

Interview with: Paul Buckland

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Interviewer: Lynne Fox

[CD ONE]

Q: This is Lynne Fox for the Thorne and Hatfield Moors Oral History project. It's Saturday the 9th of December 2006 and I'm talking this morning to Professor Paul Buckland. Good morning. Could you tell me, to begin with, where and, where you were born?

A: I was born in Nottingham but my father since he worked on the railway, travelled a lot and eventually we ended up in Doncaster and I went to school in Doncaster, Doncaster Grammar School. From there to Doncaster Technical College and then to, a joint honours degree in Birmingham in geology and archaeology and after a year in Kenya came back and did a PhD in geology, but looking at the quaternary of the Vale of York.

Q: Could you outline to me, your, the area of your interest and your specialism?

A: Hmm...

Q: I know it's quite widespread so it's difficult [laughs].

A: Not easily, no, but in terms of local interest I, when I was at school I got involved with Doncaster Museum, mainly with Peter Skidmore and with a group of natural historians and also with Malcolm Dalby, the keeper of archaeology in the museum, and I guess from that developed a local interest in quaternary history of the Vale which I hope to take on to a PhD topic.

Q: Can you tell me what you mean by the quaternary?

A: Oh, quaternary is the last two and a bit million years, the equivalent to, to the Ice Age if you like, but yeah.

Q: And that interest developed through your connection with Doncaster Museum?

A: Initially yes. Initially my sitting and drinking coffee with, with Peter Skidmore and the other colleagues, Colin Howes, the late Albert White. Mike Clegg as well was there in those days.

A: Mike Clegg as well was there in [inaudible 02.17].

Q: How did that develop? How did that interest move on?

A: Hmm, well I ended up doing contract work really for what's now English Heritage, it's predecessors, working as a Field Archaeologist and I, I just developed really an interest in Birmingham. Fred Shotton, who was in charge of geology in those days was also a man interested in the quaternary and so I guess he was the person who really directed me in the direction of quaternary studies.

Q: Was Doncaster particularly, Doncaster Museum, did that have particular collections or people that were,

A: A mixture of both. The late John Lister excavated a series of Roman pottery kilns to the south of Doncaster, mainly in Cantley and Rossington, and the material had just been dumped in the museum basement so we organised ourselves to get it all washed and sorted and my work in Roman potteries was one strand as a result of that, but also because of the connection with the natural historians there. I, I guess, the one thing I remember most is the late Mike Clegg talking about house mice in coal mines and how interesting this was and I guess that started my interest in natural history as well as archaeology, and I'll always run them as parallel strands, I don't see them as separate pigeon holes.

Well from then on I worked with insects, largely because I set off on a PhD topic which someone was already doing, Geoff Gaunt at Leeds, and we met and we had a total overlap. It was very obvious he was the better stratigrapher because he was working for what's now the British Geol. Survey and mapping the region, and so I really had to do something different. There's Russell Coipe in Birmingham, he had developed the field of quaternary entomology and I guess it was inevitable that I took that direction. Working initially on late glacial deposits, mainly in North Lincolnshire, but then when William Bunting found the track way on Thorne Moor, we started to work with peat samples initially from, from Thorne Moors.

Q: So quaternary entomology, can you describe it?

A: Well it's the study of insect remains from deposits from the last two million years or so, and you can get the details of processing from Nicky, but it's a case of extracting the remains from peat and other anaerobic sediments and then identifying them by very close comparison with a good reference collection. Doncaster actually happens to have a very good collection of British insects particularly Diptera and Coleoptera, so it's quite useful to have that collection as well as the collections in Birmingham to use.

Q: And what do you use them for? What's the purpose?

A: Individual species have individual habitat requirements, so you can reconstruct the past environment by looking at those habitat requirements. We can also look at their distribution

in terms of climate and, I'm sure Nicky has said, there are more species which are now extinct in Britain from Thorne and Hatfield Moors than anywhere else in Britain. That's an indication of the concentrated of work that we've been able to do there.

Q: And you say you've always linked archaeology with natural studies?

A: Well yeah, an Icelandic friend of mine says archaeology is only relevant when it's talking about the environment and the climate and I'm inclined to agree with him. The study of artefacts is mainly a means of providing a dating framework for mainly the impact of man on landscape.

Q: So you started life basically in Doncaster?

A: Yes.

Q: And from there you went?

A: Birmingham Geology, and then I spent a year working on, mainly on tephra, volcanic ash in Kenya, but I had to come back because of tropical diseases for treatment, and took up a PhD in Birmingham, worked in Birmingham two and a half years then I went to York to work in the Arch Trust, then I went from York to Doncaster as the Archaeological Field Officer. And then from there to teach geography in Birmingham and then on to Sheffield [inaudible].

Q: And has your interest always been in, or largely in this country, been in the same area, geographically the same area?

A: No, no. I, there are a whole series of local, points which require elucidation, but no I worked in the Hebrides, Orkney, Shetlands, try and keep out the south of England but occasionally sites down there. Much of my work's been abroad. Either on the North Atlantic islands or in Egypt [inaudible]

Q: Could you tell me a little bit about, how your connection, we talked a little bit about William Bunting already, directly with Thorne and Hatfield Moors began.

A: Yeah, I can remember bits of it. I went out with Pete Skidmore to Lindholme Island in the days before Hatfield had been totally destroyed really, and I can still picture going out onto this area with Peter and looking at the vegetation and he being able to put a name on absolutely everything in the landscape, and I guess it started from there really. And then I, I on other visits I got to know William, and I've got the greatest respect for him, a tremendous character, and we sort of kept, kept the usual sort of dialogue going, anybody having a dialogue with William Bunting consisted of him shouting at you and you sort of trying to get back. Oh it was great fun. Tremendous character.

Q: Can you tell me what Hatfield Moor looked like when Peter Skidmore took you the first time?

A: Yes, I mean it was starting to scrub over in the areas we went into with birch but it, it was still a raised mire. This would have been, when would it have been? I guess mid-'60s if not a bit before then. I was still at school anyway, yes, when they were going out there to do some surveys and he said, "Do you want to come along?"

Q: So that generated an interest in, or an appreciation for, some of what was-

A: Yes, yeah I guess yes. I mean my father also had interested in both archaeology or natural history, so. He would always point things out wherever we were, so, I guess it developed as part of the interest as well

Q: Can I just take you back, can you tell me when you, when you first went on with Pete Skidmore, can you remember what it looked like, what the vegetation was like, what it looked like? What impression you got from it?

A: An area of, of wetlands, lot of sphagnum, lots of Eriophorum. I can remember Eriophorum in flower across the bog and some birch scrub developing out across it. Not good at word pictures.

