



the River Restoration Centre
Working to restore and enhance our rivers

River Restoration in the UK: limitations, drivers and aspirations

Jenny Mant
therrc.co.uk
And
RESTORE restorerivers.eu



Restored River Ogwen, North Wales

Moderator

We have Dr. Jenny Mant from the River Restoration Centre in the United Kingdom and today, she will talk about the river restoration in the UK. And you can ask questions in English or in Japanese. Please come on stage. Please.

Dr. Jenny Mant

So, thank you very much for inviting me and, secondly, I was invited to this [Technical Difficulty] by you to talk [Technical Difficulty] history of [Technical Difficulty] restoration and then some examples of the river restoration projects in the UK. Do you need to translate for me or I'll just carry on?

[Japanese]

Moderator

Yes, okay, you can carry on.

Dr. Jenny Mant

Okay. So, it's fine.

Moderator

Yes, it is.



The UK's Rivers

- Modified over many centuries. Particularly rapid over the last 60 years.
- **Approximately 80% of English rivers have had part of their channel modified.**



Due to:

- land clearance/deforestation
- medieval milling
- water meadows
- navigation
- land drainage
- flood protection
- abstraction
- urbanisation

This has resulted in:

- **Extensive straightening**
 - damaged wildlife habitats
 - reduced value of fisheries
 - reduced aesthetic appeal
- **Loss of floodplain wetlands -**
 - reduced ability of the floodplain to provide economically viable functions.



Okay. So the rivers in the UK, some of these may be the same in Japan, some might be different, but there has been multiplications to a lot of our rivers and that's in England, Scotland, Wales, and Ireland; there are four countries, over many, many centuries starting with the industrial revolution in the 1800s. But over the last 60 years or so, there's been a massive, massive change, particularly as there has been more infrastructure and a lot more housing occurring. So, as that's happened, the rivers have changed and become much more constrained.

There have been a lot of reasons over time why it's happened and the first port of call, it has more to do with clearing the land for agriculture and taking away the forests. Another big thing that happened was milling – a lot of milling, for industrial use and for making flour as well and that happened a long, long time ago, probably about 600 or 700 years ago and you'll see a lot of remains of mills on many, many of our rivers and there will be weirs wherever there is a mill and a millwheel as well, so a lot of rivers like that have been affected.

Another thing is a completely different thing to that actually is in terms of water meadows where people used to manage the water and decided when they wanted the water onto the flood plains for agricultural use. So, those are very old reasons for the changes and modifications.

Perhaps the more recent things are things like navigation, so moving goods from one place to another and using the boats for that and, more recently, for recreation. Draining the land, almost the opposite to the water meadows and taking as much water off of the land to keep it as dry as possible and then for – meaning that there was potentially more water in the rivers at shorter periods of times which has affected the rivers.

One of the most important things there more recently is there's been more infrastructure has been looking at flood protection, so how do we stop those houses and those industries from being flooded.

On the opposite of flood protection, the other thing that's affected rivers is abstraction, so because we're a smaller island with quite a lot of big population, there's been not a very real need for use of water for domestic use and also for agricultural use. So if we have a drought, if we have a dry period, often the waters at the rivers become almost dry quite often and that's a problem in terms of the ecology. And that's what will come about because of increased urbanization or a lot of it has as well. So, that has a main impact on the rivers. Instead of natural rivers, they've been put into culverts or into concrete banks and beds.

So if you look at the figure here, about – I heard somebody else saying this earlier – about 80% of English rivers, in particular, Hood English, because probably in Scotland, there are more natural rivers but, certainly, in England, 80% of rivers have had a part or most of their rivers modified and couldn't be classified as natural.

So the main things that has happened, the rivers that once meandered through the countryside had become very, very straight, they've been over-deepened, they may be made much deeper so they don't leak into the flood plain anymore. The effect of that has been that the wildlife habitats have been destroyed and, in particular, because it's a very important interest in the UK is the value of the fishery has decreased. We have a great importance on salmon, in particular. So salmon eggs but also trout because people like to fish them and they pay lots of money to go fishing for those but

also they're very important from the commercial side of things as well.

I think a majority of people would agree that a river in a concrete bank and bed is not really very attractive to walk alongside, so it looks at that side of many of our rivers as well.

That's the actual river itself. If you look at the surrounding flood plain, they have been disconnected from the rivers, so that natural use of the flood plain in terms of flood risk and increasing the amount of habitat for various species has also decreased. And it's a very important side to that because those flood plains can actually provide an important element for the economy as well in terms of the amount of habitats it provides particularly for those fish and those invertebrates that the fish needs, so it's balancing all of those elements and the flood plains are very important for our economy.

UK river management changes

Past - Flood 'Protection' and Drainage

Deep channels, walls, culverts, embankments.

Present – Risk Management (floods, e.t.c.)/catchments

Storage, capacity, and more natural rivers.

Land (soil) management, sustainable drainage systems, functioning floodplains, ecosystem services

Future

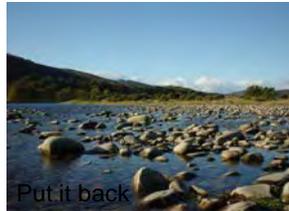
Integrated planning policies -> river restoration



Dig it deep!



Give it space



Put it back

So, in summary, really, in the past, if you look at the management of river channels in the rivers in the UK, in the past, there's been a lot of flood protection and drainage, over the last 60 years. So if you look at this first picture on the side here, we have many, many rivers that look like this – more like drains really. They're deep, they have walls, sometimes they have a top on them and you can't see them at all and they have these steep embankments as well. So not natural at all and we have lots like that and that's what's happened in the past.

There's now a bit of a change to try and look at risk river flood management – risk management of those rivers in a different way and look for opportunities to include restoration as part of flood risk management, so allowing the river to have more storage, more capacity by widening those areas out and helping to have facilities for some habitat as well but I'll talk a bit more about this river a bit later on, so to try and create more natural river systems to actually help with flood risk as well.

And then also along that side, looking at the soil management in the catchments, understanding where the water gets into the river and trying to have things that we call SUDS or sustainable drainage systems that manages the amount of water that goes into the river as well and trying to think about

functioning flood plains.

But what is the thing here – up here showed are ecosystem services. Do you have that terminology here, ecosystem services?

Male Participant

In Japanese?

Dr. Jenny Mant

Yes.

Male Participant

Yes.

Dr. Jenny Mant

Yes, okay. So it's very, very, very important in the UK, I know. In America, they call it something different and I can't remember exactly what it's called but it's what drives a lot of river restoration now. It is beginning to drive it. It's the concept of putting a value on the ecology.

