are mild with an exception of the most northern and eastern areas.



Europe is rich on water resources. The rivers Donau, Rhine, Main, Thames, Seine and Spree are examples of big and rich rivers. Europe's water consumption is generally based on surface water. Rivers and seas take care of most of the water supply, but groundwater is also an important water resource for some European countries. It is mostly the smaller countries without a lot of access to surface water that base themselves on groundwater.

The average European has access to up to 3200 m³ of fresh water and only about 21% of the available water resources in Europe are used. From these numbers it might appear as if all European people have a rich access to water, but this is not necessary the case. The reason for this is that the water in Europe is unevenly distributed. This results in water shortage in several places in Europe. The fact that the fresh water is not evenly distributed in Europe doesn't mean that some countries refuse the use of water to other countries. The uneven distribution of water is mainly because of the climate conditions. There is for example less access to water in southern Europe than in northern Europe because the climate in southern Europe is dryer and warmer than in the north.

Several of the big, water-rich rivers run through many different countries. This has surprisingly not led to big conflicts between the different countries.

Europe's history has through many centuries been affected by armed conflicts between different countries, but none of these because of water! The main reason why water has not caused big conflicts between countries in Europe is most likely because water shortage is generally not a big problem. Also, very few European states are dependent on water access from neighbouring countries.

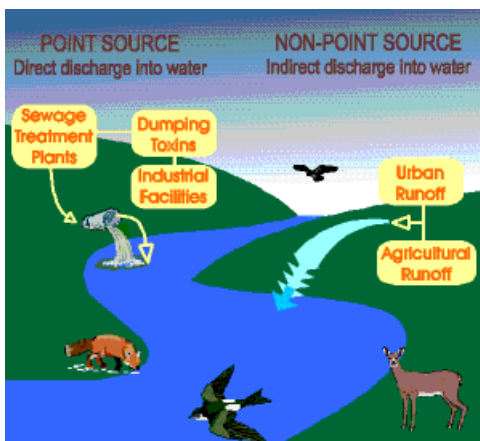
Europe has big pollution problems on their water resources. As a follow of the industrial revolution, Europe had many factories and such along rivers. The factories were often very polluting, and toxic waste from the factories and cities ran out into the rivers, which has had unfortunate consequences for the water.

Today in Europe, a lot of the industry is a long the riversides and the rivers are still important for transport. An example of this is in the Ruhr valley, where the transport on the Ruhr River is conclusive for the industry in the Ruhr valley.

As mentioned above, industry and transport tied together with waterways has led to pollution of the water. In the time after the industrial revolution, the pollution in the European water was extremely bad. The Thames and the Rhine River are excellent examples of this, but in the later years Europe has improved. European countries have in the last years done a lot to restrict the industrial waste into the waterways. This has led to increased water quality, especially in the big rivers in Western Europe and in the north.

It is not only the industry that pollutes the European waterways though. Water pollution like sewer and drainage from cities has to a big degree worsened the water quality many places. The countries in Western Europe have tried to improve their problems around the outlet of sewer and drainage. In the later years this kind of waste has been filtered and treated so that the water in the western European rivers has become better.

A big part of Europe's water problems is because of agriculture. In the southern parts of Europe, the agriculture demands artificial watering, because of the climate conditions. In these areas a lot of the water resources are used for this. Through big irrigation systems the water disappears from rivers, lakes and from the ground. The fact that the southern European agriculture is so dependent on artificial watering can cause water shortage in these areas, especially during droughts.



The agriculture does not only demand a lot of water in many areas, but it also pollutes the water. Water from the agriculture causes uncertain consequences for the water in rivers and oceans. Especially the organic materials hurt the water quality, and the water may in some cases not be used for

drinking anymore.

As mentioned above the groundwater is not the most important water resource in Europe, but it is important for the areas that base their water consumption on it, for example in Denmark or Slovenia. The groundwater has good quality, easy access and is relatively easy to treat. The groundwater is also threatened with pollution. The biggest threat though, is maybe that the groundwater level keeps sinking in Europe. The reason for this is that we use more ground water than the amount of water that fills it back up.

Another problem in connection with ground water is that ocean water goes into the ground water and thus makes it unusable for many uses, as drinking water for example. This phenomenon is a problem along the coast of the Mediterranean, the Baltic Ocean and the Black Sea. There is usually no big water shortage in Europe but during dry periods there can become a shortage of water for agriculture in the Mediterranean areas. It is therefore not the quantity but the quality of water Europe has problems with. The bad water quality that parts of Europe are facing, is because of industry, agriculture and waste from the cities.