Q: [laughs]. And was, did you see any, much evidence for the exploitation of the moor by,

A: Not on Hatfield at that stage, but later of course when I went to Thorne the extensive peat cutting but of course, in those days it was block cut, so you had a series of trenches with basically tram ways between where the peat was stacked and then shipped out, this whole area stripping doesn't come in until relatively recently. There was a chance of survival of the biota when it was cut by block cutting, and it was possible to have some sort of an arrangement which would have allowed the re-growth of the bog. Once they started area stripping there is no chance. The other problem, of course, is that the biota that you have now is not what created those bogs. Basically there's an element of inertia in all of this, so although they were still growing they were not growing in the way that they had grown previously.

Q: I know that you've done work in a wider area than Thorne and Hatfield Moors and I think it would be helpful to say some, to talk a little bit about that so that we can, what I'd like to do is to try and create a picture of, as early as we can really, of what the whole area around Thorne and Hatfield Moors was and how they came into being if you like. So can you just outline some of the work that you've done in the wider area? You talked a bit about the Humber and so on.

A: It's a long story to include the whole of it, but the most recent thing we've been looking at is the history of the pro-glacial lake, and if you look at a map of the last glacial maximum of Britain, the largest feature other than the ice sheet is this large lake filling the Humber basin, which is blocked in by ice along the east coast blocking the Humber Gap down into the Wash. We knew from dates on the Yorkshire coast, at a site called Dimlington that that was more recent than 18 and a half thousand years and from dates on top of those deposits it was going to be older than about 11 and a half thousand years. And what we have been doing, Mark Bateman lecturer in geography in Sheffield, is to try and narrow that dating down, and we now know that the lake basin which forms the flat on which Thorne Moor in particular has grown, that great flat of the Vale of York and the lower part of the Vale of Trent, basically the Humberhead Levels., sits on deposits which are significantly more recent than 16 and a half thousand years and are older than 13 and a half thousand years, so you've got a very narrow window in which the ice moves down the coast, blocks the Humber and the Wash, touches against the coast of north Norfolk and the lake fills in to a depth of, well from the present surface is to 30 metres OD. But of course a lot of that is infill anyway, and we think that drained catastrophically, by the lifting of the ice sheets simply because of the volume of water, ice floats in water of course, it breaks out through the Humber Gap. The whole thing drains catastrophically and then the ice reforms at a lower level lake to about 7 metres OD, gradually in-fills with sediments, and these are the Lake Humber silts on which the rest of the landscape is basically moulded and the wetlands down there, so those, when that drains, that lake essentially silts rather than drains, there is some blockage at the mouth of the Humber of morainic material and that is broken, the rivers cuts deep channels through Lake Humber silts and then as sea level rises with the melting out of ice sheet, particularly the Laurentide Ice Sheet in North America, which is what influences the initial sea level. These channels infill so that by about, about four and a half thousand years ago we're at, sea level is about, the present level and water logging is starting on the Humberhead Levels, but what actually causes the development of the peat lands over what is basically a mixed Oak forest, is run off of fresh water. So the main problem with flooding on the Levels is not rising sea level but is actually fresh water run off down the major rivers of the area. That leads to the water logging of soils, the death of forest, and its replacement initially by fen, through poor fen, and to the development of bogs which are independent of the water table and the rising, the rising of these great Sphagnum dominated domes and in the nineteenth century it is said you could stand at Thorne in summer and you could see Crowle, but in winter you couldn't because the amount of water take up in this great sponge of Hatfield, sorry of Thorne Moor.

Q: You talked about the ice coming right down to Norfolk.

A: Yeah.

Q: Would that cover the whole land down to Norfolk?

A: Only along the coast. The previous glaciations, I mean the actual basin itself has been scooped out, well if we, we number glaciers and inter-glaciers based on the evidence from the ocean cores, so we're living in stage one at present, inter-glacial. The last glacial was

maximum stage two. The glaciation which scooped out this great basin of the Vale of York probably belongs to Stage 12, conventionally called the Anglian but whether the correlation's directly similar.

Q: Can you give me a date for that? Just to place it].

A: Not very easily no. Maybe 250 thousand or thereabouts.

Q: So that's when the original basin was formed that the silt,

A: From the soft rocks of the Trias were gouged out by a large ice sheet which covered the Pennines as well and also it's when things like the Don Gorge and Creswell Crags were created. They are created sub-glacially by water flowing under pressure from a decaying ice sheet which would be a number of kilometres thick, and that was the entire landscape down as far as the Chilterns.

Q: Down as far as?

A: The Chilterns.

Q: The Chilterns. We're later, we're looking at a later period and talking about, if we could talk about Lake Humber. Can you give me a date to place the formation of the first, the deeper lake?

A: Yes, it's going to be younger than about 16 and a half thousand real years.

Q: 60 and a half,

A: 16 and a half thousand, yes.

Q: And is that from present?

A: That's from present yes.

Q: So the, the lake formed because the Humber Gap was blocked with ice that was continuing down the coast,

A: Yes.

Q: And was quite deep as well as you said.

A: 30 metres OD, yeah.

Q: Then there was this massive catastrophic breakthrough,

A: Yeah.

Q: Which emptied, or at least drained some of that water away.

A: It drained the whole basin because Geoff Gaunt's evidence shows that there is a phase of periglacial activity, that is freeze thawing activity disturbing the sediments and river channels are cut to at least minus four metres OD. So that catastrophic drainage just flushes the entire system out. The ice front then reforms and blocks the Humber but it doesn't go particularly far south, just over into North Lincolnshire. That deposit comes in about as far as Old Winteringham on the Trent and the Vale of York glacier at this stage, it's, it's a bit difficult because the low level lake partly relates to the moraines at York and Escrick, where there are major morphological features that you can see. It's very difficult to know where that ice front reached. At its maximum probably it related to the high level lake but not absolutely sure. We need to go and cut some more, we need some money to dig some holes with a JCB to sort this lot out and the classic place is at Tudworth where you can actually stand on the moraine and you can see the deposits banking up against it, and unfortunately when they built the M180 there we didn't get at the sections at the right moment in time. I saw the sections through the moraine and it's crossbedded Magnesian Limestone gravels. Didn't get the section which would have given us the detailed stratigraphy we needed.

Q: Can you just explain what you mean by a moraine?

