**Water, Society and Sustainability**

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**Lecture – 11**
**Water Technologies in Medieval India I**

So, in the previous lectures we had learnt about water management techniques or not management, but rather harvesting and conservation techniques. That were prevalent an existence in ancient India, pre-colonial India. So, today also we will be covering pre-colonial India, but mainly focusing on mediaeval India; that is across the Sultanate and the Mughal regimes. Now the, this whole topic the theme called water technologies in mediaeval Indias. So, I have divided this into 2 parts.

So, in this particular lecture part 1 of water technologies in mediaeval India, I am going to discuss and first I am going to give you context that how there is a change from, you know, ancient to the mediaeval times. So, what was the changing context so, that would be discussed. And then I would be talking about like the various water technologies or rather the various water use and conservations, technologies or techniques that the Sultanate and the Mughal rulers implemented across India. More importantly in the area of their rule, that is north India again specifically north-west frontier province.

So, this would be one. And the second part water technologies in mediaeval India to that would be basically focusing on the water lifting devices. The water lifting technologies, because the Islamic rulers they were extremely renowned for the design and implementation of water lifting devices in India. And this is a knowledge that they not only, you know, I mean they not only culminated or nurtured within the Indian context, but we will get to learn that these Islamic technologies were prevalent already in south central Asia from long back, from where those technologies were transferred to various places where Islam could establish its rule.

So, these are the 2 major themes within water technologies in mediaeval India. So now, let us first concentrate on part 1, where I will be discussing the context and the various water use and harvesting techniques under different rulers of both the Sultanate and the Mughal dynasty.

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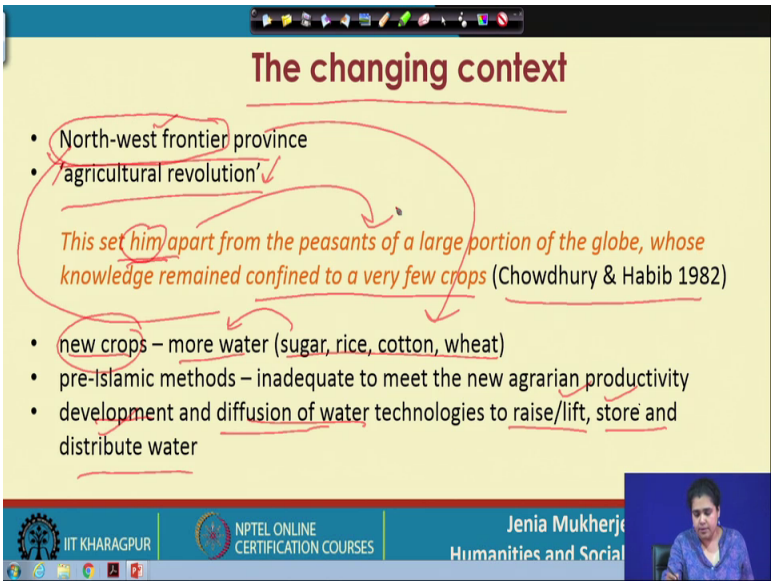


So, as I was mentioning about the changing context. So, I think we should highlight on this particular geographical terrene or geographic location which is north-west frontier province. And this is very important because these particular region it is extremely arid and semi-arid in nature.

So, it is very different from the topography and climatic conditions of the indo gangetic plain, because indo gangetic plain criss cross by several tropical rivers it very fertile, but, you know, unlike the indo gangetic plain north-west frontier province is a desert region. And which had very less agricultural productivity. Now, one of the major contributions of Islamic rule in India was that during the Islamic rule north-west frontier province was transformed from an arid region to a region, where there was I mean where land was brought under the plough.

So, there was cultivation and number of crops numerous so, we will get to learn about that gradually, numerous crops and vegetables and fruits, were cultivated in this particular area through the use of extensive and elaborate water management techniques by the Islamic rulers. And even Irfan Habib who is a very renowned historian on mediaeval India specially who focus on the Mughal rule the Mughal India, and he also I know he is an economic historian. So, he came up with an argument that during this time during the Mughal time and also the pre Mughal time, there was an agricultural revolution in India.

So, we will not enter into the debate that whether India had an agricultural revolution during this time or not, but this is for sure we can definitely accept this particular argument; that India and more specifically north west frontier province it saw, it visualize a lot of a agricultural you know, productivity and agricultural prosperity that through which the farmers also could make the fortunes. So, yes the upon Rai Chowdhury and Irfan Habib in their edited volume on the Cambridge economic history of India of seminar and braking volume which was published in 1982. So, they are Chowdhury and Habib rights mentions, this set him, now who is this him? Him is the Indian former. So, this him apart from the peasants of a large portion of the globe.

