Oceanography, Population Resources and the World

Roger Randall Dougan Revelle

The International Scientist

Interviews conducted by

Sarah L. Sharp

in 1984

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INTERVIEW HISTORY

Thirteen years have passed since these interviews occurred in August 1985. During this period, much has changed at Scripps Institution of Oceanography and throughout the world. Roger Revelle died in July 1991, after an extraordinary life dedicated to research and learning in oceanography, population science, and international scientific cooperation. His life represents one lengthy, intricate chapter in the history of international science in the twentieth century.

This fourth, and last, volume in the oral history memoir series, "Oceanography, Population Resources and the World," allows Revelle to recall aspects of his career in the 1960s and 1970s, including the directorship of the Center for Population Studies at Harvard, his work on the White House-Interior Panel on Waterlogging and Salinity in West Pakistan, his tenure on the Indian Education Commission, and international scientific debates that occurred through the Pacem in Maribus and Pugwash conferences. These pages are not scientific discussions; rather, they breathe as quiet anecdotal reminiscences of an academic scientist's career and life.

Interested readers may wish to consult additional sources that reveal Revelle's autobiographical and biographical notes. These items include other volumes in this oral history memoir series (Preparation for a Scientific Career; Observations on the Office of Naval Research and International Science, 1945-1960; and, Director of Scripps Institution of Oceanography, 1951-1964), as well as Judith and Neil Morgan's Roger: A Biography of Roger Revelle (1996), and "Roger Revelle - Statesman of Science", a television program produced in 1992 by KPBS-TV in San Diego.

Revelle did have the opportunity to review the verbatim transcript of these interviews. He penned in several emendations within the text, which have been incorporated in the final transcript. Ellen Revelle Eckis also took time to make a few notes which clarified information.

In order to prepare sufficiently for these interviews, the interviewer-editor conducted research on several levels: examination of the Roger Randall Dougan Revelle Papers which have been collected at the SIO Archives in La Jolla; reading of secondary works that highlight the recent history of oceanography and other aspects of Revelle's career and life; and, consultation with Revelle himself about critical episodes that he thought needed oral documentation. Throughout this project, Deborah Day, as archivist at SIO, provided invaluable and generous support. Day suggested topics to pursue with Revelle, as well as mapped and led the way through Revelle's extensive manuscript files.

Revelle's significant contributions to oceanography originally came to the attention of the Regional Oral History Office, at the University of California's Bancroft Library, through Harry N. Scheiber in 1984. Professor Scheiber was instrumental in the interviewer-editor's obtaining a seed grant from the UCSD Chancellor's Office to initiate preliminary research and interviewing. The entire "Oceanography, Population Resources and the World" project received additional support from Friends of Roger Revelle, Friends of the UCSD Library, the Institute of Marine Resources, the Office of Naval Research, the History Department at Bowling Green State University (OH), as well as SIO itself.

The original audio tape recordings for the interviews represented in this transcript are housed at the Regional Oral History Office, Bancroft Library, University of California Berkeley.

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Philadelphia, PA

INTERVIEW HISTORY

I DIRECTORSHIP OF THE CENTER FOR POPULATION STUDIES, HARVARD UNIVERSITY, 1964

[15 August 1985]##*

9 Bow Street

Sharp: One of the things we didn't really talk about yesterday, and I think we need to, is how exactly the appointment to Harvard came about. Maybe we could do that first.

Revelle: The dean of the School of Public Health was a man named John Crayton Snyder, who was a Pasadena High School boy and turned out to be a classmate of Ellen's at Pasadena High School. He was a very humane, decent man in the tradition of public health. His own research was on trachoma. He was particularly interested in building up the School of Public Health and raising money for it, and he got the idea that we could have a Center for Population Studies which would be a source of funds and an area of expansion of the School of Public Health.

So he approached some of his philanthropic friends. He was very good at money raising. One of the policies of Harvard is that every tub stands on its own bottom. What that means is that everybody raises his own money, and they had an elaborate fundraising apparatus to help you do that.

For reasons that I don't quite understand or know, -- I do know that Harold Thomas, my friend from the Pakistan project, was a member of the faculty of the School of Public Health as well as of the faculty of Arts and Sciences and the Division of Engineering and Applied Physics. It was probably he who put the idea into Jack's head that I might be a possible candidate for director of this new Center for Population Studies.

The other people I had worked with from Harvard on the Pakistan project were Bob Dorfman in the Department of Economics, who would not have had much contact with Jack Snyder, Bob Burden, who was a colleague and sort of an assistant to Harold Thomas, Wally Falcon in what they called the Development Advisory Service in Harvard part of the Center for International Relations. But none of those others had much contact with the School of Public Health. But Harold did. So they asked me to come back and be interviewed, be a candidate for the job of Director of the new Center.

I gave a talk to them about our Pakistan work and what I saw as the problems of developing countries, of which certainly one of the most important components was rapid population growth. That certainly was true of Pakistan. Jack had gotten Richard Saltonstall of the famous Massachusetts Saltonstall family to endow a chair, the

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* This symbol indicates that a tape or a segment of a tape has begun or ended. For a guide to the tapes, see p. 97.

Richard Saltonstall Professorship of Population Policy. So they offered me that chair and the directorship of the center.

Another person involved with it was Dana Farnsworth, who was head of the Student Health Service, and Ross McFarland who was a physiologist who had worked on aerospace problems, problems of aviation physiology, particularly problems of low oxygen at high altitudes. I remember Tom Weller was also a member of this group that interviewed me.

Sharp: When was all of this taking place?

Revelle: In 1964, the spring of 1964. I had worked a lot with several people, the ones on the Pakistan project, and Harvey Brooks, who was a good friend of mine too, although he was not a member of our panel. He was sort of assistant to Jerry Wiesner as the President's science advisor.

Sharp: Were you considering other places to go at this point?

Revelle: No, I wasn't. I wanted to stay here as chancellor of the La Jolla campus. Herb York had resigned and they were looking for another chancellor. He didn't last very long. At that time he was not much of a professor or much of a chancellor. He's become a wonderful professor, and since then he has been acting chancellor. He has been everything. He has been chairman of the senate as well as acting chancellor. He's an absolutely first-rate guy, but he just wasn't much of an academic then, he didn't really understand how the university worked. Clark [Kerr] essentially fired him.

They were looking for a new man, and I thought by this time the antagonism might have died down, but it hadn't, in the Board of Regents, apparently. So I told you yesterday that Clark was out poisoning plants when I said I had to talk to him! Then later he came up with this idea that I should retain my professorship here as well as at Harvard, but that was impossible.

Sharp: This letter, the one that you wrote in June of 1964, I'm sure you remember it.* It set out some of the pretty strong feelings you had about the new obligations that you had to Harvard and trying to keep those clear.

Revelle: Sure.

Sharp: I wasn't sure what was behind all of the --.

Revelle: Well, it was just sort of a foolish move on his part, obviously impossible. I let him down gently by saying he should confer with Dean Snyder about it, but as far as I know he never did.

Sharp: There is the juxtapositioning of the position being created at Harvard. I'm wondering if you thought about what was going to happen if that didn't come through?

Revelle: Oh, I really hadn't worried about that; I didn't really want

June 7, 1964

Dear Clark,

In our last conversation, you urged me not to sever my connections with the University of California. I feel so much love and loyalty for the University, and have been involved with it for so long, that I could not possibly cut it out of my inmost thoughts or my subconscious. But I believe you were talking about something more formal and external — that I should retain a Professorship in the University of California while at the same time occupying the chair at Harvard. I am perfectly willing to do this, subject to my commitment to Harvard to organize and lead the Center for Population Studies, which at least for the next several years will be a full time job. However it seems

me it is too late for me to suggest this to the Howard people, since the possibility was never mentioned in any of our discussions prior to the meeting of the Howard Corporation last week.

Dean Snyder would have good reason to think I was not dead serious about giving my utmost to a most important and difficult task.

This is the kind of situation which you can handle with President Pusey, and that can't really be handled at any lower level. Moreover, ~~whatever is done~~ whatever is done must be done quickly if it is going to serve your purposes. The Board of Overseers meets on June 10 and Howard wishes to issue a press announcement immediately thereafter, on June 11; for nation-wide release on June 15. I think they would like a dim view of revising the press release after they sent it to the newspapers.

I urge you therefore, if you want to do so, to get in touch with Mr Pusey as soon as possible. I will agree to any arrangement you two can work out and to any announcement and an arrangement

Sincerely, Roger

the job very much, I wanted to stay here, and I probably would have stayed here if it hadn't come through. I would have definitely stayed here if it hadn't come through. I would have probably resigned as University Dean of Research because I thought that was a non-job, but I would have stayed as director of Scripps probably.

But there was never any problem about the job coming through. The problem was deciding whether to take it because they decided after I was there that first time to offer me the job. They spent months working on wooing me.

Sharp: What were the plusses for taking the job?

Revelle: Well, the main plus was that I thought the population problem was very important, something that I thought was really urgent, and something had to be done about it. I didn't know much about it, but I learned a lot subsequently. I remember Carl Eckart was not convinced. I talked to him, as I always did. He was my sort of father confessor after Harald Sverdrup died. He wasn't much older than I was, about ten years older I guess. He said, "Well, it may be that the population problem will just solve itself, just go away."

That certainly was true later in the United States; the baby boom just stopped about 1960. The birthrate went down to very low levels. It didn't stop in the less-developed countries. The birthrate still stayed over 2 percent of the population for a long time. It still is. In some countries it's as much as 4 percent.

Then the other [plus], of course, I was flattered by being offered a position at Harvard, which is, I thought, the pre-eminent university in the world. Now I think that Berkeley is probably greater, after having been at both places. Anyhow, it is one of the two or three top universities in the world.

Sharp: Yes, it certainly was then.

Revelle: It was then, yes.

Then the other thing was I had these very good friends whom I had worked with for several years, Harold, the two Bobs, Bob Burden and Bob Dorfman, Wally Falcon, Peter Rogers. He was just getting his Ph.D. then. And then Joe Harrington was another one. And Jack Snyder had a very winning personality. He was so gentle and so sweet, and had a sweet wife named Ginty.

I don't really remember what the turning points were, but it was not a hard decision to make.

Sharp: I would think that getting into it, because it was a new center and on a much, much smaller scale of operation --.

Revelle: Yes, very much so.

Sharp: -- that you might have had some hesitancy about whether or

not it might succeed.

Revelle: Well, Jack had raised some money for it. He not only got the Richard Saltonstall Professorship, but he persuaded Lamont Dupont Copeland, the president of the Dupont Company, to endow four so-called Andelot Professorships.

Sharp: Right, yes, I have seen mention of those.

Revelle: And he had some promises of support from the Ford and Rockefeller Foundations, although there wasn't anything specific about it. Also, we at least -- I'm not sure that he did -- we did get some support from Cornelia Sacife May of the Mellon family.

Sharp: In some of the budgets, those professorships are listed, and the fact that they are named and endowed. In some ways it's really easy to see how the funding was put together through those different endowments.

Revelle: That's right.

Sharp: I thought we might talk some about the funding of the center. We can do that now, but there was one other activity that you were involved in that seemed like a real departure for you.

That was the work that you and some other people were doing for Lyndon Johnson. In August of 1964, before you actually went to Harvard, you and some other people put together this committee of scientists and engineers for Johnson.

Do you remember that?

Revelle: Yes.

Sharp: And George Kistiakowsky and Jerry Wiesner headed it, I guess, but it was your idea?

Revelle: No, it wasn't my idea. I think it was their idea.

Sharp: Oh, was it? What did you do?

Revelle: Well, we essentially wrote position papers for those guys, or tried to write position papers, and also we got quite a bit of publicity, although we didn't spend much money. It was called "Scientists and Engineers for Humphrey and for Johnson." This was apparently sort of standard operating procedure in those days. Not anymore. It was then. It was, for me at least, not very time consuming. I never made any political speeches or anything like that.

Sharp: But this kind of politics was not something that you got involved in very much.

Revelle: Never did.

Sharp: I didn't find too much mention of it.

Revelle That's right, I never did.

Sharp: Why did you this time?

Revelle: Well, I guess Goldwater was running against him, and I thought Goldwater was a real menace to the country, which he was, although he's more sensible in some ways than Reagan at that. But I don't think that was a major activity. Although it's interesting that it somehow got into the record.

One of the problems about going to Harvard, one of my conditions I was that we should be involved with the faculty of Arts and Sciences, it should be a university-wide center, and not just a center for the School of Public Health.

Sharp: That was clear. The courses that were being offered, for example, there was a very interdisciplinary feeling.

Revelle: That's right.

Sharp: It's clear in some instances how the ideas for the courses came together, but I thought we might talk about the teaching and course offerings that the center developed because it's certainly interesting to see it evolve.

Revelle: Yes, it is.

Sharp: Just for an example, in January of '65 you were lecturing in a seminar, Demography and Human Ecology, and that was <u>in</u> the Department of Demography and Human Ecology, in the School of Public Health.

Revelle: Is that what it was called? I thought it was called the Department of Population Sciences. Maybe it was called Demography and Human Ecology.

Sharp: The names changed.

Revelle: Yes, they did. We had no demographers. I guess we did have, we had David Herr, who was an assistant professor.

Sharp: Yes, I have that name.

This early course in January of 1965 of course that's just the second semester that you were there, but also, for example, there was something called, a year later, Religious Ethics and Population Control. That was offered by Ralph Potter, who was at the School of Public Health, and Arthur Dyck who was at the Divinity School.

Revelle: They were both in the Divinity School. They were very young assistant professors.

One of my drives was that I thought we should develop population ethics at the center in collaboration with the Divinity School. In fact, this was part of my general feeling that it ought to be a university-wide center.

Let me just talk about this in a more or less coherent

way. As I said, the most important problem was for it to be a university-wide center and not a School of Public Health center. Jack was always in conflict with the medical school, so we never really did get much involved with the medical school, although we got involved with John Rock, who ran the Rock Clinic, which was essentially an infertility clinic. He was quite old by this time, but he was a Catholic and a very courageous man, vigorously opposing the Catholic position on birth control. He had actually been the one who tested the oral contraceptive in Puerto Rico. The original work was done by a man named Pincus at the Worchester Foundation for Biological Research, Gregory Pincus. So it was Pincus and Rock who were involved in the development of the oral contraceptive. And we tried our best to be in close contact with John. I'll tell you something about that later.

The main problem at the beginning was to have a place on the Cambridge side of the river, and Jack found this little house, 9 Bow Street, which belonged to Harvard. I guess it had originally been what they call at Harvard "a cat house." It doesn't mean a whorehouse, it means a boarding house, before the various houses were developed, the Adams House, the Eliot House, Freeland House, and so forth. It was built about 1860. It was a three-story building with a basement, and it looked pretty ideal for our center. It was small enough that it was very intimate and cozy.

Then Bill Claff, the business manager of the School of Public Health, found some lovely furniture in a Harvard warehouse which had belonged to the Cabot family. There was a huge dining room table, and we built a big conference room in 9 Bow Street and put this table in it. It filled most of the room. It was just perfect. Lots of hardwood chairs around it, and lots of chairs that had belonged to the Cabots. Then downstairs we had a little library and office space and administrative space.

Pauline Wycoff really pretty much supervised the reconstruction for this house. We decorated it over the door with a statue of a baby, about so big [gestures size], and then various things that I brought back from India.

At the same time that I went to Harvard, I became a member of the Education Commission of the government of India, more or less over Jack's dead body, because he thought I should spend all my time raising money for the center. But I felt that I needed to know a lot more about developing countries, that this was a very important thing to do educationally, for me, and therefore for the center. So I spent about one month out of three in India between 1964 and 1966.

Sharp: I saw a record of a lot of trips going back and forth.

Revelle: Yes. This was a fifteen-member commission. Ten of them were Indians, Indian "educationists," as they call themselves. Then there was one Frenchman and one Japanese and one Russian, one Englishman, and I was the American

member of the commission.

The chairman of it was a man named Kothari, who was a physicist. He was also chairman of the University Grants Commission of the government of India. He had been a delegate to the Pugwash Conference at Udaipur in 1963 when Harrison Brown and I were both there, and I had talked a good deal about the Pakistan project. He was so impressed with that that he got me appointed as a member of this commission. So that Pakistan project did various things.

Sharp: Yes, it did.

Revelle: It still is, in fact, after all these years.

So that certainly slowed down the financial development or the staffing of the center. It was very difficult staffing it anyhow because Harvard and most universities are just not very able to accommodate non-departmental activities. At Harvard you have to have a faculty appointment in a department; you can't have a faculty appointment at a center.

Sharp: It sounds like the University of California.

Revelle: Exactly the same.

Sharp: If you want to do something out of the ordinary or create a new position that doesn't fall within their expectations --.

Revelle: It's very difficult, essentially impossible.

That was the wonderful thing about the Scripps Institution. It really wasn't an organized research unit, although some people liked to think of it as that, it was an institution, it was a unique enterprise, and we could appoint faculty members to the institution, not to a department. That was wonderful. Even the College of Agriculture has to have departments. The people who work in the experiment station are not necessarily faculty members. But all our guys at Scripps could be faculty members, if we had the money.

So [at Harvard] what I had to do was to work with individual departments to appoint faculty members.

The other thing we did to begin with -- and again Pauline Wycoff was responsible for this -- was to develop a library for the Center for Population Studies, which we had over on the Boston side of the river in the School of Public Health.

She found a wonderful woman named Wilma Winters [spells it] who was a real Yankee and always called herself "Wilmer." So we always called her Wilmer Winters or called her Wilmer. I still get letters from her occasionally, and she still signs herself "Wilmer." She was an old maid who was taking care of her aged and I guess difficult mother. She lived outside of Boston in the suburbs. She was a wonderful, warm, gentle, and enterprising human being,

always doing things for everybody in the center, particularly for those on the Boston side of the river.

We got quite a big chunk of space out of the new public health building that Jack was having built. He didn't really see the need for a library, but I thought it was darned important to have a library. The tradition of public health is an activist tradition. They go out in the field and organize essentially administrative programs, like greatly reducing malaria and eliminating smallpox. These field programs are typical public health programs, and it's not a very scholarly profession. Whereas I felt that the population business, as you can easily see, could be a center for scholarly activities, and was, in fact, in several other universities in the country.

So anyhow, we got this 9 Bow Street, which is really a marvelous little building, and we got a library and offices. The public health building, the Center for Population Studies really only had the library there. The rest were the offices of the Department of Population Sciences.

About the funding, in the long run we never got anymore funding out of Richard Saltonstall, beyond the chair, and out of Lamont Dupont Copeland, primarily the Andelot Professorships. We got some money to begin with out of Cornelia Scaife May, quite a bit; I don't remember, several hundred thousand dollars. We got money from a man named John Musser, who was one of the important elements of the lumber business, associated with Weyerhauser and those other lumber companies of the northwest United States. We got money out of the Ford Foundation.

The man in charge of population studies there was Bud Harkavy, Oscar Harkavy, and we got a million or two out of him. We got a grant from AID for teaching people from underdeveloped countries about population problems. That was a $2 million grant. **##**

"The Population Problem"

Sharp: You also had a project in India?

Revelle: But we ran into great difficulties there. The Indians were getting quite independent. They didn't like to have foreigners working on their population problem.

Sharp: Yes, that's really clear in some of the letters that were going from you to John [Wyon].

Revelle: Yes, and John was sort of a product of the British colonial mentality. He never really was able to adapt to the new way the Indians were looking at things.

Sharp: To accept some cooperation on their ideas, to accept that the Indians had their own ideas.

Revelle: To work with them, to get them to be out in front.

Helen Gideon was an Indian, an Indian physician, and she and John Wyon worked together in the Punjab, in the Ludhiana district of the Punjab. Khanna was the market town. She died just about a year ago of cancer. Like many physicians, she was a very humane and loving person.

They had worked in these villages there, ostensibly trying to introduce modern methods of birth control. But they were handicapped by the Indian Ministry of Public Health, even in their first project, which would only let them introduce foam tablets or some other rather ineffective method, and condoms I guess too, but not the I.U.D.'s and not the pill. Then they wanted to go back and make a resurvey, and they did.

Sharp: Is that the Medak?

Revelle: No, that was a re-survey of Khanna.

Then they wanted to start in this new project in the Medak area of but they were never able to do that. The Indians never would agree to it.

Unlike John and Helen, there was a man named Taylor -- I have forgotten his first name, who had worked in the Punjab for years. He was a member of the Johns Hopkins School of Public Health. He was born in India, he was brought up in India, and was much more able to adapt to the post-independent India than John was.

Anyhow, the money when I was there for that project came from the NIH, from the population center of the National Institutes of Health. As I remember, we never got much money from NSF or from NIH either in the social science aspects of the center.

Hilton Sallereck working on human reproduction, had reasonable size grants, and Warren and Gretchen Bergrin, working in Haiti, also got fairly well supported.

In general, at that time, there were really three or four different attitudes toward the population problem. One was that of the biologists, people who worked with other animals and other critters, exemplified perhaps best by Paul Erhlich. He thought it was terrible, that human beings were going to breed themselves into a catastrophe, and that's sort of a general position of biologists even today. They think of human beings as analogous to other animals, and they aren't, as anybody who has looked at the social sciences knows.

Sharp: Because they deal with choice and other --.

Revelle: Well, they have cultural evolution. They can evolve culturally within a hundred years or even less, and, of course, they have memory, so the past means something to them and they can think about the future. Other animals don't really think about the future. So because of this memory and this consciousness of time, thinking about the

future, and the ability to evolve through cultural evolution, human beings are so different than any other animal you just really can't apply biological analogies to them.

The one thing that maybe has some relevance is so-called socio-biology, the idea that we're more or less controlled by our genes and our genes' objectivity is trying to survive. The basic notion of socio-biology is that the human being is just a device invented by a gene to produce another gene, like a chicken is just a device invented by an egg to produce more eggs.

The genes want to survive, according to this hypothesis. So, for example, you're very much concerned about your children because they have half your genes, much less about your grandchildren because they have a quarter of your genes, hardly at all about your great-grandchildren with only an eighth of your genes, and so forth. And there's certainly something to that.

That's socio-biologists' explanation of altruism. But again, it's overlain and really it can be submerged, and can be completely dominated by peculiarly human characteristics of human beings. So I never had any faith at all in the biologists, at least after I got started in this business.

Sharp: They were just missing too much?

Revelle: I thought so, yes.

The second group is people who think there're too many "niggers", too many "wogs", too many people in less-developed countries. Cornelia Scaife May was sort of an outstanding example of this. She was a real racist, and in the long run she never gave us much money after she really found out what we were up to.

Sharp: What the guiding principles were, what you were doing, yes.

Revelle: The third group of people are people in public health or are concerned with public health, and they feel, quite rightly, that families with too many children have a hard time, particularly poor people with too many. The children never get enough to eat and they don't survive as well. I guess John Wyon would be a physician who felt strongly this way, and quite properly.

Then the fourth group are those who say or think that population growth is a serious problem, one of the quite serious problems of mankind, but it's involved with other problems. It can't be separated out from the problems of poverty and underdevelopment or effective resource utilization, but must be looked at in historical perspective, and that it's a problem which involves many of the different aspects of human scholarship and human science, not just administration of contraceptives, and that was really my position.

Sharp: That you couldn't just convince people to use birth control

for its own sake?

Revelle: No, not unless you had a reason for it. Many people did have a reason, and most people should have a reason, if they just thought it through. But there are problems that make it difficult.

So I never felt that the center should be very much involved with administration of family planning programs, and that antagonized quite a few people, the Planned Parenthood types. Many of them were particularly concerned about high birthrates in the United States, and of course the high birthrates were mostly among poor, uneducated people, but it sounds sort of racist. I think many of the Planned Parenthood people are not racist; they're concerned about human beings.

Sharp: When the center was getting going was exactly the time in the United States when awareness about birth control and the use of birth control was really pushing forward. In getting a Center of Population Studies established, one might automatically assume that that would be a special interest.

Revelle: Yes, and it was, but more in other centers than in ours. At that time there were half a dozen centers all started about the same time. North Carolina, Michigan.

Sharp: At the universities?

Revelle: Yes. At Tulane, at Columbia. Columbia, North Carolina, Tulane, Michigan.

And departments of demography and population studies were developing in many places, like Berkeley and later USC. David Herr went to USC and Kingsley Davis is there now, after having retired from Berkeley.