So, the thing that's perhaps missing a little bit now in terms of driving all this forward is planning policies. How do you plan around rivers and linking that to best practice river restoration and that's part of what the River Restoration Centre is all about, is trying to help make those linkages.

Last week! Floods, floods and more floods



And then when you listen to the news in the UK, floods week but we had most of the country – a lot of the country was under water, lots of floods. This is actually quite a small flood but you can see these guys were going – this is a – on this particular occasion – though I do like cycling but not through floods.

So there's a road there and, obviously, they're not going anywhere but that's the sort of one side of it but there were a lot of houses that were completely flooded and people didn't leave. Some people lost their lives as well. So, it's a big problem when this kind of thing happens and it happened a lot in the country and it's a problem and it has a problem with economics as well because people can't move from one place to another.

What should our rivers be?

- Part of our natural landscape
- Our water resource
- Bio-diverse environmental 'corridors'
- Linkages between scarce habitats
- Urban greenspace and amenity resource
- Transport routes

BUT: we often have...
Sewers!, rubbish tips!,
untidy!, unsafe!, no habitat

Through poor management



So given the way that we live our lives, what really are we trying to aspire for our rivers to be in perhaps most – many parts of the world, they really need to be a part of our landscape and we have to think about rivers as an important part of where we live. What tends to happen? They tend to be hidden away and forgotten about and I think, obviously, if you know the river in Tokyo then you will know that there's a big road over the top of it, so the same applies. It's hidden away. People probably don't really think about water as an important river.

We have to also think about it as an important resource for water. We can't forget that we have to have water to live, so we have to think about this as well.

But from a restoration point of view, they have to have lots of different habitat to support the species that live in there and particularly with the discussion about climate change, it's important to have as many opportunities or as many species to survive variations in that climate variability and that's important and making sure that those habitats link one type of habitat to another to create these river corridors.

But there are also – particularly in urban areas, they can provide really nice

green spaces and amenity resources for local communities to enjoy. I mentioned navigation earlier and, obviously, we can't forget that in some cases, they do still provide a good transport route and we have to think about that. So, it's integrating all of those things that we are talking about in the illustration. But what we actually have far too often is this and it just turns into tip where people chuck all their rubbish in the river and it's not what we want.

Rivers

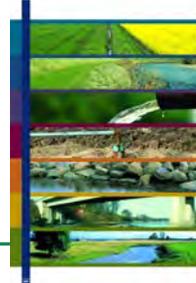
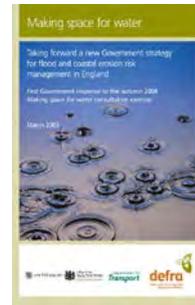
Good quality versus poor practice



So really, we'd like to have this – there should be good management of the rivers but often this is what we have instead and it really doesn't support very much wildlife, it's too wide, there's only a small amount of water in there and you can't see it, you can't get to it, so that's what we have to deal with and try and improve.

Policies and Directives – Can they help?

- European Directives
 - Habitats and Species Directive (1992)
 - Water Framework Directive (2000)
 - Floods Directive (2007)
- UK Legislation
 - Making Space for Water
 - Catchment Flood Management Plans
 - Sustainable Flood Management
 - Land drainage consent
 - River Basin Management Plans



So within Europe and the UK, there are various policies and directives and the question is can they really help us improve our rivers? If you look at the PRAGMO document that you will get, I think, a copy of at the end of this which looks at monitoring of rivers, there's an element in there about this what's called the Water Framework Directive which is the second one, the Water Framework Directive, 2000, and the Water Framework Directive drives everything that happens in Europe on our rivers, right across Europe, not just in the UK.

It's there to try and identify how to improve water quality and how to improve habitats and each country in Europe has to put a plan together which is this year it is River Basin Management Plan and put a plan to get it to say how they're going to improve the river at particular points in time. So, the next point in time is 2012 and if each country hasn't delivered what they said they were going to do then the European government will fine the countries. So, there's a big incentive to actually improve all of our rivers.

So, that's the Water Framework Directive. Alongside that, we have our Habitats and Species Directive, which is a European directive, which identifies species which are rare or endangered and it says you have to improve the habitat for those particular species.

On the other side, we have a Floods Directive in Europe and sometimes those directives don't always join together because if you're looking at improving flood risk, it doesn't always link to improving your habitat, so there's a problem there sometimes and that is being discussed, at the moment, as how we can make those directives link together more clearly.

Then, in the UK, we also have our own directives and we have from the government a statement that says you must try and make more space for your river. It's a statement. It's not a law. It's not a requirement really but it is a statement that says you must try and do this but it's not always taken on board.

We also tried to have a simple Sustainable Flood Management and that's again linked to making space for the water, trying to work with the natural processes to improve our flood management rather than building higher and higher walls.

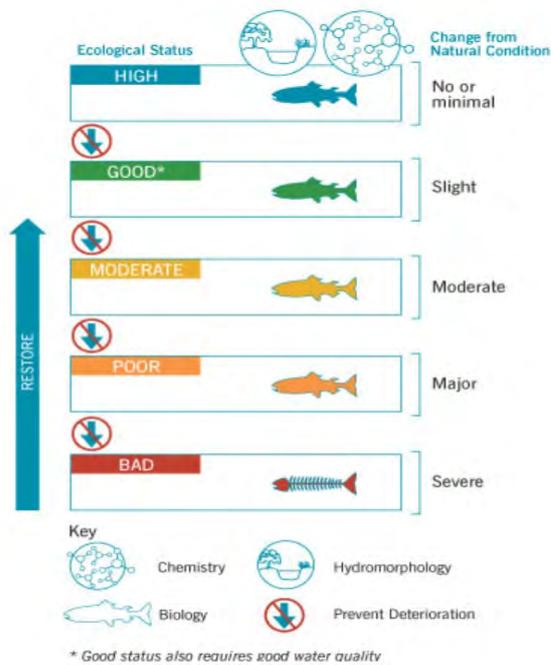
Well, we have a legislation with Land Drainage Consent which means that people can't just take water out of the river, so the opposite, we have a drought condition, no water in the river, you can't just take water out to try and reduce that impact as well.

And then we have, as I mentioned before, these River Basin Management Plans and the Catchment Flood Management Plans to try and understand what is happening in our rivers at the catchment scale.


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WF Directive

- Targeted at Aquatic Ecosystem Quality
- Prevents Further Deterioration
- Enhance Aquatic Ecosystem Quality through a program of measures
- Promotes Sustainable Water Use
- Implement first round by 2015
- Investigations and walkover surveys



So, this is the Water Framework Directive in a very simple term. It's a big directive about this thing, so this is a very shortened version. But the aim is really to identify your river as to whether it's bad, which is down here with this fish to the top and the aim is to try and get your river up to high ecological status that at top there to become as natural as it possibly can and each river is identified as to where it is at the moment on this scale and you have to say where you think the river will be in about 2012 and then you have to implement processes to allow that to happen.



