

Slide 1 - Okay, so Hello everyone, as you all met me on Thursday, I'd just like to say hello and welcome to my lecture course. I'll just introduce myself again. So, my name is Nick I'm a PhD student at the University of Manchester primarily studying the conservation of black rhinos in Kenya, which is what this is a photo of here. And over the course of the next six lectures and I'm going to take some of the principles that Kathy has introduced you to. And some of those evolutionary principles I'm going to apply them to the field of conservation. So why do we see the diversity that we do want to, and what are we doing to protect it basically. So in this first lecture I'm just going to introduce you to the field of conservation, a bit about its history. And just some general overview of what the field is and what it does and how it's evolved over time.

Slide 2 - So this is just a quick lecture plan So these are the topics that will go through today, so the global diversity of life, the number of species, we see on earth. And then, a bit about the history of conservation, how it came to be how humans realize that they can cause extinctions and then what species and most at risk of extinction. And then, how conservation as an activity came to try and prevent those extinctions and then into the field that is today. I will obviously expand on this in future lectures, but this is just a bit of an overview of the field and how those principles of evolution evolutionary biology that have given rise, the diversity, we see how they are the underpinning of conservation and trying to protect life on earth.

Slide 3 - So I think you've seen this before, but this just shows kind of the pattern of global diversity of life on earth. So you have this latitude and or gradients of diversity, where you get the highest amount of diversity in the tropics. So on the equator and then it decreases generally as you go away from the equator towards the polar regions. So this image here is the species numbers of vascular plants on earth so just a bit of a demonstration of this one taxa how their diversity changes over that latitudinal gradient but it's a very similar pattern that you see for other taxa as well.

Slide - So what has evolution given us? So that the most basic unit of diversity that we usually use in evolutionary biology and ecology and in conservation is the species. So this here in italics is the definition of the of a biological species so there's lots of different ways of defining what a species is. The most commonly used, I would say is the biological species concept, and that is a group of organisms that can reproduce with one another and produce fertile offspring but they're reproductively isolated from other species, and so you can get some things that look quite similar. What's a good example? So say a lion and a tiger look quite similar they're very close related they're in the same genus but they're different species because they don't reproduce. You can have lions and tigers breeding with each other and you get things, called ligers but they tend to be infertile so the definition means that you have to have fertile offspring. The biological species concept doesn't always hold true and for some groups of organisms, it becomes a bit difficult, especially plants and other organisms that often reproduce asexually. And this doesn't really work for them, sometimes but it's the definition that's most often used and it's the one that will kind of generally stick to during this course.

Slide 5 - So how many species are there is a very interesting question and one that we don't have a definitive answer for. So this graph on the right hand side of the screen shows the number of species that have been identified for all these different taxa and the estimated number of species of each of those taxa that have been unidentified. So as you can see, for lots and lots of groups there's a huge percentage that have been identified, or we guess are out there, waiting to be identified. So, as you can see, on the very right hand side with the yellow and the green is huge percentages of lots of these taxa that haven't yet been identified. For Chordates, which is the vertebrates so that's mammals birds and fish that are the things that most often studied in biology really. And so that group is the one that has the least amount waiting to be identified, but then, when you get to things like nematodes that's new material to that there are very small worms and less science has been done on them they're also hardest study because they're small and so a larger percentage of those are waiting to be identified. You also get a bit of an idea from this graph about the numbers different species that are in each taxa. So if you can see the blue part for the insects that's a lot taller than for the other animal and plant groups here so that kind of gives you the idea that the the most amount of diversity we find them Earth in terms of plants, animals is in insects that group has the most number of species, so in total we've identified about 1.6 million species, this might be out of date now, it might be a bit more than that.

Slide 6 - But the vast majority of species are yet to be described, and so do we have ways of estimating how many species that are in earth. The answer is yes there's lots of ways of doing this and also disagreement about the number that gives you. The result varies anything between 3 million and 100 million species so there's a huge variation in the estimation, that you get from the different methods that you use to do this. This particular paper and all the references for the papers that I will give will be in a document that is also on blackboard and it will be in a document called references and discussing question or references and activity and that will have all the paper titles and it also have the discussion activity that i'd like you to do have a think about for this week and then we'll talk about it next Thursday, when we have all our zoom call, and you can ask any questions about the lecture learn as well.