Among the demographers there was a general feeling that there was a real problem with rapid population growth, most extremely represented by Kingsley Davis, who was at that time at Berkeley and was pretty conservative politically, a right-wing Republican. He was also a great demographer, he was a first-rate scientific worker. To some extent his objective science was not obscured, but --.

Sharp: Shaped or colored or something?

Revelle: I don't think that's really true, but in any case he had this sort of split personality. Part of the time he would just shudder with indignation at rapid population growth and the other time he'd write a scholarly article about how it was happening.

But a man named Ronald Freedman at Michigan was a much more objective demographer.

At North Carolina, the North Carolina center was headed by a man who was a public health type, Moye Freimen, and in the long run it got into difficulties.

None of these centers that pushed administration of family planning programs really has survived very well. It's not really a university subject. It's sort of related to agriculture, but not very much, it seemed to me at least, and that's the way it pretty much turned out.

I was really frowned upon by the population establishment because of the way I looked at the problem. I organized a committee of the National Academy of Sciences which was handled staff-wise by a man named Murray Todd, who was Harrison Brown's right-hand man in the Office of the Foreign Secretary, to study the consequences of rapid population growth.

We published a book about 1970 or '71 called Rapid Population Growth: Its Consequences and Policy Implications. This was published by the Johns Hopkins Press for the National Academy. This was really my major contribution to the population problem.

I still use it as a text for my course in population studies here, particularly the chapter in it on population policy. The chapter says that population policy must be infused by ethical principles. That has many implications. For example, you don't push things that people don't understand. They have to understand what you're doing and why you're doing it. You don't violate their mores. You don't do something that harms the kids, harms the innocent. You mustn't hurt the innocent. And various things like that.

Another thing we said was that population policy must be integrated with overall government policy. It's not just a separate thing by itself, pushing I.U.D.'s into girls' vaginas. It's talking about food production and land tenure and opportunity for education and the status of women. It turns out that, in fact, probably the most important single thing which brings about a decline in birthrates is an improvement in the status of women. The education of women, legal rights for women, jobs for women, particularly jobs outside the home.

Sharp: Giving them more options than they had?

Revelle: Giving them more options, exactly.

At the present time there are a dozen less-developed countries that have done pretty well in reducing birthrates, particularly China, the biggest country of all, but also Sri Lanka, Costa Rica, Barbados, Tunisia, Trinidad, Tobago, Taiwan, Korea, Singapore, Hong Kong.

All these countries of Chinese culture have got relatively low birthrates, interestingly enough. There's some kind of a lesson to be gained there.

Sharp: In China there are monetary incentives and other kinds of incentives that I understand have been used.

Revelle: Well, they actually use social pressure more than anything

else, not monetary. They use a lot of disincentives, like they don't give free education for more than two children. [brief tape interruption] They hold back food rations if a family has more than two children. Housing in the cities. In the cities particularly they can use a lot of disincentive measures, not so much in the country. The peasants are very resistant to reducing their family size, but they've managed to do pretty well. Indonesia and Thailand are doing pretty well too. Pakistan, Moslem countries in general not at all well.

Sharp: Is there a central reason why the Moslem countries have not done so well?

Revelle: I think the central reason is the low status of women in Moslem countries. They are really second-class citizens.

Sharp: And that's not changing very much.

Revelle: Not very rapidly.

But anyhow, what we talked about in this book was what were the consequences, not what were the causes, of rapid population growth. The causes are much more difficult to understand. The consequences affect many aspects of human life. You can't spend so much money on education per child if you have a lot of children. You have a rapid growth of the labor force of unskilled young people entering the labor force, many more than those that are leaving it. You have an imbalance of the generations.

Here in this country, for example, the baby boom had very unfortunate consequences in terms of just plain crime because there were so many baby boomers, and crimes are committed by young people. So there was much less control simply because of the imbalance of the generations.

It has effects on the environment of course because as populations grow, the peasants are desperately looking for more land, just to stay alive, for subsistence. And there are many such specific consequences, which we spelled out in this book.

Most of the demographers in the country were involved with writing chapters in this book, and then we had a summary of about 100 pages which I wrote. I think it was the first time people looked at it objectively, not in an emotional, horrified way like Paul Erhlich and company.

Faculty, Staff and Students

Sharp: It would be interesting for you to talk about what the students' reactions were since your classes were very large.

Revelle: Well, I taught essentially one course in the faculty of Arts and Sciences. That was called Human Populations and Natural Resources, and that began about 1966, as I remember it. Jack said I just had to do more teaching, or do some teaching. I agreed with him. This is what was called at

Harvard a General Education course, not a departmental course. It didn't lead to a major, but all the Harvard students have to take a certain number of GE courses, Gen Ed it was called. Each of these courses had names. This course was called "Pops and Rocks".

Sharp: [laughing] Did you mind that?

Revelle: Oh no, I loved it. That showed students were paying some attention to it.

Sharp: Sure, anything that would make it more popular too for the kids to take it.

Revelle: At first it was rather a dull course. The Harvard students put out something they call the Confidential Guide which is primarily a guide to Gen Ed courses. I remember the first time it was mentioned they said, "Professor Revelle is a nice old guy, but he puts people to sleep."

Sharp: Did you come up in your ratings after a while?

Revelle: I think I did because in the end I had about 300 students in the course, starting with about 75. It got more and more popular, and I got better at it. At first I used too many figures, and too much statistics, spent too much time writing on the blackboard. Some of my teaching fellows criticized this, particularly a very impressive man named Maris Vinovskis, who is now a professor of history at Michigan. Another one was Ashok Khosla, who is an Indian who has now gone back to India and has a little enterprise he calls Development Alternatives, trying to make technological developments for Indian villages, like better stoves.

I had quite a few other teaching assistants. In the end about twelve of them because of this big class. There were two lectures a week and one section. The sections were divided twenty-five students per section, so if you have 300 students you have to have twelve section men, as they are called. Then you have to have a head section man.

This worked best when the head section man was a woman who was an anthropologist. Her name was Wormser [spells it]. She was a very courageous, remarkable woman. She did her doctor's thesis on the tribes of the Northwest Frontier, the ungovernable tribes, where nobody's life is worth very much and women are worth about twenty-five cents.

Sharp: In which country was she working?

Revelle: That's the Northwest Frontier between Pakistan and Afghanistan, the hill country, the mountain country which nobody has ever been able to govern.

Pakistan nominally has control of it, but the guy that runs it (which is in a vale, the Valley of Peshowar), his primary job is to organize raiding parties in the hills when the hill people come down and steal women or steal cattle or kill people. The Khyber Rifles still exist in the Khyber

Pass, and he organizes a company of Khyber Rifles and marches in, burns a few villages. Naturally the people give up the criminals, and he takes them back and hangs them in Peshowar.

That's the way Pakistan, that's the way the British governed the Northwest Frontier. It's really a wild country. It's like the mountains of Kentucky, only ten times worse.

And my gal, my head section man, is just finishing her thesis. She hasn't got her Ph.D. yet, even after all these years working on the cultural and social anthropology of these hill people.

Sharp: It sounds really fascinating, but so far removed from civilization as we know it, right?

Revelle: Oh yes.

There's a little kingdom there called the Kingdom of Swat. I'm not sure she was in Swat, but she was in a place something like that, which is a dependency of Pakistan, sort of a colony of Pakistan.

The sultan of Swat, I remember, although I think he had a different title, a very funny title, the "Wali of Swat" the high poohbah of Swat, got a decoration at the same time I did from President Ayub Khan, when I got the Sitara-i-Imtiaz. They have what they call a [lost on tape]. That was a day for medal giving, and he got some kind of a decoration I remember, at the same time I did. He was a funny little man.

Ayub Khan was a great big man, about as tall as I am, and he weighed about 225 or 250 pounds. He was not blond but he looked like an Englishman, went to Sandhurst, and talked like an Englishman. He was what the Pakistanis call a pathan [spells it], from the Northwest Frontier, this wild country that I'm telling you about, but the civilized Vale of Peshewar part of it. We will talk more about that when we talk about our project in Pakistan.

I taught this course for about ten years. I think the last time I taught it was in 1976. That was the time when we had 300 students. One of the touching ceremonies at Harvard is that the professor's last lecture is attended by all of his colleagues; they all clap wildly at the end of it! I remember that very well.

Over the course of time we got several professorial appointments in departments that were also members of the center, particularly Nathan Keyfitz, who was appointed to the Sociology Department and is one of the world's leading demographers, a first-rate guy. He was at Berkeley before he came to Harvard, working with Kingsley Davis and Judith Blake Davis. He took very well to Harvard. Harvard was just his dish of tea. He became a popular member of the Sociology Department, what they call the Department of Social Relations. He brought a lot of credibility to our

center because he really was a demographer and not an amateur like me.

Sharp: It sounds like you depended quite a bit on demographers.

Revelle: Well, demography is the only real science of population studies. It's essentially a mathematical subject, has a mathematics of its own.

Sharp: And yet population studies have a certain interdisciplinary nature, much like oceanography. I mean, people studying small specialties, and then putting the information together.

Revelle: That's right. **##**

We had a good deal of problems toward the end because Jack Snyder retired, and a new dean was appointed, I mean Howard Hiatt [spells it], from the medical school. He was quite young and quite vigorous and very ambitious and wanted to really revolutionize the science of public health and to get more scholarly people into the act, more good scientists.

We had a professorship, the John Rock Professorship, and he insisted that the man to fill this would be an ecologist named Lovins who was a mathematical ecologist, didn't know a damn thing about population problems. The John Rock Professorship was, if anything, the one thing where we really were concerned was human reproduction. Lovins never was interested at all in human reproduction, but he was an innovative ecologist, more or less.

Anyhow, Howard rammed this appointment through, and it has turned out very badly. Lovins never worked with anybody else and never has produced anything since he went to Harvard. He was a pal of a guy named [Dick Lewontin] who came in at the same time to one of the Harvard departments of biology, who distinguished himself, as far as I'm concerned, by turning down a membership in the National Academy of Sciences.

Sharp: I thought those were pretty coveted.

Revelle: Well, they are for the most part, but this man is a Communist, or I think he is. He's certainly a Marxist. His argument for turning down the election was that every now and then the academy did some classified work for the government, and this was bad business.

Anyhow, Lovins and he were pals, and I think Lewontin influenced Hiatt to get him.

Then Howard chose as my successor a man named Bill Alonso.

Sharp: That was your successor. That memo that you wrote him, remember that, that I sent to you?*

Roger Revelle, Papers 1929-1980, MC6, Box 17, f. 21, "Havard Center for Population Studies, 1976-1977," SIO Archives, UCSD.

MEMORANDUM

For: Bill Alonso

From: Roger Revelle

Subject: Responsibilities and Opportunities of the Director of the Harvard Center for Population Studies

On my retirement as director of the Harvard Center for Population Studies I wrote a memorandum to the Ad Hoc Committee appointed by Dean Hiatt to direct the affairs of the Center until a new director could be chosen. In this memorandum I outlined my concept of the duties and responsibilities of the director. These include but are not limited to the following:

1. Allocating space.
2. Maintaining secretarial, administrative, and other services.
3. Proposing faculty and research staff appointments.
4. Helping to develop and prepare research projects.
5. Approving issuance of Center Reprints and Research Reports.
6. Supervising operation of the Center Library.
7. Preparing budgets.
8. Planning or stimulating development of courses in population sciences in cooperation with Departments of Instruction and Research.
9. Arranging Center seminars.
10. Helping organize, manage and arrange research and other conferences.

11. Welcoming and entertaining visitors.

12. Maintaining extramural relations with government agencies and committees, foundations, learned societies, and population activities in other universities, and intramural relations with other components of Harvard University.

13. Serving on university and SPH committees.

14. Giving speeches and carrying out other public relations functions.

15. Preparing reports to donors and granting agencies.

16. Helping to raise endowment and operating funds.

17. Keeping the staff happy, accenting the positive and minimizing the negative.

18. Proposing evolution and application of policy.

The directorship is a fine platform for an eloquent person who has something fundamentally important to say and is dedicated to saying it. In my case I believed deeply and tried to communicate that the problems of poverty and population are inextricably interrelated and that these problems can be solved only by extraordinary efforts on the part of all men of good will. The argument should be buttressed with clearly reasoned principles and presentation of many kinds of data.

Second, the principal task of the Director is to bring together scholars of diverse disciplines in a concerted attack on the complex issues which underlie the population problem in the poor countries. He must find, encourage, and provide intellectual stimulation to natural and social scientists (and humanists) concerned with resources, with future food supplies, with the ways of overcoming deeply imbedded tradition and injustices as well as with demographic, economic and political analyses--in short, scholars representing many of the fields of study in the university.

Third, the Director must bear the primary responsibility for raising funds to carry on the work of the Center at the needed high level. His ability to do this will rest in large part on his eloquence outside the university and his ability to recruit and inspire people within the university. At the same time he must be flexible, able to grasp opportunities when they appear and to channel a variety of interests in directions appropriate to the university and to the Center.

Fourth, the Director should be primarily a synthesizer rather than a reductionist. This is an uncommon gift among scientists, particularly at a high intellectual level.

Revelle: Yes. He was a specialist on migration, rural to urban migration, or urbanization in general. His father had been a professor at Harvard and he wanted to come back to Harvard. He was a disaster as director of the center. He didn't have any concept of how you organize a multidisciplinary program. He wasn't interested. But he was a moderately well-known scholar.

About that time also, Howard appointed a committee to review the center, a committee of demographers.

Sharp: It sounds like trouble.

Revelle: It was trouble, and I think they recommended that I should be relieved of the job as director, but about that time I became president of the American Association for the Advancement of Science. Howard began to realize that I was in fact one of their shining lights.

Sharp: That was '73, I think.

Revelle: Something like that, yes. '73 or '74. So he dropped that idea. Also since I was about to retire anyhow. But, from my point of view, he was a disaster as dean.

Finally he got an associate dean named Elkan Blout who was a very much more sensible guy, much more diplomatic, and much more conciliatory. That, in the long run, pretty much saved the School of Public Health. Hiatt was Derek Bok's first appointment of a dean, so he stood up for Hiatt against a kind of revolt in the School of Public Health by many of the faculty members.

Interestingly enough, that's typical of Harvard. Harvard is not a democracy. It's run by a corporation of five members, plus the president. It's called the President and Fellows of Harvard College, a self-perpetuating body.

Sharp: And they have quite a bit of --.

Revelle: They run the place. Then, under them, each school has a dean who controls the budget, unlike the University of California deans who don't control anything.

Sharp: Which is what you found out.

Revelle: [laughing] That's right!

I used to say that Henry Rosovsky, the dean of the Faculty of Arts and Sciences, was the most powerful man in the United States. In the long run I think that's right because he was responsible for selecting, recruiting, financing and retaining the heart of Harvard, the Faculty of Arts and Sciences.

The intellectual life of the country depends to a large extent on what those guys think and write and do. So, in fact, in that long-run sense, I think Henry Rosovsky was a very powerful man, and before him McGeorge Bundy and Franklin Ford and other people, Paul Buck, Ed Mason.

The faculty have really very little to say about running the place. They have a little to say about who is appointed, but not very much. Each faculty appointment is recommended by and essentially made by an ad hoc committee appointed by the president of the university, or in the case of the Faculty of Arts and Sciences by the Dean of the Faculty of Arts and Sciences. It usually has two or three outside people on it, outside the university altogether. The president sits on every one and the dean sits on every one.

Sharp: Well, in your case, in the center, when you were wanting to make appointments, did you have to go through the School of Public Health, or through --.

Revelle: No, it depended on the department. First it had to go through the department, like the Department of Economics, or the Department of Social Relations, or the Divinity School, because the professorial appointments were primarily in the department. Non-professorial appointments I could make or our executive committee could make or our advisory council could endorse them and essentially we'd do it. But faculty appointments had to go through departments, as they do at UC too. I don't know about other places, but certainly UC and Harvard.

Then the president would appoint this ad hoc committee. I remember when Nathan Pusey was president I sat on two or three of these. I was on a couple with Bok too. But the president had a lot to say about it. Basically it was the president's decision. Pusey had very good taste, interestingly enough.

Sharp: At least it was good for that, for the center then.

Revelle: Oh yes. He built up a tremendous faculty and he did it by intuitive, as I said, good taste, intuition about who was good and who wasn't.

Anyhow, Hiatt was Derek's choice, the first dean he appointed, so he felt quite touchy about anybody criticizing him. What Hiatt wanted to do was a very good thing to do; that is, to modernize Public Health because it's a multidisciplinary science or field involving economics, politics, and social sciences, the business school and the Kennedy School of Government -- all of them -- he got them into the act with Public Health, and that was a very good thing to do.

Sharp: It seems like that would fit in pretty well with what the center --.

Revelle: Yes, it would. The trouble is he had such poor judgment about people, and also he was in a hurry. At a university you can't be in a hurry.

Sharp: The center was still working on a relatively small scale --.

Revelle: Oh yes.

Sharp: -- and the choice of appointments is even more important I suppose if you're working just with a rather small staff where there's a lot of interaction.

Revelle: Yes. Well, we have a list of people who were involved with it here.* [Sharp gives list to Revelle.] It wasn't so very small. The people who really had their offices there were Bergman, Dorfman, Dyck, Keyfitz, Potter, Revelle, Tabors, Peter Rogers, David Heer, John Wyon, but these people now were in the Population Sciences Department, the Department of Population Sciences. David Heer, Noel McIntosh, Steven Plank, and Henry Vaillant. And then the research associates: Repetto, Bergman, Frisch, Jim Gavan. That was about the size of it. And then Salhanick and Wyon, and some other people in the Department of Population Sciences. We were closely involved with them.

We had an Advisory Committee of people from all the faculties. Harvey Brooks, Milton Katz, George Homans,Roger Revelle.

These pages are sort of mixed up, but some I didn't mention were, members of the center were Hilton Salhonick, Jack Snyder, Harold Thomas, and John Wyon. Altogether it was about twenty-five people.

Then the Advisory Committee was about fifteen people. The principal ones were Brooks, Cochran, George Homans of Sociology, Milton Katz at the law school, the dean of the School of Design, Pat Moynihan in the School of Education, Janet McArthur in the MGH, Henry Rosovsky, at that time he was a professor of economics, before he became dean, this was the original list. Ted Sizer in Education, Fred Smith in Environmental Studies, Krister Stendahl, the dean of the Divinity School, and Ray Vernon who was head of the Center for International affairs.

Sharp: How did you use the Advisory Committee?

Revelle: Well, we would meet about once every two months, and they were very helpful. The main thing to do was to talk about the future of the center, what kind of people we should try to get and who they should be, and how we should get money and what projects we should [undertake]. Everything was discussed with these people. The whole thing was a learning experience for everybody. There had never been a center like this before. [brief tape interruption]

One of the people we thought of for one of our Andelot chairs was Norman Ryder who was a sociological demographer who later went to Princeton, but he had offended Jack Snyder. We had a conference -- in fact, we did it at Scripps -- about the future of the center. Population specialists from different parts of the country came to it, including Ryder. He was very acerbic in his opinions, not so much about us but about problems and people. So he antagonized Jack, and Jack didn't want to have him, although I thought he would have been a very good addition

Roger Revelle, Papers 1929-1980, MC6, Box 17, f. 43, "Ford Foundation [Site Visit, September 6, 1972]," SIO Archives, UCSD.

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Arthur James Dyck, A.B., A.M., Ph.D., Mary B. Saltonstall Professor of Population Ethics

Gino Germani, Lic-en-phil, Monroe Gutman Professor of Latin American Affairs

Roy Orville Greep, S.B., S.M., Ph.D., A.M.(hon.), S.D.(hon.), Director of the Laboratory of Human Reproductive Biology, Harvard Medical School

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Alexander Duncan Langmuir, A.B., M.D., M.P.H., Visiting Professor of Epidemiology, Harvard Medical School

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George Fisk Mair, A.B., A.M., Ph.D., Visiting Professor of Economics and Population

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Raymond Vernon, A. B., Ph. D., A. M. (hon.), Herbert F. Johnson Professor of International Business Management, Member of the Faculty of Public Administration

to the center. We got Keyfitz who was a much milder, more gentle type.

The great man in the scholarly side of population studies at that time was Ansley Coale at Princeton who was an economist. He had been developing a big research project to study the history of population growth and population control, family planning or whatever, in all the provinces of Europe, trying to get some information about each of the European provinces.

It was an interesting concept in that the provinces were more important than the countries. The countries were relatively modern inventions, but the provinces had been there for a thousand years, like Provence, for example, and Touraine and Languedoc and so forth in France. Germany is a more obvious example. All the little kingdoms of Germany were each essentially little provinces.

This was a very productive project. What they found was that in different parts of Europe, essentially birth control had been prevalent in some and not in others, and it spread from those that adopted it to nearby provinces. So it was sort of a contiguous geographical spread.

Sharp: So there was that kind of influence that it was spreading out?

Revelle: Yes. Even in the sixteenth and seventeenth centuries some parts of Europe had practiced birth control. Others had not. There was no semblance of birth control in Brittany, for example, no semblance of birth control within marriage, but the women married quite late. They had something called the European marriage pattern.

Sharp: Late into their twenties?

Revelle: Yes, very late into their twenties. Twenty-six, twenty-seven. That's how the Bretons limited their population, by late marriage.

All over western Europe there was this so-called European marriage pattern which was late marriage of women. In fact, the women were often older than their husbands, which was clearly a device for birth control. But not so much contraception. In Europe coitus interruptus has always been the method of choice, next to an abortion. It's only recently that these much more satisfactory methods have been introduced, like the pill, for example.

The name of the man in North Carolina, by the way, was Frieman. He'd been in India working for the Ford Foundation. In the late 1950s and most of the 1960s, the Ford Foundation had a kind of a minor empire in India.

India, Ford, AID and "Underdevelopment"

Sharp: Just from the correspondence that I could see even in your papers, it looked like the Ford Foundation had quite a lot

going on.

Revelle: Oh yes, it certainly did. They built a series of beautiful buildings, three of them, right next to the India International Center, in a park which was full of Muslim tombs, pre-tombs, the so-called Lodi Tombs, and as Ford pulled in their horns they gradually got somebody else to take over these buildings. Mostly they're now taken over by the World Bank. The World Bank has sort of taken the place of the Ford Foundation in India as a development agency. Similarly, AID had an empire in India, which Pat Moynihan pretty much dismantled.

Sharp: I thought we might talk about both AID and the Ford Foundation, just with respect to the center because of the kind of funding that they were giving you, and weren't giving you; it wasn't always successful.

Revelle: That's right.

Sharp: We might talk about it, just what their objectives were in giving you the funding, sponsoring some of the projects and programs -- as well as center's operating funds. There are some obvious points where you got funding and where you didn't.

Revelle: The ones we didn't get I don't remember so well as the ones we did get. [laughing] But let me tell you about the ones we did get. I don't remember the dates exactly.

Sharp: 1971 is one good year. Almost $2 million from AID.

Revelle: Yes, that was essentially our only AID grant. This was primarily for teaching graduate students from less developed countries. We established a series of fellowships for these graduate students and we were going to teach them about population problems basically from a social science point of view and a demographic point of view, the mathematics of it. That was why we got Nathan Keyfitz there, for example. He came at about that time. We promised them that we would make these appointments and we made them with the Andelot professorships, the Andelot endowment. One of the things that AID wanted to have was a man who would run this program.

Sharp: Right. And you thought that was fine because they were willing to pay for it as part of the grant.

Revelle: Sure, I thought it was a very good idea.

Sharp: One less thing for you to do.

Revelle: That's right. I'm not sure that my choice of the man to do this was a wise choice. His name was Eli Bergman. He'd gotten his Ph.D. at North Carolina. He was certainly not a scholar, not a very good research worker, and particularly Bob Dorfman took a very dim view of his being assistant director. In fact, if you look at the minutes of the executive committee meeting, we said he wouldn't be the assistant director, but Bergman insisted on having that

title. I made a mistake in yielding to him on that, but I had to get somebody, and there didn't seem to be much other choice than getting him. He did pretty well at the job, getting these fellowships, applications distributed, and picking the people.

Sharp: And picking good candidates to come?