A lot of the European countries have done a lot to improve the water quality in rivers, lakes, and groundwater, but a lot is still left to do. The improvements can be seen especially in the western countries. The problems with water are challenges that the new European Union stand over.



AFRICA

BY ALEKSANDER REINERTSEN

When someone mentions lack of water, people are likely to start thinking of Africa. Is it true that all of this continent is troubled with little water, or is this just a totally wrong picture we have from the media?

There live about 880 million people on this continent. This is a lot, but compared to Europe the density of population is rather low, and in Europe they are doing alright on their current water situation.



If we take a look at a satellite picture of Africa, we can clearly see the deserts of Africa, but the lack of mountain ranges is also clearly visible.

Africa mainly consists of deserts, savannahs and rain forests. It's naturally more a lot of water in the rain forest, but in the more dry areas, like Sahara and Kalahari, it is definitely harder to get access to clean, fresh water.

The thing that mainly makes it hard to get access to clean water in several of the African countries is the obvious lack of mountain ranges. There are mountain ranges in the east and the northwest of Africa, and also several ranges throughout the continent. There are however too few ranges to make proper waterfalls and/or lakes everywhere water is needed.

There is enough water in Africa, make no mistake about that.

Africa is actually believed to be

the continent with the best possibilities for increased hydroelectric power usage. So why do the pictures of thirsty children appear on our TV-screens now and then? We'll try to give you some of the answers.

Some Europeans use 230 litres of water every day, while some Africans have to live on less than 10 litres every day. This is of course enough for drinking, but different diseases are likely to emerge when people are unable to clean their own bodies. A second problem is often the quality of the water the Africans have access to. It is not unusual that several of the water sources are rather dirty and polluted, and found far away from the places people live.

It is important to understand that the most populated areas in Africa are located south of Sahara. No matter if there is enough water here or not,

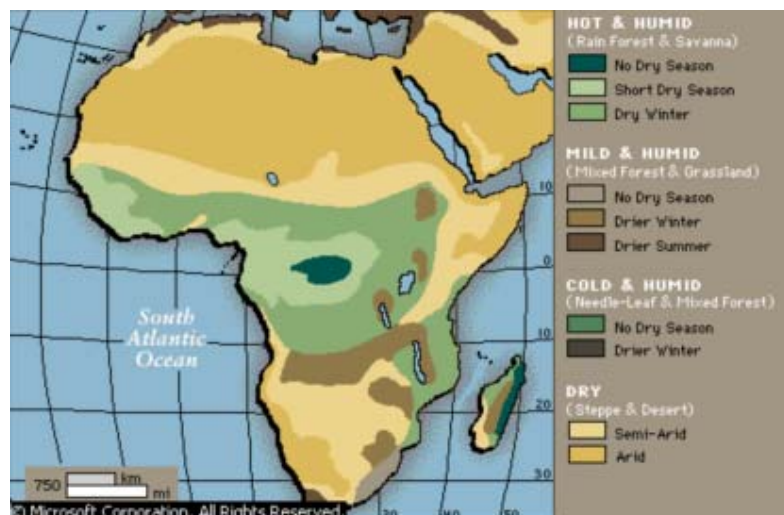
these areas are areas with conflicts and sometimes even civil wars. If one region has enough water for more than its inhabitants, a problem could be to share the water fairly, in countries where there are disorder and confusion, and sometimes even anarchy-looking conditions.

In some areas where the water supplies are depending on rivers, like in the countries around the Nile, the increased utilization of the river by one country would affect the countries lying further down the river. There are, fortunately, not too many conflicts where countries argue about the right to the fresh water of rivers today, but in the future, with larger numbers of population, increased utilization of the Nile and other rivers could result in serious conflicts and a great lack of water. Today most rivers are giving fresh water to many people, but it is a problem to distribute all the water from them.

Lakes are also found many places throughout Africa, and these do also give a lot of water to the inhabitants around it. Fortunately it is usually easy to decide which country that "owns" a lake, and there are in general few arguments, regarding lakes, between different countries. A problem could however be to utilize lakes, as with rivers and ground water, properly and distribute the valuable substance coming from it properly. Dams of water are also interesting, in Africa quite new, projects, especially taking place in the south of Africa. Dams like these may be able to solve many water problems in the future, and are also today helping the African population to get water they need today.