WFD aims to: Restore Degraded Habitats

- Good Ecological Status (GES)
For all watercourses not impacted severely
- Good Ecological Potential (GEP)
For all watercourses designated 'Heavily Modified', or 'Artificial' Compromise (ecology/ society)

River Restoration



There are two parts to the Water Framework Directive. There are rivers that you need to get to good ecological status. Now, if you remember, I said that 80% of rivers in England are not natural. This, in good ecological status, assumes that you have all the natural processes still in place for your river, and perhaps, for example, if it's just the water quality that is a problem or a small problem with the river. And so then you would expect to try and improve it to good – the best ecological status that you can.

But most of our rivers are actually coming to this category; they're very, very modified, they're artificial, they're not natural really and so then you're trying to get your river to what's sort of good ecological potential trying to make the best that you can for your river for the ecology and for society as well. And that's really where river restoration comes in, in specific, rather than here because apart from the water quality elements, these rivers are normally seen to be fairly natural, so it's this that river restoration mainly focuses on.



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River ‘Restoration’ Demonstration Projects

So now, I’m going to show you some examples of some river restoration projects that we’ve completed in the UK. So, these are mainly pictures. So, it’s nice and easy to go through really.

River Skerne, North West England



Later on, you'll be given some little bookmarks about the River Restoration Centre and on there is a website for the River Restoration Centre. If you go to the website, it tells you lots of information about river restoration and there are a lot of case studies on there and one of the main case studies that we have, which was one of the first restoration projects in the UK is this one, which is called the River Skerne, and it's in the North West – no, actually that's wrong.

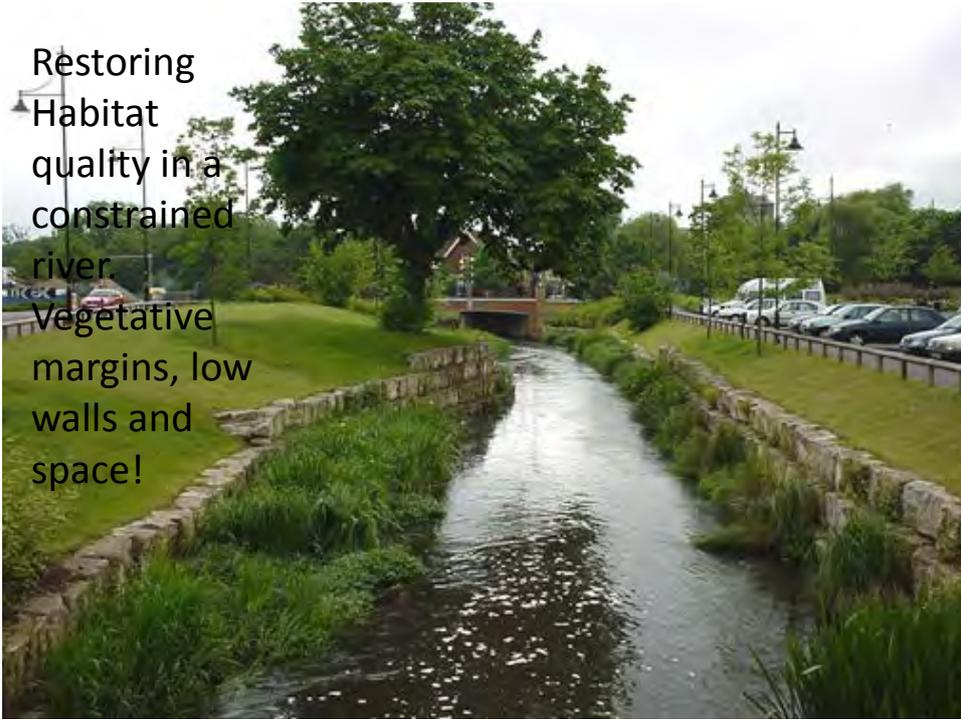
I've put that wrong. I will change this. It's the North East, not the North West – it's North East of England. I forgot my geography so – so it's up in the North East and, in fact, last week with the floods, this particular river was on the news as having severe floods. So, it would be interesting to see how this particular project has fared. So, this is what it was like before the restoration. This is the park area here and there is – you can see that it's very straight. The river was over-deepened, over-widened, and there was no connection to the flood plain at all.



So, what they did was try to put back the natural river as far as they could. They had to look at the historical information and try to restore the river to more natural habitats and created these wetland areas connected to the river. For example, here, for fish habitat during flood appearance so that they could sit there when you have floods. And also, this area was lowered and the banks were lowered so that during floods, this whole area is meant to naturally flood and then helped to protect the main urban area downstream and I have seen this in floods, so I know that it does actually work. This is a good example. It's a big example of a restoration scheme.

Restoring
Habitat
quality in a
constrained
river.

Vegetative
margins, low
walls and
space!



But not all of our restoration schemes are that big and sometimes you can only do very small restoration on your project. This particular river here is a very constrained area. You see you have a parking on either side and a small amount of grassland on either side. And originally, there were high walls on either side of the river which meant that the river was very, very constrained. So, the local government took the big walls out and still maintained this, putting some stone along the side because you can't have this river moving around because you have two car parks on either side.

But what it does do is that it increases the capacity during a flood event so that the water can come up here, which it couldn't before, and it allows you to put in some vegetation habitat along the edge of the river here so it can support more species. So, that happens quite a lot actually in small places in the UK that are doing these small scale projects but they are very important.

Community involvement in a small stream: South West England near Bristol



This is another small scale project which I saw a year ago and it had just been completed and what happened here was – if you see this block here, there were some small weirs along the river to about that height and behind them was lots and lots and lots of fine silt wire material and the local government had to keep coming and taking out all of that material and the local residents didn't like it because it smelled horrible and there were mosquitoes sitting in the river and people just didn't like it.

So the local community asked if they could do something different and they had a guy there who was very enthusiastic and he said, can we not take out the weirs that are holding the silt and narrow the river by putting in vegetation and bars and the local community said, we are happy to manage this vegetation so that if we have too much or it shifts, we will manage it and go in and make sure that it's okay.

And so they had a go and they tried to do it and this was about 2 or 3 months after the project had been completed and I walked in the river with some colleagues and we picked up some stones and under the stones were lots and lots of fish and lots of invertebrates very, very quickly that weren't there before, so it was a really good opportunity and there are people who walk along here and enjoy it as well. So, it wasn't very expensive but it's a good

opportunity in a small area to do a small bit of restoration but it only works because the local community is prepared to manage the river.