A: Yes, it's the deposits laid down by the ice and this is the terminal moraine, this is the moraine which marks the edge of the ice. We've recently got evidence showing that there is a phase of glaciation which immediately pre-dates the high level lake where the ice front lay further, certainly further to the south west. So far we haven't managed to sort out just how far that goes. The large moraine which runs down from Kellingley, Thorne sits on it, and I looked at when they were underpinning Thorne Church, I was able to look in sections there and you've got these Magnesian Limestone dominated gravels on that moraine, it's the same at Tudworth where the motorway section is. I've seen bits of it on Lindholme Island and Geoff's Map, the southern limit's across Wroot. So if you drive on that road which curves through the village of Wroot you're actually driving on top of the limits at one moment in time of the last glaciation, and as I say that's got to be more recent than 16 and a half thousand years ago.

Q: And the moraines are formed because the ice sheet actually moves, doesn't it?

A: Yes, it's carrying sediments so as it melts out it's continually moving forward. And if it reaches a still stand then a deposit will – which will form an end moraine, they're all, lots of other types of moraines. That structure seems to reflect the ice sheet floating in the high level lake, so I, we have a very dynamic system, we did a rough calculation that to, to infill the lake with water given the present flow, would only take 25 years, because the Humber drains roughly one quarter of the land surface of England. So it doesn't take too long to build it up and you can see these events being related, that the Humber Gap gets blocked there is ice in the Vale, the Vale of York, the lake level rises, the glacier in the Vale of York is then unstable basically,

Q: Starts to float

A: Yeah, and it shoots forward into the lake basin and at the same time of course the ice in the Humber Gap has been weakened and that rises and the whole thing, the system collapses and, if I coin Russell Coupe's phrase, it probably happened on the first Thursday in Lent, I mean it's all a very rapid occurrence and then the rivers cut down deeper and is sufficiently long for the landscape to suffer freeze thaw action, so the gap between high level and low level lake maybe a thousand years or so. You just can't tell. We haven't yet got those dates on the low level lake.

Q: What kind of life forms would there be at that time?

A: Couldn't find any. We've looked quite a lot at the sediments of the low level lake and, it's true Arctic. Probably the best parallel for that landscape would be the dry valleys of Antarctic. Immediately before we've a site at Finningley, which we've still got to finish writing up and get it back to it, which has got an insect fauna which at the present day you find either at a high elevation in northern Norway or along that little strip of real tundra along the north Norwegian coast. Throughout Britain there are several sites that belong to what's called stage three immediately before the maximum expansion of the last, and there are pulses of life but it, it's progressively one in which the fauna and flora is being impoverished and then during the phase of massive ice expansion development we can't find any evidence of life in the lake at all.

Q: When do we start to see some life?

A: After the last glaciation, well the best site locally was again in the M18, M180 cut. At Sandtoft we've got a site, which is with an insect fauna, which is already warmer than present day I guess up to about 13 and a half thousand years ago. I'm sure if we got the right deposits we could go back another five or six.

Q: And what kind of insects would they be?

A: Well the material that we've got from Sandtoft is a fauna that at the present day you'd find in the south of England, so it warms extremely rapidly from high arctic, and we get a trace at other sites of the high arctic assemblage, the first immigration of fauna, but it goes warm very quickly and stays warm for best part of a thousand years, and then it cools fairly rapidly to conditions rather like southern Finland of the present day and birch woodland developed across the landscape, and then it goes cold again for just under a thousand years and it, it goes as cold as the beginning of the late glacial episode. So it goes back to high arctic conditions and we get a beetle fauna which again is more from regions of high altitude. Not as continental as the previous forms but still a severe cold environment. Then we get a phase of blown sand deposition which, all the way across the Vale of York, banking up against the, well these are the sandy heaths of North Lincolnshire, it's the origin of those and if you dig a hole through those you'll get a peat horizon at the bottom, to about 11 and a half thousand years old.

Q: Peat underneath the sand?

A: Yes, yeah and within the sands as well occasionally and they all produce cold biotic forms and then although we don't have a local site to get to do this, it warms extremely rapidly. So rapidly in fact, that you can't resolve a sample at all. We want sample sizes of about five litres and that means the best you can do is two and a half centimetres or so, and you get a cold fauna and you get a mixed assemblage and you get a warm fauna. And we know from the ice core, or the ice cores, that turnover takes approximately 20 years, so you go from a high arctic to warmer than present day in less than 20 years. And in the early part of the present glacial, it's far more continental as you would expect with a middle/low sea level. I guess it's difficult to find, well there is no direct analogue but it's probably the edge of the Hungarian Steppe with very warm summers and very cold winters essentially.

Q: And can you give me a date for that too?

A: Well yes, if you want it in real years it's about eleven thousand six hundred and seventy, that's by counting ice accumulation in the Greenland icecap, annual accumulation, in radio carbon chronology it's ten thousand years.

Q: Do we have any, do we know why it warmed up so quickly?

A: The only way you can only put so much heat into the system is to switch on and off the North Atlantic Drift, so it's the heat input from the North Atlantic Drift which allows that sort of, and then the cover sands are an interesting episode because they are driven by winds blowing from the west, so even though it is still cold the system is starting to switch and these sands are deposited, an awful lot of snow as well, so it's got to come off the ocean rather than off ice. So the Coversands are an episode of change and flag this change from one system to another. Talk to Mark about that, Mark Bateman, because it's his PhD topic.

Q: We normally associate sands with deserts and heat so,

A: Well there's relatively little vegetation cover at this time and in fact that's what you see when you look at the peat, the peats within and below the sand, you see an increasingly open landscape.

Q: Has the insect record been continuous then, from when you first mentioned it?

A: There aren't, well yes. You have to sort of look at other sites in order to build the complete record, but it's a tabular rasa, it's a clean slate at about 15 thousand years with virtually no life, probably beyond algae on top of the rock but that's about it, and then you get a progressive immigration of species. The first things you get are things like... well you might be surprised but Caddis flies are in early. They may be weak flyers but they get taken up into the aerial plankton, Chironomids the non-biting midges, they provide a much clearer record for rapid change than the beetle faunas.

Q: That's quite significant that midges and so on are quite ancient in that area.

A: Well yeah, I mean they're rained out across the landscape and if they find a suitable habitat then they breed and they breed, they're oscillators, they go into rapid population increase.

Q: Once the basin's silted up, once the lake has started to silt up and, and what do we see then?

A: What happens then is the rivers are down cutting towards the Humber but they're carrying a significant sediment load and so you get a series of levees built up, along all major rivers and you can track them and some of those track on rather different lines from the present rivers. Because as they cut back in from the Humber Gap and create these deep channels, then occasionally we get a position when it breaks through them I think and the channel is different. We can map these and Geoff Gaunt's done it, mapped the levees of these rivers.

Q: What are the levees?