Revelle: Yes, that's right. The man in charge of the AID program was a man named Ray Ravenholt. I don't know whether his name appears or not in the correspondence. He had a very simple notion, and that was that if you just saturate the air with condoms that birthrates would go down! I mean, that's of course figurative speech, but he felt very strongly that all that was really needed was just to push contraception, make contraceptive devices available and free and cheap and widely distributed. The administration of Family Planning programs was his bag and making large grants to anybody anywhere who would distribute contraceptives.

I never felt that that was the most important thing to do. I felt, and I was only partly right, that what was essential was to see what the social conditions were that made people have lots of children and try to change those social conditions.

Well, it turns out that both things are true. Lots of people will use contraceptives if they are available, and there are lots of people who won't. If you make them easily and freely available to the people who will, that will certainly reduce the birthrate somewhat. If you try to change the conditions, that will also reduce the birthrate. Those two things really have to be done together.

Sharp: The fellowships and having the candidates come to study at the center and in the department from these less-developed countries -- the idea was that they would then take their expertise back to the countries and work on change?

Revelle: Exactly. And they did that. It was a really quite successful program.

One of the most successful, in some sense, was a woman named Sabiha Sayed, who was a Pakistani. [spells her name] Her stepfather, who was also her uncle, was the Pakistan High Commissioner to India. She came from an aristocratic family in Pakistan. She had been married at the age of sixteen, one of these typically subcontinental marriages of convenience. She had two children, I guess at a fairly early time after getting married. And she had no education at the time, a typical Pakistani woman, but she wanted to get an education, and she did. She went to the University of Lahore in the Punjab. They called it, the University of the Punjab. She then went to Berkeley and got a Master's of Public Health, and eventually she showed up at our place looking for a D.S.C. The School of Public Health didn't give Ph.D.'s, it gave D.S.C.'s.

She had just a burning desire in her belly to do something about the status of women anywhere, but

particularly in Muslim countries. She wasn't awfully bright, but she was very, very determined and a wonderful character, had strength of character and persistence and energy.

Sharp: Sometimes persistence works just as well.

Revelle: Exactly. [laughing] I spent many, many hours with her, helping her get through the ropes of the Department of Population Sciences. ##

They were very reluctant to allow her to be a candidate for a doctorate degree, but eventually they did, and she did get a degree. I used to have sort of an all-day seminar on Saturday for her and two or three other people who were these fellows, talking about population policy and everything we could think of about population. So they got so they were pretty good at it, the students.

Sharp: Since you had spent all that time in West Pakistan and India, by then you knew almost more than anybody else at the center and in the department too, the larger department. You would have a way of understanding what the issues were, how the students could approach them, and really help them pull it all together.

Revelle: That's right.

She is now, or at least the last time I saw her, about a year and a half ago, head of Women's Activities for the Pakistan government. When she started there, she started on two programs. One was to teach the women in villages how to sew, and the other was to teach them how to read.

It turned out that all the women wanted to learn how to sew, but they didn't give a damn about learning how to read! They had nothing to read, and it didn't fit into their patterns of life. It was quite surprising to her, but anyhow that's the way it turned out.

She is still married. Her husband teaches history in the University of Islamabad, the same guy.

Sharp: So they have a rather unique relationship, very different from what you would expect.

Revelle: Yes, yes. But she left him for years and years, you see, to get this education. I never did understand, and I still don't understand, her family relationships, but it's typical of the subcontinent that marriage there is a real institution, not just a love affair.

Sharp: When she came she was always by herself?

Revelle: Oh yes. She brought her two children with her.

Sharp: Oh, she did?

Revelle: Yes. She arrived one night fairly late, about nine o'clock

at night, not having bathed for about a week, working her way from Pakistan here. I met her, and finally got her installed in the graduate students' living place. They had a big sort of dormitory for graduate students and their families, Harvard had, and I managed to get her into that.*

So that was one of the things I'm proudest of about the center was this wonderful woman, getting her started and getting her under way.

Another woman who I got to know quite well and spent a lot of time with, one of our first fellows at the center, first senior fellows, was a woman named Laila Hamanasy. She was an Egyptian who was a professor of sociology at the American University in Cairo.

Harold Thomas and I had spent some time in Egypt at that time working on problems of the best use of the Aswan High Dam. The basic problem was how much power to produce versus irrigation, to maximize the benefits, how you could release the water to get steady power as much as possible and at the same time to vary the release for irrigation.

We came across Mrs. Hamanasy, Laila, and we talked her into coming to the center for a year, and she did, with two of her children. She had taken a Ph.D. at Cornell in anthropology, and she was known at Cornell as the "passion flower of the Nile"! Not because she was immoral but just because she looked like a passion flower. By this time she looked like a sort of fat Nefretiti. Not too fat, but plump. A beautiful woman. Very noisy, very talkative.

Since then she has more recently been working for the UN in their Social Science Research Center in Geneva. She has done that for several years now. I also got her into the Pugwash movement, and spent some tine in Egypt with them, with her and her husband. Her husband was a professor in the medical school at the University of Cairo, the head of the orthopedics department of the medical school, and a very fashionable and well-supported physician.

She was starting a project in Egypt, which we helped somewhat with, of factors affecting birthrates and fertility in Egyptian villages from a sociological point of view. She had a lot of students working on it in the American University in Cairo. She had an assistant, a man, who started there as an assistant professor and eventually took her place as professor of sociology. This was a very well worked-out and very respectable project scientifically, as it should have been with her background.

Sharp: Did she go back to Egypt then afterwards?

Revelle: Yes, she went back after that and started on this project.

---

* Ellen Revelle Eckis added this note during her review of the transcript: "Actually there were two apartment buildings, in Boston, with various size apartments, for international students, of the School of Public Health."

I remember one thing about her. Most of the time she was here, she and her children had some kind of respiratory problem, colds or bronchitis and things like that. She used to say that it was just as dangerous for an Egyptian to come to the United States as it was for an American to go to Egypt! They just got too many diseases.

One of the things that Harold Thomas and I did was to send one of his students, Walter Spofford, to Egypt to study this problem of the Aswan High Dam. We wrote a paper on it which was one of the first applications of linear programming to this kind of water problem.

The other major source of funding, besides the funding that I've talked about so far -- which was strictly for the population problems per se, in the narrow sense of teaching people about population problems and doing work in demography and the social and economic aspects -- [was for consulting on economic and social problems.]

One of the people we brought in was Bob Reppeto. He was a Ph.D. from Harvard who had been on the staff of the Harvard Center for International Development. Not the center. I have forgotten exactly what it was called, but it was basically a program where Harvard sent people out in the field to consult on economic and social problems. My son-in-law, Gary Hufbauer, did that for several years.

Sharp: I made myself a note that he went to India, I believe.

Revelle: Pakistan. Primarily in Lahore. His particular study was the effect of income distribution on birthrates. He found, and was able to demonstrate pretty well, that the more even the income distribution, basically the higher the income of the poor compared to the rich, the lower the birthrate. This was a purely empirical finding, but it can also be explained in terms of the fact that if the income distribution is fairly equal there's a lot of hope on the part of poor people that they can get rich, and you can't get rich if you have too many children. In other words, they can achieve more economic mobility if there're not too many children.

Then our other major field of work was really under Peter Rogers and Dick Tabors, and that was the studies of water resources development in the subcontinent.

Sharp: Peter had done the preliminary study in the Lower Ganges Basin. He had done that preliminary study in, I think, 1967, but I'm not really sure. It was basically on the development of water resources.

Revelle: That's right.

Sharp: There's a lot on that in the papers, maybe because of all the problems that were connected to trying to get that project really going on.

Revelle: We actually had two projects. One was the study of water development in what later became Bangladesh. At that time it was East Pakistan. That was a study for the World Bank. Maybe that's what you mean by the Ganges study. It was basically a study of East Pakistan. This was seriously upset by the civil war. So we really were kind of a refugee station for refugees from East Pakistan who couldn't go back, at least not till after the war was over. We had some rather poor specimens. Some good ones too.

The people who were particularly affected by this were people called Biharis. Bihar is a state of India, and a good many Bihari Muslims had moved to East Pakistan, but the Bengalis took a very dim view of them and thought of them essentially as fifth columnists from West Pakistan. Some of these people were at the center and couldn't go back. We had to somehow find money to support them, and we did. They weren't very useful, but we just couldn't turn them out.

There were some that were also quite useful, particularly those that were involved with the HIID, Harvard Institute for International Development it was called. Then after Bangladesh became a separate country, we went back there and worked some more with them.

Sharp: I'm not sure when that was.

Revelle: About '73.

Sharp: But as early as the late 1960s there was the World Bank project under way. It was a separate project that was eventually accomplished after '73?

Revelle: That's right. The bank was not very happy about it. The bank at that time, and it's pretty much still the case, had almost no use for research.

Sharp: They want projects?

Revelle: They want projects, yes, essentially. And Peter didn't get along very well with the project officer in the bank. So that ended in, I wouldn't say a disaster, but at least not a very satisfactory outcome, as far as the bank was concerned. We did a lot of work, a hell of a lot of work, and accumulated enormous quantities of data and of papers, all of which eventually got turned over to the bank.

Then the other project was a Ford Foundation project that Peter had, which was supported by Ford India.

Sharp: There was one letter from Eugene Staples to you as early as July of '67. Do you remember looking at that letter?*

Revelle: No, I don't remember that letter. I kind of remember Eugene Staples. [reads materials] I don't remember this at all. That was before we got our World Bank project.

Sharp: Between '67 and '68 there were several different kinds of correspondence setting out different projects that were

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THE FORD FOUNDATION
477 MADISON AVENUE
NEW YORK, NEW YORK 10022

OVERSEAS DEVELOPMENT PROGRAM
SOUTH AND SOUTHEAST ASIA

July 7, 1967

Mr. Roger Revelle
Center for Population Studies
Harvard University
9 Bow Street
Cambridge, Massachusetts 02138

Dear Mr. Revelle:

Joe Slater, who is presently out at Aspen on a two months study leave, asked our office of South and Southeast Asia affairs to look at the very interesting proposal in your letter of June 12. We were able to give this really first-hand consideration because our field representatives were in New York last week for a special meeting. We asked Hal Hanson and Doug Ensminger, our representatives in Pakistan and India, to look personally at the project.

I think I might quote part of a memorandum Hal Hanson wrote, the conclusions of which we are inclined to agree with:

> "This is one of the few subjects of joint interest and mutual benefit to India and Pakistan with possibly enough economic attraction to bring about joint action.
>
> "It has been my own judgment that this could only be negotiated:
>
> "(1) By an agency, such as the World Bank, which could offer a consortium of givers who could finance the proposal, and therefore the initial discussions would be more than an academic exercise.
>
> "(2) The timing must be at a period of lesser tensions between India and Pakistan. Such circumstances do not exist at present.
>
> "(3) Even for preliminary inquiries, which Revelle is proposing, the World Bank has demonstrated it has ample technical assistance funds for those developments in which it is seriously interested. I doubt therefore that Ford Foundation money is needed, or persuasive."

Hanson goes on to say:

"I can add one observation which may be under-played in Revelle's paper, and actually favors his argument. He observes that in his initial review, the advantages seem to accrue largely to India. If one looks only at water storage and controlled irrigation, this is true.

"But Pakistan is just now realizing that the annual flooding of 3/4 of its rice land in East Pakistan to a depth of 10 inches up to 25 feet is the biggest obstacle to agricultural improvement, and any system of flood control, whether by upstream dams, or by poltering, would be the first condition for a really great break-through in food production. Revelle's proposals for up-stream dams might provide this desired effect. East Pakistan estimated that 3/4 of its floods come over the border from India, and are not the result of rainfall within Pakistan.

"Dutch advisors presently in East Pakistan are advising a massive program of polters (dike enclosures) comparable to the Dutch reclamation of the Zuyder Zee. There is no economic cost/benefit study yet.

"Moreover, the Pakistanis have just begun to attack India in the UN for its construction of Farakka Dam in West Bengal, which will deprive East Pakistan of down-stream irrigation water on a project called the Ganges-Kobadak, which is a very costly pumping system for lifting Ganges water into raised canals in East Pakistan, and intended to serve 250,000 acres.

"Thus, the opening blows are being struck now for a dia-logue on this India-Pakistan water problem in the east, counterbalancing the Indus Basin treaty for West Pakistan, reached in 1960. Revelle's paper could be a very useful contribution."

Although we agree with Hanson that the political moment is not ripe and that the World Bank is a more suitable place for such a project to be initiated, none of this affects our view that you have got hold of something very interesting which could be, as Hanson says, a most useful contribution.

Sincerely,

ES Staples

Eugene S. Staples
Deputy

trying to get under way. The Ganges River Basin project was one of them and there were many descriptions of the tensions between India and West Pakistan, and India and East Pakistan. [reviewing letter, Revelle laughs.] You laugh.

That letter made me wonder a bit about what kind of person Staples was.

Revelle: A very nice, very smart, and original person. Primarily an applied mathematician.

Sharp: Well, yes, he looks like he wants to apply it quite a bit --.

Revelle: Oh yes.

Sharp: --as a result of that memo.

Water Politics and the Indian Government

Sharp: Maybe we could talk more generally about the efforts of the center to do certain projects and certain programs in the less developed countries and the role of the governments, (the role of the Indian government, the role of the West Pakistani government), in hindering or assisting what the center decided it wanted to do as a project.

Some of the letters set out your ideas about what might be done. Almost as a scientist setting out a certain objective, but then the political realities set in and things don't happen.

Revelle: That's right, quite right.

The more successful of these India-Pakistan projects, primarily an Indian project, was a big grant we got from the Ford Foundation of India sometime in the early 1970s, after we had done this work in Bangladesh. This was to bring scholarly fellows or essentially faculty members from Indian universities and the members of Indian government departments dealing with water and agriculture and related fields to Cambridge for a year to three years of study, of work, really research, on problems of resource development, particularly land and water development, which was our bag.

Peter Rogers and Dick Tabors ran that program, and it lasted, basically, until I left. It continued after I left, but Peter never got along with Bill Alonso at all, so he moved the project to the School of Design, and from 1976 to '78, I had my office in the School of Design, not in the center.

We had a couple of dozen people that Peter recruited in India from universities and from government departments to come and learn about programming, planning and analysis of water resources. It was basically water resources and land resource projects. Lots of reports came out of that, not many papers. In fact, I must say I'm disappointed with Peter Rogers in that he has not ever established much of a

public reputation because instead of publishing papers for publication, he has published reports.

Sharp: And you have to get it into the literature so it will be circulated?

Revelle: That's right. And he hasn't done that.

Sharp: It's like the final step of the research.

Revelle: That's right. He has done everything else but that. He has never done that.

Eventually Dick Tabors left as our funds ran out and went to MIT, where he works on their energy project. Peter is still on the faculty at Harvard as a full professor in the Division of Engineering and Applied Physics, but I don't think they are very happy with him for just this reason that he hasn't published very much. One thing he did publish recently was an article in the Atlantic on the United States water resources problems.

Anyhow, the purpose of this Ford Foundation project was literally to train and to develop a capability for analysis in the Indian scientific community. This was the kind of analysis that had first been started by Harold Thomas, the so-called Harvard Water Project, in the late 1950s, early 1960s, where they applied modern analytical methods, including so-called system analysis, to water resources development. Bob Dorfman was very much involved with that. Henry Jacoby, and then Peter Rogers and Joe Harrington. A man who later went to North Carolina was sort of the manager of it.

That was a great step forward, but then other people have taken it up and gone much further, other engineering departments and engineering firms. This was a pioneering, typical university type of effort. Then Peter applied it, as I said, with these Indian engineers and scientists and economists in India.

One of the people that he became very much involved with was an economist at the University of Delhi, Professor Bhadic. They have worked together recently on energy problems in India, rural energy problems, problems of biomass as an energy source.

One aspect of this was something that I did with Teddy Herman, an Israeli engineer. I was much impressed by the waste of water in the Ganges. If you study the flow of the Ganges, you find that about four-fifths of it takes place during the monsoon season.

The reason why so much water is wasted is that they can't use it during the monsoon season, when a lot of rainfall and flooding takes place over large areas in the Ganges Plain in India and in Bangladesh. About half of Bangladesh is flooded during the monsoon season, literally flooded with several feet of water on the ground. On the

other hand, during the rest of the year there isn't enough water. They haven't got enough water for irrigation to grow crops.

They have tried to solve this problem by building dams so they can store the water, what they call over-season storage, to hold it for the winter season. But the geology of the country is such that there aren't many good dam sites. It's quite a young geology.

The mountains are steep, and easily eroded, quite unlike the United States where there are many huge reservoirs like Lake Mead back of Hoover Dam, and Lake Powell back of the Glen Canyon Dam, and others on the Colorado, the reservoirs back of the dams in the Sierra Nevada, the Grand Coulee Dam on the Columbia, and the other dams in the northwest United States where you can store enormous quantities of water.

Those sites don't exist in India. The reason is that the valleys are too steep, so you build a high dam and you just get a little bit of water back of it. You can see how that would be. It costs several times as much per acre foot of water to store water in India as it does in the United States, maybe five or ten times as much.

On the other hand, the Ganges Plain is a great sponge. It's a huge pile of alluvial sediments, maybe 20- to 30,000 feet thick, a down-warped valley. The Indian subcontinent moved across the Indian Ocean and butted up against Asia, and in the process the Ganges Plain was down-warped and the Himalayas were pushed up sky high, a process which is still happening. There's a lot of sediment there, and that sediment is just like a sponge. It can hold a lot of water.

So my idea was to store the water underground during the monsoon season and to pump it up and use it during the dry season, pump it up so you release space for water to sink in during the next monsoon. You could store a lot of water underground this way. One hundred million acre feet of water could be stored in this sponge, this sedimentary sponge, if there was space for it. **##**

We made some calculations which showed that if you pumped on both sides of the river during the dry season, you could lower the water table quite significantly in a few years by several tens of feet. It would look like this. [gesturing] Here's the river here, and the water table is right close to the surface at the river, and if you pump here you get the water table lower and lower.

Then it partly fills up during the rainy season, during monsoon, and the next year you pump it down still more and you get still more storage.

Well, we wrote a report on this and then 1 published a paper in Science -- with an Indian scientist, Professor Lakshminarayana on this proposal for underground storage on a very large scale in the Ganges Plain.* We showed how it

Roger Revelle and V. Lakshminarayana, "The Ganges Water Machine," Science 188 (1975) 611-616.

The Ganges Water Machine

Roger Revelle and V. Lakshminarayana

The river Ganges and its tributaries, and the flat and fertile plain through which they flow, are one of earth's great natural resources. For thousands of years abundant water and generous land have provided the foundation for a highly developed civilization based on agriculture and for one of the world's largest concentrations of human populations. But farming is mainly traditional and at a subsistence level, with little surplus, and as a result the population has remained overwhelmingly rural and most people are desperately poor. Although irrigation from canals and wells has been practiced for millennia, chiefly as a protection against the uncertainties of the monsoon rains, the water resources are largely untapped; the small fraction of water used for irrigation is poorly managed and its productivity is low.

Deeply embedded cultural, social, and economic problems inhibit modernization of agriculture and fuller utilization of the water resources. Capital investments and technological changes on a large scale are also required. As experience elsewhere shows, the introduction of technological changes on the required scale might break the chains of tradition and injustice that now bind the people in misery and poverty.

Ganges and Its Tributaries

The Ganges Basin covers parts of four countries, India, Nepal, Tibet, and Bangladesh; eight Indian states, Punjab, Uttar Pradesh, Haryana, Himachal Pradesh, Rajasthan, Madhya Pradesh, Bihar, and West Bengal; and the Union Territory of Delhi. We shall consider that part of the Basin that drains into Bangladesh through the great distributary called the Padma. The other main distributary, called the Bhagirathi, has long been moribund and now serves only as a spill channel for Ganges floods. Within India, the Ganges Basin, as we have defined it, covers 800,000 square kilometers (*1*). Its population is about 225 million, somewhat more than that of the United States, which covers nearly ten times the area. At present rates of growth, the population will double in 30 years.

The fundamental problems of land and water development in the Ganges Plain arise from the highly seasonal flow of the river and its tributaries. Nearly 84 percent of the rainfall occurs from June through September, and 80 percent of the annual river flow takes place during the 4 months of July through October.

The average annual flow of the Ganges at the Hardinge Bridge in western Bangladesh is 36.2×10^6 hectare-meters, and the monsoon flow from July through October is 28.9×10^6 ha-m. During the remaining 8 months of the year, the river carries only 7.3×10^6 ha-m (*2*). Part of this dry-season flow comes from groundwater in the Ganges Plain, and the remainder comes mainly from the Himalayas.

Even at present, the dry-season flow of the Ganges is barely sufficient for the needs of India and Bangladesh. If irrigation with either groundwater or surface water continues to be developed along the lines of present programs, the dry-season flow will be continually reduced. In order to develop the full irrigation potential of agricultural land without unacceptable reduction of the dry-season flow of the Ganges, it will be essential to store a portion of the monsoon waters for use in irrigation. Because of the steep slopes of the Himalayan foothills and the flatness of the Ganges Plain, surface sites for storage are scarce, and costs per unit volume of surface-stored water are several times higher than in many other parts of the world. On the other hand, there are great possibilities for underground storage, which should be relatively inexpensive.

Present Needs for the Ganges Low Flow

Irrigation in Bangladesh. The average rainfall in Bangladesh is higher, and the potential for increasing groundwater recharge from rain is greater, than in the Indian part of the Ganges Plain. Unfortunately, there is a wide variation among different districts, just as in India. Revelle and Herman (*3*) estimated that water from the Ganges is needed in Bangladesh during the low flow season to supplement groundwater irrigation in three districts in the northwestern part of the country. In the southwest, where the groundwater is saline, Ganges water is the sole irrigation source. In other districts some Ganges water is needed to minimize saltwater intrusion. The sum of these needs totals about 1.8×10^6 ha-m.

Diversion of low flow waters for Calcutta port maintenance. Part of the Ganges waters during the low flow season must be diverted at the Farakka Barrage through the Bhagirathi into the Hooghly River, to maintain a sufficient freshwater discharge past the port of Calcutta. We learn that the feeder channel at the Farakka Barrage has been designed and constructed for a capacity of about 0.29×10^6 ha-m per month. This is more than half the average low flow of the Ganges during the 3 months of February through April. These are also the months when the need for surface water is most critical in western Bangladesh and when the flow into the rivers from groundwater is minimal.

Navigation on the main stream. Economic development in both India and Bangladesh would be hastened if the Ganges could be used as a great international waterway for transport of heavy or bulk materials. Conversely, as development proceeds, the needs for year-round water transportation on the river will rapidly grow. A water route down the Ganges and up the Brahmaputra into Assam would yield large benefits today.

Year-round transportation will depend directly on maintaining a sufficient dry-season flow. Even for relatively shallow barges and moderate-sized ships, an average river depth of 5 m would be desirable. With a width of 900 m and a velocity of flow of 0.35 m per second, this would require a minimum discharge of 1550 m^3/sec, or about 3.2×10^6 ha-m during the eight dry months.

Downstream water quality. The growth of modern agriculture in India,

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could be done, and the figures work out very well. It's, however, an expensive thing to do.

Probably a much better thing to do is simply to grow rice over vast areas during the monsoon and let the water sink in from the rice fields. It infiltrates pretty fast from a rice field, like about an inch a day or half an inch a day. So you get a lot of water stored just by growing rice where you have paddies, where the water is about six inches deep. You keep those filled up and water just goes down, particularly if you don't puddle it too much. So that's probably the way it should be done, but the Indians have gotten more and more difficult in accepting any advice from anybody.

Sharp: Do you mean the Indian government? When you say "accepting advice," you don't mean the scientists?

Revelle: No, I mean the government. The government is very secretive. The government engineers are very secretive. They won't share their data with the university people in India. They regard it as some kind of military secret -- what the facts are about hydrology.

One of the reasons for that is that they have a continuing conflict with Bangladesh because they built something called the Farakka Barrage which diverts water from the Ganges into the Hooghly River. It is supposed to keep the port of Calcutta free of sediment, and Bangladesh used to take a dim view of this because they say they need the water during the dry season to irrigate <u>their</u> land, and they think they're not getting it because of the diversion in Farakka Barrage.

The result is that, as in all water projects, there's a lot of bad feeling and a lot of secrecy and it's very political and it has very little to do with what would be the best thing to do economically.