So, they say that they, you know, there is a there is a difference between peasants or formers of India peasants of the rest of the world, while because peasants of a large portion of the world, their knowledge was confined to a very few crops. And compare to that Indian peasants they had the, you know, they have the flexibility to grow numerous crops. And here comes the role of the water techniques the water practices that were prevalent or that were implemented under both the Sultanate and the Mughal rule.

So, and what was the result? The result was, you know, new crops not only, you know, old crops where practiced or were cultivated in the north-west frontier province, but new crops were also introduced. And this new crops included sugar rice cotton and wheat, then we all know that these crops like sugar, rice, cotton, wheat it actually required lot of water. So, more water lot of water was required. So, then we will come to know that how in this particular arid region, they could really, you know, manage to grow crops like sugar, rice, cotton and wheat that are water intensive.

So, as you can understand that pre Islamic methods, they seem to be extremely inadequate to meet the new agrarian productivity the new agrarian needs. And so, development and diffusion of water technologies we definitely, you know, this Islamic period or mediaeval India. It is loaded with thickly loaded with the history of development and also diffusion. Diffusion means spread. So, spread of water technologies to raise or lift water from, you know, from you know, the ground from the depth and also stored and distribute water. So, as we were discussing our focusing on north-west frontier province which is otherwise a desert. So, it is very important to, you know, to lift water from the subterranean portion of the soil.

So, how did they tackle that? So, how did they came up with the lifting devices, how could they raise, lift, store and distribute water. So, this is the story of lifting storing and distributing water in the north west frontier province leading to an agricultural revolution, if not agricultural revolution, but at least increase in agricultural productivity that set up our the Indian farmer from the peasants and farmers of the rest of the world.

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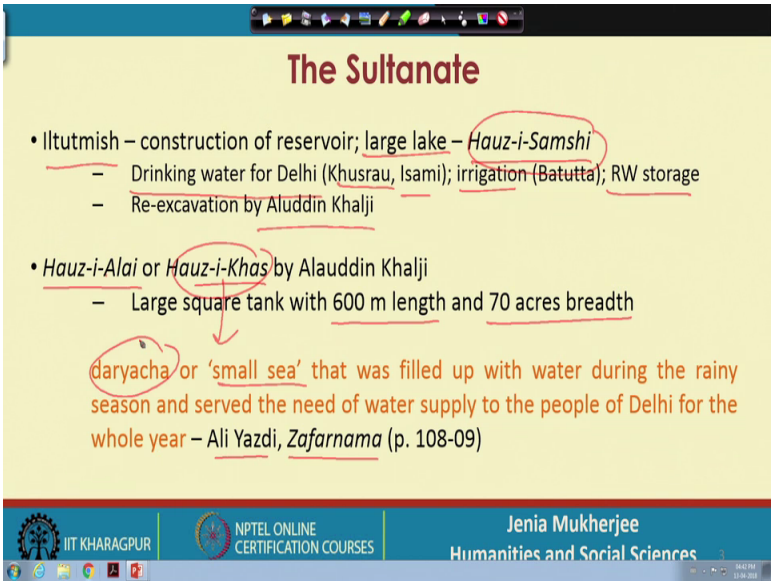


Yeah, so, now coming to the Sultanate rule. So, Iltutmish is a person; is very interesting that when we actually study our conventional history textbook. Conventional history textbooks never mention about the very other interesting aspects of Sultanate rule for that matter or Mughal rule.

So, but nowadays, you know, there are a group of historians that I had already talked about who are focusing on environmental history. So, if you, you know, go through their accounts you will find that, you know, you will find the environmental history during the different dynasties or during the different regions or rule that happened in India. So, the environmental historians, they offer us with an information that Iltutmish was one of the first rulers who could construct very big large scale water reserves. She was the first Delhi Sultan who constructed water reserves, and during his rule during his reign this particular lake the large lake called Houz-i-Samshi, which was almost like 2 miles in length and one mile breadth.

So, such a big lake such a large lake was constructed under I mean during his rule. And this reserves and lakes were responsible for both the purpose of meeting the drinking water needs of Delhi. And also the irrigation needs irrigation for agriculture. And these were also this also serve the purpose of a rainwater storage or rainwater harvesting. So, all these 3 like drinking water, irrigation and rainwater storage. And one interesting question is like a from where do we get to know about these details, like, this particular these facts that, you know, under Iltutmish these reservoirs were constructed the large lakes were large lakes came up they meet the drinking water irrigation and rain water storage needs during that particular point of time.