For several people in Africa, ground water is the most important source of water. The problem is however to filtrate this water, and get it out to the people, instead of getting the people to the water. As mentioned earlier, a serious problem is that ground water sources are located far away from many people depending on them. It is actually in the areas where people depend on ground water that the lack of purified water is greatest.

One can in other words say that there is no lack of water in Africa. There is rather a lack of proper distribution of the substance on the continent, and a lack of proper filtrating equipment. If Africa in the future get better co-operation between the countries there is a chance that many more Africans than today will be able to utilize the existing water resources they have got.



The climate in Africa

ASIA

BY ANDREA SÆTRE

Asia is clearly the biggest and most populated continent. Because of Asia's great extension, the climate varies between tropical in the south and arctic in the north. The mountain regions in central Asia make a clear division between different climates. Most parts of Asia have an inland climate because the humid air from the Indian Ocean cannot get over the barrier that the east-west oriented mountain region creates. In China though, humid air from the Pacific Ocean pushes its way inland. This happens because the mountain regions in this area do not create a barrier.



The continent's great extension gives room for very many varied social, political and natural circumstances. Finding a common problem for Asia's water situation is therefore very difficult. On the UN homepage it says that Asia's water consumption has increased from 600 to 5000 cubic km from 1900 to 1980. With relatively little water amounts that are distributed unevenly, the increase in consumption causes a lot of pressure on the accessible water resources. In addition to this, parts of Western and Southern Asia will experience an ever-increasing lack of water.

60 percent of the world's population live in Asia, but Asia only has access to 36 percent of the world's fresh water reserves. In addition to this, 80 percent of the world's population that live without access to satisfying sanitary conditions live in Asia. This being said, there is no doubt that this continent will be meeting a lot of challenges when it comes to water resources in the coming years. It is not hard to understand that this will affect a large amount of people.

As already told, Asia has many challenges both today and in the future. There are many things going on that are trying to improve the water situation, but there are some projects and conflicts tied to fresh water reserves that are especially worth noticing.

The most world known dam development is found in China. This project has gotten the name "Three Gorges". To achieve waterpower, dams must be built. The "Three Gorges" dam will be the world's largest and is being built on the Yangtze River. Because of the dam, 1.1 million people have had to move, 153 cities and towns, and 28700 hectare with cultivated fields will be flooded. China's enormous waterpower potential together with a quick economic growth makes such waterpower projects of a lot of current interest for the government.

Urbanization and the access to fresh water are closely tied together. The town population in Asia increases 4 times faster than the population increase. Because of this, the water supply is about to collapse in many cities. Bangkok and Beijing are two examples on this. Beijing's daily water necessities increased a hundred times from 1950 to 1980. A consequence of this is that the groundwater has sunk so much that it is evaluated to move the whole capital. "Keiserkanalen", which is the world's longest manmade waterway, may be changed to become the



The Three Gorges dam

main method of transporting water to the city. The level of the groundwater in Bangkok has sunk 25 meters since 1950. Such a development is obviously not very positive for Asia's fresh water reserves and it also clearly shows how urbanizing and the consumption of extremely important water resources are tied together.

The battle for fresh water can often be the factor for serious conflicts in Asia. The conflict between India and Pakistan about the mountain region Kashmir, has become bigger the last years. Both Pakistan and India want to own Kashmir, which today is shared between the two countries. Pakistan is socially and economically dependent on the Indus watercourse which has its source in the Indian part of Kashmir. This conflict is about the right to dispose these water resources.

Another example is how India and Bangladesh are fighting about the water resources from Ganges, which is the Indian's sacred river. It should also be mentioned that especially southeastern Asia are suffering from a lot of pollution. The over-consumption of natural resources is about to cause major damage in this area. The pollution is also a threat to people's health, and the result of agriculture and fishing has become worse. The pollution of the water in Asia is mainly because of the outlet of harmful substances from industry, and from the use of chemicals in the agriculture. The pollution of rivers has become a big problem. The rivers Ganges and Bagmatie are examples where the most damaging pollution comes from the dye houses along the riverside and from sewers. It is known that the rivers also become polluted as a result of many Hindus putting their dead in rafts on the river or casting their ashes into the water as the death ritual is supposed to be done.

In conclusion to this, we can see that Asia's future is rather sad. The water consumption is much bigger now than what it was for a couple decades ago and it just continues to grow. The reason for this increase does not seem to be the population growth. Especially urbanization, industrialization and more accepting economic politics lead to an increase in water consumption

per person. These factors also lead to a growth in water pollution. The level of the ground water is sinking in Asia because of over-use and the battle over water resources can also lead to serious conflicts. In the end, when we know that 80 percent of the world's population without access to satisfying sanitary circumstances live in Asia, it shows how critical the situation actually is.