The other thing is they left these stones in here – these slots because if there was a problem and it didn't work, they would be able to put the weirs back and put it back how it was before but it's very popular.



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River Restoration

and

Flood Risk Management

I mentioned Flood Risk Management. So, these couple of examples are really to show you what you can do that links flood risk management and river restoration.

Sustainable Flood Management



- Jubilee River, London

A '2nd River Thames' for Windsor & Maidenhead.

11km of shallow, linked, linear gravel bed pools. Designed to reflect the habitat lost from the River Thames.

High land and property prices made the project viable at £115,000,000. =£10M per Km.

Only in London!!

Now, somebody in this room I know has already been here. This is the Jubilee River in London and mainly a second river was made and not an actual river and it's a flood risk channel. That's, first and foremost, what it is. Normally, if you have a flood risk channel that takes water during the flood flows, you will have it in a concrete channel like that with no habitat or vegetation at all. This is very unusual project. It's a very big project. You can see it's 11 kilometers of river – new river but the difference here is they created a lot of habitats within the water course.

It wasn't cheap. It works out about £10 million – I don't know how many yen that is but a lot of yen per kilometer of river. So it wasn't a cheap option but because of where it is and you may have heard of Windsor Castle and Eton School, which is a very, very expensive private school, so there are a lot of expensive houses in this area. The decision was made that they need to do something that was good to reduce the flood risk in this area and also have some habitat diversity as well. So, you can link those two things together.

River Long Eau, Eastern England: working with farmers to improve flood risk management



If you go to London, go to ask to look at the Jubilee River and you can walk along it. It's a nice walk as well.

But, of course, London isn't the only bit of the UK that floods. It's everywhere out as well. And this, I'm sorry, the picture is not good but I think you can see a lot of it. It's not just flood risk problems in urban areas, there's been a lot of flood risk issues in farming areas as well and the farmers are beginning to realize that actually sometimes just keeping the water away from their land doesn't work because they don't get the crops that they want to grow anyway and actually, if they change the types of crops that they grow, they can allow floods to come out onto the river a bit more frequently providing they don't – the water can get back into the river quite quickly.

So, actually, by having steep banks and then often levees on the side which stopped the water going back into the river after a flood is a big problem for the moment. And if you go to the eastern part of England, near where I live, New Cambridge, you will see lots and lots of rivers that just look like drains like this.



So this is how this particular river was before the restoration and, in this case, you can see the farmer was happy with this. He understood the concept. They dropped the bank on this side completely so it took that big bund away with the idea that the river can flood into this field more naturally and then when the flood is finished, it will go back in very quickly and he just changed his agriculture to accommodate it.



And that's what happens and then that protects areas a bit further downstream, so beforehand that wouldn't have happened if the water would have just carried on downstream to the next town. So, that's a big difference.

Craigie Burn, Scotland

- Enhance habitat
- Urban aesthetics
- Low flows



Up in Scotland, this is quite an interesting little project. It's called the Craigie Burn. In Scotland, they don't call their rivers, rivers. They call them burns so if you go to Scotland, remember they're burns; otherwise, you'll get a lot of, watch it mate. This was a river that they wanted to put a Flood Risk Management, so they over-widened and over-deepened the river.

This height is the water from the river whilst they were doing the work. If you take the water out of the pipe, there's no river because there's not enough water in that pipe for the river. So most of the year, the river is dry like this, no river anymore, only when there's high floods. So by widening the river, all the habitat has been taken away from the river.

Metz, France – habitat in flood risk zones



And yet, a similar example of this in France actually. Here, you can see they widened the river but actually, they put in some habitat along the edge of the river, so in low flow conditions, you would still have some water in there. All of this vegetation is very soft, very flexible, so in high floods, it just flattens and, therefore, it doesn't reduce the capacity during a flood event. Yet in caveat, anything you must do is if you have more woody stiff vegetation, for example, up there is a tree beginning to grow, you must take that out because that can have an effect and could reduce the capacity. So if you adopt this approach, you need to manage it as well.



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River Restoration **in** **Urban Parks.**

So, a lot of our restoration actually happens in urban areas and urban parks.

River Brent, Wembley Stadium, London



It's a good opportunity and a lot of it has happened actually in London and in Edinburgh in Scotland. And if you look on the RRC website, you will see a document called the London Rivers Action Plan and there are some good case studies in there of river restoration projects.

Now, this one is the River Brent and if any of you are keen on football, you may have heard of Wembley Stadium and this is very close to Wembley Stadium. In fact, you can hear the football going on. It's that close and you can see it from the side as well. It has a lot of history with Wembley Stadium actually.

So this is how the river looked before the restoration, classic concrete channel, concrete bed, so it happens over and over again. So, the aim was to try and restore it through the park and there were two communities outside of the park and they were very different types of communities and they never talked to each other. They never spoke to each other and they were quite unsure of each other because they were so different. So, as part of the restoration project, they put in a new bridge across the river as well to try and create a link between those communities.



So, this is the restoration project in construction. Again, they looked at the history and the project is being completed. They looked at the history of the river to see how much it used to meander and where it used to go. But, in this particular case, there was a lot of discussion with the local community before the project was completed. People were very concerned that where you might have erosion on the outside of the bend and it was close to the houses. One day, the river might erode into their house. In fact, that's probably not going to happen.

But in order to ensure and to give people confidence that that won't happen in the future, some of the outside of the banks had to have, what we call, bioengineering, a mixture of engineering and plant growth to stabilize those banks and so they used material from the old concrete beds and banks along the bottom of the bed of the river here and then at the top, it created a mesh of tree trunks that grew with wire to try and stabilize the banks and you will see what I mean.



This is in construction. I hope that you can see it very well. Can you see these poles under the wire at the top there and those are actually live bits of vegetation and then away from the most erosive bits of the river they just put in these rolls of vegetation at the bottom and allowed the more natural processes to work with some erosion.



And that is a group of students having a look and doing a precursor – a pre-PRAGMO on the river. So, trying to look at how the river was functioning as part of the restoration.

If you look here, here, and other places, it's just the beginning of those areas where that vegetation and the poles were put in place and they're starting to grow up.



And a little further along the line, each area you see there, and up there, and further into the distance, that's where those trees were actually growing up to try and stabilize those banks on the outside of the bank and in other places, you can see natural erosion occurring where people weren't worried about it.

A word of warning, if you construct something like this, you need to go back and manage those trees because it's the roots that are integral to stabilizing the banks, so you have to cut them down every now and again to make sure that the whole structure doesn't become destabilized. But it's a good example. It's a good project to go and have a look. If you go to London, ask to go to the River Brent.