So this method get us this predictable relationship that you seem to get over time, as more and more species general families orders have been discovered so as you go from A to e you get these smaller units of taxonomy so phylum is the biggest. So these graphs show the rates of discovery of these different taxa and, over time, so we start with a phylum, which is the biggest group so that's arthropods which includes insects. and chordates which is all vertebrates and so, as you can see, over time, more and more of these file have been discovered until it's reaching an asymptote. So that suggests that there aren't that many more of those to discover so there's about just over 30. As you can see that, and then, as the taxa gets smaller as you get more and more to there's more classes and there are finer there's more orders and then our classes and we're not quite reaching that asymptote, but it is the same patterns over time we're discovering more and more of these taxa. And it's going to reach the number that exist, so will eventually if we carry on doing this work we will discover all of these taxa and but the smaller, they are the longer it's taking us to discover them all, because there's more of them.

And so, as you can see, with the species, we're not even close to reaching that asymptote yet, but using some statistical models, you can predict what the asymptote for each of these taxa will be and doing this gives you an estimation, that there is around 8.7 million species on earth, so this is just one way that you can you can predict how many species that are on earth. And there's lots of different methods now and around 8 million is probably about a good guess for how many species

that aren't so there's lots of them out there and there's also lots that we have to discover so there's lots of diversity that we still don't know about on earth.

Slide 7 - And so, one term that's used to describe kind of all the variation of life on earth is biodiversity, this is defined by the Convention on Biological Diversity which was is an international agreement that commits signatory countries to conserve their biodiversity to this sustainable use of that biodiversity and to the fair and equitable sharing of benefits arising from genetic resources. So this is just an international agreement between lots of countries to agree to conserve and use their biodiversity sensibly. And so, and that's the definition there, so it doesn't just include species, while species are very important aspects of it it's also variation within those species. So I know that you've been talking with Cathy about genetic variability by diversity as a concept captures that interest species variation as well, so those that variation within a species so whether or not that adaptive variation ecological variation or genetic variation as well. So, as you can see here on the right hand side, this is just some maps that show the diversity of large mammals on earth. And so that seems to be more diversity in Africa in India and East Asia, and so this is just large mammals and then the threat of those large mammals as well on the graph at the bottom so that's the percentage of species that are currently threatened. So, as you can see, East Asia, including Myanmar and there are quite a lot of large mammals there's also a lot of threat to those mammals as well, so a lot of them are in danger of extinction, and so this just to give you an indication of how the by diversity that we see is relevant to conservation. so in conservation, we care about those animals those species that are threatened, and so we will look at these countries where a lot of those species are threatened and seeing what we can do about that.

Slide 8 - So that's kind of an overview of what we're trying to protect we're trying to protect that diversity that evolution has given us on earth and all those species that we see and but why do we do conservation. So fundamentally, it is about preventing extinction of these species but that's not the be all and end all of conservation. Species don't just exist separately from each other they're not just things that we go and look at in a museum. They live, they interact, they create ecosystems, they create landscapes so conservation is also interested in scales above the level of the species, so the landscapes, they live in the communities they live in the interactions between those species and the ecosystems that they create. And, as well as that it's also interested in the variation below the level of the species so we're interested in conserving that interest species variation that genetic variation as well, which is something that we'll talk about in a in a future lecture.

Slide 10 - So now i'm going to talk about how a bit about how conservation as a field came to be. And so, in the past from in the western world from classical times, which is kind of ancient Greece ancient Rome. Which is when we start getting lots and lots of written records that we can we can look at how people view the world. Up until the early 19th century so that's the early 1800s and generally, this is a generalization and it's just kind of considering what the Western world and i'll explain why i'm just thinking about the western world in a minute. And people consider themselves as separate from and superior to other forms of life which generally stemmed from religion. From the Judeo-Christian religion generally in the western world, and so in that religion in those religions and from the Torah and the Bible it's it stated that humans were made in the image of God, whereas animals weren't. And then in also the creation story of those religions it's often stated that humans were given dominion over the earth, so what that led to for lots of societies and lots of big periods of history is that people thought that they could sort of do whatever they wanted with the natural world, they could just extract all the resources that they wanted from it, and it was theirs to create value from to take things from to get food from, to make money out of, and they were justified in doing that because man was superior to those other forms of life.