OCEANIA

BY ALEKSANDER REINERTSEN

Oceania is a continent consisting mainly of Australia, New Zealand, New Guinea and several other pacific islands. The number of inhabitants found here is the least found on any continent except Antarctica.

The water situation in Oceania is in many ways split in two. The situation in Australia, New Zealand and New Guinea, and the situation on the smaller islands in the south- and mid pacific.

In Australia people live in the areas with the most rain and water resources. This would be along the coast, and especially in the south and south-east. In this region there is actually falling enough rain to provide all the inhabitants living here with all the water they would need. Even if this is so, the Australians utilize quite much ground water, which they eventually will run out of. If they run out of it, the amount of rain water falling on the region will be enough to fill up the pools in Queensland and New South Wales; it will just cost a little more money. A problem could occur however, if the population increases rapidly in the next few years. If this happens, the amount of ground water will be reduced even quicker, and the rain water may not be able to supply the population with the water they need.



Satellite picture of Australia only



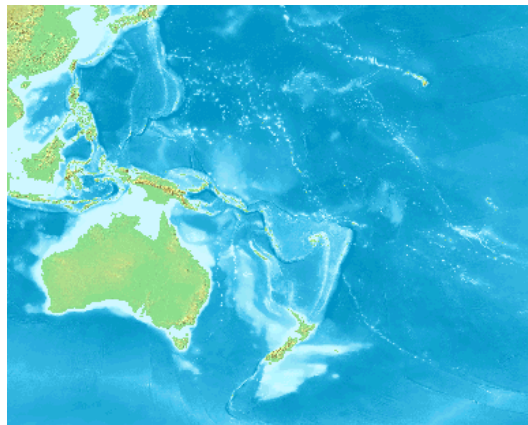
Oceania except Australia

In the deserts of Australia there do not live many people, and the water that is there, is enough to supply the inhabitants of the different towns and places.

The very biggest problem Australia faces is the global changes of the climate. This could cause the temperature anomaly "El Niño" to change, which over time would cause less rain to fall on Australia.

Most of the smaller islands do currently have enough fresh water available. This situation could change however, if the average temperature on earth should continue to rise. This would cause the ocean to expand and maybe cover some of the islands' fresh water resources. The changes may even cause entire islands to get covered by the Ocean. In addition to this the problem with less rain falling on the different islands could also occur here, just as well as in Australia.

The water situation in Oceania is currently very good. Low density of population and several different fresh water sources helps the different islands to get the water they need. Even if the current water situation is not too exciting today, it could certainly become more interesting with the global changes of the climate we are expecting in the future.



NORTH-AMERICA

BY ALEKSANDER REINERTSEN

There are today different opinions on the matter of the borders of South- and North America. We will however think of North-America as Canada, U.S.A. and Mexico.

North America is today a modern continent with more than 450 million inhabitants. This makes it the fourth largest continent on earth in population, and it's also the third largest in area.

The biggest problems regarding fresh water on this continent are found in the west of the United States. The amount of ground water is shrinking rapidly here, and in many areas they will soon run out of it. The amount of artificial watering to agriculture has had to be reduced in order to get enough water to the different households, to mention a taste of what may be to come in this region. This part of the U.S. is also depending very much on the river Colorado. Nowadays there is almost no water coming from this river to the sea and Mexico are struggling because they cannot utilize as much water as they would like to as a result of the United States exploit of the river further up.



North-America

Notice the dry-looking surface in the west of the United States

In the future the west coast could have a serious water problem if the number of inhabitants continues to increase. The U.S. has always been depending on their technology to get enough water. Scientists do however agree that it will be a challenge to make even more of the water found in this part of the country. Some of the biggest cities on the west coast have based their entire water supply on the Colorado river and the ground water located on the west coast, and a lack of water in this area could result in a disaster the U.S. are likely never to have seen anything like.

In the other parts of U.S., there are also places here where they are utilizing very much of the ground water. This causes of course the amount of the substance to shrink, but they are not facing as dark times here as they are on the west coast. In the mid- and eastern parts of the country, there are

more rivers, and especially in the middle of the U.S. the density of population is low.

In Canada the current water situation is satisfying. The density of population is low compared to its neighbour in the south and the future looks rather bright as well. The Canadian mountains create quite a lot of waterfalls and lakes, which brings much fresh water to the Canadian people.