River Restoration through Fisheries & Conservation Projects

Another big thing in the UK is river restoration through fisheries and conservation projects. I mentioned at the beginning that fish are a big interest within the UK and there are lots and lots and lots and lots of weirs in our country and that every one of them stops fish getting upstream so that they can't spawn and it affects the whole lifecycle of those fish. So government is talking about this in a big way, can we remove the weirs, how can we move them, is it safe to remove them, are we confident that we know how to remove them.

The other side of the problem is that we are talking about how do we look for natural sources for energy and one of the big natural resources is potentially increasing the amount of hydropower units we have. If you have a weir, it's a good place to put the hydropower.

Witham, Lincolnshire



- Weir no longer used
- Fisheries problem
- Siltation
- Disrupting natural flow regime

- Return free passage
- Remove eyesore
- Restore natural functions

Gravel 'riffle'

That's the one we've got to turn around. So, this is the one – the project that I was talking about minutes ago. So you'll often see in the middle of nowhere – in the middle of the countryside, weirs, like this, apparently for no reason. They're probably related to historical milling or something like that. Usually, that's what it is. And you look around and there's no mill anymore. There's no infrastructure. There's nothing and so, in this particular case, there was a real opportunity to just take that small structure down.

People get very, very uncomfortable without taking even small structures like this at rivers because they think it's going to change their natural processes. So this is a really good opportunity here to try it because it didn't matter if there was a problem when river moved because that would be catastrophic and this is the river a little while later and you can see by taking the weir out and putting in some gravels to create a natural river riffle. Quite quickly, it looks very, very natural and vegetation started to grow on there as well and so it's quite an easy thing to do and can be done quite quickly and cost effectively as well and it improves the fish passage as well.

I would say in this particular river system, we're not talking about salmon and trout that would jump over that weir with no problem at all. We're talking about what we call coarse fish which like this kind of habitat and really don't like jumping over even small weirs like this.

Inchewan Burn, Scotland



(左の図の説明)

So, there's a bit of a conflict there between those two elements of what we have to deal with and it's still not resolved. However, from a point of view of river restoration, we would prefer to remove the weirs if we can and in terms of – oh, I've got some pictures of the weir. And I had a picture of some weirs but I don't know where they've gone.

I may have deleted them by mistake actually when I was looking at them but I have another version so I can put them back on but I had a good picture of a weir beforehand and then the weir being removed and then putting in some gravels in the bottom of the river and then allowing those gravels to shift around within the river to create a mixture of habitats for the fish and allow fish to then go upstream but also to ensure that the river was still stable by putting in those gravels. I'll find the picture and give it to you in a minute here because I think that's what I might have done. I might have taken it out of this presentation maybe at the start. So, I apologize for that but I have it.

But fish is also very important in terms of this example here. I talked about the fish being important in the UK. It's even mostly important in Scotland. Scotland and salmon are very, very important. This whole industry of salmon

is very important. And often the fish can't get out to the spawning ground again and this is a brilliant example of a small stream – that is a river and it's difficult to believe it but it is a river. What happened to this particular river is that there was a roadway put across the river and the local council was very concerned that if there was any movement in this river, it could undermine the road and it's a very high energy river with lots of mobile gravel in it.

So they decided that when they built the road that they would put in lots and lots of wire and hold all the gravel in place on the banks and the bed. But, unfortunately, because there's so much erosion in this river, it just pulled everything out and to make matters worse because there are big holes in these big gravel baskets, the water just disappeared underneath while there was none at the top, so there was no chance of any fish ever getting upstream to a very nice natural river.

So they decided after a lot of discussion with the River Restoration Centre, that what we could do is to replicate the upstream channel but to put in some big stones that were concreted into the bank – I'm sorry – into the bed and that the small bits of gravel from upstream would then start to make a more natural bed but it would be safe for the road because actually the whole of the big stones were actually concreted into the bed of the river and would stay there and support the road.

(右の図の説明)

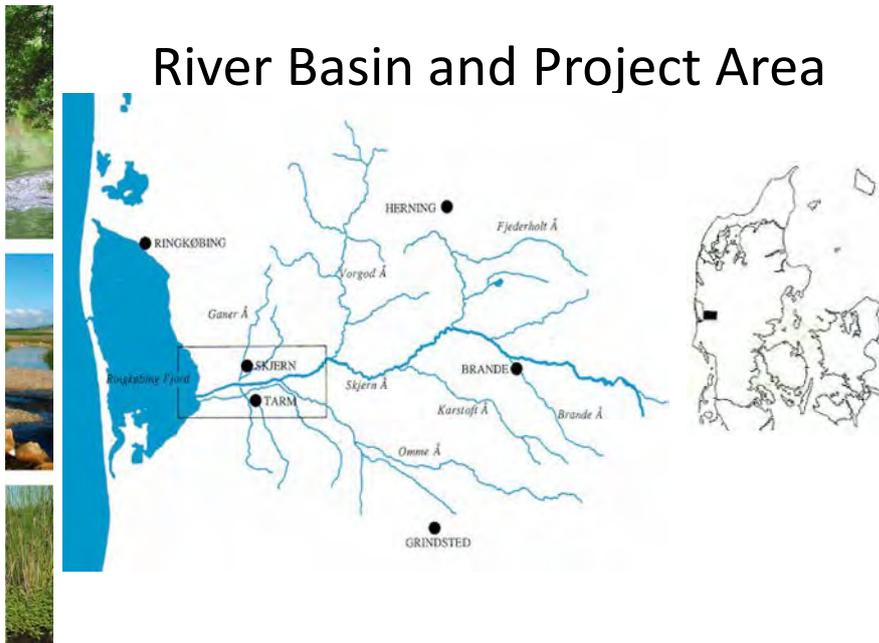
So, this is it's under construction. You can see here that the wire has disappeared and they're starting to put in some infrastructure into the river and this is that same river that has actually been restored and each of these big stones here is cemented into the bottom of the river and it looks really good and it was done about 5 years ago and I saw this river this year and it's still looking really good and the fish can now get up and spawn upstream. So, you can always do something.



River Rehabilitation Further afield in Europe

So the last bit I really want to talk to you about is just feasible examples in the UK, but like everybody else, we learned lessons from other countries and as part of one of the river restoration projects that we were involved with, the River Skjern, which is on our website. This was 10 years ago or so – we joined with Denmark, who also restored a much bigger river, and this is kind of an aspirational thing that, I think, everybody can learn from.

River Basin and Project Area



So, this is Denmark. You can have a look afterwards and see what Denmark looks like. Up to the north of United Kingdom and it's on this side – the western side of Denmark and this is the catchment here and the restoration bit that was restored was this downstream here. And you can probably see here, it's about straight and if you know anything about a lot of the Norwegian and Danish-type landscape, it's very, very flat.