The other problem is that most of the water in the Ganges comes from Nepal, and the Nepalis would like the Indians to help them develop it, in Nepal. The Indians have been very reluctant to do that. In fact, their behavior toward Nepal is much like our behavior toward Mexico. You know, push them around and --.

Sharp: And see them as inferior.

Revelle: That's right, yes. They treat both, the Nepalis and the Bangladeshis, the downstream and upstream riparians, as a bloody nuisance.

Sharp: This was in the seventies, '73, '74, when you were working on the Ganges Plain? The relations between American scientists such as yourself and the Indian government were not as good in this period as they had been earlier?

Revelle: No. They had been getting worse.

Sharp: And is it due to just politics within the Indian government, and this increasing secrecy, or was there some other element?

Revelle: Well, the basic reason is that the Indians are getting more and more self-reliant, there are more and more skillful people in India. Why should they pay any attention to a bunch of foreigners? Even though the foreigners may have good ideas, [it's the fact that] it's not invented here.

Sharp: The succession of high leadership in India, from Nehru to Shastron Gandhi and now young Gandhi --.

Revelle: With a short interval with Desai.

Sharp: Is that part of the reason, the changes in the directions that the highest leaders have gone in, has that had some repercussions and made relations more difficult?

Revelle: Mrs. Gandhi didn't like Americans. She was always suspicious of them. She was always claiming the CIA was spying on them. I don't really know how much of that has washed off on her son.

I'm now involved with the National Academy Committee which is supposed to evaluate and sort of supervise something called the Indo-US Science and Technology Initiative. The part that I'm concerned with is the so-called monsoon project.

I have been pushing this idea of mine ever since we published that paper in Science, and I've gotten many Indians enthusiastic about it but never the right Indians. For example, the last one was M.S. Swamianathan, who is one of the great agricultural scientists of the world. He was a member of the Indian planning commission. We went together to the secretary of irrigation and power, and he just blew us out of the water. Now Swaminathan has gone to the Philippines as head of the International Rice Research Institute. It has happened several times like that. I worked with an Indian named Mehesh Chekeval at the Indian Institute of Technology at Delhi, and he hasn't been able to get anywhere either.

Basically, the problem is that the Indian water engineers were trained by the U.S. Bureau of Reclamation in 1912. The Bureau of Reclamation at that time gave the back of its hand to ground water; they weren't interested in ground water at all. They were interested in dams and lining canals so they won't leak and things like that, all of which, I think is just exactly wrong in India, but they think it's great.

They're worried about waterlogging and salinity. What they should be worried about is getting enough water.

Sharp: And being able to control it, and distribute it at certain times of the year, and adapting it, and so on to supply it.

Revelle: Sure. But politics have so much to do with water resources.

In the state of Quzeral they're building a dam called the Narmada Dam, and they're building a huge canal system to use the water from the Narmada River, but what they're planning to do is to carry it way out to 100 or 200 miles from the source. Not because that's economically a good place to use the water, but because of politics. They have to keep all these people happy.

However, this is not unique to India, as I pointed out, but it's more obvious in India perhaps.

Sharp: I'm interested to go back a little bit to some of the teaching that you were doing, the big turnout that you eventually had in these courses.

Maybe you could talk just a little bit about how the American students were perceiving this new information about population, and the relationship between who uses resources and population growth.

Revelle: One reason I think that course became more popular was the growing interest in the environment, preserving and improving the environment. I talked quite a bit about that in the course, but I talked mainly about less-developed countries and their problems.

There were about twenty lectures altogether, as I remember it, each of them pretty much carefully worked out and prepared.

I remember one of them was about the use of water and water resources. Maybe more than one was about that. In that case I talked about Thailand, the use of the Chasphye River, how there was a conflict there and it was very typical between the demands of Bangkok, a huge city, and the upstream farmers for the allocation of that water. What Bangkok was actually doing was pumping out water and the city was sinking because they didn't have enough water from the river. Then that makes all sorts of other problems of pollution and drainage, which is quite serious.

I talked a good deal about agriculture and the use of energy and the use of modern technology in agriculture, quite a bit about the consequences of rapid population growth, population policies, population growth in historical perspective. [And] this thing I was just telling you about -- about the European marriage pattern, [and] for example, the fact that primitive peoples have a rather low birthrate, hunting and gathering societies. As we know from the one surviving hunting and gathering society, the Kalahari bushmen. They have a relatively low birthrate and a relatively low death rate. High death rates and high birthrates came with the development of agriculture because people lived close together and they got infections, they got diseases. So high birthrates are really driven by high death rates.

I'm sorry, maybe I'm not answering your question.

Sharp: What did the students think of all this new information? Do

you have any sense of how these American students, undergraduates at Harvard, what they thought of a new way of looking at less-developed countries, for one thing, and looking at resource issues from almost a sociological perspective?

Revelle: I can't say how all of them looked at it. Of course, students are wildly diverse, particularly Harvard students.

But there were quite a few of them who used to come up and ask me, "How can I get into this field? What do I have to learn? What do I have to study? What do I do next?" What I told them always was you have to become an expert in something, that it's no longer possible just to have good will and go to a less-developed country and say, "I want to help." They will say, "We want to help you out; which way did you come in?" [laughing]

They are just not interested in amateurs. If you are a professional forester or a professional agronomist or a professional engineer, there are lots of opportunities. So what I used to tell them is, "You've got to get more technical. You've got to learn some technology in depth." Some of them did that.

Sharp: There is this picture of the center that I'm putting together of teaching more about the less-developed countries, and some of the issues that they deal with about population and use of natural resources; and doing basic research in the countries using federal grants to do some of the --.

Revelle: And Ford grants --.

Sharp: -- and Ford grants to do some of the original research; and, bringing individuals from these specific countries to the center to learn more about how to pull all the information together.

Different aspects of education, I guess, educating Americans like myself who know almost nothing about the less-developed countries.

Is that what you wanted to do with the center? Is that what you thought the center was supposed to do in the long run?

Revelle: I guess so. I don't really think I had that idea in advance. I didn't really know what it should be in advance. I thought of it in advance essentially as a research institution to learn about population problems, and that's what I thought universities are all about -- research and teaching on the basis of research.

Jack Snyder had a different idea. I think he was never very happy with my way of doing things. He thought that what the center should be would be an activist organization studying methods of introducing and promoting contraception, birth control.

Sharp: More of the typical School of Public Health plan.

Revelle: That's right, yes. I think he had in the back of his head, though he never said it -- he was a very tactful and very gentle and polite man -- I think he had in the back of his head, however, the idea that the most important thing was contraception.

I thought the most important thing was the social science side of it. He didn't have much confidence in the social scientists, for the very good reason that it's hard for them to make practical recommendations.

Sharp: Or generalizations even.

Revelle: Yes. Nevertheless, this population problem is right at the heart of society. What more important thing is there than the population? It's very much of a sociological issue.

Sharp: When you left Scripps and did the White House panel work and then went to Harvard, if you look at your career sort of from the outside, which I do and you obviously don't, it looks like this tremendous detour --.

Revelle: This zig.

Sharp: -- away from the ocean. At one point, I don't recall now where I read it, but somebody was looking up what you were doing and commenting that you were a little far upstream, and it looks like you had to do an awful lot of homework to figure out what the individual researchers at the center were all about.

Revelle: Sure. I never did learn much demography. I never had enough mathematical background.

Sharp: But the basic principles, about population and the relation of population to resources. Did you pick those up from the Pakistan work?

Revelle: Pretty largely, yes, that's right. I was always interested in resources. As you know, I started the Institute of Marine Resources at Scripps. But I learned a lot about agriculture in that Pakistan project. I didn't know anything about it before. My approach was always just that approach: not how do you control population, but how do you develop the resources to take care of the population you're going to have.

Bob Dorfman was never really convinced that that was what we should be doing. He didn't quite know what we should be doing, but he felt somehow it ought to be more related to population growth specifically rather than taking care of the population growth. This was in no way a quarrel, but it was a difference in point of view.

Sharp: And in point of view in terms of direction of the center too.

Revelle: Yes. So our major activities in the end, in the last year that I was director, were basically these resource studies, although Bob Reppeto was working on the factors controlling population growth. So was Harvey Leibenstein. Harold Thomas more or less dropped out toward the end. He felt that he didn't have much more to contribute.

One of the important sort of side aspects of the center was the work that Rose Frisch did. She was the wife of a professor of physics at MIT, a very feisty, feminist gal. I brought her in essentially because she was looking for something to do in the very first days of the center. So we made her a research associate. I'm not even sure we paid her at first, but we eventually did.

In the middle 1960s the President's Science Advisory Committee started the World Food Study, and I was a member of the panel that was given that job. It was headed by Ivan Bennett, who later became vice president of NYU for all their medical sciences. He was assistant director of the Office of Science and Technology in the White House.

The parts that I was responsible for were basically two things. One was the amount of agricultural land, what was the actual potential of agricultural land, where was it, how much was it, how much could be developed. A group of us wrote a report on that, where I did a lot of the work and was the principal author of the report.

The other thing that we worked on was nutrition, what did people need to eat and how much did they need to eat. Part of that problem was how big were they? Little people don't need as much to eat as big people. I got Rose interested in this problem, and we wrote one of the papers for the study on body size and nutritional requirements for people of different sizes.

It turned out, for example, that Bengalis are quite small. The average Bengali male only weighs about 100 pounds, and the average female weighs about 90 pounds. They don't really need anywhere near as much to eat as the Sikhs, for example, who weigh on the average 160 or 170 pounds, and the women are about as big as the men.

I don't quite remember what this study consisted of, but it was basically a study of the requirements of the different populations, the food requirements in terms of numbers, age distribution, sex distribution, and body size.

This led Rose, then, to a further study of the relationship between body composition and fertility. She developed the hypothesis that women who don't have enough fat on their bones in proportion to body weight are infertile. It's quite clear with anorexic women; they don't even menstruate. But even women who are not anorexic but don't have the right proportion of body fat often don't menstruate either. For example, women athletes don't menstruate. They have too much muscle compared to the fat content of their body. She has developed this hypothesis

now for the last fifteen years or so, perhaps more than that. It has never been very widely accepted by the population people because what it basically says is if you feed the people of the developing countries they'll have more babies.

Sharp: Just exactly the opposite of what you would like.

Revelle: But it's probably correct.

She has written papers in which she points out that it's quite essential in providing food aid, for example, to also provide birth control because those women are well fed are going to get pregnant.

Actually, it's not a simple problem. Women in less-developed countries are often malnourished, and the result is that as long as they're lactating, as long as they're nursing their babies, they're likely not to get pregnant. Whereas with a well-nourished woman in the United States it's not the case.

Sharp: The direction of your research, once you got to Harvard, spread out quite a bit in terms of your interest in food, body size --.

Revelle: Rose and I wrote several papers on this.

Sharp: This was later on. This was in '74, '75?

Revelle: Yes, I think so. It may be a little bit before that because the World Food Study I think was 1965.

Sharp: I was thinking there was another one that was going on.

Revelle: That was the one with Harrison Brown for the National Academy. I was not involved with that.

Side Notes: Back to California, University Fellowship and Living in Cambridge

Sharp: I'd like for us to close for today, but I think we need to get you out of Harvard and back to California. ## And, retired from there.

Revelle: Well, that was no problem because of Harvard regulations. You had to retire from an administrative job at sixty-five or sixty-six, maybe sixty-seven. I was born in 1909, and I retired from the professorship in 1976. I must have been sixty-seven. You were able to stay on until you were seventy on a half-time basis. I tried to do that for a couple of years, spending half the time at Harvard and half the time here at UCSD. But it was not a satisfactory arrangement; I never really did either one very well. [brief tape interruption] As I remember it, Walter Munk was the one who really arranged my coming back. He talked to Bill McElroy, who was then chancellor here.

Sharp: There isn't too much on it, except there is this letter that you had written to Herb York that set out all the terms of it, but it is written long after any informal arrangement might have been worked out. Do you remember that letter?*

Revelle: [after reading letter] I don't remember, but it's clearly a reasonable letter.

Herb suggested that I should join his group in Science, Technology, and Public Affairs. Walter had the idea first that I should come back here as a professor, and he talked to Bill McElroy. Bill McElroy offered me the job and asked me what I wanted to do, so I said I wanted to be professor of Science and Public Policy. Then he got me in touch with Herb, his program in Science, Technology, and Public Affairs. That's how it happened.

At that time, in '75, I was sixty-six years old, a reasonable age, ten years ago. I had already retired from the University of California at the time I left here in '64, so I couldn't have a full-time job. In fact, by that time, I'd already started drawing retirement pay, not for my own sake, but because Polly Wyckoff developed a cancer. She had an operation for breast cancer which didn't work very well, and as a result she developed a bone cancer and she was dying slowly and painfully.

So what I basically did was to appeal for my retirement pay and then turn it over to her. It was about $6- or $700 a month, something like that, not very much. Retirement pay was based on your highest salary at the time you retired, and in 1963-64 I was getting about $22,000 a year as director and dean, very much less than people get now!

Anyhow, that's why I did it, so when I came back I could only have a 49 percent time appointment, which was perfectly reasonable as far as I'm concerned because we have plenty of money, but I'm incapable of working part-time!

Sharp: I noticed that.

Revelle: So I worked full-time regardless. They were very nice to me. They gave me a secretary and an office, allowed me to teach. It's wonderful; I love it.

Sharp: Did you like coming back to UCSD?

Revelle: Oh yes, sure. I loved Harvard. Harvard is a marvelous place. There's a wonderful collegial atmosphere there. I was a member of the faculty of Arts and Sciences as well as the faculty of Public Health, so I was really right in the middle of it. The faculty of Arts and Sciences is Harvard in many ways. And I belonged to the Saturday Club and the Tavern Club. These are sort of special Bostonian enterprises, particularly the Saturday Club is very interesting.

It was founded by Nathaniel Hawthorne and Ralph Waldo

19 May 1975

Dr. Herbert York
University of California, San Diego
P.O. Box 109
La Jolla, California 92037

Dear Herb:

This is to let you know that Ellen and I really will be returning to La Jolla at the beginning of 1976. The enclosed copy of a letter to Bill McElroy gives the details.

I am looking forward with great enthusiasm to the possibility that you, Professor Lakoff and I "can find some beneficial and happy way of combining our mutual interests in Science Policy questions." As an ernest of my good intentions, enclosed is a reprint of my talk on "The Scientist and the Politician," given at the 1975 Annual Meeting of the American Association for the Advancement of Science.

For the past seven years I have taught a general education lecture course for graduates and undergraduates here at Harvard entitled, "Human Populations and Natural Resources." Possibly it could be modified to fit into your program. This course is the survivor of half a dozen courses on the environment, population and development which sprang up and died down here during the past several years. Last fall we had about 200 students.

In a separate letter, Professor Lakoff has suggested that the three of us might offer a new course on the general subject of industrialization and its political and social impact. I am not sure I know enough about industrialization to be able to say anything very useful about it, but I am willing to try to learn. In contrast, I have become more or less of an expert on problems of agricultural modernization and food production, and maybe these could be fitted into what he has in mind.

I have agreed, perhaps foolishly, to give the commencement address at Revelle College on June 15, and Ellen and I will be coming out for that

weekend. Perhaps you, Professor Lakoff and I could get together for a preliminary discussion which could be continued at various times later in the summer when we are at home at 7348 Vista Del Mar.

With affectionate regards to you and Sybil,

As ever,

Roger

RR:ljg

Enclosures

Emerson in 1840. The purpose of founding it was to start the Atlantic Monthly, and they did that, but after the Atlantic was started, they decided it was so much fun that they would keep on with it, and it became then just a luncheon club.

Sometime in the 1870s they conned a Forbes into joining the club. The Forbeses are traditionally a very rich family in Boston, and he endowed them with $15,000, an endowment which has now grown, with typical Yankee thrift and ingenuity, to about $135,000. So it's one of the few places in the country where you can get a free lunch.

Sharp: The Saturday Club, where is it located?

Revelle: It's located just in people's heads, but they meet once a month at the Union League Club in Boston. The Union League Club is itself an interesting Boston institution. The famous club in Boston is the Somerset Club on Beacon Street.

During the Civil War many of the members were Copperheads, people who were very sympathetic with the South and disliked "niggers". A Negro regiment was organized in Boston. This Negro regiment marched down Beacon Street and some of the members of the Somerset Club pulled down their blinds so they wouldn't have to see it. Other members of the Somerset Club took a dim view of this; they were abolitionists. So they formed another club called the Union League Club, which is about two blocks down the street from the Somerset Club.

Of course, one of the members of the Union League Club was a local Adams, of the Adams family. They were always very liberal. A present representative of the Adams family is Thomas Boylston Adams. He is a good friend of mine and he got me into the Saturday Club.

This is a very distinguished group of people. John Kenneth Galbraith, Samuel Elliot Morrison, Archibald Cox, Charlie Wysanski, a lot of great Bostonians. They meet once a month in the Union League Club and have good wine and a good lunch, free. The club actually has a place of its own is the Tavern Club, which is right down on Boylston Street, the other side of the park or the Boston Commons from the Somerset Club. It's full of professors, of course, businessmen and lawyers, professional men in Boston. It's not just an eating club, but they also give plays written by the members and things like that.

Sharp: All of that offers a kind of atmosphere and fellowship that doesn't exist here, or if it exists it's in a very different form.

Revelle: It doesn't exist. Unfortunately. That's the most disappointing thing I find on coming back here.

We're trying to do something about it by organizing a faculty club. I'm not even sure it's going to work, but at least we're going to try. The great difficulty, is that people are so concerned about their discipline, and so

little concerned about the university.

Sharp: Is there a reason for that kind of preoccupation?

Revelle: I don't know, but maybe that's the way things have been going in the last few years in other places too. My son, for example, is a professor at Northwestern and a lot of the Northwestern faculty he doesn't know. They stick to their discipline pretty much. Here the problem is exacerbated by the lack of housing close to the university.

Sharp: There's no sense of real campus community.

Revelle: That's right. The other problem is there's no Telegraph and Bancroft, no Harvard Square. Anyhow, it ain't the same as Harvard. Another great thing about Harvard was the faculty club where people would go to have lunch from all over the campus. They have a long table there which seats about forty people, and you might sit next to anybody from any part of the university and talk to them, and it doesn't have anything to do with what you're supposed to do.

Sharp: At the Men's Faculty Club at UC Berkeley, that does go on.

Revelle: The same thing. That's true.

Sharp: And the Women's Faculty Club as well.

Revelle: Oh yes, very much so. Berkeley has a much more collegial atmosphere than we have down here.

Sharp: That's really true. When I was a graduate student here there was never anything. I never knew anybody else in history. I never had time for it.

Revelle: Whereas at Berkeley, I used to go to the faculty club when I was a graduate student in 1931, and I loved it. It was wonderful. It really made me feel part of the academic world. So this has been the great disappointment here, the lack of real spirit of the campus, of the university.

Sharp: When I was a graduate student, on Friday afternoons we would go down into La Jolla and drink beer together.

Revelle: Yes. TGIF. For a while they have had a celebration like that right on the campus every Friday after noon, right in front of the gymnasium, on that knoll there, with a band, a noisy band. You can hear them all over, and they used to have beer. There was some difficulty with that because of the age of the students these days.

Sharp: Yes, it wouldn't be selective enough.

Revelle: It's too bad too. I think they ought to all have beer. Maybe not too much, but some! On the Scripps ships we would always take several hundred cans of beer and in the evening we'd ration out one or two cans to everybody on the expedition.

Sharp: You used to have some pretty awful movies, from what I

learned, on the ships, that you would get movies. I'm not sure where you would get the movies.

Revelle: I've never heard of that. No one ever told me about that!

Sharp: Maybe you're not supposed to know.

Revelle: Well, I don't know, I may not.

Sharp: On MidPac there was that young high school student who wrote the diary, Ned Barr, and he was in the diary and he was writing about the different movies that were shown, but they were pretty bad, I guess.

Revelle: Well, there was nothing pornographic about them, they were just bad movies. I think those were mostly on the PCE(R); I don't think we had them on the Horizon.

Sharp: Now I don't remember which ship he was on.

Revelle: It must have been on the PCE(R). Navy ships always have movies. We just didn't have room on the Horizon.

Sharp: Well, it sounded pretty crowded.

Revelle: It was, particularly when we took all the scientific party from the PCE(R) on board.

Sharp: I think we've covered what I wanted to with respect to your years at Harvard, unless there're some other --.

Revelle: Things that you want me to say.

Sharp: Right. Now, you can think about them and we can start in the morning on picking up a few extra thoughts on Harvard if you'd like to.

Revelle: Well, I just want to say one other thing. We were very well accepted there, particularly Ellen. Most women eat their hearts out to belong to one so-called women's club; Ellen belonged to three of them!

Sharp: She had a lot of work to do then.

Revelle: Not really. It's not very much work, but it's a great honor to belong to them, and she had no problem at all. One of the reasons was we were outlanders. They didn't know anything about our social status. They just had to take us as we were. It's interesting that this closed Yankee society is so open to foreigners. That's particularly true of Harvard. Harvard is a place where people come from all over the world.

Sharp: And they are used to that.

Revelle: Yes, they are used to it.

Sharp: So she liked going there, she liked the meetings?

Revelle: She loved it. The only thing she didn't like was the summer

weather.

Sharp: She was telling me about that this morning. I guess it was too hot and very muggy in the summertime.

Revelle: She didn't mind the winter. I didn't like the winter. I was always afraid of falling down on those icy sidewalks.

Sharp: Well, she complained that you didn't dress correctly in the winter and that she did better in the winter because she did a better job of dressing for it.

Revelle: That's possible, but it didn't affect my feet. That was my real problem. Oh, I get cold too, I guess. I think what she wanted me to do was wear more long underwear!

We had a nice house just off Brattle Street, on Larch Road, right across the street from Endicott Peabody, "Chub" Peabody, the former governor. Right next to us on the south side was a house built about 1750, something like that. It had belonged to the same family for a long time. Next to them was Randall Thompson, the composer, and his wife.

Sharp: That was quite an interesting and illustrious neighborhood that you moved into.

Revelle: Yes.

Sharp: Did you get much time to associate with these people or were you very much confined in your work?

Revelle: We did quite a bit of entertaining. But I thought that was part of the job. So did Ellen.

This house that we were in was an Italianate house built by an Italian portrait painter, married to a woman musician. I was kind of reluctant to buy it because I was afraid people would say, "Those damn Californians don't like our New England architecture. They stick to their California architecture."

Sharp: It looked quite different than the houses surrounding?

Revelle: Yes that's right. But Ginty Snyder, Jack Snyder's wife, said, "If you don't buy it, we <u>will</u>." [laughing]

Sharp: So the race was on?

Revelle: So that made it kosher. It was a nice house.

Sharp: When you've moved like that, do you participate much in the setting up of it yourself, or is that left primarily to Ellen?

Revelle: Whenever we have moved I've always managed to be away somehow! She gets it done. This is not deliberate, but I'm away a lot and it just happens that way.

Sharp: When you were talking about your arrangements for 9 Bow

Street, getting the furniture and making the physical arrangements, I wondered if it was something that you liked to do with your own house, or something that was really left better to others?

Revelle: I like to have the right kind of paintings and engravings and things like that on the wall. I bought quite a few things like that, and objects d'art in general I bring back from trips, lots of trips. I don't do it so much anymore; we've got so much stuff already!

[gestures to window] For example, those things in that window down there are all things that I've collected.

Sharp: Where are they from?

Revelle: Well, the ones on top are from Crete, from Knossos. The ship in a bottle was something that Ellen had when she was a girl. But the ones on top, those funny, strange figures are Minoan, they are replicas of Minoan sculpture. The little object is a Ganesla, an Indian elephant god. The rest are just there by happenstance. The picture of the whale diving is one that was taken on a little one-day expedition I led a couple of years ago for a conference we had here.

Sharp: Off the coast here?

Revelle: Yes, off the coast here on the Ellen Browning Scripps.

Sharp: Did you take the picture?

Revelle: No. It's a very good picture. Far too good for me to take.

Sharp: The whale was really cooperating.

Revelle: Yes, he sure was.

Sharp: Or she.

Revelle: He or she. I'm sure the whales can tell, but it's very hard for people to tell the difference!

Sharp: Yes. **##**

I remembered after I left that you had mentioned the last lecture that you gave at Harvard when all the faculty came.

Revelle: Well, not all the faculty, but some of my friends came.