So, from where do we get this kind of information? This kind of information is available from the Persian sources, which are known as Persian chronicles from the Urdu sources. And they had, you know, they provided patronage to may court poets many, you know, court patrons like Amir Khusrau Isami, and also if you go through these accounts, if you go through these chronicles and sources and evidences, you will get to know about this history. So, these sources also mentioned that this particular lake Hauz-i-Samshi it was again re excavated by Alauddin Khalji. So, it was very important for the water needs of Delhi and the adjoining areas.

So, that is why it was it became important and eminent for Alauddin Khalji to re maintain and re excavate this particular lake and the reservoir. So, apart from that so, apart from maintaining Hauz-i-Samshi that was built under that came up under Iltutmish, Aluddin Khalji also under his I mean under his reign at this particular reservoir, they are very famous one call Hauz-i-Khas also known as Hauz-i-Alai so, these was constructed.

So, it is a large square tank with 600-meter length and 70 acres breadth. So, it is a very huge lake which is still I mean remembered in Delhi because we will see picture, where we will see how, you know, surrounding this particular tank and inter complex and the complex is still there though the tank I mean the tank that we have today it is very different from, you know, the tank that was built during the time of Alauddin Khalji.

So, but Hauz-i-Khas is still very much prominent and present in both the, you know, both the cognitive memory. And also the physical space of Delhi. So, Ali Yazdi again another scholar, on during the Islamic time. So, he wrote an account of the Sultanate rule and this account is called Zafarnama. So, Zafarnama mentions that daryacha or small sea that was

filled up with water during the rainy season and serve the need of water supply to the people of Delhi for the whole year.

So, he mentions Hauz-i-Khas as a small sea. So, you can understand how much water it contain. So, it was large because we already know 600-meter length and 70 acres breadth it is almost Daryacha or small sea.

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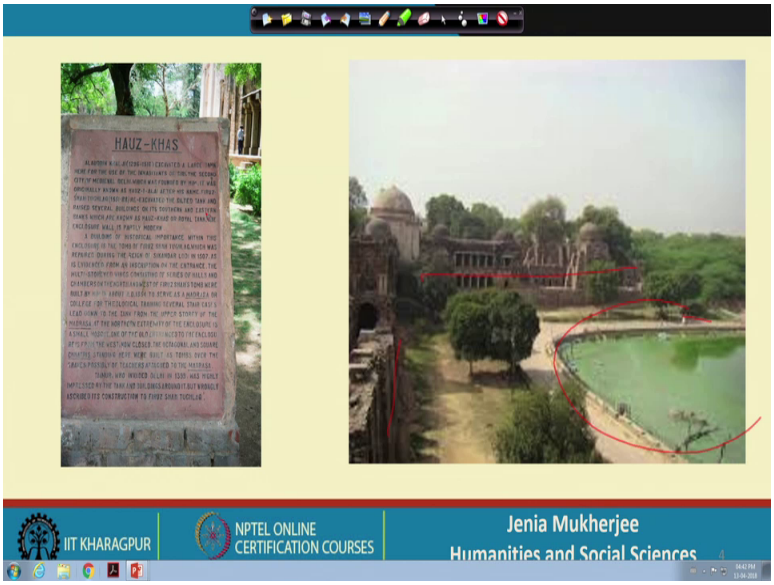


So, as I was mentioning this is the famous Hauz-i-Khas complex. So, you are there is this is the tank and, you know, the large complex surrounding this entire area. So, these are areas are inhabited by people. And this is an interesting valley and the stone that mentions or provides information about Hauz-i-Khas that Alauddin Khalji excavated this a large tank.

And it also provides the information that it was I mean after Aluddin Khalji it was also mention it was also maintained and re excavated by Firoz Shah Tughlaq. So, there is a long history about Hauz-i-Khas that you find in this particular instruction. Now, coming to Mohammad Bin Tughlaq it is very interesting, but before going to Mohammad Bin Tughlaq there is little bit of coverage on Ghiyasuddin Tughlaq.