Slide 11 - And, and the other aspect of that is that nature was seen as sort of an unlimited store and it was often thought that because God had created the world, it would be impossible for man to destroy it to have a big enough impact to kind of get rid of bits of it to significantly alter large parts of it. And, that includes causing extinctions. So for a long time, it was impossible to cause species to disappear completely from the world obviously you could kill individuals but it was thought to be impossible to completely get rid of a whole species, it was just thought that wouldn't it be possible. Technology wasn't an advanced the world seemed huge vast so it would it would almost seem completely impossible to wipe out a whole species. And how this changed in the late s early 1800s, and so this is a Frenchman called George Cuvier. He was a very famous paleontologist often called the father of paleontology. And he did some very famous work looking at fossils of mammoths and another elephant like species, called the mastodon and he compared those fossils to skeletons of African and Asian elephants that we see today, and he showed that those two species, the mammoth and the mastodon didn't still exist on earth. They were different to the elephants and it did not exist, therefore, they must have gone extinct there's such massive animals, so a mammoth was bigger than an elephant so absolutely ginormous. And it was impossible that they were hiding somewhere that we hadn't discovered them so Cuvier is often credited with having proved or given very strong evidence that extinction was possible that species could disappear from the planet to completely.

Slide 12 - And then, once it was found out that extinctions work possible and humans that they realized that they were, it was possible that they themselves could cause extinctions so it wasn't known at the time, what caused the extinction of the mammoth and the mastodon. But a bit later on, it starts to be realized that humans definitely could cause extinctions. So these are two famous kind of early human caused extinctions well early in terms of recorded history. We'll talk a little bit more in a minute about how very early humans are also likely to of course extinctions, but these are two that were famous in as having been recorded as definitely being caused by humans, so the bird on the left, which some of you may know, is the dodo. So this was a flightless bird that had lived on Mauritius and because so lots of island birds like this and islands that don't have mammalian predators like rats or stoats or other predators like that. They become flightless because they don't have to worry about and then all their eggs being preyed on by mammals, so they become flightless and then they're quite defenseless in the face of mammalian predators being introduced to those islands. So humans sailed to those islands and on their ships, they had cats, dogs rats pigs which they either purposefully introduced in the case of pigs often as a source of food or accidentally introduced in the case of rats. Rats escaped from the from the ships and got on these islands and then started finding very easy sources of food in these birds. So the dodo went extinct in about the following the arrival of Dutch sailors on to Mauritius, and so they introduced dogs pigs cats rats and monkeys which all were known to prey on the species and the Dutch sailors themselves also hunted them for food. Because these birds were not adapted to the presence of humans or other predators, there are stories that it was very easy just to walk up to them and hit them on the head with a stick and then you've got dinner. And so, this is a very famous example of how humans starts to realize they can cause these extinctions. And so it was only a few decades between this bird being discovered or recorded for the first time by Europeans and then going extinct. The other one is the Steller's sea cow on the right. And so, this lived in the in the Aleutian islands or the Bering strait which is right at the top of the Pacific Ocean in between Russia and the USA. And so, if it wasn't thought that extinctions could be caused on land, it was thought even more unlikely that extinctions could be caused in the sea. Because the sea is so vast and it was just seen as this kind of unlimited larder that people could go and take things out for food or in the case of this sea cow, fur. So this sea cow went extinct in 1768 due to hunting for the fur trade, so these, as you can see a huge animals, and so it

was really valuable about and hunt them for fur, and then they were also eaten. So, as you can see, compared to one of those men absolutely ginormous animals, I think, roughly five or even more meters long. And, and then, so this is just another example of an early extinction and people started realize oh, we can cause extinctions and we can even cause extinctions of marine mammals, as well as terrestrial ones.