There's been a lot of agriculture over time and what they have done is they've put in what's called dikes and big levees on either side of their rivers and their rivers are really no more than big water courses through the countryside with no natural diversity at all.

Lessons from Europe



" In England when we see flooded fields we see it as a sign of failure. In Holland it is a feature of a working water management system"
John Prescott



Denmark

River Skjern. Late 60's
Denmark's largest land
drainage scheme, 4000ha
wetlands lost. Deepened,
straightened, embanked
and pump-drained



.....
.....today's cost £22M.



And you see big tracks of land like this and you can see very, very intense agriculture, very intense, and then the river just going through here. But it's not really sustainable.

This type of agriculture, because you've changed the natural dynamics of the water and its link to the flood plain, requires a lot of fertilization, it requires a lot of irrigation and over the time, that affects the land and now what they were actually growing on here wasn't great particularly cost-effective anyway.

So, the aspiration is to try and restore this very undynamic river.

Before: Highway for water bordered by dikes



This is what I was talking about. These big dikes here stop any water going into their surrounding flood plain and then the flood plain is then drained as well, big pumping stations are to make sure that the land stayed very dry, but not cost effective either.

River Skjern ready to bend again



So this is that that particular project when it was under construction and again, a lot of design but the aim was to try and restore the river and try and allow it to link into the flood plains, reconnect to that flood plain and get those flood plain processes back working, very important for wetland birds in this particular case. There's a lot of migration of birds from one place to the other within the UK but up to Denmark as well.

Nature areas and intensive farmland side by side



And that is that river actually in floods. You can see the difference between the part where there hasn't been any restoration that was before, and this big wetland area that now occurs when the river comes out into the flood plain. So, that's the kind of thing that we're really trying to link all those elements together.



River Restoration encompasses many 'ideals'

- Integrated catchment management
- Multi-disciplinary teams
 - Engineering
 - Geomorphology
 - Hydrology
 - Water Quality
 - Ecology/Conservation
 - Fisheries
 - Landscape
 - etc....
- Understand the processes involved, the inter-relationship between the river, its floodplain and the catchment.
- Build this knowledge into the design at an early stage.
- Involve all functions to ensure that the project is appropriate and can meet its objectives.

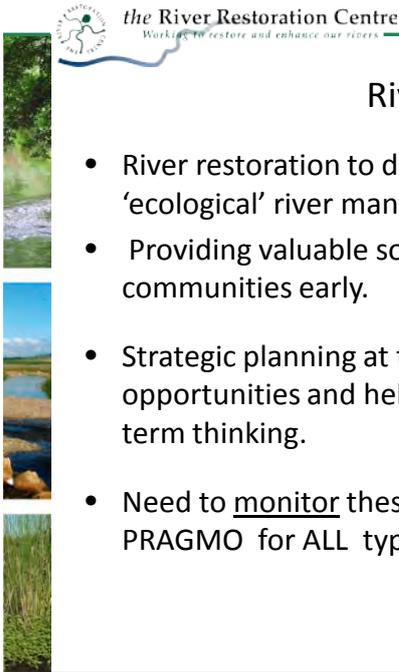
So I think the main importance of what I've been trying to say is that river restoration encompasses many, many ideas and you have to be prepared to link engineering with ecology, with social sciences, with economics. All of those things are equally important. You need to understand your water quality is very, very important in terms of any river restoration.

You have to understand what your historic landscape is and you have to understand the natural processes of river which vary from river type to river type. And also how much water you have and when you have that water. How much water is used, extracted, and how much water you have during floods and they will start to help you understand what you can do to restore your river.

So if you understand those processes and you understand the whole catchment and also linking it with the flood plain, you have more opportunity to try and restore everything back that's economically viable. And you need to understand that at the beginning, before you even start doing the river restoration projects, no good thinking about it later on, and that's why the Water Framework Directive is really good because it's made every country think about their river at the catchment scale, understand each of their river systems, and that helps you to think about what you can do to restore your

river.

And the other important thing is to involve all these teams of people and the local community at the beginning of a project so that you can make sure that everybody is in agreement as to what the objective of your project is and what are the limitations of what you could do.



Rivers: the Future

- River restoration to deliver sustainable and economic 'ecological' river management.
- Providing valuable social benefits but must engage with locally communities early.
- Strategic planning at the catchment scale can maximise opportunities and help minimise the constraints requires long term thinking.
- Need to monitor these new project.... Monitoring guidance PRAGMO for ALL types of monitoring.

So, what are we going to do in the future? We've come a long way, I think, over the sort of last 10-20 years of river restoration and don't forget that it's still quite a new science or a new discipline. Everybody understands a little bit about linkage. It's still very new, relatively speaking, and it's difficult to pull that information together.

What we're trying to do is restore rivers so that we can link sustainable and economic ecological river management. So, it's those two elements.

We must also think about the social side of things. That's equally important and, as I mentioned before, we need to really think about the community that lives by that river before we start doing our restoration or implementing our restoration and visions and aspirations.

Catchment scale is absolutely essential in terms of understanding what you're going to do in one place and what the constraints might be and you need to think about that in terms of the short term and the longer term as well.

And, finally, where we've got to now, we have, certainly, in the UK, carried out a lot of different types of river restoration projects. We have a database that has about 2000 projects or so. Some are very small, some are very big, but

what government is now asking is, well, okay, there's all these restoration projects but how can you demonstrate whether they are successful or not. Is it worth us investing any money in the future river restoration or shall we discontinue to put high walls and leave it as a sewer with lots of rubbish in it. You've got to show us the inside side of things how can you demonstrate that it's been successful.

And so what we did is we put together this document that has guidelines on how to have integrated monitoring and it's not just meant for detailed scientific evidence collection, which can be very, very expensive and time-consuming. It's also looking about how you can help get global communities involved to collect data appropriately to help demonstrate that these projects have been successful. And, in fact, even by getting people enthusiastic about their local river, you could argue, is one step towards saying that the projects and restoring rivers is a good thing to do and can be a very successful thing to do.

So, that's where we are in the UK. We're just getting to that point of we've got quite a lot of experience and the techniques and what works – we think what works and what doesn't but we don't have the evidence to support what we've done.

<質疑>

Moderator

Okay. Thank you. So, are there any questions? You can ask anything.

Male Participant

Thank you for your presentation. So I've heard of Greenberg Policy in England, so Greenberg Policy has function of environmental and ecological corridor. So, I have a question. Does the Greenberg Policy include the river and river management?

Dr. Jenny Mant

It should do. Yes, you say, it's a policy. It's an idea and there's also a thing called Blue Corridors. The idea or the concept is that it should think about the rivers. It's a concept that is a local community – I'm sorry – local government concept.