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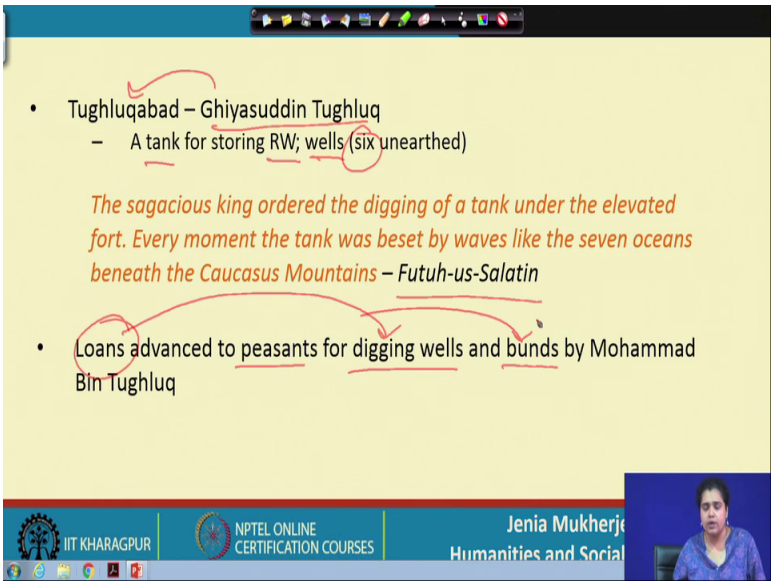


And Ghiyasuddin Tughlaq we know from our again from our school history textbooks that Ghiyasuddin Tughlaq, he found this particular city called Tughlaqabad, right. And so, Tughlaqabad it was very important so, when one particular city is designed, the first important thing that is, you know, important to be planed for so far as city planning is concerned, which is known as water in water out. That is from where would the city get its water supply? And then where the city would actually channelize it is wastewater? So, this is known as water in water out technology. So, when a particular a planner plans city the most important thing that is need to be taken into consideration is this water in water out process.

So, the same thing also, you know, Ghiyasuddin Tughlaq knew this particular thing. And he knew this particular thing and he knew this particular is validated by the fact that when plan Tughlaqabad he also plan the construction of tanks for storing rain water. He planned the construction of numerous wells so that to ensure water supply in this new city of the Tughlaqabad. And the, from archaeological excavations we find that 6 of these numerous wells had been unearthed.

And so, this is something from Futuh-us-Salatin I think by Izami so Futuh-us-Salatin a very important source again, it mentions that the sagacious king order the digging of a tank under the elevated fort. So, every moment that tank was beset by waves like the 7 oceans beneath the Caucasus mountains. So, it seems that he is comparing, you know,

the beauty and the extent of the tank with other regions. And so, the beauty is captured in his a poetic lyric where he mentions that beset by waves like 7 oceans beneath the Caucasus mountains.

The very interesting poetic manifestation and reflection of what he could observe from this tank. And, then after Ghiyasuddin Tughlaq, Mohammad Bin Tughlaq (Refer Time: 16:21) started and it is very unfortunate that we only if we if I ask anyone that though they remember Mohammad Bin Tughlaq and all.

And they will say yes and they will say that he was the match king of India. Because that is how he is portrayed in again conventional history textbooks. So, he is categorized as or he is stigmatized rather as the match king of India. But this is a very linear and partial history this is not true, because lot of interesting things lot activities happened during the reign of Mohammad Bin Tughlaq. And one should also know that, you know, Mohammad Bin Tughlaq was highly criticized for transferring his capital from Delhi to Daulatabad.

But one reason that why he had to transfer the population or his capital from Delhi to Daulatabad is that during that time in that region of India was encountering was suffering from a great famine. So, it became very important for Mohammed Bin Tughlaq to think about how, you know, this famine could be tackled, addressed. So, we see that from the various accounts we get to know if we I mean only go through the accounts of imperial historians like and Stanley lane poole, and all then Mohammed Bin Tughlaq is only, you know, identified as a majesty.

But, if you look into the other sources the Persian chronicles for example, Mohammed Bin Tughlaqs biography has been written by one of his sister. So, if I go through those sources we will find that Muhammad Bin Tughlaq he really was very serious, I mean to come up with steps effective measures that can really control a famine. So, what he did his that he advance loans, advance loans to peasants for digging wells and bunds. So, this is what Mohammed Bin Tughlaq did and though all his experiments were not very successful, but it is found from these records or sources that he was quite sympathetic to the peasants. And he try to help them to fight the peasant, to fight the famine by providing loans to them.

And these few loans where actually provided with the only purpose of digging wells and creating bunks for managing water, storing water. Yeah, Firoz Shah Tughlaq so, who came to after Mohammad Bin Tughlaq. So, had lot of challenges in front of him because Mohammed Bin, Mohammed Bin Tughlaq reign exploded some problems few crisis for the empire and so, when Firoz Shah Tughlaq he came to power he had lot of challenges in front of him.