Slide 13 - So this slide looks at some different ideas of what an extinction is and how they can how they can progress in the modern world and. So this actually comes from the paper that i'm going to ask you to read for our discussion session next Thursday. And so extinction seems like a quite simple idea so it's just when species disappears from the earth to the moment of extinction is when the last individual dies, and then that species, no longer exists on earth. And what the authors of this paper think about is how it can happen in different ways. So for Linnean extinction and all those species that we talked about before that, on that are yet to be discovered. So there's loads and loads of species that we haven't yet discovered and it's likely that some of these have already gone extinct or will go extinct before we discover them before there before they recorded, and so this is talking about one of those species that has disappeared before it's been recorded by science and formally described. The Wallacean extinction, which is named after Alfred Russell Wallace who I think Cathy may have taught you about in biogeography. And so, these are species that are thought to go extinct, but actually survive in an undiscovered location somewhere there's a population somebody that hasn't been recorded, so they survive. In in those populations and then later on in time those populations are discovered and so it's seen that they haven't gone extinct. We will skip over the phoenix extinction for a minute i'll come back to that. Ecological extinction is when an animal goes extinct in the wild, which is a phrase you may have heard before, so this is when there is an extinction, but some individuals are kept in a zoo or another breeding centre and then later in time, they can be reintroduced. So on the y axis there you've got this global wild population size, as you see it crosses the zero there, so it goes extinct in the wild but later on in the future it's reintroduced, so there is a wild population again. And the local extinction is when there is a population somewhere else in the world, but a local one, so a small population somewhere it goes extinct or, as we call it extirpated. And then in the future individuals can be reintroduced from that other wild population and. This last one here is true extinction, so this is when the last individual dies and that species is gone forever from from the world and we can't we can't get it back and so there's there's two lines on this and one is because the authors specify between a contemporary extinction so the species has been recorded by modern science and the other one is before conservation science or the conservation movement became a thing and science started recording is extinctions so lots of species or some species may have gone extinct before they recorded so by Conservation science and before they were thought to be to be meaningful and so before this extinctions may not have been considered to be that important. After conservation became important when things go extinct it's a big event it gets recorded and so before the dodo and the sea cow as we spoke about before and lots of species may go extinct, and it just wasn't considered important so probably maybe wasn't recorded. The phoenix extinction is a bit of a different situation where there is an extinction, yes, but some genetic aspects of that species survive in a domestic species or something else. So say a wild cow goes extinct in the wild, a bovid. But you can recreate something that looks like that wild bovid from domestic cows. And this is a very controversial topic and something I will not talk about too much. Can you kind of recreate something that is close to that wild species, even though it's going extinct,. I just bring this up, because it is something that we're going to discuss next Thursday but it's also just the thing that the extinction isn't just that simple process of the last individual goes extinct there's lots of different ways to think about it both ecologically and in terms of an anthropocentric point of view so what humans think about extinction. So it's now a very important concept in

conservation and it's very emotive. Something going extinct is terrible news and we've lost it for ever it's a lot of a lot of conservation messaging you'll see you know, we need to save this species, we need to prevent it going extinct. And that that kind of language is used a lot to try and try and get people to support conservation because extinction is seen as a very bad thing. So there's something that will expand on a bit more in on Thursday, but I just wanted to introduce you to some of these concepts of how extinction isn't just a very simple process.

Slide 15 - So now i'm going to talk about what species are most at most risk of extinction in the modern world. So species around the world, face lots and lots of different threats and which is something that we'll talk about a bit next week and future lectures. But so there's things like habitat destruction, climate change, hunting or poaching, there's invasive species. So there are lots of threats that these species around the world face. What particular characteristics of different species make them vulnerable to different threats? This paper here talks about what species are most vulnerable to extinction. For large species it's mostly direct killing so if we think about hunting of rhinos for their horns, hunting of elephants for their tusks. There's whaling, when we think about commercial fishing that targets really big species like tuna. And these large species are most often threatened or them mostly threatened by this direct killing. For small species they're more likely to be threatened by habitat destruction, habitat degradation. So because they have they tend to have a smaller range and they only exist and quite small area if that little area is destroyed or degraded, then the whole species goes extinct, because their whole habitat has been destroyed. So this is just thinking about vertebrates and it would be interesting to have a look at how this varied for other taxa as well. So for plants, you know, there might be certain things where it holds true so very big trees often prize for their timber for their wood, so they have kind of been directly killed. And then for smaller species, it may be that this habitat loss and habitat degradation is more important.