To start with, the idea of green planning, green infrastructure didn't necessarily think about the rivers but it's interesting that a lot of local governments have found that where their green corridors are, are next to the river, and so now they're thinking maybe we need a river restoration strategy for our river because this is how we can best connect all of our different parts of the corridor. So it's the other way around but in a lot and lot of places, they're finding that that's actually what's happening. So, the two things are naturally linking together which is good.

Male Participant

Thank you.

Moderator

Okay. Another question? In Japanese? No.

Male Participant

Thank you for your presentation. I went to the Jubilee River 5 years ago. Jubilee River, when you started construction of this project?

Dr. Jenny Mant

Where was it constructed? When was it completed?

Male Participant

Started?

Dr. Jenny Mant

When was it studied or constructed, I'm sorry?

Male Participant

I think it's not clear [ph], so we will have someone else...

Moderator

Yeah, when was it started?

Dr. Jenny Mant

When was it started? What the design before – I think it was about – they started thinking about it a long time ago, about 20 years ago. Yes, because there was a lot of problems on the river. There's an invasive plant in the UK which is a big problem and it's actually – I don't know whether you've heard it but it's called Japanese knotweed. It's a plant you have here that tastes like rhubarb when the plant is small. I don't know...

Male Participant

Smaller – bulbar.

Dr. Jenny Mant

It's long, tall, and has leaves like this.

Male Participant

I see.

Dr. Jenny Mant

And it's a native plant to Japan but it likes our rivers and it grows everywhere and other plants don't grow. In the Jubilee River, there were lots and lots of Japanese knotweed, which had to be removed when they started the project. The problem is you have to contain it because it grows through concrete,

through anything really, and there was also a lot of contaminated material so they had to decide how to deal with that. So it took about 20 years for the project to be designed but it was completed in, I think, 1992 or thereabouts. It's quite an old project and it's been there for quite a long time. It took, I think, about 3 or 4 years to construct if I remember rightly, quite a long period of time.

Male Participant

Okay.

Dr. Jenny Mant

Okay.

Moderator

Are there any questions?

Male Participant

I know that you do have a lot of knowledge of the various restoration projects or something, so I want some leads. The Thames River was biologically built at the time of the industrial revolution of England. So my question is if we did some vegetation project or if we want to grow some vegetated area around the Dezhnev River, that we should consider the quality of the river bottom because without making biologically alive the river bottom we cannot do any vegetation or green protection. So, I don't know how long time it took at that time to alive the Thames River from the dead to alive?

Dr. Jenny Mant

Okay. I don't know. I don't know how long. I've no idea. It's been something that's sort of been talked about through my lifetime and I know it was, you say, a problem and then probably about 10 years ago, there was an announcement that actually they had found some salmon going up the Thames, so it's very difficult to know because there was a lot of sewage going into the river not treated properly and, gradually, over a long period of time; 10, 20, 30 years they improved the amount of discharge adjusted going into the river, so it's difficult to know how long it really took and it's not still perfect now.

It's better and it can support wildlife. So if you have a river and the water quality is bad, you could probably, if you had enough money and you wanted to improve every area, identify every area where there was an issue with the water quality, you could probably fix it relatively quickly in a few years because the Water Framework is saying over a period of 10 to 15 years, we expect you to improve the water quality significantly in all your rivers. So it can be relatively short and quite easy to fix but, of course, it takes a lot of money and change in the infrastructure to do now.

Male Participant

The second, in the previous moment, a few years ago or maybe 20 or 40 years ago, we didn't have that much information about the industrial revolution effect on the river but now we have the many examples of how the industrial revolution or encroachment or something like that or you can say the development; development that stopped the river life.

So, in this moment, we can stop or we can shout our voice to stop – not stop such type of work but before doing this type of development, we can take some prior project, how can we alive the river or something like this? So, in this moment, we can do like this, before developing any industrial project or something, we should consider about the river or the drainage system?

Dr. Jenny Mant

Absolutely, yeah, and that's why I mentioned sustainable urban drainage, so making sure that when you're thinking about restoring your river or if you have a river near to a development, you make sure that you implement the right drainage and you have space along the side of your river with more natural vegetation to help reduce the amount of pollutants getting into the river and it's not just industry, of course. Roads are terrible – absolutely terrible for pollutants getting into the rivers really.

So, yeah, it should be always considered as part of anything that you're doing. And also although you need to improve the water quality by thinking about making sure that you have some habitat features or make sure that your river isn't too wide with the amount of water you have in it. That can improve the

oxygenation in the water, which can help disperse the water quality as well. So, there is a rationale for doing some restoration at the same time as you were trying to improve your water quality so that the habitats can then form as you improve your water quality. Okay.

Male Participant

Yeah.

Moderator

Now, let me ask questions. Do you know what I want?

Male Participant

May I ask here two questions? One is for funding. So I think that globally the fund comes from the government, local or central. So is there any – I mean, other than the governments, like landowners or private companies?

Dr. Jenny Mant

Okay. You're right. A lot of the money comes from the government or has done recently, not in the past, but more recently because of the Water Framework Directive and a recognition that if we don't restore our rivers then the Central European government will fine the country and there have been various other directives, the Nitrates Directive, for example, and in Brussels, the central government will fine the country very heavily, so they know that they have to put some money in.

However, I mentioned that fishing and local communities love fishing and we have a lot of fishing clubs and some of them are private and you have to pay a lot of money to belong to that fishing club and that money is collected and often used then to restore the river. So, that's a really good source of funding for river restoration.

Probably a third part, in Europe, there is funding for environmental benefits and groups of people and charities can apply for that money to do restoration work. So there are different places and sometimes it will be local landowners who will say I want to restore my river but they usually have an economic driver for doing it, i.e., they want to restore their river because then they know

that more people will pay to come to fish and then they can have the revenue from it. So, yeah, but maybe that's me being cynical but I think it's probably the truth, but it doesn't matter. It's another way of getting money.

Male Participant

Okay and the other one is that you mentioned about the sediment perhaps. So, what kind of sediment probably is severe in rivers?

Dr. Jenny Mant

It depends where you are.

It depends on the type of river but probably the main concern that we have is when you have fine silt or fine sediment that has come from the fields that aren't managed properly and the sediments just come straight into the field or from the roads and obviously the roads contaminate it in one way but if you included the fields, you will have a lot of fertilizers in those sediments as well and the problem is if you get a lot of fine sediment in the system, it will often deposit where you have a wider section of river which might be supporting a nice gravel habitat for fish to spawn and if it then sits on the top of that it will intersperse in the gravel and stop the fish to spawn in that area, so it's probably fine to learn what's more of a problem mostly, not in ways but generally speaking.

Male Participant

It posed a problem on the habitat?