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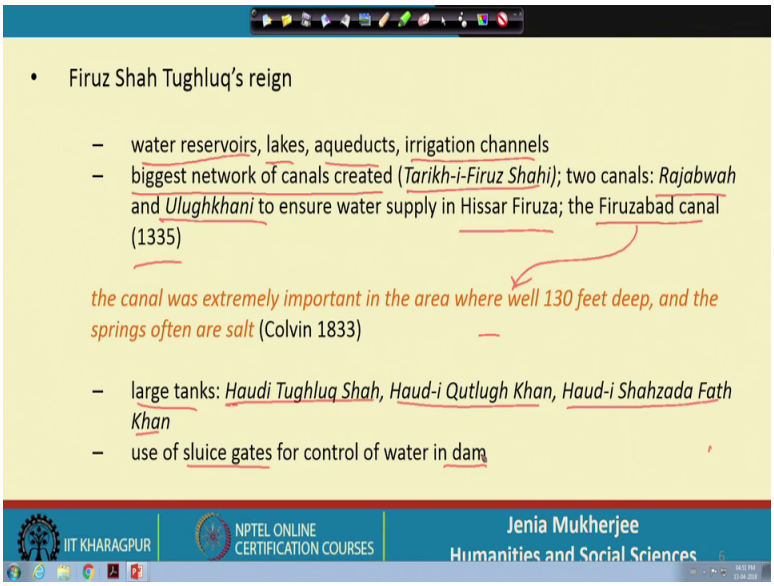


And he is very famous I mean so far as water conservation and water use techniques are concerned.

Because, during Firoz Shah Tughlaqs reign, numerous water reservoirs, lakes aqueducts, irrigation channels were constructed. And the so he is credited with coming up of the biggest network of canal. So, and there are various sources, the most important being Tarikh-i-Firoz Shahi. So, Tariq-i-Firoz Shahi mentions that Firoz Shah created biggest network of canals. So, we these 2 canals were very famous. So, one this Kajawah canal bringing water from the Yamuna and the Ulughkhani canal bringing water from the Sutlej.

So, these 2 canals Kajawah and Ulughkhani. It ensure water supply in Hissar Firuza. So, Hissar Firuza was the new town, the city again which was constructed by under Firoz Shah Tughlaq. So, it is I mean during the Sultanate regime we also have very interesting history of the emergence of new cities like Tughlakabad, like Firozabad, like Hissar

Firoza and all that. So, the Firozabad canal was the big canal it was also excavated in 1335 and this gets mention in the report of major Colvin. So, Major Colvin he looked into the history of canals both small canals and large canals in Delhi. And so, his one of his papers also got published in the journal of Asiatic society.

So, from so, I have taken this reference from there. So, Colvin mentions about the Firozabad canal, and he says that the canal was extremely important in the area; where well 130 feet deep, and this spring's often are salt. So, where wells are 130 feet deep and this springs they are often salt. So, you know, remembering these challenges it should be kept in mind that the Firoz Shah canal really have to play a major role for ensuring water supply for this particular region.

So, apart from canals Firoz Shah reign is also credited with the construction of large tanks. And these are some of the famous large tanks which were constructed under his rule. One is Haudi Tughlaq Shah Haud-i Qutlugh Khan, Haud-i Shahzada Fath Khan.

So, these are few of the large tanks that were constructed. Then there is another interesting information that we get. That is the dams sluice gates were constructed. And this is very important because this is the first time that we, you know, the this is the first time that we find the mention of sluice gates. And why sluice gates were there in this damns? Because, it was very important to control saline water. So, sluice gates were constructed with the specific intention or function of controlling the saline water in the damns. So, this is also very important because Firoz Shahs Tughlaqs reign for the first time it introduced the use of sluice gates in the bunds and the dams.

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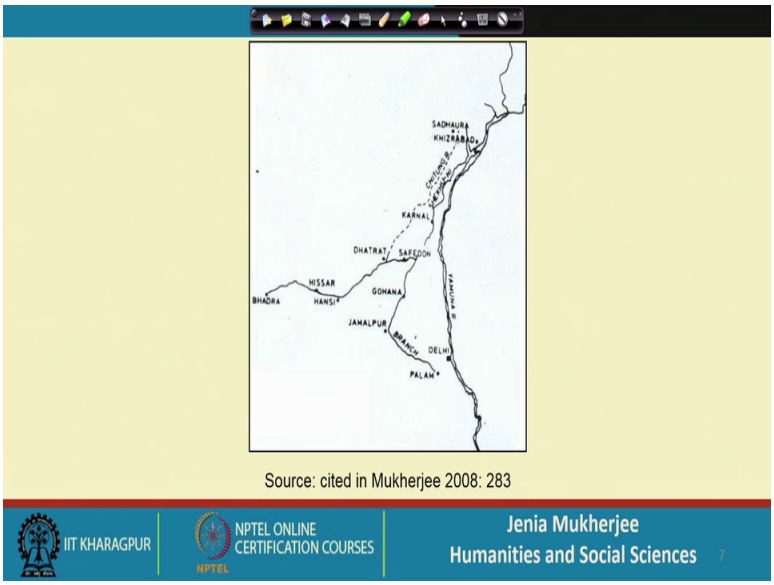


So, the picture of the canals and Hissar.