A: They're, the banks laid down as the river basically as they're cutting, there's a flow down carrying a large sediment load so it's laying down a lot of sand and it builds banks to either side.

Q: And when do we start to see human occupation?

A: Well we've got, if we forget the pre last glacial maximum sites like – like Creswell and the like, in the immediately post-glacial period we have a scatter of what are called Creswellian artefacts which occur thinly across the landscape, but there's quite a number from Coversand sites in North Lincolnshire but that's largely because of the deflation sites, you

know, as the wind blows the sand away you get a concentration of artefacts, and well these so-called broad-blade obliquely blunted points which run through from the later Palaeolithic to the early Mesolithic. I guess... well it depends what date we put on the Messingham site but that's the best dated example. A radio carbon date's come out about ten thousand five hundred, I would say on the beetle fauna it's a thousand years older than that, simply by comparing our beetle fauna with faunas from elsewhere and Mark's dating suggests that it's a bit more than that. And though we have, well two things, one there is a deposit of charcoal within the peat and it's willow charcoal, and an end scraper, and I guess it's an individual hunter out on that landscape looking for either horse or reindeer.

Q: When you say within the peat, you're not talking about the main peat body of the moor/

A: No, these are the thin peats which underlie or are within the coversands.

Q: And what kind of environment would it be and what, how would they be making a living basically?

A: I, I think in that particular case, looking at the reconstruction of the environment from the pollen and from insects, it's a very harsh tundra environment. Perhaps the only trees are birch in protected hollows, the rest of the birch is dwarf. This is the period we know as the Younger Dryas simply because one of its most characteristic fossils is the leaf of the plant *Dryas octopetala*. My guess is that it is an individual hunter, a sort of Rambo type figure, the probability is that the only settled sites are further to the south, and so we're just seeing these casual hunters moving northwards. Once it starts to warm up then you get more and it becomes permanent occupation, so sites like Creswell become more permanently occupied.

Q: What kind of, what kind of thing would he be looking to hunt in that environment?

A: There's one bone from that site which is of a bovid.

Q: That's a cow kind of?

A: Well it's either bison or wild cattle, you can't tell them apart. I'm not very happy about the dating of that because we don't have evidence of either in the late glacial and because it's the ankle bone it is really solid, it could be derived from older deposits. But looking at other sites, I mean Creswell's a mess because it's been turned over so often but there is enough in terms of dated material to show the presence of reindeer and probably horse as well, and the Flixton site in the Vale of Pickering produces horse there. So it's a case of, on the whole, I mean the reason for being at Creswell is you can practice head 'em off at the pass, because these are animals who move from one grazing area to another and you sit and wait, and if they don't come you die and this is what happened in the Canadian Arctic often enough. And so you can envisage groups of hunters in places like Creswell, when you start getting a scatter of artefacts, it suggests that these are individuals out tracking individually. You can't

keep up with a reindeer it's far too fast, but you can stalk individuals. On the other hand you don't sustain a family community very well on that basis.

Q: At some stage I understand that there was quite a large forest then developed?

A: Yeah, we have a gap in the record in terms of the paleoecological record. The archaeological record with sites like Misterton Carr, which is a large assemblage of a broad blade Mesolithic with the usual group of obliquely-blunted points, a few tranchet axes. Then some narrow-blade Mesolithic from the same time and Neolithic material, unfortunately our environmental record only starts again during the Neolithic with rising sea levels the channel's silting up and we've sites in both the Don and in the Idle which show the development of lime forest, oak forest is secondary forest, the normal, if there is such a thing, forest in lowland Britain at the present interglacial would be lime dominated, and the insect population shows this as much as, well better than the pollen inventory. The plant macro evidence from Misterton Carr is, well the site is packed with lime trees, so you envisage a forest dominated by, by lime giving way in the wetter areas to oak/alder forest, progressively as the lime woodland is cleared, that's replaced by oak forest once. That's what we see at the base of the succession on both Thorne and Hatfield, they're very different bogs. Thorne develops by this process of water logging. Hatfield is slightly different. There is acidification and then, partly related to rising water table but partly also related to clearance, the development of a heath which gives way to raised mire.

Q: I'll come back to that in a minute. What are these clearances that you are talking about?

A: They are small temporary clearances which take place within the Neolithic.

Q: These are manmade clearances?

A: Yes, yeah, yeah. There's a lot of discussion at the moment about the nature of the forest. Chap called Frans Vera working in... mainly in Holland, has suggested that what drove the forest change was grazing. Palynologists don't like that all because they like to see this continuous forest from the Channel to the Minch. I think Frans should be right, purely for theoretical reasons. It's very difficult to see the evidence and the palynologists seem so convinced that it's closed forest it's a difficult thing persuade people.

Q: So there's a possibility that hunter gatherers were actually clearing areas to, is it,

A: Possibly, yeah, yeah, but the big problem is the frequency of natural fire. Certainly across Thorne & Hatfield Moors and Gretel Bostwijk is worth looking at, the dendro sequence shows a return period across those bogs of about 350 - 400 hundred years and she's got at least three fires after the disappearance of the oak forest, which itself shows evidence of fire. The return period in mixed oak woodland may be two thousand years or thereabouts but it

still occurs. You just need a run of a few dry years and the lightning striking the right place and you get a fire.

Q: The return period meaning the re-growth after...

A: The return period is a return period of fire. I think the, Gretel's evidence would suggest that it's natural fire and it's striking into moribund pine forest. So you've got this serial succession going on in the bog and the bog develops pine forest, the pine starts to... well it suffers from a rise in water table and just exactly what's causing that's a problem in itself, and then you've got fire which burns right across the moor, at least five square kilometres of it on Thorne Moor and you can correlate across to Hatfield. Unfortunately, because of loss of record we're never going to get the details when the system finishes.

Q: Can we see the remains of some of these trees?

A: Hmm, well yeah, yeah. They turned enough of it out when they were cutting the peat, yes, yeah, and in the ditch sections, yeah, you can see a little bit of what's left.

Q: So the trees that they would, we would call bog oak, is that what we're looking at?

A: At the base of the bog there are oaks and oak, alder, willow, the usual sort of wetland assemblage, as you go up into the raised mires, much more acid soils, its pine dominated. So there are thousands of pine trees being turned up.

Q: So, if we had a walk along Thorne Moor and we saw some of these trees standing there in the, in the peat, what kind of age might there be?

A: Well between three and a half and four thousand.

Q: You mentioned there, and I wanted to come on to that, the difference between Thorne and Hatfield Moors.

A: Hmm.

Q: We talked already about how the area is quite an interesting and significant boundary, already. Can you say something about the difference between the two places?