Slide 16 - So this just shows some of the results for this work. And what it shows is the importance of body size varies between taxa. So the kind of the threats that different body sizes face is different for different taxa. So for the amphibians, and it is the very, very small species that are the most often threatened. And so that's probably due to habitat loss, but maybe all other things, including disease so amphibians, are facing a lot of diseases right now including chytridiomycosis. I think I was struggling saying upload but it's a fungal disease and then for mammals and sharks, which is the cartilaginous fish that's the sharks and rays it's the larger body sizes of those taxes that are most often threatened, which is probably due to that direct killings and they're being hunted for food and for other products, including the ivory, which I mentioned before, of the elephants.

Slide 17 - And so, as well as body size small ranges also increases on ability which I was talking about, which is most likely, because the smaller arranges the, the more likely it is that a certain destructive activity. So say a mine has to take out a an area of land that's kind of 10 square miles something like that, so a very, very big mine. And you know there's a very small species that only lives in a few square miles. That mine going over that the range of that species destroys the whole range so very small species are vulnerable to that, whereas the largest species realize arrange that same activity is just going to take out a small part of their range.

Slide 18 - So this is looking at something that I mentioned before, which is that it's, not just those extinctions of the dodo and the stellar sea cow that we've actually recorded, so we discovered those species and then humans cause them to go extinct. Humans have probably been causing extinctions, for a long, long time. So before humans started to travel around the world and colonize new places, so this is thousands of years ago when humans or Homo sapiens started to move out of East Africa and move around the world, finding new land masses to live on. There is a very strong correlation between where those humans move to and extinctions of large bodied animals, so all the species outlines here that you see in black are animals that went extinct around the time that humans arrived on that continent. So you see, at the very, very top left and that's one of the mammoths that I was talking about before. And one of the other elephant like species, I think, in the top right in Russia. One of those is the mastodon, I was talking about as well, those fossils that Georges Cuvier found and described. So all the species in black here are ones that went extinct around the time humans arrived on that land mass and then all the ones in green are the one that existed into the modern day and still exists now, so, as you can see around the time that humans arrived on continents. A lot of these large bodied species went extinct, and there is a lot of argument about this about whether or not it's humans that directly caused these extinctions but the evidence suggests that at least humans, at least had a part to play in those extinctions. And so it's not just modern humans that have been causing extinction there's likely that humans or homo sapiens have been causing extinctions for as long as they've been moving around the world. And it's probably these large body species that were so vulnerable because they're so attractive in terms of hunting for food, so you kill on these large animals, and you know you're going to be able to feed yourself your family for a long time.

Slide 19 - And this is just kind of drawing of some of the species that were present in North America. And before humans arrived awesome this megaherbivores I think don't think it's just America, but some of these megafauna that were likely caused to go extinct by humans. I think these are just the American species actually but it's not too important, just to give you an idea of that there is a this big diversity of large bodies species are present before ancient humans started to move around the world and likely caused the extinction of lots of these large bodied animals.

Slide 20 - So yeah have humans cause the extinct have course humans cause a significant increase in the amount of extinctions that are taking place on earth. Yes, definitely so. As you can see here, this shows the extinction rates of different tax or over time. The dotted line there is the background extinction rate for all taxa. And then each colored line is how the extinction rate of different taxa that has changed over time. So the green line is is all the vertabraes and then it split up into mammals and birds at the top and there's lots there's been lots and lots of extinction, so those species in modern times. And slightly lower amounts of extinctions of the reptiles amphibians, and the fish, which is the yellow line at the bottom there. This difference, maybe, partly due to recording so we're likely to have recorded more of the extinction of mammals and birds, but it's also likely that we have cause more those distinctions because we have been hunting, a lot of those large bodies animals for food. And kind of causing other extinctions. Due to direct killing, but also in other ways as well.