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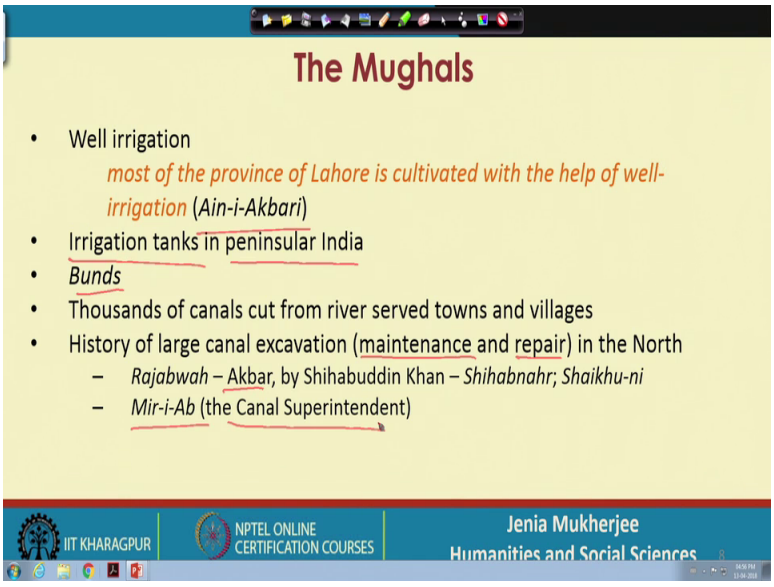


Yeah so now, I will come to the Mughal rule. So, Mughal rule is also credited with the with well irrigation. Numerous wells are been unearthed, numerous wells were excavated under the different prominent Mughal rulers. And again as I mentioned that we have this Persian chronicles we have the Urdu sources where the like books. And the accounts by the court poets and also the foreign travelers we also have some epigraphic sources that talk about the wells and water reservoirs bunds and Bundara's. So, Ain-I Akbari the

famous account by Abul Fazal who was Akbars court poet. So, Abul Fazal mentions in Ain-i-Akbari that most of the province of the Lahore, which is today in Pakistan is cultivated with the help of well irrigation.

Also one important point to keep in mind here is that they implemented well irrigation or a water reservoir in specific areas according to the specificities of those geographical location. So, for example, the topography and the climate and other geomorphological features of Lahore prompted them to devise well irrigation mechanism or to design and develop well irrigation mechanism over there which might be different from other areas where we find the prominence of tanks.

Which might be again different from other areas where we find the prominence of bunds and Bundara's. So, these in mapping the specificities mapping the specific context was very important for both the Sultanate and the Mughal rulers. And first they use to understand the physical features of a particular region. And then they used to come up with, you know, plans or techniques which are extremely tuned to those particular regions.

So, for example, so far as Lahore was concerned. So, they had the idea they could understand from Lahore's typical topography of specific tomography, that for Lahore wells where the most important I mean the wells could be the most important water technology, that should be that should be, you know, a spread across the lengths and breadths of Lahore.

So, again so, as I mentioned so, Lahore we find we irrigation on the other hand in peninsular India we find irrigation tanks. Similarly, we find the bunds in various regions of north India, thousands of canals were cut, thousands of canals were cut from river which used to serve the towns and villages. And so, these canals were used again for the purpose of both drinking water and agriculture irrigation more importantly irrigation. And we also have a rich history of a large canal excavation. And very importantly this canals were not only excavated, but they were also very much maintained and repaired, ok.

So, we have the history of a maintenance, re excavation and repair of this particular canals. And for example, Rajabwah that we already mentioned. So, Rajabwah used to bring water from the Yamuna river and it is excavated during the time of Firoz Shah

Tughlaq. So, it was reactivated by Akbar. It was also maintained and re maintained by one of the provincial officials who is Shihabudhin khan. And so, the name of the canal Rajabwah it became Shihabnahr. Because Shihabudhin Khan he invested funds for the excavation of the canal.

Again, these canal was reactivated as I mentioned during the time of Akbar. And the so it became shaikhu-ni Shaikhu-ni is very interesting because Akbar use to call his son Jahangir as Shaiku Baba. So, on his name this canal was renamed. So, another important administrative post that we find during this time is Mir-i-Ab. So, Mir-i-Ab means the canal superintendent. Interestingly this legacy continued during the British period as well, because during the British period also we have the post of this canal superintendent. And so, the post of canal superintendent was also very much prominent and who was called Mir-i-Ab during the Mughal rule.