Sharp: We didn't really talk about it, but I wondered if you wanted to finish up a little with that. Since you had recalled it I wondered if you wanted to talk about it just a little bit and then we can go into some of the international topics.

Revelle: Well, there really isn't very much to say that I remember. I remember Nathan Kefitz particularly was there, and Bob Dorfman, Harold Thomas, and other people I'd been associated with. I guess we had a little champagne or cake afterwards,

maybe both champagne and cake, a typical little ceremony that they have at Harvard. But I don't really remember very much about it. They didn't say anything. They just listened, and then of course, as typical of most university classes, the class applauds at the end of the course, and then the faculty members joined in. What I do remember was that the class kept getting bigger and bigger each year. The last class was the biggest. It was about 300 students.

One of the things that Ellen and I started, we used to have a class party for the students, but it was surprising how few of them came. We'd give two parties, two successive nights, so they could fit it into their schedule. Usually no more than eighteen or twenty came to one of these, so about forty altogether, not much more than 10 percent. We used to give these parties in 22 Plympton Street, which was one of the two little houses that we had for the Center for Population Studies.*

22 Plympton Street had been the headquarters of the Crimson (the Harvard student newspaper), but they moved out and we took it over. It was right on the other side of the parking lot from 9 Bow Street.

My secretaries would work pretty hard to get refreshments and beer. I don't know whether we had wine or not, but I know we always had beer to drink. I think we had wine too. It was a very pleasant evening. We would have one of these lantern slide projectors that would automatically show a series of slides on the screen and sometimes a little movie.

Sharp: What kind of slides were these?

Revelle: Well, slides of Pakistan or pictures Peter Rogers had taken in India and Bangladesh.

Sharp: Do you think the students were just too shy about coming?

Revelle: Well, they weren't used to socializing with faculty members.

Sharp: It's pretty awkward if they're not used to it.

Revelle: Yes. They just didn't believe any professor would do that. So it was partly disbelief. I don't think they were shy. Harvard students are never shy that I can see. Some of them disapproved. They seemed to think that there should be a distance between the professors and the students.

Sharp: That that should remain even outside of class.

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*Ellen Revelle Eckis added this note during her review of the transcript: "Just for the record -- we had these parties at our house, too, which Roger apparently forgot -- before Christmas. And I always helped to decorate for the Christmas parties at Plympton). Transportation was probably why we changed from house to office -- more convenient for the students."

Revelle: Yes. Of course, that's not true with graduate students. These were undergraduates. But I think Ellen enjoyed those and I enjoyed them, those little student parties. You could get to talk to the students about their concerns and not about the course.

Sharp: What were some of their concerns?

Revelle: Oh, money and getting through. You know what they are.

Sharp: Sure, grades and all that.

Revelle: Grades. Sex. They usually didn't talk much about that.

Sharp: No, probably not. [laughing]

Revelle: They were also interested in conversation about world problems and intellectual things quite a bit. They didn't let their hair down at all.

Sharp: The students that came to the parties, were they generally students you had already met through some other way?

Revelle: No, they would introduce themselves. I have a very poor memory for student names. I have to ask them every time what their name is.

Sharp: Especially if there're upward of 300 in the class it's nearly impossible.

Revelle: Yes.

Sharp: Well, I think unless there are some other thoughts that you have about Harvard, we'll get right into the international area.

Revelle: All right.

II THE WHITE HOUSE-INTERIOR PANEL ON WATERLOGGING AND SALINITY, WEST PAKISTAN, 1961

Background

Sharp: We need to first of all talk about the White House panel and lay out that pretty clearly, what exactly you were supposed to do as the chairman.

In 1960 I had seen that there was something called the Indus Waters Treaty between Pakistan and India. Part of the treaty had created a development fund, as I understand it, with money from the United States, from the World Bank --.

Revelle: The Aid to Pakistan Club.

Sharp: Right. And several other organizations.

Revelle: The Aid to Pakistan Consortium I guess was the official name of it. That was the United States, England, France, Japan. I think West Germany was in it. Canada I'm pretty sure, the western powers.

Sharp: Within a year or so President Khan contacted President Kennedy.

Revelle: President Ayub Khan. Not Khan. Every Pathan is named Khan. Actually his name was Mohammad Ayub Khan. Why don't I start on how that happened?

Sharp: Okay.

Revelle: When Kennedy came into office, he appointed as his ambassador to India John Kenneth Galbraith. His ambassador to Pakistan was, as I remember it, a professional diplomat.

Ayub Khan had fairly recently taken over the Pakistan government in a military coup. He was the so-called martial law administrator. In that position he also named himself president of the country. As I said yesterday, he was a big man who had gone to Sandhurst like most high-ranking officers in both the Indian and the Pakistani army. They all knew each other very well. They had all been members of the same army before partition.

It must have been very much like the situation in the United States at the time of the Civil War. All these guys had gone to West Point together and knew each other very well and liked each other, but they were professional soldiers so they were willing to fight each other if they had to.

I'm not quite sure about this, but it may very well be that during the Eisenhower Administration we had given military assistance to Pakistan on the theory that they were in the front line against the Soviet Union.

John Kenneth Galbraith advised Kennedy strongly not to give military assistance to Pakistan, or to give the minimum amount, because he said what those guys are really looking for is to fight India, not to fight Russia at all, that they would use these armaments to fight India.

At that time the Pakistanis were pretty cocky. They thought that they were such superior soldiers to the Indians, that even though they were a very much smaller country they could defeat the Indians in a real battle, in a real war. They have subsequently learned that that is difficult, essentially impossible. The Indians are so much more of a country than Pakistan.

So when Ayub Khan came to Washington he actually made a speech before Congress. It was very well received in Congress, but Kennedy said that he would not give him arms, but he said, "We would be glad to help you out in any other way."

Abdus Salam, the Pakistani then-retired physicist who later won the Nobel Prize, who as on the faculty of the University of London, and Jerry Wiesner had talked together either before this visit or after. I think they must have done it before the visit, in preparation for the visit. Jerry Wiesner was President Kennedy's science advisor.

They had talked about the problem of waterlogging and salinity in West Pakistan as a serious problem. Jerry felt that this was something that maybe the Americans could help with a solution to.

So when President Kennedy turned down Ayub Khan's request for arms but said we'd be glad to help out in any other way that we can, just name a problem, Abdus Salam had told Ayub Khan that in fact the Americans would be very happy to help out with the waterlogging and salinity problem. So Ayub Khan said, "Well, we do have this problem. Our agricultural lands in West Pakistan are being destroyed by an accumulation of salt in the soil and the water table rising to the surface."

"Waterlogging and Salinity"

Revelle: "Waterlogging and salinity" they called it. Which happens to all irrigated lands where you don't have proper drainage. It's a universal consequence of irrigation without proper drainage. And Kennedy said, "Well, that's just the kind of problem my science advisor can solve." [laughing]

Jerry Wiesner had a staff, two people whom I knew particularly well. Gene Skolnikoff and Bob Kriedler Skolnikoff is now a professor of political science at MIT, and Bob Kriedler runs his own foundation. He was vice

president of the Sloan Foundation for many years. Two very nice, competent young men.

I was just coming on board. I wasn't actually there yet, but it was planned that I would come to the Department of the Interior as Stewart Udall's science advisor. Jerry said, "Well, obviously Roger is the guy to solve this problem. He's an oceanographer, so he knows about salt. He's the nearest man we know of that we have any control over who might know something about the subject." I, of course, didn't know anything about it at all. Nothing, nothing. Zero, zero.

Harvey Brooks, being Jerry's assistant, knew about the Harvard Water Project and he recommended members for the panel we were about to form. Among them Harold Thomas and Bob Dorfman who had been the leaders of the Harvard Water Project and had applied systems analysis, particularly linear programming, to water resource problems. So that part of the panel was already sort of pre-selected, Thomas and Dorfman. I think they also selected a couple of other people. Leonard Katz and Bob Gomer was a professor of chemistry at Chicago. [refers to list]* Yes, Bob Gomer, Leonhard Katz, Bob Dorfman, and Harold Thomas were all sort of pre-selected by Jerry and Harvey. One of the people in Jerry's office was a man named George Lukes who became our staff officer. Then the rest of the panel was mostly selected by me or by the small group that started with it.

Sharp: Just suggesting different people for it?

Revelle: Yes. Tom Maddock. Richard Reeve. Charlie Bower. Maybe Ayers Brinser, who was a sociologist, he may have come from the original Brooks' nominations.

I selected Rollin Eckis who was then president of the Richfield Oil Company, my oldest friend. We went to Pomona College together.

This membership on the panel was more or less rammed down the throat of the Agency for International Development by the White House, but AID insisted on having a member on the panel because they said the main problem was administrative. So they appointed John Blandford who was a consultant to AID. He must have been about seventy at the time. He was supposed to be an expert on administration.

I got John Isaacs to come aboard. He was my idea man at Scripps. He had been assistant director. He literally produced one idea a week all his life. A fantastic man.

Sharp: That's the kind of assistant to have.

Revelle: And we got Cecil Wadleigh from the Soil Conservation Service. He was our only real agronomist. David Todd was a hydrologist, a professor at Berkeley, a specialist on ground water. Herb Skibitske was a modeler with the Geological Survey, a hydrological modeler. He used analog computing rather than digital computing. He built big models of

John Dove Isaacs III, Papers 1943-1980, 82-84, Box 25, "Pakistan Draft Report, Sept. 1962, Chapter 1-2," SIO Archives, UCSD.

PRESIDENT'S SCIENCE ADVISORY COMMITTEE

WHITE HOUSE - INTERIOR PANEL

ON WATERLOGGING AND SALINITY IN WEST PAKISTAN

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irrigation systems with electric circuits representing the different canals and the different dams. Condensers separated the dams and flashing lights! I never really understood it very well.

Sharp: It sounds like something AID might have liked to see.

Revelle: Probably, yes. Well, it was an old-fashioned method for studying water resources systems. These have lots of interacting relationships with each other.

For example, suppose you put water into a canal, you've got to be sure that it gets into the fields, it just doesn't run out the other end of the canal. You only put in so much water. The problem with a dam in over-season storage is that you never know during the season how much water you're going to have from rain and runoff. So they have to be careful not to empty the dam too soon, but on the other hand to have a lot of room in the dam in case they have a flood.

It's amazing how complicated and difficult these decisions are, and they have to, of course, be robust, the system has to be robust so you can take account of large variations which you can't predict.

Michaels, I don't remember him very well. I'm not sure that he was much involved with the panel. Bower and Reeve were at the US Salinity Laboratory at Riverside.

So if you look at this list, you can see that Blandford Bower, Langbein, Lukes, Maddock, Reeve, Skibitske, and Wadleigh, were all government servants, civil servants, in the Geological Survey or in the Department of Agriculture. Revelle, Brinser, Burden, Dorfman, Gomer, Isaacs, Michaels, Thomas, and Todd were all university types, university faculty members. And than Eckis and Blandford and Katz were from industry, outside universities anyhow. It was a rather mixed bag of twenty people.

The panel was, as I say, assembled. I didn't choose them. I chose some of them. Harvey Brooks chose many of them. We first met in Washington with the engineers who were working on the developments under the Indus Waters Treaty.

We must say a word about the Indus Waters Treaty. At the time of partition, one cause for conflict that was real and serious was the fact that the headwaters of all the streams that irrigated the Indus Plain rose in India, all the tributaries of the Indus River.

Geographical and Historical Notes on the Indus River Area

Sharp: I brought this map. That's from your article. It helped me to visualize. [brings out map]*

Revelle: Well, let's just look at it a minute. This is the Indus

Roger Revelle, "Mission to the Indus," New Scientist 17(1963) 340.

Mission to the Indus

One of the most remarkable exercises in international cooperation in science has been the work of a panel of American scientists who have studied the irrigation system in West Pakistan and come up with far-reaching proposals for improving the agriculture of that country. This special article is by the Panel's chairman

by Dr Roger Revelle
Science Adviser to the Secretary of the US Department of the Interior

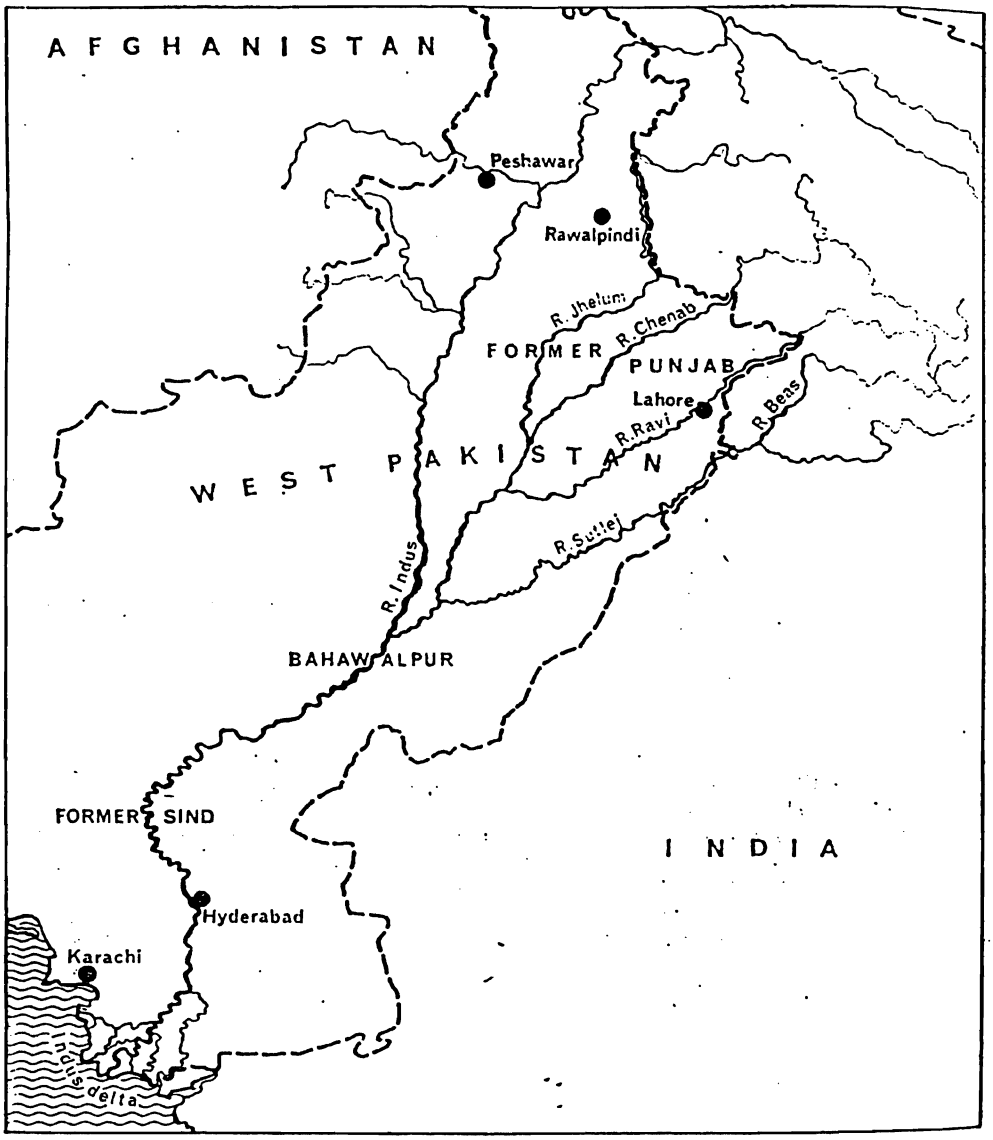

FIGURE 1. *The Indus and its tributaries—an early centre of civilization, but today a "less developed area".*

IN 1961, President Ayub Khan, of Pakistan asked President Kennedy to send a group of scientists to study the problem of waterlogging and salinity in West Pakistan, which was throwing large areas of farmland out of cultivation or greatly reducing the yields. Dr Jerome B. Wiesner, President Kennedy's Special Assistant for Science and Technology, appointed a panel of 20 specialists from many disciplines in the natural, agricultural, engineering and social sciences. The panel analysed the problem in detail, aided by graduate students at Harvard, where a great deal of digital computing was carried out—indeed some of the students said that, for a while, the Indus river flowed through Cambridge, Massachusetts. President Kennedy recently sent our report to President Ayub Khan. In it we gave our opinion that waterlogging and salinity must be attacked as part of a broad approach towards a large and rapid increase in agricultural productivity. What began as a study of a specific problem led logically, in our interdisciplinary analysis, to a plan for the development of West Pakistan, requiring unprecedented effort from the people of that country.

When Alexander the Great marched across the wilderness 2300 years ago, and came to the Indus, the greatest river he had ever seen, civilization had already existed there for 2000 years. The river gave its name, which simply means "river," to a sub-continent and to a religion (also, by one of the monumental confusions of history, to the early inhabitants of the Americas).

The flood plain of the Indus and its five great tributaries—the Jhelum, the Chenab, the Ravi, the Beas and the Sutlej—bearing the melted snows and monsoon rains from the Himalayas to water green ribbons of floodland, was naturally a place where farmers would settle and which conquerors would covet. The last of these, the British, worked a transformation of the land. There had been some great irrigation works before, but nothing compared with the barrages and 10 000 miles of canals which, beginning in the mid-19th century, the British engineers created in the Punjab and the Sind. British administrators encouraged hundreds of thousands of farmers and their families to immigrate into the newly watered lands; each farmer was allocated fifty acres, and a grid-like pattern of villages was built to house the new "canal colonies".

The development of irrigation is continuing today. Under the Indus Settlement

here. The Indus is a wild river, a big river, that rises in the Himalayas somewhere back in here. It carries a large load of silt from the Himalayas. It was hardly developed at all until you got way down here into the Sind. On this side of the river is a large desert, the Thar Desert [spells it]. Then coming into it are rivers coming from Afghanistan whose names I can't remember now, but there are two or three rivers from Afghanistan that come into the right bank of the Indus.

On the left bank of the Indus there are five streams, the Jhelum, the Chenab, the Beas, the Sutlej, and the Ravi rivers. The fact that there are five of them gives the name to the Punjab. "Pun" means simply five and "jab" means river. So Punjab is the Land of the Five Rivers. Beas, Sutlej, Ravi, Chenab, and Jhelum, all of which come into the Indus down here together at the northern end of the Sind, in a region called Bahawalpur. The Sind is down here below Bahawalpur.

These streams, including the Indus, have been used for irrigation for thousands of years. The so-called Harype or Mohenjedan civilization, 2000 B.C., one of the earliest civilizations, about the same age as the beginning of the Chinese civilization, had what are called inundation canals. They simply dug ditches from the river and during the monsoon season these canals would fill up. They would irrigate a zone about ten miles wide on each side of the river.

During the nineteenth century, beginning about 1880, the British started putting in what they called barrages. A barrage is a low dam that doesn't really store much water, but raises the level of the river. The river is flowing like this [gestures movement], you put this barrier in the way and in order for the river flow to continue the river has to rise, so it flows over the barrage or through the barrage, through the gates of the barrage, or around the end in some cases.

In general, it's a low dam going all the way across the river with gates in it. Then during the monsoon or whenever the river was high, these barrages would divert water into big canals, huge canals. Some of the canals were as big as the Colorado River, 15 million acre feet. Mostly they are not quite that big, but 10 million acre feet was a typical flow, the amount of water that they'd carry during the course of the year. They were as much as a hundred yards wide and about 10 feet deep. You come across these things, it's just like coming to a river.

Then the canals would branch off into what they called tributitaries and then into minor canals. I guess the tributaries were the last ones. Major canals, minor canals, tributaries, and then the actual diversions into the farmers' fields.

For the diversions into the farmers' fields, the water was taken from the distributaries through a small gate about two or three feet wide that the farmers managed themselves.

The tradition was that they would build their own watercourses. Each watercourse irrigated about 400 acres and the average size of a farm was around five acres, so it had to be a whole group of farmers who together operated these watercourses.

Typically, it made an awful lot of difference which end of the water course you were on. If you were out at the tail end you were liable not to get any water because the farmers at the near end would take it all, and put it on their fields before it got to the far end.

The distribution of the water was fairly corrupt, a lot of bribery. Having a friend who was the water engineer made a lot of difference, things like that. The rich farmers of course always got the best of it, and the poor farmers got the bad end of the stick.

In any case, the British moved into this area hundreds of thousands of Indians, mostly Sikhs, but quite a few Muslims too. Muslims and Sikhs, from other parts of India, not only from Attar Pradesh and the eastern Punjab but from and other poor parts of India. They established canal colonies, in typical British fashion on a grid system. So here's a canal colony, a village. Here's another one two miles away, and here's another one two miles away. Here's another one two miles away, over this vast plain of the Punjab. It's like driving over the ocean. It's flat, a sea of green, not blue, green, but a remarkable sight, hundreds of miles of flat country, flat flood plain.

This worked fine for twenty or thirty years. The Punjab became known as the bread basket of India. They mostly grew wheat. **##**

And it was true, the water table rose because the canals leaked. The water table was originally about 100 feet deep in the centers of these doabs, these plains between the rivers. [spells doab] They have names which they take from the rivers on the two sides. For example, this doab is the Chas doab, between the Jhelum and the Chenab. This one is between the Ravi and the Chenab. I can't remember the name of this one. Between the Ravi and the Sutlej there was still a different name. I'll think of this in a minute. I'm not sure I can think of that one. Bari. This is Bari doab. Between the Beas and the Sutlej, this area between the Sutlej and the Beas, this whole area was Bari doab. The Sutlej never got its name into the act, but the Ravi and the Beas did. [referring again to materials] I don't remember the name of this one for the moment.

The capital of the Punjab is the city of Lahore, the famous old city of Lahore where many Indians, as well as Pakistanis, grew up. It was a Hindu and Muslim city and they lived in fairly good, peaceful relationships with each other.

The first non-Indian to see this country was Alexander

the Great, who came from the West and crossed the Indus. There was a man on the other side of the Indus named Parus, a local king, a local ruler, who opposed Alexander with an army of elephants. They were like big tanks, and the Greeks were scared to death of these elephants. What Alexander did was to cross the Indus several miles to the north of where Parus and his army were lined up, come around in back and poke the elephants from the rear and drive them into the river. So he defeated Parus.

Parus was brought to him as a captive. Alexander said, "How do you wish to be treated?" and Parus said, "Treat me as a king." Alexander was so struck by what a proud and good man he was that they became allies, and they were allies together for the rest of the time Alexander stayed in India.

He probably got as far east as the Ravi River and camped there. He was planning to go across India because had heard there was an ocean on the other side of India, but his troops mutinied. They said, "We're tired. We want to go home." [laughing] Alexander apparently spent three days sulking in his tent and finally said, "Okay, if you want to go home I guess we better go home."

So then they sailed south down the Ravi to a place called Multan, which is an ancient city. It's still there, thousands of years old. Alexander stormed the city and captured it, but in the process he was badly wounded. He never really recovered from that wound.

They continued down the Ravi to this area here which has a special name where the rivers come together, and then finally into the Indus, and from the Indus into the Arabian Sea. They had rafts that they sailed down the river with, and they built boats.

He divided his army into two. Half of them went by sea along this "Mukran" coast and half of them went overland. They suffered terribly because it was a terrible desert country. Both the sailors and the land party had a very hard time. When they finally rejoined each other in the Persian Gulf -- if you keep on here long enough you get to the Persian Gulf -- Alexander didn't even recognize his admiral, the admiral was so weather-beaten and so worn down. Alexander only lived about six months after that. He died there in the Persian Gulf.

Sharp: From the wounds?

Revelle: Well, that's what I think, but different people say different things. Lots of people of course took a very dim view of him and they say he drank himself to death, but I think he died of wounds from the Battle of Mukran.

Move the Water, Increase the Nitrogen, Raise the Yield

Revelle: Anyhow, coming back to the situation when we started on this project. The water had risen in all of these doabs

up to very close to the surface, as you can see from this picture here. [refers to materials] The water table was always right at the surface under the river, but between the river, where the canals were, here's the river, here's the river [pointing], a lot of these canals were put in all the way across that country, in between the rivers. All of them leaked and the water table rose.

Well, you can see the canals. Here, these little lines are supposed to be the canals. The water table rose under each one of these canals, and eventually, all the way across the doab, the water was only a few feet below the surface. The aquifers had just filled up, the sponge had just filled up right close to the surface. The water then rose by capillary action to the surface. The water evaporated, and the salt in it accumulated on the surface. They had crusts of salt on the surface, or near the surface.