A: Yeah, the bulk of Thorne Moor sits on Lake Humber clays, so there's a relatively impervious horizon. Hatfield Moor, much of it sits directly over the podsolised surface of the, what are called the Older River Gravels, which are deposits which partly belong to the

last inter-glacial stage 5e but there's some doubt as to whether they all belong to that, and also in part over, hmmm, over Sherwood sandstone. The origin of the two bogs is very different, in that Hatfield Moor, although it does relate to a rise in sea level there are no extensive fen peat deposits in the base and Nicky's evidence shows that.

Q: Can I just interrupt you 'cause I don't want to pick this voice up.

[END OF CD ONE: 42.06]

[CD TWO]

Q: You were telling me about the basis of Hatfield and Thorne.

A: Yeah, Hatfield rests on some fairly porous sands and gravels so without a high water table it, it wouldn't develop into a, a raised mire, apart from the fact that that landscape had already become heath before it moved over towards wetland. So you get the development of a litter layer over the sands and gravels, a heathland litter layer, progressive acidification and the development of nuclei of bog. On Thorne it's different. It sits over, largely over, directly over Lake Humber clay silts. Increased fresh water run off leads to the flooding of oak forest and the death in situ of the forest. You don't see that forest on Hatfield and their trajectories are different from then on, they are very different places.

Q: So we're actually talking about the edge of Lake Humber? Can I see it in terms of, you know, the lake and the shore almost?

A: No, there's no lake at that stage at all. Lake Humber was drained six, no sorry ten thousand years before pretty well.

Q: But that, but that might be, is that, am I being too simplistic in terms of that's where we're at, that Thorne is actually where the lake was and Hatfield is-

A: The Lake Humber clays only underlay the northern edge and the Idle Valley to the, to the east of Hatfield Moor so it's, yeah I don't know, the big problem of using this term shore people immediately think that it's a contemporary lake. In terms of the deposits yes, you're right but,

Q: Hatfield's always been dry land?

A: Hatfield develops from heathland to raised mire whereas Thorne goes from oak forest, in fact it goes from lime forest on the Thorne Waterside evidence through oak forest, wet oak / alder forest to death in situ of that forest. The development of fen through poor fen to raised mire, which becomes independent of the water table and both bogs are then fed by, largely by rain.

Q: Could you just tell me how you found that out in terms of the peat? Just tell me how you found that out?

A: Well, it wasn't just me, there were a lot of people working on this, but that, without human interference the natural succession over much of lowland Britain would lead to raised mire. There would be flood plain mires as well which would also become progressively more acidic as they became independent of the water table. It's a habitat which has virtually disappeared in this country. There's nothing like it. Thorne and Hatfield were the last remnants of those extensive mire systems, they've gone now and we'll never recreate them.

Q: But why did the, why did it disappear throughout the country?

A: Well drainage and peat cutting.

Q: Human activity?

A: Yes. Yeah, very much so. They were, they were sufficiently big to survive and areas in Somerset Levels also survived. And there are little pockets here and there but they were the last areas of extensive mire, and of course we've lost the lot courtesy of Fisons and their successors.

Q: Are there any parts of the moor that retain a useful record?

A: There are, in the areas at the north end of Lindholme Island there are successions which must come through to the relatively recent period. That is for the last thousand years or so. Elsewhere we have records which are Bronze Age, late Neolithic and that's it. But it doesn't mean they're not likely to give new information. I don't think I could properly guarantee that if I went out and started stripping the bark off the tree we'd get another, a fossil insect, we'd get something else which is new to Britain. I think we've only just scratched the surface. We have concentrated on, on the [inaudible] beetles but there are other groups. I mean Pete Skidmore made a point that there were burrowings in some of the pines which looked like an ant *Camponotus*, that's restricted to Scandinavia at the present day. It's here in the Late Glacial, it may have survived through on Thorne and Hatfield Moor right through into the Bronze Age so there's a lot which we really need to do.

Q: But even so, there are records in the landscape and throughout the peat in parts of Thorne and Hatfield Moors that take us from the beginning of the earth, so to speak, right through to about a thousand years ago.

A: There are records for, between four and a half thousand years and about a thousand years ago, within the peat. There are scattered peat deposits like the ones below the coversands which go back to 12 and a half thousand years, and then sites like Finningley, where in peat

horizons in these gravel pits to the south, there are deposits which are about 30 thousand years and, well on a site at Austerfield which Geoff Gaunt looked at, produced deposits in the last inter glacial, 120 thousand years ago.

Q: Can I concentrate now on human activity in the area, and not just in Thorne and Hatfield Moors but, but in the wider area, in a regional context so that we can see how they fit within that, can you tell me something about later human activity, in terms of, you know, Stone Age onwards.

A: Yeah, well there's a significant scatter, particularly over on the Isle of Axholme, of polished axes I think there are, is it seven axes from the Misterton Carr site alone, from the Neolithic to early Bronze Age. For surviving Neolithic monuments, well if it is Neolithic then as interesting as Gringley Beacon which has never been excavated. It's a huge great mound which sits and looks out across the Levels, and part of that was cut away when they built a water storage system there and I was told that there was a scatter of flint found. There are several long barrows of course when you come over onto the Magnesian Limestone outcrop, one or two of which survive as visible mounds.

Q: Survived as what, sorry?

A: Visible mounds, you can actually go and see them as structures. Some of those are in quite significant places as well, Hangman Stone Hill, which is between Marr and High Melton, the mound's gone now but you can still stand where it was, the view from there shows, again the whole of the Levels, you can see the Yorkshire Wolds, you can see the Pennines so they, they are places which sort of seize the landscape.

Q: And can you just briefly say what long barrows are?

A: They're, yes, they're communal burial mounds of the Neolithic period, yeah. There's a fair scatter of Bronze Age round barrows as well, most of which are only visible as ring ditches from aerial photographs because they've been ploughed out. The, from a pollen work that Brian Smith did of the area, extensive clearance starts in the late to mid Bronze Age, and then you go from a landscape, on the levels at least, of small temporary clearances, and those temporary clearances are probably last several hundred years so it's not really that temporary. But the coalescence of these small clearances into extensive destruction of forest really starts with the land use of the late middle Bronze Age. By the late Iron Age there was probably no natural forest left. Any woodland that's left is a woodland which is maintained as a source of materials for the maintenance of communities, and it is the late Iron Age that we get these extensive field systems, which you can track from just north of Nottingham all the way up to the Don and then other systems continue northwards. They continue in use through the Roman period. There is a major phase of soil erosion which takes place... well on the one side we've got a very good date on it is, is Littleborough on Trent where the Roman town is re-planned during the Roman period after an extensive flood

[A third person enters the room].