Slide 22 - So humans have been causing extinctions for a long time and then came to realize that they were doing this, so how did attitudes get from treating the natural world as a utilitarian resource so as a place that we go to extract value to go for food, just as a place that humans can go and kind of do whatever they want to, to the case now where lots of our modern day politics and lots of our policy is directed towards protecting that natural world and preventing those extinctions.

So again, this is going to have a very heavily Western bias. And a lot of the ideas of stewardship of the planet, or of conservation originates in the Western world and I spread around through colonialism, which i'll talk about next. I am absolutely not saying that conservation is a purely Western activity. It's not at all it's just what we think of as modern conservation was kind of birthed in the western world, and then we spread it around by colonialism and there are long records and lots of evidence to suggest that other cultures have conserved the natural world and have lived with nature, for a long time and and have certainly done less damage than Western cultures have done. And i'm just going to talk about how the Western idea of conservation was birthed and then kind of moved around the world, and so part of this was was romanticism, which was a mostly artistic movement actually. So this was a sort of reaction to the industrial revolution. Which on the left here, this is actually a Vincent Van Gogh painting which isn't technically romanticism, but it's just to give you an idea of how lots of art and lots of painting started to depict the factories that the industrial revolution brought into Europe. These factories started springing up in in what otherwise would have been quite natural looking landscapes and so with this industrialization came a reaction against it, which was to try and get away from the kind of the dirty cities and towns that were springing up with industrialization. And lots of artists and poets and other people like that started and started painting the natural world and thinking about the natural world and thinking of it as a kind of an antidote to this industrialization so they wanted to get away from the dirty factories and the dirty cities and get out into nature. And so they started kind of thinking of nature as a spiritual place and as a holy place and which is often, represented by this painting on the right here, which is called Wanderer above the Sea of Fog by a painter called Casper David Friedrich. And it just gives you an idea that these people wanted to try and show the beauty of nature. And wanted to show it in opposition to the factories and the industrialization. And out of this art and out of this thinking came and appreciation of the natural world and people started looking at it more closely, seeing the damage that was being done to it by industrialization and then coming to want to protect it.

Slide 23 - And so i'm going to briefly touch on this here, but I will talk about it in more detail in future lecture. Once these ideas kind of a rose in the western world in Europe and in America, and they were spread around by colonialism, so when Western powers when an established colonies all around the world, they took these ideas with them. And, and these kind of ideas of conservation went around the world, along with. Along with other aspects of colonialism and I will talk about more about this later and how conservation is starting to or not starting to is now very heavily involved in confronting its colonial origins and it's colonial roots and the problems that come along with that and it's starting to try to deconstruct the colonial systems or conservation, that we have in place and try and put in better ones that work well with indigenous peoples that work well in developing countries and try and get rid of some of the problems that have come along with this colonial mindset of conservation.

Slide 24 - So, with the idea that we wanted to try and protect the natural world and there were five foundational conservation movements. So conservation isn't one thing or isn't one activity, it is now and always has been split into different ways of thinking, different methods and which was all in different things that people want to protect and so these are the five and I'm just going to quickly go through each one to give you an idea about what each one is focused on.

Slide 25 - So the first one is the wise use movement, so this often arose very much hand in hand with colonialism and arose in western colonies during the 18th century and then again with government scientists in the 20th century. So this was people who wanted to try and protect the natural resources that they had those colonies, so they wanted to protect forests, they wanted to protect game which is animals that were hunted for food. These people realized that these ecosystems were necessary to safeguard economic growth and they wanted to protect the resources for the future, so is very much scientifically managing those resources, so you don't destroy them and you could manage them for a long time. So, as I said, this was very prominent in 18th century Western colonies, but also became prominent again in the 20th century, when it became clear that with population growth and lots of these resources were being destroyed so again the scientists wanted to try and protect them for future use.