Yeah so, now coming to Shahjahans rule.

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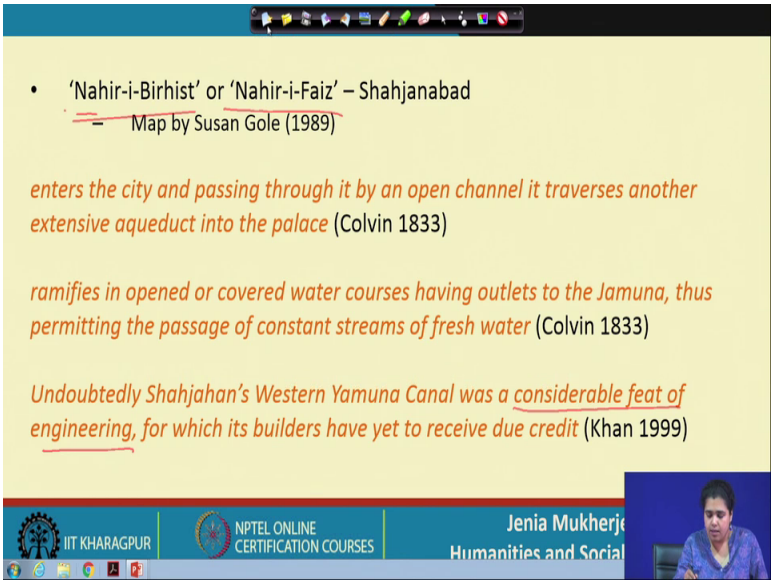


So, during Shahjahans time, this particular canal called Nahir-i-Birhist or Nahir-i-Faiz. So, this is one of the prominent canals which was excavated during the time of Shahjahanabad. It is a very interesting book, you know, Persian I mean on the on the maps the of the I mean on the maps that captures different aspects it also focuses on the canal. If you see this particular book by Susan Gold, we will find out the different panels and alignments of this particular canal.

And this canal was so important that I talked about Colvin and his research or his account on the canals in Delhi. So, Colvin says that it enters the city and pass through by an open channel, it travels another extensive acquired into the palace the palace specifically the port. So, and so, this is a some more details about this particular canal. So, this another very interesting research done by Abha Khan, specifically focusing on the irrigation of Haryana. So, this a it is a chapter published in the edited volume by Irfan Habib on the Agrarian history of Mughal India.

And there Abha Khan writes that undoubtedly this canal. So, Shahajahans western Yamuna canal was a considerable feet of engineering. This is very important. So, we are talking about the Mughal ruler rulers the, we are talking about Mughal rule, and Abha Khan is saying that it was a considerable feet of engineering for which it is builder have yet to receive due credit we will explain this when we come to the next lecture. So, coming to the final part of this lecture representation.

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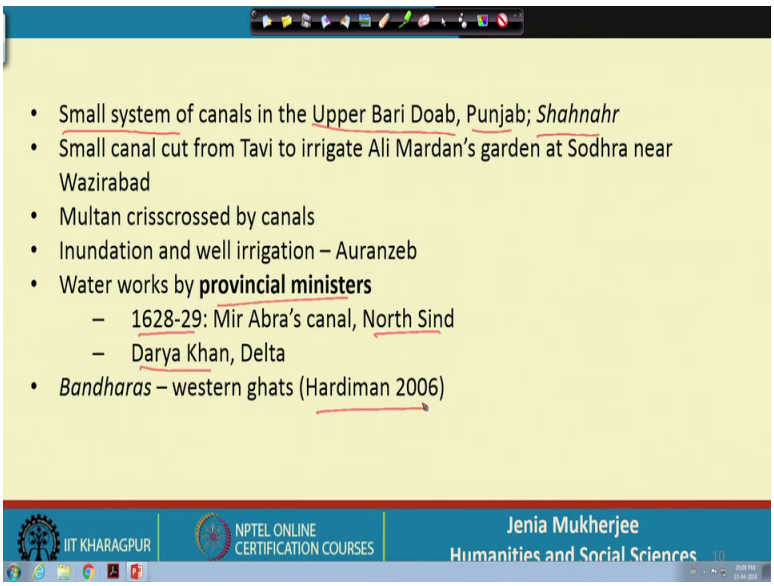


So, apart from large canals a small canals were also excavated. For example, 5 number of small canals in Upper Bari Doab region. So, Punjab the famous Shahnahr over there.