In Mexico the biggest problem regarding water is found in Mexico City. Here they are utilizing so much ground water that parts of the capital is sinking 1 cm per 2 weeks. This will in the future result in way too little ground water in the area around the capitol for the city to get enough water. Even today keeping the city with water is costing a fortune, and the city is in no way getting enough water from the rain falling on it. Today water has got to be transported to Mexico City from several kilometres away. This is expensive, and not a development in the right direction.



Mexico City marked

Similar problems as the one found in Mexico City can also be found other cities and places in Mexico, but the problem is of course not this big any other place in the country. Neither are the other cities and places sinking as rapidly as the Mexican capitol.

The water situation in North America is currently acceptable, with two great exceptions; the west coast of the United States, and

Mexico City. The authorities have got a great job to do here, when speaking of getting water to the people in these areas in the future. As for the other places on the continent the water situation is currently okay, with some minor exceptions.



SOUTH AMERICA

BY ANDREA SÆTRE

South America is made up of the southern part of the American continent. Most of South America is located south of the equator and it stretches 7200 km from north to south and 5300 km from east to west. This leads to big differences in the climate in South America. The rainy Amazon in northern Brazil and the Atacama Desert in the northern part of Chile can both be found in South America.



The world's biggest rainforests are found in the Amazon area in South America. An important argument in the battle for keeping this rainforest is that many cures for future sicknesses are expected to be found here. Every year between 30 and 40 thousand square km disappear. The places with the most rain in South America are the inner and western areas of the Amazon.

Trade winds are stable winds that come from the subtropical high pressure zones. The winds move towards the equator from both the northern and southern hemisphere. The trade winds move towards the equator, but because of the Coriolis-effect they get pushed left on the southern hemisphere and right on the northern hemisphere. This effect is very important for the climate in South America. It makes humid air with rain go from the Atlantic Ocean and towards northern parts of South America. In this way the trade winds affect the nourishment basis in northern parts of South America.

The Andes Mountains are also very important in the water supply as rain in South America. The Andes Mountains affect the amount of rain in the eastern parts of South America because when warm air rises it lets out the water it contains. As a result of this the air gets pressed over the Andes Mountains and cools down. This rain contributes to the high amount of yearly rain in the inland parts of northern South America.

The world's second longest river, the Amazon River, runs through South America. It is 6400 km long. The northern parts of South America are drained with the Orinoco River, while the Paraguay-Parana River is the river system that drains through large areas south of Paraguay, Brazil, and west of Uruguay. In this way the water supply and nourishment are secured in large areas of the lowlands in South America through these wide river systems.

It is also important to notice the weather phenomenon El-Niño which also affects the climate on the west coast of South America. It occurs between

every 2-7 years and brings a lot of rain and harsh weather. Earth and clay slides are the results in both Chile and Peru.

The population in South America is unevenly distributed. The coasts are the most populated areas. Settlements in the inland areas of South America are mostly around rivers and waterways. The strategic setting of towns around the Amazon River show this. This brings both advantages and disadvantages. Floods are today a big problem in South America, which lead to loss of human lives and economical resources.



The Amazon River

The supply and access to water in South America is generally good. Nevertheless,

there are still simple water conflicts between different groups of people. An example of this is found in Paraguay

where a group of Indians have stood forward and asked for the exploitation of the nature and water sources to stop.

There is little research being done on the groundwater alone in South America, but in the latter years people have become more aware of the importance of groundwater. People are afraid of the pollution of the groundwater resources.



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Water supply and purification

Working with this project, I've learned that there is done a great deal of planning and an equally large amount of digging/ piping before clean, potable water comes out of the tap at home. First one has to find a water source, usually the one that is easiest to get to or most reliable will be used. Often, one will then have to purify the water, a process that is performed differently according to the purity of the sources. Ways of purifying include chemical treatment, mechanical filtering and biological i.e. bacterial purifying. Through using modern technology, and if one has the necessary funds, it is possible to get drinkable water from any kind of water, it be salt water, muddy water, hard water, infected water or anything in between. But, as with everything, it is a question about money. And this is why poor countries are in the situation they are in today. Although it may seem as if we should just send loads of money to them, this is not entirely true. The funds can be infinite, but if you haven't got the proper technology, you will never be able to purify and supply water efficiently. This is why what we should do to help the poor countries, in addition to sending some money, is to send over engineers, that know how to supply the water properly, and let them help. Naturally, it would be wrong to go over there and do the job for them, and letting them do only the dirty work. No, we should let our engineers educate the natives in how to supply and purify the water, and let them control their own projects. In this way, we could also be certain that if something should happen, it be corrosion, terrorist attack, or construction mistakes, there will be people there that know how this work, and will be able to maintain the system. In this way, we can supply them with pure water for decades and centuries to come.