Dr. Jenny Mant

Yes.

Male Participant

And that's where the problem is really, it's for the...?

Dr. Jenny Mant

For the habitats, yeah.

[Japanese]

Male Participant

Please show me – in regard to slide on the Eau River...

Dr. Jenny Mant

Eau.

Male Participant

Eau River.

Dr. Jenny Mant

Oh, yeah, got it.

Male Participant

Please show your slide.

Dr. Jenny Mant

Okay.

Male Participant

The college staff is up to it.

Dr. Jenny Mant

It's in the middle. You should have done it the other way. There you go.
Which one? This one?

Male Participant

This one.

Dr. Jenny Mant

This one?

Male Participant

Not this one, after that slide.

Dr. Jenny Mant

This one?

Male Participant

Yeah, this one.

Dr. Jenny Mant

Yes.

Male Participant

So, in this case the farm on right side has become weaker than left side.

Dr. Jenny Mant

Yes, because they deliberately dropped – yes, so that the water could go out.

Male Participant

Other version, so can the farmer of the right side receive any compensation?

Dr. Jenny Mant

Compensation.

Male Participant

Compensation, yeah.

Dr. Jenny Mant

Yeah. That's usually the way. That's something else that I didn't mention but, again, we have a European policy for farmers where they can apply for money for secured streams [ph]. They are a part of the agricultural policy and if they say they are happy to have environmental benefits to their field and take some of the agriculture out of production, they can claim money as compensation.

Male Participant

They can. Thank you very much.

Dr. Jenny Mant

Yes. It's a very good point. It's all financially driven. Everything has got

money attached to it but, yeah. I think in this case, actually, the farmer – I'm not sure the farmer did have a subsidy for it but, generally speaking, they just happen to be very happy which is why we used it as a case study but, usually, you would expect the farmer to ask for some money to do the work, I think so.

Male Participant

Okay. Thank you.

[Japanese]

Moderator

Are there any other questions?

Male Participant

Is it really difficult to make that kind of agreement to the farmers and management?

Dr. Jenny Mant

It depends. What tends to happen is you will find out the farmers who are keen and enthusiastic and work with them and then sometimes what we try to do is to get the other farmers to come and have a look at these case studies and sometimes they would say, oh yes, I like this idea. It's good, I'm happy. Please, can you come and help me in my farm. But then you will get others, usually farmers who have been farming for many, many years and they say, no, I'm not changing my way of farming and you have no choice. You just have to say, okay, in 10 years' time maybe, but not today.

Male Participant

You said that for the WFD, the directive, you have to reach the goal in 2015 – in 2012. Do you believe that it's possible to achieve 100%?

Dr. Jenny Mant

Well there is another goal, 2027.

Male Participant

I see.

Dr. Jenny Mant

And then it continues. The Water Framework doesn't stop. There it says and an X number of years afterwards. I think the last one is – I can't remember but it's when I will retire, so maybe by 2020. But 2027 – 2015, 2027, and what the governments have been asked to do within the River Basin Management Plans is to be realistic and they have said we can restore a percentage by 2012 and that these are where we are going to focus and we will have restored another percentage by 2027.

So as long as they have identified that at this point and they manage to do what they have said they will do then that's fine but if they say we're going to restore 80% by 2015 and just restore 20%, then they'll get in trouble. So, a lot of the countries have been very cautious about what they can actually achieve by 2015.

Male Participant

You said about the good ecological status and a good ecological potential?

Dr. Jenny Mant

Yeah.

Male Participant

So, a good ecological potential means a lot of present situations?

Dr. Jenny Mant

For a good ecological status, it has to be as natural and as pristine and as perfect as you can get. Good ecological potential says there are big constraints in this river but actually what can I still do to improve it. And if, for example, that means putting some habitat edging and that's all you can do it. That's the best good ecological potential that you can get to. You can't make every single habitat but you can improve it, so that's the best potential that you can get towards being natural without taking all the infrastructure. So, that's the difference. It's a realism measure.

Male Participant

So, in this what case would be the good...?

[Multiple Speakers]

Dr. Jenny Mant

Essentially, yeah. Well, the problem is that the environment agency and the equivalent in Scotland and every country have identified their rivers based on local expertise and the local expertise is different in one place to another and so in 2012 were the first River Basin Management Plans and then there was a big consultation across the country and everybody – anybody in the country could look at the plans and they would look at them and say, but you said my river is natural and I know it's not natural because there is a weir here and there's a concrete bank here.

So, they would have to go and review all of those plans to see if they are correct and so it's a difficult decision to make as to how many rivers are actually natural and how many aren't and what parameters you're going to apply to make those decisions and they do differ and they are changing again. But there is a framework there to make those decisions, which is good. It's not a precise science. It can't be.

[Japanese]

Female Participant

Thank you for your presentation. I just have one question about you told to us that you go through like the history like how the river was created and that's in order to differentiate and I just found out like how long like maybe you have a go at it in order to actively pursue it?

Dr. Jenny Mant

That's a very good question. It's a very good question and it's a very academic question because a lot of rivers, you can't restore back to some natural river system that was maybe 500 years ago because it would be impossible. So what we tend to do is look at the maps that we have, which usually are about 100 and 120 years old, and look to see what evidence there is of change over that period and sometimes you will see very clearly where

the river used to be, what it used to look like, and you can use that information and that evidence.

Sometimes the change has happened before then and if that's the case, then you also need to look at the history in terms of the use of the water, how much water has been extracted from the river and identify how much water you now have in the river. The historical evidence also looks at how the land might have been used. Is there any contaminated land, for example, where you want to restore your river?

So when you look at the history, you are looking at lots of different things, not just where the river may have been. You're trying to inform a picture to make decisions based on your understanding of that particular river catchment-type to help you make sure you have the best decision-making process for your project. Does that answer your question? It's not straight. It's not one single thing. There are lots of different bits that you need to look at.

Moderator

Anyone? [Japanese]. Maybe a bit shy to ask here but maybe ask personally. Okay. So, thank you for that excellent lecture.

Dr. Jenny Mant

Thank you. But if you have any other questions you can always e-mail the centre and ask.

Moderator

Yes.

[Japanese]

Moderator

Yes, so I have the Japanese version of the PRAGMO that we don't have in here and you can access it on the internet on this site and you'll translate it to English.

[Japanese]

Moderator

Yes, you can read it. It's in Japanese.

[Japanese]

Dr. Jenny Mant

You can find it on our website in English.

Moderator

Thank you so much. I will download it.

[Japanese]

Dr. Jenny Mant

Okay.

Moderator

Okay.

[Japanese]

Dr. Jenny Mant

Thank you.

[Japanese]

[Multiple Speakers]

END