It was a devastating sight to see it from the air. You would fly over this country. These canal colonies which were on this grid system looked as if they had been struck by a disease of some kind. Some of the villages had just literally disappeared, in others there were just a few houses left. What had happened was that the farmers had been starved out. They couldn't grow any crops in this salty soil. And large areas were flooded. There was standing water over very large areas.

Jerry Wiesner was along on that first trip. We went there in September of 1961. We met with Ayub Khan, and we were very well entertained by Zulfikar Ali Bhutto, who had a beautiful Persian wife, and his daughter I later taught at Harvard, Pinky Bhutto.

We were entertained by Malik Amir Mohammed Khan, meanwhile the governor of West Pakistan. I'll show you a picture of him. Let me repeat his name: Mohammed Khan, the nawab of Kalabal and governor of West Pakistan. He was about my size and so was Ayub Khan, for that matter, the nawab was well over six feet tall, a heavy-set man, dressed in Punjabi costume, baggy pants and a shirt sort of like this, only not fancy decorated and a turban. He always wore a turban; he had a huge mustache.

He was a university graduate and a specialist in agriculture, an expert in agriculture, also a violent feudal lord. He was, eventually killed by his son, murdered by his son. But he had murdered lots of people himself, killed lots of people. He was a tyrant, a dictator, in Kalebagh but he was Ayub Khan's representative in West Pakistan, the governor of West Pakistan. He entertained us in the governor's palace in Lahore.

Ayub Khan himself lived in Rawalpindi, in the military camp there. He never got over being a soldier.

We took a trip across the Punjab in a series of jeeps I think provided by the local AID organization. One of the two memories I have of that first trip is that we were scared to death by the driving, it was absolutely awful.

Sharp: Very fast and reckless?

Revelle: Yes. Well, the roads were essentially one-way, paved roads, just wide enough for a car. Two cars would approach each other on this road playing chicken, and one of them had to give. They were both going about fifty miles an hour. One of them would pull off to the side, and they would invariably pull off on the windward side, with the result that after they got by there was a cloud of dust on the road, and if there was another car coming you couldn't see it. It was awful! [laughing]

And as I said earlier, we were lucky to survive. We stopped for water after an hour or so. John Isaacs and John Blandford came up to me and said, "Can't you do something about these drivers? We're scared to death." [laughing] They were green around the gills and white as sheets.

Sharp: And you were scared to death as well?

Revelle: I just assumed that was the way it was. I wasn't going to do anything about it, but when they said they were scared too, then I had to be a leader and I had to do something about it! So the driver slowed down a little bit after that.

Sharp: You talked to him or did he figure it out by the way you looked?

Revelle: We talked to our Pakistani guides and sort of mentors, and they talked to the driver. But literally this cloud of dust would just completely obscure the road from the driver that turned off. They would always turn off on the windward side.

Then the other thing, which was much more important and really this was the fundamental discovery we made, we stopped at a farm and Charlie Bower, the director of the Salinity Laboratory of the U.S. Department of Agriculture at Riverside, picked a leaf of corn, which they call maize, because the British word corn means simply grain of any kind, and he studied this leaf for about five minutes.

He looked up finally and he said, "This corn is not suffering from salt in the soil; it's just not getting enough nitrogen. The leaf shows that it's very deficient in nitrogen." Well, that was really the payoff for the whole project, as I realized as time went on.

Most of the rest of the panel took the waterlogging and salinity problem very seriously. These idea men -- Gomer, Katz and Isaacs particularly -- had lots of ideas for getting rid of the salt, like sucking it up with porous sheets.

Sharp: And the tube wells and all the rest of it?

Revelle: Well, not the tube well. The tube well is the way to do it, but they had lots of other ideas, like sucking it up with plastics or with special salt-loving plants, various things like that.

They were full of interesting and useless ideas! They were all just a bloody nuisance on the panel, even my friend John Isaacs, because they thought there ought to be a lot more research

on different ways of getting rid of the salt.

Sharp: But the real issue that the nitrogen fed to the crops was inadequate?

Revelle: Exactly. It wasn't a salt problem at all.

There were two real problems. One was the water supply for the farmers. It wasn't that the farmers had too much water. It was that they weren't getting enough water because so much water leaked from the canal system into the ground. Besides this corrupt system of distribution. The other problem was there wasn't any fertilizer and the crops were sort of standard, old-fashioned varieties that got along without much fertilizer.

But there was also a problem with the waterlogging and the salt in many areas. AID had been conducting an investigation of this, with the U.S. Geological Survey, for several years.

For a long time people had tried pumping down the water table with wells, drilling what were called tube wells which are big wells inside a casing, inside a steel pipe. You put a pump down there at the bottom of the hole and you pump out the water and spread it on the surface and let it evaporate.

It was thought that this would somehow lower the water table. But they'd never done it on a big enough scale. They had done it in areas maybe one or two or three miles across, in diameter. The result that water flowed in from the sides, As fast as they pumped it out from the center, it would flow in from the side. So you got no effect at all. It was sort of like trying to pump water out of a bathtub. You could make a dip with the water here and put the water over here, and it would just flow right back again.

So the big thing that Harold Thomas and Herb Skibitske did with their linear programming and their mathematical analysis was to show that you had to do this over quite a big area in order to actually lower the water table. An area which was big enough so that you pump water out faster than it flowed in from the sides.

You see, there's a relationship between area and circumference. The area goes at the square of the radius and the circumference goes at the first power of the radius. So if you have a circle just one mile in radius, the circumference is $2 \pi r$, which is six miles, and the area is πr squared, which is three miles. Six miles in circumference and three square miles in area.

But now suppose you take an area ten miles in radius. $2 \pi r$ will be sixty miles, but all of a sudden the area becomes πr squared, which is 300 square miles, do you see? So that area goes up a hell of a lot more rapidly than the circumference does. You go to 100 miles, πr squared is 30,000 square miles and the circumference still is only 600 miles.

Sharp: So if you're pumping the water out, and it spreads out --.

Revelle: You just put it on the surface and let it evaporate, but the

area relative to the circumference grows very fast. You pump out a lot more water, of course, but compared to the amount of water that flows in, it's very much greater.

Well, the great virtue of doing this was that the farmers got about 40 percent more water. It really did three things. It washed down the salt because they would pump out more water than would evaporate, so some of it would run back, and that water that ran back would carry the salt with it out of the soil into the underground. It would lower the water table because water evaporated at the surface, which it wasn't able to do when it was below the surface. You spread it out on the surface and the water would evaporate and therefore you had less water. The third thing was that they could use that water for irrigation. So all the water went through the crop plants. The plants, of course, just flourished. For the first time in their lives they were getting enough water. It was amazing what a difference it made.

In addition to that, we thought it was absolutely essential to add fertilizer and to get better seeds. It was just about this time that Norman Bulary was coming up with his improved wheat varieties. He came out there and talked to the Indians about improved varieties, and also to the Pakistanis.

What these improved varieties did, there was nothing magical about them, they were just very responsive to fertilizer. The reason they were responsive to fertilizer was that they could hold their heads up. They were so-called dwarf varieties. You see, you would get a big head of grain without the plant just falling over on its side, lodging, as they call it. Really what the miracle wheat is all about is that it doesn't lodge, it doesn't lie over on its side, therefore you get much more grain. All the nitrogen that you put on it goes into grain. There are many other things about these improved varieties. The architecture of the plant is such that it gets more sunlight and things like that, and its genes are resistant to disease. A lot of good qualities are built into these grain revolution cereals.

Anyhow, all of this worked at once. They began to use fertilizer, the farmers dug the tube wells, they got the better wheat varieties.

The ultimate result was that in about ten years the wheat production doubled in West Pakistan, it went up 7 percent a year for ten years, which means doubling. It was a great success agriculturally during that time. This was, say, from 1963 to, say, 1973.

Sharp: Did it take a lot of convincing of the local farmers to use so many different new things?

Revelle: That was one of the interesting things about it, and this was where we made our great mistake. We thought that the farmers were a bunch of ignorant slobs! And they were. Most of them couldn't read or write. They were illiterate. But as somebody said, although very few Pakistani farmers can read or write; most all of them can figure, and they could tell whether they were going to make a profit or not. So prices are tremendously important to farmers.

They immediately saw the virtue of the tube wells. Our recommendation was that there should be these so-called climate controlled reclamation projects, so-called "scrappy" areas of one million acres which should be pushed one at a time by the government, drilling a thousand tube wells, bringing in fertilizer and better seeds and agricultural extension and the works.

The farmers drilled 70,000 tube wells all by themselves! And the reason that they did was, the wells were so profitable. You could get two crops instead of one. The water was under their control. They didn't have to bribe some damned engineer to get the water. They could use the water when and where they wanted to use it. It made all the difference in the world to have those wells.

Not all the farmers did it, of course. There were something like 10 million farm families in the Punjab, but a lot of them did, and then they would sell water to their neighbors. It was capitalism not gone wild, but working very well.

Sharp: And did they use the fertilizer and the new seeds?

Revelle: Sure, of course. They used everything.

The basic thing that we did was really quite simple. We said -- it isn't really quite true but it's pretty true -- that the Punjab could be like the Imperial Valley of California. It was one of the great agricultural resources of the earth. All they needed to do was to modernize their technology and it would blossom like the rose. And it did.

In other words, our main message was a message of self-confidence, there was no real problem. The problem was just improve your technology and take advantage of the water.

There were many different aspects of this. One was that we tried to make economic analyses, Bob Dorfman particularly, and Wally Falcon too, showing what was necessary for a profitable agriculture. That was quite a useful part of the report.

The problem of the Sind was far different, and I don't think the problem of the Sind has been satisfactorily solved to this day. In the case of the Sind, the groundwater was salty, like it is in the Imperial Valley of California. So you can't use the tube wells, in very large areas at least. You're just pumping salt back up. That means the only kind of drainage you can have that makes sense is what's called horizontal drainage; that is, carry off the irrigation water to someplace else, where you're not farming.

In principle, it should be carried to the Arabian Sea or to the Thar Desert in the area between India and Pakistan. There were some big lakes in the Sind and you could do something with those lakes. You could mix the water to some extent, the river water with the ground water, and use the mixture.

Sharp: Just to reduce the salinity?

Revelle: Yes. But in general, there was no simple solution like there was in the Punjab. The other problem was that the farmers were not

anywhere near as good. The Sind had traditionally consisted of big landed estates with agricultural laborers, whereas in the Punjab there had been these canal colonies with many, many small farmers, independent, small operators. A big farm in the Punjab is fifty acres.

Sharp: So they really were small farmers.

Revelle: Yes. Two or three hundred acres was really quite big. Whereas in the Sind, the Bhutto family had thousands of acres, for example. But you remember I told you yesterday that I spent a very bad morning with Bhutto because he was a Sindi landlord and he said we had to make recommendations about the Sind too.

The reason this was important was that our advice had a lot of effect on AID and on the World Bank. So he didn't give a damn whether our advice was good or bad, as long as we said something.

Sharp: So that they got the funds?

Revelle: Yes. I took a very dim view of him, particularly after that morning. It was just like being in the office of a Boston politician, little men running in and out with handwritten messages and Bhutto making decisions all the time we were talking, dozens of sort of errand boys coming in and out, mostly fat little men.

He was very much like the famous mayor of Boston, Mayor Curley. Bhutto was about as close to Mayor Curley as you could get and be a Muslim instead of a Catholic.

Anyhow, we spent quite a lot of time working with Pakistani engineers and technicians in an organization called WAPDA, the Water and Power Development Authority of West Pakistan. The head of that organization was a man named Ghulam Ishaq Khan. He was a Rathan, as you could tell by his name being Khan. G-h-u-1-a-m I-s-h-a-q, no u, just I-s-h-a-q.

In the Arab language somehow they don't put a u after a _q. (For example, qereshi will be q-e-r-e-s-h-i. It's a k sound.)

He was about the smartest guy I have ever known in my life. A wonderful man. He was until recently at least, in effect, the prime minister of Pakistan, the chief advisor to the marshal law administrator, General Zia. He became president of the Bank of Pakistan, which is sort of their treasury department and he has held a succession of very responsible, supervisorial [positions], running the country in one way or the other, after he left WAPDA. He is now the President of Pakistan (1989-1990).

He would sit on one side of the table and the panel members who were there would sit on the other, and he all by himself was the equal of all of us together. He was just incredible. He knew so much about it. He had a degree in botany from the University of Lahore. He was not an engineer, he was just a very good man, a conscientious, thoroughgoing, completely patriotic administrator. On one occasion we drove together from Randipuhr to Lahore. ##

This was a day-long trip. So we had a lot of chance to talk

and we got to know each other. I never met his family. His wife was in Purdah. She just never appeared at all at public events. Some of the wives did. Bhutto's wife, this beautiful red-haired Persian, did appear. Everybody was very much smitten by her.

Sharp: Did they like her better than they liked him?

Revelle: Oh yes, sure, naturally. She was and is a very good person. She's sort of the head of his party now in Pakistan, although I think she's been very ill lately, and it's really my student Pinky Bhutto who leads the party. She was a nice girl but no genius, no intellectual giant. She wasn't stupid either, but she was about a B student.

"The Revelle Report"

Revelle: After this first trip to the country, we went back and got all the data that we could about Pakistan, and our report had a hell of a lot of data of all kinds about the country. It's called the Revelle Report. We spent about two or three years writing it.

Sharp: I have seen several drafts. I think I sent you one of the drafts.

Revelle: Yes, you sent the summary of one of them. In the end it was just a small group of us who took responsibility for it. That was Thomas, Dorfman, Burden, Falcon, Peter Rogers, and I. One of the reasons for that was that Katz, Isaacs, and Gomer had all these what I thought were completely wild ideas about how to get rid of the salt, which we ignored.

We thought we had a solution and we just talked about the tube well solution all the time, which was a perfectly reasonable and adequate solution. We didn't need all these fancy things, like spreading asphalt on the surface and growing fish or something like that. That was John's idea.
[brief tape interruption]

Jerry Wiesner by this time, I guess had left. Daniel Dunning was President Johnson's science advisor. Is that in one of the letters here somewhere?

Anyhow, in the long run the last letter was from Johnson to Ayub Khan -- of course written by us or by somebody in the science advisor's office.

Here it is here. Well, this is from Kennedy.* [reads from JFK's letter] "The most far-reaching conclusion of the panel was that waterlogging and salinity must be attacked within the context of a broad approach toward a large and rapidly increasing productivity. This can be done by an integrated application of all the factors of agricultural production, combined with sustained human effort and sufficient capital investment to attain momentum and improvement."

We recommended that they concentrate on a million acres at a time. That was based on our bias in favor of government action. What actually happened, as I said, was that the farmers drilled

COPY

THE WHITE HOUSE

Washington

August 9, 1961

Dear Mr. President:

Since your visit, we have been hard at work on the problem of waterlogging and salinity in West Pakistan; and I thought you would like to know where we stand.

A panel of experts was assembled shortly after your visit to Washington to examine the possible solutions to both the technological and economic problems of waterlogging and salinity in West Pakistan. Dr. Jerome B. Wiesner, my Special Assistant for Science and Technology, and some members of the panel have had the opportunity to discuss the scope of the problem and our plans with Dr. Abdus Salam. You may wish to hear his report upon his return to Pakistan. We have also had the benefit of guidance from men on the U. S. Operations Mission of our International Cooperation Administration in Pakistan, who know the plans of the West Pakistan Water and Power Development Authority, who happened to be in the United States during the past few weeks. The panel has thus had an excellent opportunity to learn the past history of the problem and to hear about the technical approaches now contemplated to control waterlogging and salinity.

We have also enlisted the direct interest of Mr. Udall, my Secretary of Interior, and of his science advisor, Dr. Revelle. Specialists from our Bureau of Reclamation, Geological Survey, Department of Agriculture, and other United States Government agencies have joined forces with scientists and engineers from Harvard, the Massachusetts Institute of Technology, and the University of California to study your problem. Among the group are men who are pioneering in the development of new methods of analysis of complex hydrologic, agricultural and economic problems. They are convinced that a solution to your problem in West Pakistan can be very helpful in providing a solution to similar problems in this country.

We have tentatively identified four major areas of concern which should be studied concurrently:

First, a comprehensive and, to the extent possible, detailed analysis of the probable effects of different proposed systems for combating waterlogging and salt accumulation in the soil, and at the same time increasing the supply of irrigation water, with the objective of identifying the best and most practical system. Our panel is now beginning such a comparative analysis of the alternatives, based on all available data.

Second, an examination of applicable irrigation techniques and management plans for the Rechna Doab area in which wells are now being installed. The West Pakistan Water and Power Development Authority's No. 1 project in Rechna Doab will provide a means of checking the analytical studies as well as the efficacy of the tube well approach. Experience in our western states indicates that problems of irrigation management increase greatly in scope and complexity when ground water pumped from wells is used in conjunction with canal water for irrigation. It may be necessary to modify the water courses and to build diversion structures to handle the additional water from the wells. I am told that it will certainly be necessary to devise methods for scheduling water delivery, both from the canals and the tube wells, for collection of revenues, for operation and maintenance of pumps, and for guidance to farmers in productive application of the increased water supply. The problem of management will be complicated by the necessity both to lower the water table and to increase and stabilize the water supply for irrigation.

Since the West Pakistan Water and Power Development Authority's responsibility for construction will shortly be completed, you may wish to consider as soon as practicable the kind of management organization and procedures which the new irrigation practices required by the tubewell system in Rechna Doab will demand if they are to be effective.

The third problem, as our experts see it, is that of maintaining and increasing the harvest from irrigated lands, having in mind the fact that agricultural conditions may be improved by the availability of more water than heretofore. Specialists from our Department of Agriculture will study this problem with the hope of making recommendation that may be helpful in increasing agricultural productivity.

Finally, we plan to examine the e t to which the equipment and materials needed in these enterprises cou pplied by your industry, either from existing or new plants. We are c nt that a substantial portion of the mechanical and electrical equipment needed for the project, and perhaps also the agricultural materials, ultimately could be produced in Pakistan, thus helping in the development of your country's economy.

Our scientific and engineering te ow lans a first visit to West Pakistan--by part of the group--during th e ay pa of September, if that is convenient for you. They hope to benefit from on-site inspections and evaluations and from discussions with experts of the West Pakistan Water and Power Development Authority, the Department of Irrigation, the Department of Agriculture, the Soil Reclamation Board, and other government officials.

On the second matter we discussed--that is, assistance in developing your technical institutes--Dr. Wiesner has deferred action until the major study on waterlogging and salinity control is well under way.

You should know that our people have been greatly challenged by the scale and human meaning of this problem, and they are proceeding with an enthusiasm which I share.

With warm personal regards,

Sincerely,

/s/ John F. Kennedy

His Excellency Mohammad Ayub Khan
President of Pakistan
Rawalpindi, Pakistan

their own wells.

Sharp: And they got going pretty fast.

Revelle: Yes, that's right.

Sharp: I have a couple of specific questions. This is a letter that you sent to Leona Baumgartner at AID.* You set out quite a few different projects that AID might support. I thought we might just talk about the implementation, the big plan, of the panel's ideas, and what the future looked like in terms of AID support for the work that resulted from the panel's investigation.

Revelle: Say that again.

Sharp: I thought we just might talk about what you had in mind for AID to do and how it all occurred after '63, after the recommendations were made.

Revelle: [after leafing through papers] Where are the questions? I don't see the questions in here. The ten research questions. [reading from materials] "The project should be broken down into five categories: health and nutrition, agriculture and economic and social research, education and communication and engineering." "Enclosed." We don't have the enclosure [here].

By that time Leona was one of the assistant administrators of AID. I guess she was sort of in charge of the research part of AID.

This project was carried out to some extent over AID's dead body. They had to put up all the money, but they didn't like it very well because it was a bunch of amateurs getting into their business. I remember one aspect of this was that Dean Peterson, who later became one of my very good friends, was at that time professor of engineering at Utah State University. He later became vice president for research at Utah State and more recently has spent a lot of time in India with AID -- he wrote a letter to a senator complaining about this bunch of amateurs getting involved with the serious problems of West Pakistan.

The senator forwarded the letter, as was typical, of course, to Jerry Wiesner, who wrote an indignant reply back to Dr. Peterson and said, "You ought to find out more about it before you criticize."

So he did find out more about it and he became one of our most loyal and enthusiastic supporters. We have been very good friends ever since. I'm very fond of him.

Sharp: There are a couple of exchanges between you and Bob Burden and some of the other people who were really doing a lot of the writing of the report.

March 14, 1963

Dr. Leona Baumgartner
Assistant Administrator
Administration for International Development
State Department
Washington 25, D. C.

Dear Leona:

Enclosed is an outline of research projects needed for agricultural development in West Pakistan. These correspond to most of the research needs I listed at the meeting of the AID Research Committee on February 28. The projects are broken down into five categories: Health and Nutrition; Agriculture; Economic and Social Research; Education and Communications; and Engineering. Each project is assigned priority 1, 2 or 3 depending on whether it should be started immediately, within three years, or within five to seven years. We have also indicated the types of investigation required, that is whether the project consists of one or more of the following kinds of work: data collection; "sophisticated" surveys, involving development of survey methods as well as expertise in conducting the survey; analysis, by which we mean compilation of existing information and application of various analytical methods to answer various questions; and experimentation, that is, field or laboratory experiments and tests. Possible contractors are listed for each project, mainly to illustrate the kind of organization which could appropriately undertake the task.

We have given first priority to ten projects. These are the ones I wrote down on the blackboard in Jerry Wiesner's office. Twelve projects are listed as second priority and five as third priority.

Drs. Robert Burden and Harold Thomas of our Harvard group are sending Dr. Fei detailed descriptions of six of the first priority projects, together with estimated of required personnel and annual dollar costs. The estimated dollar costs for the other four first priority projects are as follows: project 1, Nutritional surveys - $150,000; project 5, Irrigation water requirements - annual dollar costs for a five year period, $200,000; project 15, Modification of school curricula for agricultural development, annual dollar costs for five year period, $100,000; project 19, Economics of fertilizer production - $75,000. In

Dr. Leona Baumgartner #2

addition to these foreign exchange costs, there will be expenses that can be paid in PL 480 rupees.

In selecting these projects and assigning priorities we have been guided by the following considerations:

1. Investigations involving only data collection should be carried out by the Government of Pakistan, possibly with technical assistance from the US Operations Mission in Pakistan. Such investigations do not fall within the cognizance of the research division of AID, and are not included among the projects outlined herein.

2. Investigations requiring sophisticated surveys, analysis, or experimentation could be partly supported by the Government of Pakistan and partly by the research division of AID or, in cases where only US personnel are involved, entirely by the research division of AID.

3. The selected projects should be relevant and important to the solution of the problems of agricultural development in West Pakistan.

4. The projects should contribute to the development of methods and techniques which have wide applicability in less developed countries.

5. Wherever possible, selected projects should involve education and training of Pakistanis, with the objective of transferring the projects to the Government of Pakistan as soon as practicable.

6. Selected projects should be aimed at increasing the efficiency of technical assistance programs in Pakistan and elsewhere.

7. In assigning a priority to a project, determining factors are: (1) the importance of the problem; (2) the time when the results will be needed in the program of agricultural development in West Pakistan; and (3) the time required to obtain these results. For example, the development of higher yielding plant varieties will take at least five years, and the results are needed as soon as possible; hence this is a first priority project.

One project which is not listed but to which I would give an extremely high priority is a multi-disciplinary analysis of the problems of East Pakistan, along the lines we have attempted in our panel report. This would involve first an identification and formulation of the fundamental problem or problems of East Pakistan, and then an attempt, using various methods of analysis, to arrive at a plan for attacking these problems. Among the elements that might be involved are:

Dr. Leona Baumgartner #3

1. Engineering work required for dredging, irrigating and flood control; the capital and operating costs of such work; and the anticipated benefits as a function of time.

2. The possibilities of increasing agricultural production through such measures as increased double cropping; bringing new lands under cultivation, and increasing yields from existing sown areas.

3. Factors causing the present very low productivity including: too much or too little water; inadequate fertilizer; inadequate pest control; poor seed varities; primitive agricultural practices; economic constraints on the farmers, such as marketing, credit, and land tenure pattern, uncertainties of harvesting, etc.

