Fred Pearce interview with Jesse Ausubel, full text of abbreviated version that appeared in 28 January 2006 issue of New Scientist magazine

Jesse Ausubel is that rare thing: an optimistic environmentalist. A super-optimist, in fact. He accepts most of the great environmental concerns of the age, like collapsing biodiversity and global warming. He even sees our reliance on technology as a Faustian bargain. But, he says it is a bargain in which we come out ahead. He says we can move on to a more prosperous way of life, and at the same time engineer a "great restoration" of nature. Ausubel likes to ask big questions: Will the rest of the world live like America? Will there be enough resources to serve humanity? And he likes big answers, like giant zero-emissions power plants and super-dense cities. Where did all this come from? Well, he's a New Yorker, for one thing. But also, he says, it's down to his father, who studied the history of technology.

Q: What makes you such an optimist?

A: Working in The Rockefeller University here in New York, I am overwhelmed every week by what people are learning. Genetics offers the most dramatic examples; but in materials science and so many fields it's almost as astonishing. Modern science is very young. Even if you go back to Galileo, it's only 400 years old. Large-scale organised research is less than a hundred years old. Maybe it started with the German chemicals industry and a few labs in Cambridge. It is just starting now in India and China. The chance to do things much better is enormous.

Take energy. It's a big cause for environmental concern. But if you look at the whole system from mining fuel to powering the desk lamp that let's me read this magazine, right now it is about 5 per cent efficient. The other 95 per cent of the energy in the fuel gets wasted along the way. We can't jump quickly to 50 per cent. But we have centuries of opportunity ahead of us. Whether you look at transport or energy or food systems, they all look juvenile to me. I mean that in a positive sense. They look very young, with great potential.

Q: You began your career as an environmental scientist. But do you now think environmentalists are part of the problem or part of the solution?

A: The greens themselves are part of a dynamic ecology, raising the alarms. Functionally, they are Earth-sensing instruments. They are absolutely necessary. When I started my career in the mid-1970s, I began in marine pollution and then, in 1977, I became one of the first people to work full-time on global warming. I felt my main job was raising the alarm.

That's important. But after 7 or 8 years, I thought if I am going to have a long career in environment, I'd like to provide solutions, too. So I spent five years as director of programmes at the National Academy of Engineering. Engineers have a different mindset from greens. They like machines that work and meet needs. A problem is the two groups don't talk to each other much.

My other thought is that greens are not good at taking a long view. They see that forest are disappearing, or population is growing, or emissions are rising, and they see disaster looming. But I have an enthusiasm for history, especially of technology. My father was a historian of the 19th century industrial revolution in Britain. History is very powerful at showing that things fall as well as rise, including technologies. In fact, the history of technology is largely the history of substitution. Evolution is a series of replacements.

Q: For example?

A: Here in New York, the density of horses a century ago was environmentally disastrous. Their replacement by automobiles was a huge environmental benefit. But of course every system has fallout. Cars were dangerous. If they then had stayed as dangerous as they were in the 1930s, the automotive system couldn't have grown. They needed headlights and windshield wipers and seatbelts. Then other problems grew, like urban air pollution. So we developed catalytic converters. And as pollution gets worse, there are hybrid vehicles and hydrogen fuel cells. They might allow a world with, say, two billion cars, compared to the 600 million we have right now.

It's not so much that there are limits to growth, in the famous phrase, but rather that any technology, like any empire, contains the seeds of its end. Instead of the technology growing exponentially and destroying everything around it, some other technology will generally take over that is superior.

I agree that in some senses, technology is a Faustian bargain. But there is no turning back. At one billion people in the world, there might have been an alternative way of living. But at 6.4 billion -- and with 4 or 5 billion who don't have much wanting more -- then you have no choice but to get better at providing the services people want.

Q: Some people would see disaster in that statement. But you don't. Civilisations do collapse, after all.

A: Yes, of course. For many reasons: from wars and plagues to environmental problems, cultural breakdown and psychotic individuals. I don't dismiss the possibility of collapse of modern scientific society. But I don't think my green colleagues have enough faith in their own scientific and technical peers.

Q: So what do you say to people who think that climate change will overwhelm us? Even if a solution is technically achievable, what is the evidence that, as a society, we are capable of making the necessary changes.

A: The climate change problem is very simple. It requires favouring natural gas, nuclear and energy efficiency as well as some adaptation. Intellectually the problem was solved in the early to mid eighties. But making the necessary social change is different. And we shouldn't be surprised at the problems.

Quite a few of my friends were involved in the Millennium Ecosystem Assessment, whose report came out last spring. They were furious because they felt it received inadequate media attention. But the newspapers were covering the death of the Pope and the wedding of Charles and Camilla. People are like dogs sniffing each others' genitals. Social status and sexuality are what interest us. That's not going to change. People are not going to become "rational" or voluntarily change their lifestyles. The trick is to come up with technologies that are digestible; that slip into the way we live, like iPods and laptops.

Environmentalists often neglect that products should be almost maintenance free. The solar panels that were heavily subsidised in the US and elsewhere in the early 1980s turned out to be a big nuisance for people who put them on their roof. They got dirty and needed to be cleaned every other weekend. So they didn't catch on.

Q: Is that why you think big is the key to clean energy, because it is more convenient than all those solar panels and wind turbines?

A: In the last decade or so, big has been out of fashion. So I've tried to draw peoples' attention to the big opportunities. For instance, it's a lot easier to capture emissions from a few very large power plants than from lots of small ones. And renewable technologies like wind and solar power take a great deal of land. So I emphasise the opportunity to build very large gas-fired plants – five or even ten gigawatts, -- with zero-emissions. I think that's a better solution.