Slide 26 - The second one is the Community open spaces movement, so this often arose in cities. With people like Olivia Hill who wanted to try and encourage the residents of these new cities to have access to parks and open space, because they believe that it was good for people's health and there's now a lot of evidence that this is true, that being out in nature, is very good for your health.

Slide 27 - So the next one, I will quickly summarize more at the end and show that how different movements and these different philosophies you end up with different ways of protecting the natural world. So the third one is the wildlife movement, which was very much focused on big animals so bird watching and hunting and kind of outdoor recreation that kind of traditionally masculine outdoor recreation and that again is being deconstructed in a lot of modern conservation as on the problems that come along with that are being identified, especially with the rise of feminism and feminist ways of thinking about conservation. And so Theodore Roosevelt, one of the US Presidents was very famous for going on a long game hunting trip in Africa and also did a lot of hunting in America. So these kind of people wanted to protect wildlife because of the recreation value it gave to them, so the hunting and the birdwatching and I said, and it also came with a sense of stewardship so humans were allowed to kind of dominate nature and to hunt in to do what they wanted, with it, but because of that they had a responsibility to protect it, they thought about paternalistic stewardship for nature as well, and so they wanted to protect it, for their own self interest, but also because they felt a kind of a stewardship for it as well.

Slide 28 - The fourth one is the nature monument movement. So this is quite closely allied with the kind of the museum movement and the geological nature monument movement so it's people who wanted to protect aspects of the natural world because of the interest they had for it and because of the wonder that it gave them. So, so this goes hand in hand with natural history and cultural history sort of go hand in hand here and it's lots of the people who wanted to protect with natural history also wanted to protect the cultural history. Because of the intellectual and aesthetic value that it had, and so they wanted to stop it being protected so that future generations could go out and appreciate these monuments for the values that they thought that they held. And

so again this came to prominence in in Western European cities, primarily in early 20th century. You don't remember exactly kind of who was involved in these things and exactly when they arose it's just to give you an idea that the conservation means different things to different people. And the value that you have that you put on nature, the value that different people have that different people think, nature has leads to different ways of protecting it.

Slide 29 -And finally, we have the wilderness movement, which is very heavily associated with the USA with an important writers like Ralph Waldo Emerson here and man called John Muir. These people thought that large expanses of land that didn't have humans in were very valuable and they wanted to protect these wilderness from industrialization and from modern human alteration. So this is very closely tied to that romanticism, that I was talking about before so those artists and these men wanted to and women now wanted to protect that aesthetic value and that spiritual value that they thought that people listening to had as a nature, with no people in a thought I had a particular spiritual value, and that was in opposition to industrialism and wanted to protect that. So this was kind of the foundational movement for the ideas of national parks, which the first one was yellowstone National Park in America. And so, America is a country it came up with the idea of national park and that idea has spread around the world and lots of places now lots of conservation, especially in the 20th century was dominated by the idea that we need to put a fence around the area and then remove the people from it and that's how you do conservation.

Slide 30 - So, as I was saying these different reasons, protecting the natural world lead to different methods of doing it so for one example i've got here is tree plantations versus naturally regenerated forest. So if we think back to the kind of natural resource management of conservation it's about using the natural world for its value.

Slide 31 - And so, this picture here shows on the left tree plantation. So natural resource managers might go for this kind of conservation. Trees are part of the natural world and so they may want to plant these forests and do these kind of things to try and create value for the future. However, in the UK lots of these tree plantations are made up of non native species. And as you can see down at the bottom on the Left that aren't really many undergrowth species here it's sort of just the pine tree is just the conifers. And no other species present whereas on the right is a native broad leaf forest, which is the kind of forest that we get in the UK naturally. As you can see, along the bottom there's lots more plants along the floor, and this for us and the right probably contains many more species than this for us on the left, however, those natural resource. Conservation may be preferred for natural resource managers service on the left, because they want to get the most value out of their the area of land that they manage this these fast growing conifers. It may also lock up carbon so it's not just the values that they have in terms of money, but it might be also be all we want to try and protect against climate change so planting these forests with conifers might be lock up carbon, whereas on the other side, this forest might be better for biodiversity, so if you were trying to protect biodiversity for own sake that might be better. And it also might be better in terms of an aesthetic value so you know if you want to go for a walk maybe lots of people would prefer to walk in this kind of natural woodland that has many more interesting species and look at and many more species to experience it might be that some people prefer this forest on the left. But it's likely that if people are looking for that kind of spiritual connection to nature or that recreational value they would prefer this forest and the right.