Q: [inaudible 09.29].

A: It's all being recorded. As were your phone calls so we now have a record!

Q: It's all right, don't worry about that.

* personal comment by third party

A: I gathered that. Okay.

[Third person exits room].

Q: Can we go back to the Roman period?

A: Yes, at Littleborough on Trent, a site which a chap called John Wade and the late Derek Riley. Have you met, probably met Derek Riley?

Q: Yes.

A: Derek and I put together John Wade's work there. Derek had shown an enclosure, oblique to the Roman road, which was clearly Roman and John had done some excavations in the vicarage garden to show that there was an earlier settlement which was orientated with the Roman road, and between the two was a thick flood deposit from the Trent, you can see round the back of the Trent there. It looks as if the town site there was overwhelmed by flooding in the early third century and is then re-planned using a natural gravel mound within the Trent valley on a totally different alignment. Now from Sandtoft we had evidence of extensive flooding on site, which I dug with the late John Samuels, and then John Sadler who is now back at Birmingham geography, did his thesis on looking at alluviation of the bog. There seems to be a major change in all the river systems within the Roman period and that we can see,

Q: A natural, a natural?

A: No, I don't think it is natural. It's very difficult to be sure and those who are really into climate will say there was a climate change in the early third century. But I think it's much more likely, and we've done working in northern France which shows this as well, that it's agricultural innovation. That they, this is the first time they are using a plough which cuts the root mat and once you start cutting the root mat of the vegetation then your soils start to

erode. And our present flood plains are very much a creation of that, so we, we cease to get organic deposition in the Don and in the Idle at that point, and these deposits feather out into the edge of the peatland, the, the raise mires. We really need to do some more, again we need more long sections to correlate these, but the creation of our modern alluvium dominated flood plains is a feature of forest clearings followed by extensive clearings, followed by the adoption of the plough when it starts to cut through the root mat.

Q: I know that there is, I don't want to call it a theory, but the, a theory that the northern arm of the Don actually is a manmade construction.

A: It is yeah, yeah.

Q: It is?

A: I, yes. Yes I think Geoff's mapping work shows that very clearly. If you drive northwards on the, on the M18 you will note that the road goes into a slight dip just before you come to the junction with the M62. That's subsidence into the former bed of the river Went, so the Went crosses the Don, that northern arm of the Turnbrigg Dyke, it's very difficult to date it but it's one of two, there are two other major river diversions. There's the Bickersdyke, which takes the Idle out to West Stockwith, and then there's the cut off which takes the Derwent directly out into the Ouse rather than through Howden. Howden's where it is because it's on the old, the old Derwent there and you can again, you can track that if you take the road from Howden across to Selby. You can see as you're coming up to the point, where the modern course of the Derwent goes out into the Ouse, you can see, because of these drying out within the channel, you can see the path that the old river, river Derwent. Now we have a reference to that in an Anglo Saxon charter, so that diversion must have existed by the ninth century. Bickersdyke is a difficult place name, but it maybe Anglo-Scandinavian and the Turnbrigg Dyke which is the northward course of the Don, well it cuts across, very clearly cuts across the River Went, we have a document which refers to the death of, is it Richard do Hoveden? He dies in Doncaster and is taken back to Howden for burial and it looks as if the Turnbrigg Dyke is navigable at that time.

Q: And when was that?

A: That's in the 12th century, late 12th.

Q: Eleven hundreds?

A: Yeah, so that channel must have existed by then. It seems very unlikely that a channel cutting across multiple landholdings was likely to have been made in the late Saxon or the early medieval period. It may even have cleared out then, the probability is that those diversions form part of a series of Roman diversions.

Q: Roman river diversions?

A: Whether they're for navigation or for drainage is another matter, all depends on you make of the evidence.

Q: So a lot of Roman activity then?

A: Yes, yes, yeah. There's extensive pottery manufacture to the south of Doncaster. I think there's probably over a hundred kilns, I did count them up recently, and they, there's a group of kilns which we haven't yet found but on the distribution of products must lay somewhere to the south of Doncaster, in the period somewhere between the late 70s and 120. But the system really takes off in, I guess in the 140s with the expansion into lowland Scotland and an interesting, I guess he's an entrepreneur, a man called Sarrius who was potting at Rossington Bridge, he was using a die which he also uses in the Midlands and it looks as if he cuts his transport costs by setting up a manufactory for making mortaria at Rossington Bridge, but the potters there are not just Midland potters, he brings in a group of potters from Dorset to make black burnished ware and he also makes vessels which are imitating metal vessels, imitating pewter, but their ultimate origin is in the Saintonge region, in France. So he's, he's buying in slaves to pot for him, he probably has never touched a pot in his life although he has his trademark on pots. And there's a group of other potters, he co-stamps with two men, one called Secundua and another one called Setibosius, now whether they're the people who are actually running the manufactory for Sarrius, because we know he's also potting in the Midlands at the same time, and then pottery production locally continues through the third century, it's always very difficult to date, but in, there's another boost to production in the early years of the fourth century, and again quite widespread production certainly as far north as Catterick and probably as far north as Hadrian's Wall, under Constantine. And then there's the, the system seems to collapse and East Yorkshire manufactories, Nene Valley and Lincoln manufactories, dominate local use.

Q: Why would, the potteries, the pottery industries be placed where they are, you said to cut down-

A: Well with the expansion into Scotland, then Sarrius, who clearly has military contracts, needs to cut transport costs because his main manufactories are in the Midlands around Mancetter north of Nuneaton. That's a pretty landlocked place although they probably use the little river Anker to take material eventually down the Trent. Rossington Bridge is where it is because it is the northern limit, I think anyway, of the tribe known as the Coritani, and the southern element of the Brigantes. Now the way taxation works in the Roman period is that you're paying taxes to your cantons, your civitas, and if he crosses that boundary then he's paying taxes to two different groups, so the probability is that he takes it as far north as he could possibly go within the same civitas. And of course that gives him access down the Torne out into the Idle and on out into the Don. The thing about moving pot is it's a bulk commodity so you'd move it by water you move it by water. We got one or two pots actually out of the river further along turned out during dredging so it does seem as if that's used.

Q: So the, the easiest form of communications would have been by water?

A: Yes.

Q: But not solely?