Q: So big is beautiful.

A: I am a New Yorker. Of course I think big is beautiful. But it is beautiful in context. I don't favour putting the Empire State Building in the middle of the Mojave Desert.

Q: Often your ideas seem to go with the grain of technological development. But you also want denser cities when everyone is moving to the suburbs and beyond. How come?

A: Once people can afford automobiles, urban sprawl is a big problem, because people instinctively maximize range. You find in every society people spend about an hour a day travelling, whether they are walking or driving or flying; it's almost an immutable law. Sprawl follows from a rise in average travel speed.

But compact high-rise cities could be a huge benefit to the natural environment. They save land and allow mass transport to work. I imagine future pedestrianised super-dense settlements with a 100 000 people all within one square kilometre, connected by jetspeed underground maglev trains that allow continental range and free-range buffalo between the cities.

People like living close to each other if the urban design is good. Look at medieval cities, which are dense and people love them. But since the start of the 20th century, the architectural profession has mostly been a disaster, with design that pleases only other

architects. People reject it. I'd look to eastern China, where they are building very dense, vertical urban agglomerations that look more like fantastical video games than modernist machines for living.

But people will still travel. In some ways we are returning to a seasonal society. Like Heidi's family in Switzerland 150 years ago, who alternated between the high and low pastures. Now you have people who migrate seasonally from their home in New York to their other home in Florida, or from Europe to the Canaries.

Q: Is there enough room for that?

A: In land terms, yes. The compensating factor is that land used for growing food is shrinking. We are growing calories and protein much more efficiently. Yields are growing by 2 per cent a year, and that is faster than population growth in most places. If all the world's farms could meet the US farmers' current yields, we would need only half as much farmland. The opportunity for a great restoration of nature, putting back the rainforests and so on, is there.

And what we can do on the land, we should try and do in the oceans as well. A decade ago, I started to wonder what was happening there. Colleagues said 95 per cent of the oceans were unexplored biologically. Most of the data was about 200 seafood species and mega-fauna like whales. So I helped set up a Census of Marine Life, starting in 2000. It's like a Domesday Book of the ocean.

For almost every species that is tradable, or anything that lives near the shore or the surface, humans are behaving largely as we did on land up till 100 years ago. We are hunting rather than farming, and to excess.

Q: You have talked about farming the oceans. How would that work?

A: Most aquaculture in future will be in closed systems on land; but I'm in favour of experiments in the oceans. The total amount of seafood sold in markets round the world is only around 100 million tonnes a year. You can imagine that, if people continue to want seafood, there would be a much moderated wild fishery. There would be a large land-based aquaculture industry, and maybe 20 or 30 million tonnes a year of seafood might be raised by true ocean farming. We would add ingredients like iron to fertilise the ocean and create phytoplankton, and see what grew, whether tuna or whatever. Aquaculture can spare marine life, which is splendid beyond belief.

Q: You once asked: will the whole world be able to live like Americans? Will they?

A: On average, people have been living better for the past 200 years, as measured by life expectancy and in material ways, and I expect that rise to continue in the big population concentrations like China, India and southeast Asia. I'm not saying people are happier or treat each other with greater dignity. But when I visit China or Singapore, the acceptance

of modernity makes it feel more like America than if I were in Europe, say, where the emphasis is on preservation.

So in that sense much of the world will be like America. But I'm not optimistic about an egalitarian future. There will always be parts of the world that lag behind, tragically and potentially explosively. Sub-Saharan Africa is one candidate, and parts of the Muslim world, where you have the ideological rejection of progress and science. If that continues, their way of life will be very different. Cultural curtains can maintain differences for a long time.

Q: What about Europe?

A: Europe is becoming profoundly conservative. It has the world's greatest cultural heritage and hence the most to lose. People like the hedgerows and vineyards and don't want change. But Europe is becoming uncompetitive, and its population is ageing. Europeans don't seem to be replacing themselves. The Catholic Church is a year older every year, unrefreshed by youth.

Q: But if we take the long view, maybe the world has gone through a period of great change, and we are headed for more stable times, with stable populations. Even China is ageing fast. The whole technological revolution may one day grind to a halt, and maybe Europeans are pioneering the way to a different kind of society.

A: Maybe. But I worry about Europe also because it seems to be tiring of modern science and especially technology, which it largely created. Europe still does fantastic research but the balance between raising and solving problems seems grim. In most fields of engineering and technology, there is more vitality in the US, China, India, maybe Brazil. Europe is not incubating many solutions. I do love the new jumbo Airbus and Skype.

Q: Isn't the US equally guilty of turning against science, with growing opposition to Darwinism and reproductive technologies, for instance?

A: In the US, some on the right appear to reject science, but they don't reject the fruits of science. On the left, some generally support science but reject technology. The left wants to ban genetically modified organisms (GMOs) and the right stem cells. They are the same! Each side alerts us to certain dangers and opportunities. Overall, I am not fearful for science in the US. It has a youthful feel.

But in the long run I do think the rejection of science is extremely dangerous for any and all societies. I am an optimist because, as I said, science is still so young and has so much to give. Giving up on science is probably the biggest threat to modern civilisation. It's not something that would happen overnight. But if we stop the R&D enterprise, and stop getting better at what we do in farming or transport or scores of other occupations, then after 20 or 30 or 50 years the chances for human misery, and for destruction of the environment, would be huge.