Slide 32 - So this just gives you an idea that conservation isn't one thing it's lots of different ways of protecting diversity for lots of different reasons. And so, all these different threads of historical conservation have given rise to modern conservation, which is carried out for a huge range of reasons and by a huge range of people. And this leads the arguments quite all the time, where even

people who all described themselves as conservationists might fundamentally disagree, both on what we are aiming for, and how to achieve those aims. So you end up with different priorities methods and aims and conservation.

Slide 33 - So this is just an idea of how many different actors are involved in conservation and so the red circles here show governmental actors, the blue show private the private sector so companies and other groups like that. Purple shows non governmental organizations such as charities that are involved in conservation and yellow shows just independent systems that might be involved in conservation as well. And all these actors come together in different ways to do conservation in also in completely different ways and you end up with all these different methods of conservation, to try and protect the natural world at the bottom here, this is just a few few examples of of how conservation can be done so different combinations of these actors in different projects come up with different ways of protecting the natural world.

Slide 34 - So the justification for doing conservation have also progressed from those historical justification, such as the wise use and the wilderness and things like that, I mean a lot of those still exist in modern conservation, but they're also new contributions as well, so I know that Kathy has spoken to you about ecosystem services. So this a ways of this is way of categorizing the value that humans get from nature and so we've kind of progressed a bit in in categorizing and labeling and recognizing the value that humans get from nature. So these ecosystem services are something that I will talk about in future lectures.

Slide 35 - And so yeah again, it is just to give you an idea of how complicated modern conservation can be and all the different factors that go into making a decision. of how conservation should be done, which is the black box at the bottom here so there's all these different things, including interests, the context of the area, personal context and individual preferences. So when you try and map out how conservation has been done in a particular project there's all these different factors that feed into what the final decision of what should be done. So see we're trying to decide how to protect a forest, should we put a fence around it and exclude all the people, or should we work with local communities who can run sustainable businesses, whether that's timber or or running tourism businesses or things like that. Do we allow them to do that, or do we not, and you know, are the other ways that we can source funding for conservation. So the final decision that's taken about how to protect that forest, there are hundreds of different factors that go into what which method we go with what the decision that is made is so again, you don't have to kind of memorize this at all it's Just to give you an idea that lots of different things feed into modern conservation and how it is done.

Slide 36 - And this is the final slide and it's just to emphasize that. Conservation is not just about science i've talked about a lot of different things today, including art and geography. But these all these different fields that that feed into conservation and that feed into our appreciation, the natural world and it feed into. The field of conservation as a whole, so there is science. Science is very vital and always will be vital to conservation. But there's all these other things that are important as well, including, i'm sure lots of using David natural documentaries. So these documentaries, the natural world that give lots of people, an important connection to nature and especially nature that they may not see in the real world, because it's far away. So, such as bit of a light hearted light hearted note to end on that conservation can be you can do conservation lots of different ways. You can be a scientist, you can be in the field for years and years, studying a very

small part of the natural world. Or you can be a filmmaker or photographer or all these other things are also very important, and the process of conservation.

End - So that's the end of the lecture today and I, I will put up a document on the blackboard as well as this lecture and that has all the references for the papers that you can read if you'd like to do a bit more reading. And it will also put up a few discussion questions which will be based on that paper that talks about extinction. That I talked about before, so the PDF of the people will be there as well, so if you could give that paper a bit of a read have a think about some of the questions that i've written on that document as well, and then next Thursday, you can ask me any questions about this lecture. And i'll also will also talk through some of those questions and talk through that paper and have a think about that. Finally, this the first time that i've recorded lecture and so, if there's any better ways that I can be doing it if i'm talking to quickly from talking to quietly. Please let me know and i'll try and improve for the future, so thank you very much for listening and I look forward to seeing you on Thursday.