4. Present and future demands for agricultural products.

5. Comparative evaluation of possible returns on investments in agriculture and industry.

6. Requirements for development of transportation.

7. Uses of the abundant natural gas.

8. Demographic factors influencing investment choices, such as rural under-employment, possibilities for urbanization, and rural over-crowding due to continued population growth.

9. Recommendations concerning the sequence of investments for agricultural and industrial development, and estimates of costs and benefits as a function of time.

You will realize that the above prospectus for an East Pakistan analysis is based on inadequate information. The problem might look quite different when one gets into it. However, the notes given above indicate the kind of approach that a multi-disciplinary group might start with. I estimate the cost of such an analysis, would be about $300,000. It could be undertaken in any large university which has competent departments of agriculture, economics and other social sciences, and engineering. The time required would be probably a year.

Enclosed is a letter from Dr. Maurice A. Albertson, Director of the Research Foundation of Colorado State University, which suggests a mechanism for arriving at an integrated program of research and education aimed toward agricultural development in West Pakistan. Dr. Albertson's essential proposal is that a study group be organized, consisting of land grant college staff members who have had experience in West Pakistan, to formulate both a broad program and specific research projects. He estimates that such a study would take from three to six months and would cost about $20,000. I believe both the money and the time would be well spent.

Dr. Leona Baumgartner #4

This letter is being written a few hours before we leave for Pakistan. I shall look forward to reporting to you in about ten days.

Sincerely,

Roger Revelle

cc: Dr. J. B. Wiesner
Dr. Edward Fei
Dr. Maurice L. Albertson

Enclosures: 2

Revelle: I did most of the writing, actually. These people all wrote chapters.

Sharp: You are exchanging deadlines and who was responsible for what. There's one that Bob Dorfman wrote you.* He addresses some of the problems that you had to get into, like whether or not the timetable was right or you were too optimistic about how fast things might proceed.

Revelle: Well, the essential recommendation in this letter is that we should have an extension service, develop an extension service, which is clearly a highly desirable thing to do but difficult to do. All we did was to recommend that it should be done. We didn't follow through on getting it done. And he's recommending that we do that, that we push the development of the extension service. [reading] "The biggest in-service training program for the field assistants and their supervisors. Clearly, I recommend most strongly that the following steps be taken with high priority. An in-service training center should be established in SCARPS 1." I don't think anything was ever done along these lines, unfortunately.

Sharp: In the papers you see these letters going back and forth about the writing of the chapters, and some of the issues you were going to have to deal with, but it's unclear exactly what all happened.

Revelle: Well, the one thing that I know happened -- Well, two things that happened after our report was issued. [One] was the development of the MONA project, which was an experimental area that had been proposed by the Geological Survey. It was taken over first by Washington State, and then later I think by Colorado State, or vice versa.

This was a group of American agriculturists and engineering and irrigation specialists who studied in the field the effects of salt on different crops. There had been some water management at the farm level and at the watercourse level.

One of their big recommendations was that a lot of water was wasted in the watercourses, a lot of leakage took place from the watercourses. The watercourse is this final ditch that feeds the farms, and the farmer diverts water from the watercourse into his field just by digging a little trench in it.

They recommended that these watercourses should either be lined or should be straightened out. All the holes should be plugged in, the holes made by animals and by weeds. They should be cleaned of weeds and animals, and a gate should be put in, a little cement gate instead of just digging an opening.

They greatly improved the utilization of water at the farm level, the so-called water management. This was a real research and experimental program jointly done by I think it was WAPDA and by the Colorado and Washington State people.

HARVARD UNIVERSITY

DEPARTMENT OF ECONOMICS

CAMBRIDGE 38, MASSACHUSETTS

April 16, 1963

Dean Roger Revelle
Office of the President
University of California
Berkeley 4, California

Dear Roger:

I am writing to propose most earnestly that even while we are putting our report into final shape certain emergency steps be begun in SCARP 1 to enhance its chances of success, on which so much depends. In that project time has taken us by the forelock and the present trends there must be corrected before we find ourselves with a going concern -- going in the wrong direction.

This sense of desperate urgency came upon me after I had mulled the situation over for some time and had discussed with the Ford people their experience in Ludhiana and elsewhere with the package program. I learned quite a few things in Ludhiana, etc., of which the following two are the most crucial:

1. Our time table is extremely optimistic. It should aim for a substantial improvement in farm output by five years after an adequate force of field assistants, with a good back-up of agricultural supplies, has been put into the field. The Ford people have been in operation a couple of years, now. They have achieved impressive improvements for a few cooperating farmers and villages, but the diffusion of the new techniques has not yet been appreciable, although they are working in Sikh communities and the Sikhs are, by universal agreement, the best farmers in the subcontinent. To be sure, in our plan, the initiation of a project and the launching of the field force were scheduled to be almost simultaneous. But in SCARP 1 the project was officially opened a couple of weeks ago, and the field force is still, I am afraid, years away. We should make it clear that the clock should begin to run only with the initiation of a substantial effort at agricultural improvement. This is only a matter of score-keeping, perhaps, but it matters, for this and future projects.

2. The quality of the field assistants is very important. The farmers are no fools, and they are not impressed by the advice of a young man unless it is quite clear to them that he knows his business. He must give intelligent answers to intelligent questions and must conduct himself with the assurance that only sound training and some first-hand experience can give. In Ludhiana, the villages that are cooperating are precisely those with the best qualified Village Level Workers, and the project staff is much concerned by the ineffectiveness of the run-of-the-mill field staff. In contemplating SCARP 1, I am appalled at the thought of the pick-up crew we are inheriting.

I think that we are all agreed that West Pakistan is almost devoid of competent field assistants and, even worse, of competent teachers and effective agricultural colleges for training them.

These considerations point to a serious omission in our list of project functions, a defect that must be made good in SCARP 1 on a crash basis. This function is a vigorous in-service training program for the field assistants and their supervisors. Accordingly I recommend most strongly that the following steps be taken with high priority:

1. An in-service training center should be established in SCARP 1. It could be based on one of the agricultural experiment stations in the area, or it could be built ab ovo.

2. The instructional staff should be American, at least until we know where we stand. (The Associated Rocky Mountain Universities should endorse this recommendation; so should the Peace Corps.)

3. The initial task of the center should be to offer an in-service course about six months long to a class of 100-150 trainees in residence, i.e., about a third of the field staff scheduled for SCARP 1.

4. I am not qualified to suggest a curriculum, but it should be devoted entirely to agricultural science (with a little attention to the administrative procedures that the trainees will need in their duties of arranging credit, procuring seed, forwarding inquiries and complaints, etc.), and should include some honest-to-goodness farming in addition to classroom and laboratory work. Each student should be assigned a plot of ground to cultivate in accordance with the practices he is preparing to preach (using bullocks and all). In assigning the grades at the end of the training program, the yields obtained on these practice farms should receive significant weight (this will teach the trainee, among other things, what it feels like to pray for rain that doesn't come).

5. On graduation the trainee should receive a shoulder-patch reading, say, "Farm Management Specialist, Class 3." He should also receive, beginning at that time, a project allowance whose amount depends upon his final grade.

6. As soon as the center is ready to open, about a third of the field staff of SCARP 1 should be sent to it. This will leave the remaining staff spread pretty thin, but this investment in quality and morale is eminently worthwhile; indeed, essential.

7. Graduates of the training center should be returned to it ever thereafter for at least three or four days a month, for review and additional training. This should refresh their minds each month for the tasks to be performed in the following month. These refresher courses, correspondence courses, and perhaps, more advanced courses in residence should qualify field assistants for Farm Management Specialist, Classes 2 and 1, with concomitant increases in project allowance.

8. As with everything else, this aspect of our program should be regarded as experimental, to be modified as experience accumulates.

In addition to providing a cadre of reasonably well-trained field assistants, I foresee that this undertaking will serve three important functions:

1. At present, although we suspect the worst, it has to be admitted that our knowledge of the competence and shortcomings of the available field assistants is based on rumor and hearsay. As the first class or two passes through the center we shall gain a much better understanding of where we stand. At the same time we shall learn how much of the training can be performed by the Pakistanis and how much requires foreign experts.

2. This training should enhance the morale of the field staff. A man can perform effectively and enthusiastically only if he feels that he is competent and that his competence is recognized. If he feels that he has something to contribute he will contribute it. The investment of six months in learning agricultural science will stimulate the trainees to display and realize that investment. In short, it will create some needed esprit de corps. By the same token it should raise the level of honesty and efficiency in the performance of their functions.

3. This training operation, with a competent staff, cannot be carried out without a good deal of research. Both the Ford and the Rockefeller people in India emphasized to me that one of the difficulties with their training programs is that they often do not have a sound doctrine to teach. Thus experimentation should be an important part of the program of the center, and the results of these experiments will be of first importance. The Rockefeller people, especially, emphasized the importance of experimenting with various seeds and varieties in the geographic region where they are to be used.

I recognize that this recommendation raises some political difficulties. It involves shouldering Lyallpur and Peshawar, and perhaps some other places, aside from some responsibilities they feel should be theirs. Besides, it deprives them of some of the stimulus for the growth they need. But SCARP 1 cannot wait for Lyallpur to wake up. To deal with objections, I suggest we emphasize that we are recommending in-service, post-graduate training on the spot for graduates of Lyallpur and the other agricultural colleges. We should also emphasize that this is an emergency measure, experimental in nature, and designed in large part to provide an assessment of the current situation. They still will not like it, in all probability. If so, so much the worse for them. Some such program is indispensible.

I assume that my next responsibility is to revise Chapter 4. Is that right?

Sincerely yours,

Robert Dorfman

RD:jc

A very important research project in the actual use of water.

For example, one of the things that the farmers did was to have a ditch so low that unless it was very full they couldn't get any water out of it. Things like that. The problem was to raise the watercourse so that, in fact, the water would flow from it into the field. Very, very simple things, but very critical. And I know it was one of the research outcomes.

Another one was the building of the Tarbela Dam. Ayub Khan and the Pakistanis in general were very anxious to do this. There wasn't any money to do it in the basin settlement plan, which the bank was really basically responsible for financing. There had to be extra money, and where was the extra money going to come from? It was eventually, I guess, a loan to the Pakistani government. It was a big project, a billion, $2 billion project. The biggest dam in the world, the biggest earth-filled dam in the world, about 400 feet high and about two miles long. It only holds about 10 million acre feet of water, compared to, say, Hoover Dam which holds 80 million acre feet of water, just because of what I spoke about yesterday, the geology of the country.

They had a lot of trouble with it. The main trouble is that the flow of the Indus at that point is about 90 million acre feet it per year, and they can store essentially only 10 percent of that water. The other 90 percent has to go over the spillway. The spillway is essentially the Indus River. There's very little difference between the river and the spillway. Of course, the spillway is at the top of the dam, that's the nature of dams, that you have to build a spillway so you can fill the dam. Otherwise you couldn't fill the dam. But you can't have the spillway at the level of the dam or else it will flow over the <u>whole</u> dam.

But the water flowed down that spillway at ninety miles an hour, so it was an incredible sight to see it. It dropped then a couple of hundred feet in this huge waterfall into the river valley underneath. The force of the water and the volume of the water eroded and undercut the bottom, so they had to build a new spillway and a new base for it, pouring couple of million tons of concrete at the base of the spillway.

Sharp: Just to keep the dam intact.

Revelle: To keep it intact.

The other problem was that the bottom of the dam leaked, so they were getting water under the dam, coming out on the lower side. They had to put in what they call relief wells so that they could control that water. Then they put thousands and thousands of tons of clay on the bottom of the lake to try to stop the leaks. They eventually did fairly well with that. Otherwise, again, the dam would have eventually destroyed itself by undercutting.

The third problem was that the gates for the power turbines and particularly for the release of water for irrigation, the pressure was so great on them that the water came out at very, very high velocity. As I said, ninety to a hundred miles an hour. They eroded too. Then finally the darn tunnels cracked, and they had to do something about that. It was really just a nightmare of problems.

It had nothing to do with us. We were not involved, but the engineers who were involved had a really terribly difficult time. Harold and I had written a little memorandum arguing for the construction of Tarbella in which we said it would be useful. It provided about 10 million acre feet for irrigation during the dry season.

Sharp: Was that independently that you did that, or as part of the work of the panel?

Revelle: That was independent. That was after the report.

The report became sort of a great book in Pakistan. Whenever I would meet anybody, they would say, "Oh, you're the author of the Revelle report. A wonderful book." But 90 percent of those people had never read it or even seen it! It's like most great books; they're not really ever read. [laughter]

Sharp: What would you say was the general effect of the report, as far as Pakistan and the problems it has?

Revelle: Well, I would say that it's hard to say what the effect was because several things happened more or less at once. The World Bank wrote a much bigger and better report within the next two or three years afterwards, with their enormous resources for doing so, a four-volume work, published in a regular book form, and that's certainly more definitive than our report. As I said, it was just at that time Norman Barlang was producing his new wheat varieties.

Basically what we did was to support what AID wanted to do anyhow, namely to support the drilling of the tube wells on a million-acre scale. The million acres, we had a good, rational justification for this in terms of this perimeter-versus-area thing, but it turned out you only needed 100,000 acres to have a big enough area. The million acres is just a kind of convenient way of dividing up the land.

That looked to be like our primary recommendation that you should concentrate on one million acres at a time. Then just go through the whole Punjab and the Sind, 25 million acres over 25 years, one million acres a year. It was a very ambitious, a far too ambitious, program.

Ghulam Ishaq was against that. His reason was [that] it's impossible politically. He was, as I said, a very intelligent man. He said, "We have to sort of spread the gentle rain evenly over the countryside, the government largesse. If we try to concentrate, all the other people

will gang up against us. So from a political point of view, we have to be seen as doing something for a lot of different places at once, even though we aren't doing very much."

I didn't really understand that political problem very well, but it certainly seemed pretty convincing to me. The result was that the SCARPS developed much more slowly than we had hoped that they would. What saved the whole situation, as I said, was the drilling of the private tube wells.

Sharp: That they were getting going on their own.

Revelle: That the farmers were getting going. For the very good reason that they could use the water and it was under their control.

I think that the main thing that we did, in reality, as opposed to reputation or talk, was our insistence that this could be a garden of Eden, that this was a tremendous agricultural resource and could be developed in a very profitable way, very useful for the people of Pakistan.

Sharp: That it might really help them.

Revelle: Tremendously, yes. They had not had the confidence to do that really, before.

The Indus Waters Treaty

Revelle: We might just say a word about the Indus Waters Treaty. I started to, and then I stopped. These five rivers of the Punjab all arose in Indian territory, and the Indians said they wanted to divert them to East Punjab. That would have been a real cause of war, an inevitable cause of war, since their lives depended on the water.

Hostilities had built up for several years until the World Bank stepped in and said, "By the right engineering designs, we can divide the water and both countries could get enough water."

What they did was to agree that the three western rivers, the Indus, the Jhelum, and the Chenab, should go to Pakistan. The three eastern rivers, the Ravi, Sutlej, and Beas should go to India. They would build huge link canals, as they called them, between the western rivers and the eastern doabs -- these were even bigger than the canals they built before -- carrying the water across the country instead of down the country. Part of that would be to build a big dam on the Jhelum, the Mangle Dam, to store water for the wintertime. The Pakistanis also wanted to build the Tarbela Dam, but that never really got into the plan.

Sharp: The money to build all these --?

Revelle: Came from the consortium, the Aid to Pakistan Consortium, of which all the work was in Pakistan. India contributed to this too because they got all the benefit, or a lot of the

benefit.

So this avoided a war, this Indus Waters Treaty, and it triggered off a huge irrigation development, particularly the link canals, and the tube wells were part of it. That was largely the AID contribution, trying to do something about waterlogging and salinity. There were American engineers who were involved with the SCARPS development, Salinity Control and Reclamation Projects. That was an American engineering project. So was the Tarbela Dam.

There were people from other countries also involved, particularly, a British group called Hunting Technical Services. They were basically an engineering planning outfit. They accumulated tremendous amounts of data on the flow of the rivers, on the flow of the canals, on the quality of the soil, on the areas that were waterlogged and saline, every aspect of the country. We used their data to great effect.

They were Canadian and British. They didn't actually participate in planning and engineering works. They were basically a data-gathering organization, so we would know what to do.

After the report was written and submitted, then we talked about it at various places, including the Pugwash meetings and in Washington at AID Research Advisory Committee meetings and many places. It became a famous enterprise, a famous effort.

JFK Snapshots

Sharp: I wanted to ask you about the death of President Kennedy. I wondered if there was any impact on the work. Most of the work, except for the writing of the report, had been --.

Revelle: He wasn't killed until November of '63. By that time everything was just about finished.

Sharp: You were working on the report?

Revelle: It was all over really. We had practically gone to press. It came out in January of 1964, so there was really nothing left to do. We went back to Pakistan several times and talked with these people after we had written a preliminary version, and then revised it and talked again with them. That was when I told you about my morning with Bhutto.

This leads us naturally into the Pugwash Movement, but I want to finish this part if you have any other questions about it.

Sharp: No, I don't have any other questions.

Revelle: I was in Vienna when President Kennedy was assassinated. I was at an ICSU meeting. I was one of the American delegates -- to the ICSU general assembly in Vienna. We were at a party being given by the mayor of Vienna when the word came

over that Kennedy had been assassinated. It was a very shocking event, terrible. We all cried.

Sharp: I guess everybody probably remembers where they were. I remember where I was. I think everybody was just completely shocked.

Revelle: That's right. Stunned.

Sharp: It doesn't really fit in here, because I wanted to talk about it later on, but he had addressed the anniversary of either National Academy of Sciences or --.

Revelle: The hundredth anniversary of the National Academy of Sciences.

Sharp: And that was literally just a month before.

Revelle: That's right.

Sharp: And you were there. It was a big to-do.

Revelle: Yes, sure, I was a member of the council of the academy.

Sharp: And he gave a stirring address.

Revelle: That's right. It was very interesting. Jerry Wiesner and I, in fact, had been involved in writing his speech. He started reading this speech and after about ten minutes he gave up, and just started talking extemporaneously. [laughing]

Sharp: He didn't like what you had written?

Revelle: I'm not sure he didn't like it, but he had plenty of things to say on his own. He didn't need us. Det Bronk had been involved with it too, but mostly Jerry and I.

Sharp: Had you had much of a chance to really talk to President Kennedy? **##**

Revelle: In that capacity I met him.

Sharp: Of course the Peace Corps is often seen as a real hallmark of the Kennedy Administration.

Revelle: His brother-in-law, Sargent Shriver, was the head of it. I saw a good deal of the people in the White House. MacGeorge Bundy, Skolnikoff, Kriedler and Wiesner. Not so much the Irishmen, the Irish politicians. But I had very little contact with John Kennedy.

III BASIC IDEAS, BASIC RESEARCH -- INTERNATIONALLY SPEAKING

Pugwash Conferences, 1960s-1970s

Sharp: I thought we might go ahead and talk about Pugwash.

Revelle: I made myself a little list about that.

Let's follow on from this particular discussion because there was a meeting that fall in 1963 in Udaipur in the state of Rajastnan at the Lake Palace. Rajastnan was formally known at Raj paitawa, and it was divided up into a lot of little kingdoms. One of them was the little kingdom of Udaipur, that was the capital city. Its most striking feature is a lake right in the middle of this quite dry country. In the middle of the lake was Lake Palace, made out of marble, a beautiful thing. The raja of Udaipur made it into a hotel. It's called the Lake Palace Hotel and it's a very nice place to stay.

In that same lake he had given refuge to the guy that built the Taj Mahal, Shah Ishak, before he became king. The Mogul emperors, each of their sons revolted against their father, and he revolted against his father. His name was Jehengir. His father drove him out. Eventually he overthrew his father, but for many years he was just rebelling against him, and he took refuge in this lake, on another island in the lake, which you always go to see if you are at the Lake Palace.

Anyhow, there was a Pugwash meeting there. Mrs. Gandhi attended it. This was long before she was prime minister. She was then sort of the companion of her father. At that time he had had a stroke. Harrison Brown was at that meeting and Bernie Feld. I don't remember who else.

Pugwash meetings are usually divided into four working groups. Their custom was that one of the working groups is on developing countries. The most important one was the one on arms control, but I usually paid little attention to that, and was involved almost entirely with the working group on development.

Sharp: When people talk about the Pugwash conferences, the arms control issue is usually seen as the issue.

Revelle: That's correct.

Sharp: It obviously had all these other issues that it was dealing with. If you look at some of the Pugwash conference material over the years, assisting developing countries, ideas of scientific development such as the kind of stuff you have done, it makes much more of an impact in the later conferences than it does in the earlier ones, the attention in the reports it gets.

Revelle: That's correct. The reason for that was that they brought in more countries, and most of the developing countries couldn't care less about the nuclear issue between the US

and the Soviet Union. They had to think of something that they were interested in. They, of course, were interested in development.

The trouble is most of the attendees didn't know anything about development. It was kind of an irreconcilable difficulty that if the developing countries wanted to talk about it, the people there didn't know what to talk about.

But anyhow, at Udaipur, the chairman of the working group on development was this man B.S. Khotari who was head of the university grants commission of the government of India. [spells Khotari] I talked about our Pakistan adventure, and he was very much impressed by it -- in fact, the whole working group was -- and our report says quite a bit about it, the report of that working group. The result of that discussion was that he got me appointed as the American member of the education commission of the government of India.

Sharp: I thought we might talk about that a bit.

Revelle: He was the chairman of the commission. This was a so-called parliamentary commission appointed by the elected house, the House of Commons basically of the Indian government. So the next two years I spent about one month in three in India as a member of this commission.

We can talk about that later, but anyhow this was the outcome of that conference, as far as I was concerned.

During the conference, I got into quite an argument with Mrs. Gandhi because I said, without really knowing much about it, that there had been very little improvement in the Indian villages since independence.

Sharp: Must have been a popular idea!

Revelle: It wasn't popular with her. She took a very dim view of it. Actually, I was probably right, but she didn't want to think so.

Then later we went to Delhi, some of us, particularly Harrison Brown and I went to Delhi, as the guests of Hussein Zaheer, who was the director general of the Council on Scientific and Industrial Research. He was a Muslim, revolutionary. In those days, in order to get anywhere in India you had to have been in jail during the independence struggle, as they called it. And he had been in jail, and he was a loyal member of the Communist Party, and he was a good chemist. Then he became head of this organization that had government research establishments all over India called the Council on Scientific and Industrial Research.

He was our host in Delhi. He put us up at a hotel called the Rajpath Hotel, which I remember because I don't think I have ever been so cold in my life. This hotel was built for warm weather, and it was all open-air sort of circulation, so the wind would come from the outside right

through the corridors and right through your room! It was just really quite cold. Delhi can be quite cold in the wintertime, even though it doesn't snow. A lot of people die from exposure because they are malnourished, and the temperature gets down to around forty degrees or less.

Prime Minister Nehru invited Harrison and me to come and visit him. He was always very soft-hearted about scientists. But he had had a stroke and he was not very well. We made our appointment there. Mrs. Gandhi was there, and it was quite clear the only thing she wanted us to do was go away just as quickly as possible. [laughing] A minimum of bothering her father. She made it very obvious that we should make the visit about one minute long, if possible.

But he, of course, wanted to talk about science. He couldn't talk very well because of his illness, so we did leave after a bit. I think Harrison had met him before. He had spent some time in India in the '50s when Nehru was in his prime and in very good shape. At least when I met him he was feeble and weak. He had not lost control of himself, but he wasn't very much interested in talking.

Sharp: You had mentioned in one letter after Nehru passed away, which was within six months, you had written Professor Zaheer that you had really appreciated Nehru's help in getting the IIOE going, the International Indian Ocean Expedition.

Revelle: Yes.

Sharp: I wondered if you had met him at that point?

Revelle: No, I never had. The only time I ever met him was in November of '63. Or maybe not November. October. I think this must have been before the ICSU meeting in Vienna, because Harrison was at that too. He was the foreign secretary of the National Academy then, and I'm pretty sure he was at that meeting.

Well, so much for that Udaipur meeting. The one other thing I remember was that an awful lot of people, including Abdus Salam, got dysentery, but I didn't, at that time, and I was surprised that Abdus did. There's no immunity just because you're an Indian or a Pakistani to it. In fact, I used to say that most Indian villagers are sick most of the time. Most of them never know what it is to have a solid stool.