A: No, no. I mean it's also sitting on the Roman roads, north south coming up from Lincoln Bawtry and then northwards. We've got the bridge in fact in the bed of the river, the river Torne at Rossington Bridge as well. The route came across, well it's now of course destroyed by the M18, but past Bessacar Grange, past the parish church in Cantley, St Wilfred's, which is at an odd orientation and that orientation is actually at right angles to the Roman road rather than east, west. Down to Rose Hill, where the two most northerly kilns we know are, in the field to the north of the railway, across the racecourse and down into Doncaster and there's a fort at the river crossing in Doncaster. But there's, there must have been an earlier fort further to the east in the Julio-Claudian period.

Q: And there's some evidence of local roadways I think you found in the Thorne area?

A: In terms of the Roman period the, there is a road which doesn't go down into Doncaster, it's in fact the road across Waterdale and on eastwards formed by Thorne Road, by Thorne Road out of Doncaster, what's now Eden Thorpe used to be Street Thorpe and the probability is that that name relates to, relates to the Roman road, yes. Then the crossing point for the Don Valley is probably at Tudworth / Bradholme in that that's the one point where relatively hard ground approaches the river. There's got to be a fort out there, somewhere at Crowle, there are a few finds from Crowle which suggest that there is an early fort there. There is then a fort at the mouth of the Don, the old mouth of the Don that is, at Adlingfleet, and then the next one is Old Winteringham on the Humber crossing. And they, well the first phase of those must belong to the 50s. There's a large fort, fortress at Rossington Bridge, and there's a significant number of coins of the Julio-Claudian period, 54 to 70. That fort is abandoned with the expansion to the north, and the fort is built at Doncaster, but there must be another fort to the immediate east of Doncaster, somewhere in the region of, well I guess it used to be International Harvester's, I don't know what that company is now, people who make tractors down there, somewhere in that area there is an earlier fort than the Doncaster one. And the earlier river crossing, if there was one that crosses to Almholme and then goes northwards up towards Askern, and another fort northwards on the Aire.

Q: Quite a large military presence?

A: Hmm, well yes in, in the 50s and 60s there was a legionary vexillation fortress at Rossington, it's a big fortress. A base sitting at the northern limits of the Coritani.

Q: And that's at Rossington?

A: That's at Rossington yeah. If you go down the hill to Rossington Bridge the road goes off to the right into Rossington village, there's a field on the left, and crossing the river is the large fortress there.

Q: So the area is actually on the boundary?

A: Yes.

Q: Of these two,

A: It remains on the boundary in the Anglo-Saxon period as well.

Q: Hmm, this is where we get the later battles and so on that we-

A: Yeah, yeah, we're working on a site at Conisborough which is, seen some pretty interesting data there. There's a site which we think surrounds the later church, it's got a late Anglo-Saxon church Northumbrian style, even though it's south of the traditional boundary of the Don. But we have a boundary, a wooden boundary, which is basically the wrong way round in that the wooden facing is to the outside rather than to the inside of a large ditched feature, and that's, we've got a date on that which is, puts it into the very end of the sixth or the very early seventh century. This is some work we've been doing with David Hey, who's done the historical side and the archaeological unit here ARCUS. And the history of that site is interesting because there's a Roman villa down in Clifton Park which becomes Conisborough Parks in the post medieval period, is the park associated with the castle, the deer park. But the positioning of Conisborough itself, not the castle, the church site, is probably dictated by an early burial, which is recorded by Miller, its one of these cist burials which belong to the either fifth or sixth century, and you can see that becoming, in inverted commas, a sacred site. Whether this enclosure we've got relates to the southward expansion of Northumbria or if something a little bit earlier, and may relate to possibly a monastic site which is taken over by Northumbria, it's very contentious. It's interesting environmental evidence because when we first looked at the environmental evidence it looked like a deer park. We had good evidence of, of big oak trees and fodder adjacent to the spring. Well you could just see this structure as being a deer leap designed to get deer into the park. We thought we'd get dates in the eleventh century and we've three radio carbon dates and dendro evidence, all showing that it belongs to this early Anglo-Saxon period.

Q: You made a find, or William Bunting made a find, that you've -

A: Yeah, we found an area on Thorne Moor when it was being extensively drained by Fisons, they cut through a rough timber structure which formed a rough platform at the base of the peat. Whether that's a linear feature or a rough hunting platform for hunting from we don't really know in that we didn't pick it up anywhere else. It consisted of not really shaped, it

was just timbers brought together to make a rough flat area which had large oaks at the bottom, some alder, and then there was birch on top of that. Oh it's much more interesting in terms of its beetle fauna than the little bit of archaeology, there's no artefacts or anything.

Q: Why is it interesting for its beetle fauna?

A: It produces the most recent old woodland old forest assemblage from Britain and I think we have, is it seven species which have now, and Nicky's built on this quite considerably, which are now no longer found in Britain, and the remainder of the fauna, about 20 percent of it would be Red Data Book species.

Q: So does this allow you to date it?

A: No it doesn't, we've got radiocarbon dates which show that it's about three thousand years old, that's why I say it's the most recent assemblage of an old forest. When we're looking at what the forest was like with relatively limited human impact, and the process of flooding is due to human impact so it's not quite as natural as one would like, but it gives us an image of forest which is perhaps something like the surviving areas of oak woodland, places like Bielowski in Poland.

Q: What did William Bunting find, physically?

A: He just found large timbers being pulled out of the, they were using a, an over arm digger to cut these ditches to drain the peat before peat cutting and he found that there was a concentration of timbers there, and he rung us up and said, "You ought to come and look at this." And was sufficiently insistent for us to go and look and the work starts from there really.

Q: And how much was exposed? What could you see?

A: Oh we only did a section. We cut the ditch section back by a couple of metres, so we opened up an area which was probably about ten by two metres.

Q: Ten by two metres. Is that a single thing that you found or did you find other things associated with it?

A: There are no associated structures, no. The forest in that region, well the large oaks clearly have been burned. Now whether that's man made or natural fire is another matter but we are again dealing with a moribund area of woodland, the trees already starting to die because of the rising water table.

Q: Do you have any idea of an interpretation of what it might be and what it's for?

A: Hmm, well there must be some pathway across between the Island at Thorne and the area around Crowle, the northern end of the Isle of Axholme. It could be that. It's not a pathway I'd use, I think I'd go to the old, to the levees along the, the old Don, which of course flow eastwards between Thorne and Hatfield Moor and then northwards through Crowle and out to the Trent at Adlingfleet. But we can't do a full landscape reconstruction over any area for the late Bronze Age there. The alternative, if it's not a continuous structure, is that it's a hunting platform. We tend to forget just how much game there was, in particular in terms of bird life. These skies are now virtually lacking in birds, but they would have been black with birds in prehistory.

Q: Why would they need a platform?