The Importance of Water

In 2002 there were **1.1 billion people** who did not have access to safe drinking water, and **2.4 billion** who did not have access to sanitation that is up to human standards. More than **2.2 million people** died because in some way the unsafe drinking water had affected them, and of these most were children.

We tend to take clean water for granted in many parts of the world, and we forget the importance of it. The consequences that occur when the available water is contaminated, or if there is little or no water at all, seem to be "someone else's" problem. We need to realize how lucky we are. Obviously us with a lot of resources, have to help those with few.

All living organisms are **dependent** on water, so the result is not good when this source is contaminated, or if there is a lack of water. It will cause death and illness. Often it is the weakest link that dies, which are the poor children.

Up to 50% of the water in water systems is lost due to leakage, hook ups and vandalism. The UN has found out that approximately per year the women/ females walk 10 million human years to fetch water. These humans also suffer from illness in backs and necks.

All food chains start with plants, but plants need water. Of the world's fresh water about 70% is used for irrigation of agriculture, often 60% tends to evaporate, return to surface waters or ground waters. *"I need control of water for my crops at a price I can afford,"* exclaimed a frustrated farmer.

You will meet the UN's millennium goals concerning water, and solutions to the agriculture problem. In 2003 the UN worked on **AWARENESS**. If you want to become more aware, read this essay. Try to put yourself in their shoes. How would it feel? People are in need of help, your help. With water and sanitation up to human standards the death and illness could drop as much as **75%**. You can make a difference!

Water situation in the world:

In conclusion, Asia has a rather challenging future ahead of them. The water consumption is already at a threatening point, but it continues to grow. Water pollution is also a problem that Asia should focus on. The level of the ground water is sinking and the battle over water resources is leading to serious conflicts. The situation is very critical and we know that 80 percent of the world's population that live without access to satisfying sanitary circumstances live in Asia. On the other hand, they do have several projects going on that will improve their water situation. An example is the dam development in China.

Europe is rich on water resources. This, mainly from the big rivers that run through Europe. Most of Europe's water consumption is therefore based on surface water. The few countries that do not have access to surface water use ground water. The main issue when we look at the water situation in Europe is pollution. As a follow of the industrial revolution, many factories were built along the big rivers, and their waste polluted the water. Pollution is still a huge problem, but there have been major improvements in the latter years. Conflicts over water resources are not an issue in Europe.

The supply and access to water resources in South America is generally good. The world's second longest river, the Amazon River, runs through South America. Other big rivers such as the Orinoco River also run through this continent. The world's biggest rainforests are found in South America. The trade winds make humid air go towards the northern parts of South America and these affect the nourishment basis in this area. There is little resource being done on the groundwater in South America but the biggest concern on this topic is the pollution of the groundwater resources. In conclusion, South America has a pretty good water situation.

The water situation in Oceania is currently acceptable. Especially Australia is utilizing very much ground water. Even if they do so, they do get enough rain to have enough water when they sometime in the future run out of ground water. Many of the smaller islands are likely to get flooded sometimes in the future because of the global changes in the climate. When the seas rise, as a result of these changes, not only

are the small islands fresh water resources likely to be covered, but also the entire islands could get flooded.

We all know that there do occur “lack of water crises” in Africa from time to time. However, there is enough water in Africa to supply the continents entire population with water. The biggest problem in Africa is to distribute the existing water properly, because the water is there. The problem is to get the water to the people instead of getting the people to the water. Many people are today depending on dirty ground water in Africa, while there are several not properly utilized rivers here.

In North America, that is, in this article, Mexico, USA and Canada, there aren't too many water problems. Where they are found, they are however big. On the west coast of the US, there is currently an exploit of the river Colorado going on, in order to supply the millions of inhabitants and all the agriculture in this area, with water. However, it is limited how much more water this river can supply, and the amount of water being provided to the cultivated areas here, has had to be reduced. They are also using most of the ground water in this area. The US west coast has a serious water problem. Another large water problem is found in Mexico City. This city is currently shrinking 1 cm every second week in some neighbourhoods because of all the ground water that is being spent from under the city. Keeping the city with water is also very problematic, sometimes impossible and very expensive.