Other small canals cut from the Tavi to irrigate Ali Mardan's garden again one provincial officer. At Sodhra near Wazirabad Multan it was also crisscross by canals. And, during time of Aurangzeb several accounts mention about the inundation and inundation canals and well irrigation. So, these were prominent features during the role of Aurangzeb. And

water works as I mentioned earlier it was also very much carried out not only by their Mughal rulers, but also by their provincial ministers.

So, very few examples here 2 examples so, likes between 16, 28, 29 Mir Abra's canal Eas excavated. So, Mir Abra was the provincial minister who excavated the canal in North Sind. And Darya Khan he also he also tried to store I mean try to come up with devices in the delta region. So, we get the name of another provincial minister Darya Khan for the delta. Apart from that Hardiman he has done some research on the Bundaras small scale a small scale dams, or Bundaras in the Sahyadri regions that is the Western Ghats. So, he also talks in detail about the numerous, you know, small Bundara's that were there in this region.

And how effective their role was in terms of waters storage.

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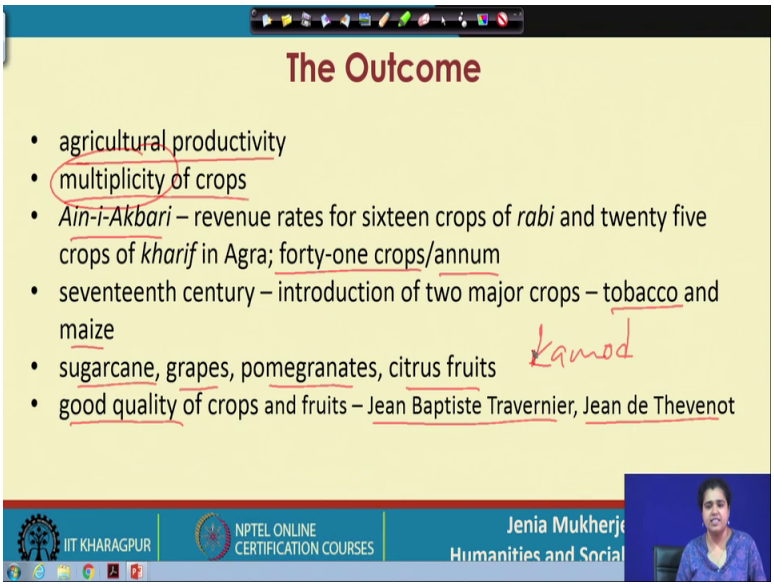


So, finally, what was the outcome of this extensive, you know, water I mean, what was the outcome of the use of these water technologies? Or what was the outcome of this elaborated extensive water techniques that were used specifically in north Indian more specifically north west frontier province? The outcome was of course, agricultural productivity. And not only increase in agricultural productivity, but also we get varieties of crops.

So, the outcome was multiplicity of crops. This multiplicity is very important, this is very important to understand; that today unfortunately we are going, you know, moving forward to a mono culture. But during that time, you know, they focus on multiplicity of crops which is very good, you know, for the health of the soil for the health of people and also for the health of the treasury. So, Ain-I Akbari it is it gives detail economic account or it also talk about the revenue rates. So, for 16 crops of Rabi and 25 crops of Kharif in Agra. So, these were the varieties of, you know, crops which were cultivated during that time.

So, it also mention about the mention about the, you know, the cultivation of 41 crops in a single year. So, let us, you know, take this very seriously; that during that time 41 crops were cultivated in 1 year per annum. And during the 17th century 2 major crops were introduced tobacco and maize. And citrus food fruits like sugarcane grapes pomegranate and other citrus foods were also grown. And not only the quantity of crops fruits and vegetables, but we get to know from the foreign travelers from the I mean from the accounts of foreign travelers like, Jean Baptiste Travernier and also Jean De Thevenot, that the crops and fruits were a very good quality. They also talk about one particular rice variety which is called the kamod. So, this is the particular rice variety. So, and they say that taste of this particular rice variety was delicious.

So, these are the facts that we get to know which help us understand that how water management techniques or how water technologies transform the north or the entire north west frontier province into a very, you know, into a into a region that could really weird or that could grow multiple crops within a season or, you know, in 2 seasons or 3 seasons in a year.

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So, this is the references for this lecture. So, as I talked about the research of major Colvin on the canals in Delhi.

Talked about Hardiman's work on this small dam in the Western Ghats. And of course, the Rai Chowdhury and Irfan Habib edited volume on the Cambridge economic history of India, and other books as well and Abha singh irrigating Haryana. So, these are the few some other few references that you need to consult to get more detailed information on what has been discussed in this particular lecture.

Thank you.