A: Well if you're trying to, to keep your feet dry while you're shooting game, a platform is quite useful. Particularly if it overlooked a pool or something like that. I mean it's like a duck decoy in the post medieval period.

Q: Can you just make a comment about how that relates to the other trackway that has been found on Hatfield Moor?

A: Hmm, well the answer is not at all. The Hatfield Moor track way is a thousand years or more older, and is a much more competently constructed structure. I mean it uses poles of pine laid across rails. There must be a site within Lindholme Island which we haven't yet found. I know there's been a lot of destruction on Lindholme Island recently, the digging of this pond, and I walked that area but there are no obvious finds.

Q: And is, we're coming to quite, we've covered quite a time period and I'm just beginning to wonder when your interest and work actually, actually runs out basically, and I wondered how much more there was in the area that you work to-?

A: Well it doesn't run out because I work with Pete on modern faunas as well, I mean we added a species to the British list by some work we did out at Sutton Common.

Q: Can you see the evidence of the 17th century drainage?

A: We've not got any well dated insect faunas from that. The late Maureen Gurning worked on faunas from the medieval moat at, at Cowick, bit of a disaster really, Scheduled Ancient Monument, [cat comes into room] and English Heretics, or rather their predecessors, allowed the moat to be dredged because they said the schedule only covered the interior of the moat, and Malcolm Dalby supervised, well supervised, he was allowed to watch the process and he managed to recover a column of samples and Maureen and I went down and

worked on the material, and she then wrote that material up, James Greig worked on plant macros and its all published in the Yorkshire Archaeological Journal. Quite an interesting fauna, it includes a couple of species, which again are old forest species, but these are surviving of course in these individual old pollards within the park, associated with the moat. We've not really looked at enough post medieval faunas, that again we need to fill because of course those sites are drying out.

Q: I know that Hatfield Chase was a hunting park in the medieval period,

A: Yeah.

Q: And is there evidence for that also?

A: Yes, I mean the Cowick evidence is part that, because Cowick is on one edge.
[dealing with cat]

A: You're an awkward cat aren't you, of course she won't sit on me.

Q: [laughs]. I just don't want her to, that's it, delete everything that we've just said that's all, that's the last thing, go on cat [door closes].

Q: That's fine. You were talking about the medieval park at Hatfield Chase and the evidence for that?

A: Hmm, again as I say apart from the work at Cowick, we haven't really looked at many faunas there, Mark Dinnin, who's another Sheffield student, he looked at the deposits from, adjacent to Sutton Common, and looked at samples which must have belonged to the late medieval or post medieval period, and again there were a few interesting species, including the Great Silver Diving Beetle (*Hydrophilus piceus*). That became extinct in the area probably in the nineteenth century. But it would be quite interesting to try to fill that gap. Harry Kenward up in York has done some work in that period, but there is a need to do quite a bit more, to look at medieval landscape. We tend to think that we know what it looked like and we don't really. Not in terms of the detail of the landscape. There was one project which, in fact the money from Edinburgh Oil & Gas, we're going to use some of that with Ben Geary to look at retting pits, because of course the retting of hemp and flax was a major industry in the post medieval period, and the curve for cannabis, which, of course, is hemp in the pollen diagrams that Brian Smith did, rises in the late Saxon period to a very significant level, so that's an industry which takes off in the late Saxon period.

Q: That's in the edges into the Isle of Axholme area?

A: Yeah, there are retting pits which come right down, certainly quite close to the course of the Idle, which we, and a chap called Mike Felsey did a lot of aerial photography back in the '60s and that area, kept giving these rectangular pits which didn't seem to bare much relationship to the post enclosure landscape, in terms of field boundaries and the like, so I guess they are pre early 19th century and Keith Miller has pointed out the place names like 'The Raites' and we're going to go and try and sample some of those pits. I've been to look at one or two of those sites with Keith and I need to go out there with Ben so we can get this work moving. It's the usual thing of trying to coincide two people.

Q: I'm conscious that we've been talking for a long time and I don't want to keep you much longer, I just wondered if you could say something about the importance of these two, Thorne and Hatfield Moors, why they're important and, you know, their significance in regional, national and maybe even international terms?

A: Well these eastern English bogs are different from anything we've got further to the west. They look much more like bogs in the Baltic region, and their beetle fauna includes elements which would be much more at home to the east rather than to the west. So despite the fact that they've been basically wrecked by the peat industry, there are still enough elements there to make, make them unique. We've lost all raised mires elsewhere, as I said before, and there's no raised mire in the Fens, for example even if there was through into the nineteenth century its all been cut away.

Q: This is unique in Britain?

A: Well they are- The problem is that any locality is unique. The assemblage is not going to be duplicated elsewhere and you have to decide, well does this contain sufficient unique elements to make it internationally significant? Yes it is internationally significant. In terms of, well the breeding populations of nightjars for a start, we're right out at the northern limit for them, in terms of the beetle some of the species which are only found on Thorne and Hatfield Moor, and Pete's work with flies shows the same thing. What we do with the fossil record is to look at the trajectory, which has led to the present landscape. One hopes one can use that to inform future conservation strategies. Very rarely done, ecologists tend to think that 25 years is a long time, they don't need to know anymore. The present solution which is being adopted is an engineer's solution, ironic they're paying huge sums of money to the people who destroyed the bogs in the first place to put dams back in the ditches which they've cut. There is a major problem because of the pumping down of the water table for Hatfield Moor, the chances of getting that back to being a decent wetland in a low rainfall area are relatively slight and some heavy handed strategy is required to reduce areas like Poor Piece from being hawthorn scrub back to heath land, I mean I'm in favour of burning it in the autumn, but the use of fire as a management tool is looked on as anathema really. Whatever you create is going to be something new and it's going to be something which is unique, that doesn't mean that it's nonetheless interesting. The peat bodies which have been cut off consisted of a species of *Sphagnum imbricatum* which is now extinct in lowland Britain, a few upland counties. and I've looked at it growing in the Baltic, in fact, and I've looked at the bogs in the Baltic which would have been what Thorne was like, say, 2000 years ago, we can't get back to that. But it's an interesting exercise to see what you can do, I mean we're not going to live long enough to see that, and one of the big problems that

conservations have is that they want immediate returns, quick fixes, it doesn't work like that. It'll go to poor fen in much of the wetland areas because there's too much nutrient. And also you've got the problem that the atmosphere's different, you've got a little ring of power stations raining out sulphur on it, the nitrogen levels are far too high. So you can get lots of money spent on trying to reconstruct the past but you never reconstruct the past, you produce something which is different. Which, in itself, is an interesting exercise and people should recognise that more.

Q: Thank you very much.