The other Pugwash conference that I remember was the first one I went to in Baden, Austria. I was asked to go by Leo Szilard. The most memorable thing about that conference was Szilard's ideas. He took a dim view of the formal discussion, thinking it was just an opportunity for the Russians to put on their act, put on their set speeches, and Americans put on set speeches. But he thought there was some virtue in informal discussions and walks in the garden.

I remember one of his ideas was to trade cities, a

typical, screwy Szilard idea. That is, if you had an accident, for example, and one American city was bombed, we should have an agreement that one Russian city would be bombed, and that would be the end of it, or vice versa. The cities would be graded according to size and importance. If New York was bombed, then you had have to bomb Moscow, but if Kiev was bombed, then you would bomb Cincinnati or something like that.

Sharp: St. Louis or somewhere.

Revelle: Yes, a moderate size city.

He had gotten me there because he really wanted me to be sort of the executive officer of Pugwash. I didn't want to be, but I was at least willing to look at it. This was, I guess, around 1960 or '61. I remember Jerry Wiesner was at this meeting too and Ruth Adams, Bob Adams' wife, who was really the kind of spirit of Pugwash. Of course, Bernie Feld was there too. It was sort of a continuing group of Americans who went to one meeting after the other. It was about that time George Kistiakowsky got involved too, but he was not there at Baden or at Udaipur either.

Sharp: I was interested in the Pugwash conferences in what you saw as your objectives in going. If you look at some of the written material, the thing that mostly you're talking about is the new interest that you were developing in the less-developed nations and really how to help them.

Revelle: That's right.

Sharp: It began to really dovetail, especially in the later period in the '70s then, with everything you were doing at the center at Harvard.

Revelle: That's right.

An important meeting from my point of view was the Pugwash meeting in Venice.

Sharp: Which one was that? Or when was it?

Revelle: I don't remember the time, but it was probably around 1970. The reason that was important from my point of view was that I proposed, and Eugene Rabinowitch strongly supported, the idea of an international science foundation.

From my point of view, this was the main outcome of several Pugwash meetings -- what became the International Foundation for Science. The idea was to support research by young research workers in their own countries, in developing countries, like the National Science Foundation supports scientists in the United States.

What was happening at that time was a lot of people were worried about the brain drain, and rightly so. There were no jobs and no hope for careers for scientists in the developing countries, so they came to the United States or England or France instead, immigrated.

The other problem was that most of these people had been trained in the United States or in the United Kingdom by fundamental physicists and chemists, people that were interested in basic research, like on the high-energy physics or cosmic rays or something equally esoteric which had practically nothing to do with the problems of their own countries.

We thought that maybe we could sort of divert their interest toward more practical problems of their own countries if we supported their research, in their country. I proposed this idea at the Venice Pugwash meeting.

One person I remember who was there the first time was Lailah Hamansy, this woman I told you about from Egypt, the fat Nefretiti, or plump Nefretiti, and that was interesting because there were Israeli people there too, and she was quite pro-Egyptian. She didn't like Israelis very well!

Sharp: No, not very much at all.

Revelle: But in any case, the Israelis who were there and Lailah did talk about their problems. The only time they did have a chance to communicate was at these Pugwash meetings. I don't remember whether there were any other Egyptians or not at that meeting.

Anyhow, coming back to the IFS [International Foundation for Science], that was proposed in our working group on developing country problems, strongly supported by Eugene Rabinowitch and made one of the major recommendations of the conference. In several other meetings, one at Sochi in Russia, one at Stockholm in Sweden, and in Fontana in wherever it was, Illinois or Wisconsin.

Sharp: That's Wisconsin. That's 1971.

Pugwash and Roots of the International Foundation for Science

Revelle: In all of these we elaborated this idea and had a special sort of panel to develop plans for the IFS. The problem was to get people like Ashok Khosia from India, who was very anti-Western, and very suspicious of any AID program thing, it was just a capitalist trick, to go along with it, with this proposal, to get a plan in such a way that they would feel comfortable with it. We worked on this at several of these meetings, and finally came out with a pretty good plan.

Sharp: What was the funding idea?

Revelle: The funding idea was that it should be a non-governmental organization, funded by national academies, or by governments through their academies. That's the way it worked out in the long run anyhow.

Harrison Brown and I presented this idea at the United

Nations Economic and Social Council, at a meeting where there were several Swedish delegates. The Swedes became quite enthusiastic about it, and particularly a man named [Sven] Brohult, who was head of the Swedish Royal Academy of Engineering. He took it very seriously, and he organized a meeting with Murray Todds' and my help, and Bob Marshak's help, to try to get the thing started internationally but at this Swedish meeting. One of the people who was there was Pierre Auger from UNESCO and people from many different countries.

It turned out that there were three different inventors of the IFS. We at the Pugwash meeting were one of them. Another one was Bob Marshak, a physicist who later became president of CCNY. The third was a Frenchman named Levi. We all had more or less the same idea. That's the way good ideas are: there's a time when they just arrive spontaneously different places.

At this meeting in Sweden, in Stockholm, the idea was thoroughly endorsed. Pierre Auger was made a member of the organizing committee and so were Brohult and Marshak and I, but Pierre Auger wanted to have it part of UNESCO. He was a UNESCO man. He had been chief scientist at UNESCO, assistant general director for science. We took a very dim view of that. We wanted to have it non-governmental.

Sharp: And pretty independent.

Revelle: And independent, yes.

So eventually Auger was sort of driven out of this cabal, and Brohult pushed it very hard. He was quite familiar with the European scene and particularly with France. We met in Stockholm several times.

One of the people we talked to was David Hopper, who at that time was head of the IDRC, the International Development and Research Corporation of the Canadian government. He later became vice president of the World Bank. He was very much taken by the idea and said that "Canada will support it."

So actually the first money came from Canada and Sweden. About half of it came from Sweden and 15 percent came from Canada. Brohult had some of his young men working on this at the international meetings and things like that.

Eventually we talked eight or nine different academies into supporting it. The French government, the French CNRS, Council for Research Nationale (or whatever the CNRS stands for), the Dutch government, the Belgian government, the Swedish government, the Canadian government. Altogether about $1 million was raised, pledged for a year.

So we incorporated the thing in Sweden, and got a very fine man as director of it, a man named Nicolai Herlofson, who was an engineer on the faculty of the University of Uppsala, but had been secretary general of ICSU. I remember in Vienna he would always announce himself, "Herlofson"

[laughing] Every time he would intervene he would say, "Herlofson."

He always made sense. They were always useful interventions. Brohult convinced him to become the first director of the International Foundation for Science. He devised a system for proposals much along the lines of the National Science Foundation. These proposals were really quite impressive documents. His staff went around and helped people make proposals and he organized a system for appraising the proposals.

Eventually, the IFS has made about 600 grants to young researchers from developing countries, usually not more than $10- to $20,000 per grant. The grants can be renewed for about four years, maybe five years.

Sharp: That's very generous.

Revelle: Eventually the young man is supposed to work his way into support from his own government. We get them started and get them really well underway.

The research in general is not very high-powered research. It's mostly fairly practical research on such things as aquaculture or [lost on tape]. Harrison decided on six different subjects that he would support, all of them applied biology.

[lost on tape] are the fungi that attach themselves to the roots of trees and presumably break up the phosphate in the soil and make it available for the tree. Without a [lost on tape] the trees don't grow. The roots have these little hairs all over them and the hairs are these fungi, interestingly enough.

Another one was vegetable crops. Another one was aquaculture. Another one was small animal husbandry. Another one was natural products and essentially medicinal products of various kinds.

Sharp: How was it decided what was a developing country?

Revelle: Well, that's easy. There's no problem about that! Any country that's developing is a developing country. I mean, any country that basically doesn't belong to OACD.

Sharp: So nobody from the United States could apply?

Revelle: Oh no. Or England or France or Belgium or Holland or Japan or Italy or even Portugal or Spain. But Africa, Asia, and Latin America. Any country in Africa, there was no question about it, except South Africa is a developing country. Any country in Asia except Japan and the Soviet Union and Israel are developing countries. Most any country in Latin America is a developing country, particularly since the Argentines have slipped back so much. We didn't get any applications from Argentina. We got applications mainly from Africa and Asia.

We finally formed a board of trustees, and I was a member of the board for many years, and finally was rotated off.

I think this is a small and very useful little organization, this IFS. It worked out better than we had any right to expect. Eventually even the US contributed. We contribute now $2- or $300,000 a year. We're one of the major contributors. But it took years and years before the US would buy it at all.

Sharp: The last time we talked about international scientific cooperation, we worked our way through UNESCO and your involvement in UNESCO. One of the threads that runs through even the law of the seas, maybe especially the law of the seas, stresses the role of the developing nations in deciding how the resources should be divided up.

Revelle: Oh yes. This was certainly not intended when they organized the United Nations or UNESCO either. Now, all these United Nations agencies have essentially become development agencies, dealing primarily with the poor countries, basically because there are so many of them. Well, they have a great majority in all the governing bodies. They organized something they call the Group of Seventy-Seven. It's now about 125. And in the Law of the Sea conference, they were the ones who pretty much guided what happened. The developed countries, they could obstruct and be negative, but the outcome had to be satisfactory to the Group of Seventy-Seven. **##**

Sharp: You better explain that.

Revelle: Well, I mean they don't run it. It's run by a self-perpetuating-board of trustees basically representative of national academies, of the academies of different countries that support it. We did have a grants committee which had several representatives from developing countries on it, like from India, a chap who runs the National Research Council in Thailand, but it isn't dominated by the Group of Seventy-Seven, even though it's entirely operated in their interest.

[Regarding] the other Pugwash meetings, I remember something about Addis Ababa because there I first ran into a man named Abdul Magade who was an Egyptian economist. We later worked with him on the Aswan High Dam problem, Harold Thomas and Walter Spofford and I.

I also met at that time, or didn't meet, but saw Haile Selassie. He gave a speech to the Pugwash group. He was a funny, small man, very unimpressive physically. He was a member of the racial group that ran Ethiopia. They were very handsome people, big, not really Negroid in their features at all, but brown-colored. Beautiful women, handsome, big men. For the moment I can't think of what they're called. Not Aramaic but something like that.

I remember at a banquet they served us raw meat, sort

of like a steak tartare, which was put into your mouth by one of these beautiful Ethiopian girls.

The other thing I remember particularly about it was I had a rather vigorous argument with [lost on tape] and Vikram Sarahai, two of my oldest friends in the Indian subcontinent. Was here just the other day. We went to lunch with him, in fact. Vikram is dead, but a couple of years ago I was Vikram Sarabai Memorial Professor at the Physical Research Laboratory in Ahmedabad.

What we were arguing about was basically the relationship between Pakistan and India. I don't really quite remember what the substance was, what my thesis was or what their thesis was. That was after the Pugwash meeting in Udaiphur. It must have been two years later. We sat up quite late at night in a bar, arguing.

[At] Venice, as I say, the two outstanding events were Leilah being there and the invention of the IFS.

[At] Stowe, in Vermont, one of the people there was Jerry Peel, I remember. I worked hard on a report on natural resource development, which Ruth Adams was quite impressed by.

[Regarding] Fontana, I don't remember much about it at all except that we still kept talking about the IFS, as we did at Soji also, in Russia, and at Radavi in Sweden. In Soji, one of the people there was Kosygin's daughter, quite a handsome woman in a heavyset, Russian sort of way.

One of the people there was Herb York, at that meeting in Soji. We caught a plane together at the end of the conference for Moscow. It was beautiful weather in Soji and by the time we got to Moscow there was a blinding snow storm. We had a hard time getting a taxi at the airport. I remember the taxi driver said, "If you pay me in American dollars, I'll be glad to take you." [laughing]

So we did do exactly that. They took us to the main hotel in the square, just down the hill from the Red Square, the St. Basil Church Square, Hotel Moscow, one of the biggest hotels in the world I guess. Really four hotels in one. We had a room right on the square, overlooking the square. It was a very touching scene because everything was covered with snow, it was just lovely, white snow. I remember half a dozen drunken Russians staggering down the steps singing in a happy, lovely way, into this square from the Red Square up the hill. It was a very touching sight to see these people after they'd been celebrating in a nice way! They were so happy about it and still singing.

Sharp: That's not the image that most Americans bring back from Moscow. A lot of Americans come back and think that the people are dim, dull, and very serious-faced, and not --.

Revelle: Well, I have several impressions. I have been in Moscow half a dozen times, and I don't have that impression at all. One of the impressions one has is it's a very clean city.

It has been built up a lot in the last fifteen years, lots of newer type apartment buildings, which are pretty much mass-produced apartment buildings. But they're far better looking than the skyscrapers that Stalin put up in which he imitated American skyscrapers, like the Hotel Ukraina, for example.

My impression of the Russians is that they're not a very handsome people, but they're very warm-hearted, nice people, I think. I don't get the idea that they're cold, stony-faced, grim, difficult at all.

They do have a hard time getting clothes and getting proper living quarters and things like that. They just don't have many consumer goods. It's quite right [that] there are lines in many of the food stores. The Gum department store right on Red Square doesn't look exactly like Robinson's. But it clearly has a lot of different things to buy, lot of people shopping.

I think of them as slightly pathetic, not really grim or unpleasant at all, trying to live as best they can and under rather difficult circumstances.

Anyhow, we caught the airplane the next day for the States from Moscow, after this lovely midnight scene of the people wandering arm in arm down the square.

The other meeting I remember was the London meeting. What I remember specifically about that was that I met Margaret Mead there, and became quite well acquainted with her. Then later, of course, we worked together quite intimately when I was chairman of the board of AAAS and she was president. When I was president and she was president-elect, and we were members of the board of directors of the AAAS. [But we] first became good friends at that London Pugwash meeting.

I don't know if you ever met her or not. She always walked with a stick like a shepherd's crook.

Sharp: I never met her, but I had seen her many times.

Revelle: When she was young she was apparently quite good looking.

Sharp: I've seen pictures, and she was.

Revelle: By the time I met her, she was quite a stocky, short, middle-aged woman. [brief tape interruption]

I didn't think these meetings were very productive as far as ideas about development were concerned.

Sharp: Was some of it a matter of clearing the air of disagreements among some of the nations? You mentioned the Egyptians meeting the Israelis, and at least trying to explain themselves to each other.

Revelle: Yes.

Sharp: I wondered what you thought was the role of Pugwash and the larger picture of international scientific cooperation? Is there a larger picture?

Revelle: It was gradually superseded by smaller bi-lateral groups between the US and the Soviet Union. For example, the present group, chaired by Murph Goldberger of Cal Tech, the National Academy Committee on International Security and Arms Control, which has met with the Russians several times the last few years, in Moscow and in this country both. [lost on tape]is a member of it. Pete Pinofsky is a member. Mostly physicists. Not entirely so.

The guiding spirit was a man with the wonderful name of Spurgeon Keeney, the son of an older Spurgeon, a one-generation older Spurgeon Keeney who was very much interested in birth control, spreading contraceptives everywhere. This man has spent his entire life in the arms control business, working in the White House and later in the academy and in the Arms Control Agency. There was a previous committee like that headed by Paul Doty of Harvard. I'm pretty sure Paul Doty is a member of this committee too. This was an idea invented by Tom Malone. He was foreign secretary of the academy.

The Pugwash has had the characteristic that its most effective efforts have been in small symposia organized several times a year when people want to have a symposium on some particular subject. Like security in Europe, for example, or confidence-building measures like better communications and things like that. Or some other specific subject -- what to do about nerve gases, or what to do about biological warfare, and is there biological warfare? Is this yellow rain, for example, something deposited by bees or by airplanes, and so forth. Those have been I think rather effective.

The big international meetings I don't think have been very effective in the last few years. They probably were fairly effective to begin with.

At Udaipur we had a battle in the last day of the conference trying to arrive at a conference report or conference resolution. The sticking point was Vietnam. It couldn't have been Udaipur.

Sharp: This was sometime in '68?

Revelle: Udaipur was in '63. We had hardly been in Vietnam at all at that time. It was really under Johnson that we intervened and under Nixon. So it must have been at a later meeting.

Anyhow, this was a nightmare of a meeting. It went to about midnight, after starting to meet about three in the afternoon.

Sharp: What was the main problem?

Revelle: The problem was that they wanted to condemn the United States for its intervention in Vietnam. I was one of the

people who didn't think that was a good idea. Harrison Brown, who was really the leader of our American group, [helped us to] finally we arrive at some kind of a compromise. It wasn't very satisfactory, but at least we were able to adjourn the meeting.

I can't really remember where that was. It couldn't have been at Udaipur.

Sharp: There weren't two there by any chance? One in the early '60s, and then did you go back later on?

Revelle: We didn't go back to Udaiphur.

Anyhow, it was a very nasty meeting. After that the Pugwash continuing committee decided they would not have a conference report. The report would be issued by the steering committee rather than the continuing committee, and not try to get agreement among the conferees, the delegates to the meeting. This was in a big hall. Sorry, I just don't remember where it was.

Sharp: We have several other issues to talk about, so I think we need to push on a little, unless there are some other comments about Pugwash.

Challenges of the Indian Education Commission, 1964-1966

Revelle: No, I don't think so, but I would like to say something about the Education Commission.

Sharp: That's next. Go ahead.

Revelle: The heart and soul of that commission was its secretary.

Sharp: Who was that?

Revelle: His name will pop into my head, but it isn't in my head right now. He was a little Brahmin who had always fought the British, had never been willing to take any income from the government of India as long as it was run by the British. He was from Puhar. A small man who always wore a a sort of diaper thing that Indian peasants wear, and then a blanket on top of that.

He was as close to being a saint as any man I have ever known. Not necessarily the best secretary, but I have never seen anybody work longer and harder hours than he did. He worked all the time. He, in effect, wrote the report for the commission.

The commission operated by meeting in Delhi and then taking trips to different states. When I was there we went to eastern Otarbadesh, particularly, where they had something called the Bindares Hindu University and also the Hindi Social Science, which was the place where Lal had taken a degree in sociology. He was the prime minister at the time.

They also had a Sanskrit University in Paminasi, literally a place where they taught Sanskrit science and Sanskrit everything. There were something like 800 affiliated colleges of the Sanskrit University throughout India. The Indians have this curious system of affiliated colleges where the university is the examining body. It doesn't do any of the teaching, but the teaching is done in the college and then the examinations are set by the faculty of the university.

There are several different kinds of universities in India. This examining-body kind is one, modeled in a funny Indian sort of way after the University of London, which was set up as an examining body for schools in India, the colleges in India. Then there are places like the University of Calcutta, which had a famous institution called Presidency College. It was a first-rate teaching institution.

[There are] places like the University of Delhi, which are also quite good universities, which have both affiliated colleges and a central teaching campus with colleges that are really part of the university. They used to say that these affiliated colleges, which formed sort of a ring around Delhi, really protected the university from being overcrowded and overrun by all sorts of mediocre types. So only the best students got to go to the university, but everybody could go to affiliated college.

Then there was the University of the Punjab in Ludhiare which was quite good, I thought. [And] the University of Bombay, which had many colleges.

Then, they were also starting agricultural colleges at that time, several agricultural universities in different parts of the country, after the model of American land-grant colleges. Some of these were quite good. The one at in the Punjab was run by and for Sikhs, the best farmers in India and among the best farmers in the world. This was a first-rate agricultural university.

So you have different kinds of universities, plus institutes of technology, plus the agricultural universities, plus medical schools.

We were not responsible for the medical schools. They were under a different ministry. Our ministry was the Ministry of Education, so we had responsibility for all the things that the University Grants Commission was responsible for, plus education at primary and secondary levels. The whole works. What we would do is go to different states and look at their whole educational system.

Sharp: Within each state?

Revelle: Yes. Because education was what they called a state subject, as it is in the United States (either a state or a city subject), but basically a state subject in India.

I had several impressions. One of the impressions was

that the kids were very regimented. You would go to a nursery school, for example, the kids would drill and all stand up at the same time -- and "Now, children, it's time to play," in an organized way, and so forth. It was really very distressing to see how rigorously organized these little children were, let alone the upper grades.

The second thing that was bad was what they called a syllabus. Both in the high school and the university, what the students are supposed to learn is established by a syllabus. What the are supposed to do is to learn everything that's in that syllabus, and essentially nothing else. This kills individuality of teaching, it kills good teaching, and it kills good students.

Sharp: They were examined then on the basis of the --.

Revelle: Of the syllabus, yes. It's a lack of freedom in teaching I thought was quite serious for good students and for good professors. It's okay for poor students and poor professors.

The other things that were very unsatisfactory were the libraries. Most of the libraries were locked. They had shelves of books but they were all padlocked.

Sharp: Why was that?

Revelle: Well, I guess the students would walk off with them if they weren't padlocked, but in any case, most of the universities have no open bookshelves.

Some of them did. I remember the University of the Punjab did, and maybe the Hindu University did too.

The thing I remember most about the Hindu University library was they had a whole room about the size of this living room piled from floor to ceiling with books with bamboo-leaf pages. These were a thousand years old or more. This was before they had paper in India. These things were all mildewing and decaying. They were just stacked up there in that humid climate, and they would be lost in a few years. It was a shame. But they didn't have any money to curate them or to take care of them. Maybe they didn't care.

In general, Indians are not much interested in history. They very rarely know the history of their own country. All the history books on India were written by Englishmen because the English are very much interested in history.

One of the members of the Education Commission was a man named Mathur, who was an economist and I think had taken an advanced degree at Harvard. He never got over being a Harvard alumnus, he loved being a Harvard alumnus. He later became vice chancellor or the University of Jdaipur in Rajistan. I think he is still active in some educational-economic capacity. Educationist capacity. They call themselves "educationists." His specialty was the

financing of education, how it could be done, who is going to pay for it, and how you could raise the money. He was very good at that.

The report of the Education Commission is an enormous work. I never was able to find out what they really recommended. The recommendations were made by the Indian members of the commission, not by the foreigners. I wrote a lot of stuff for it, and so did the other foreign members, but in the long run the recommendations were all made by the Indian members.

Sharp: What were some of your recommendations?

Revelle: Well, for example, I felt strongly that we should have agricultural universities that give a general, liberal education, like [UC] Davis. It shouldn't be just technical subjects. I wrote a good deal about agricultural education, particularly geophysical and geological, soil chemistry, biological part of it. There should be a lot of basic research and basic courses as well as the very practical courses. In other words, the agricultural education should be integrated with the liberal arts, with a general education. And of course I was very much in favor of and wrote about the problems of general [education.] **##**

Sharp: One of the issues starts much further down the educational scheme, literacy. The literacy level was very, very low in India when you were on the commission.

Revelle: Yes, it was.

Sharp: I wonder if you had some ideas, if you made some recommendations about the education of the lower levels?

Revelle: Not really. I mean, we all had to concentrate somewhat. I concentrated on university and graduate education. I didn't feel I knew enough about elementary, pre-school and high school education. I had never been involved with that in the United States, so I didn't try to do that.

Sharp: Were there other people on the commission who were focusing on a lower level?

Revelle: Oh yes. Particularly the French educationist, who was, I thought, a first-rate man, a very good man. He had been much involved in the reform of the education system in France. France had this very rigorous system too. In the old days every student in a French school, in a certain grade in a French school, every student in the country was studying the same thing on a particular day. It was programmed completely, all over the country. He took a dim view of that and reformed it in France.

The Englishman I never met, the English educationist. I met the Russian and the Japanese one, and I spent a lot of time with the Frenchman. We both stayed at the Clarendon Hotel, one of the old-fashioned hotels in Delhi. A nice hotel, very nice. I'm sorry to say I can't remember his

name either.

The chairman, Dr. Kolthan didn't exercise much initiative or control over the commission. He was pretty thoroughly involved with the University Grants Commission, which he was chairman of also. One of the big things that he had the University Grants Commission do was to translate scientific books into local languages. So he would have a physics text translated into Tamil, and Punjabi, and Hindi, and Bengali. They had to invent words, of course, in these different languages for scientific terms.

Sharp: An enormous project.

Revelle: I thought it was ridiculous. In fact, I was practically the only voice on the commission saying that we should emphasize English, that English was the only language that all Indians were willing to speak. Of course, they didn't like that very well at all because they were at that time feeling their nationalistic oats more than they are now.

Now it's quite obvious that I was right, that English is the one unifying language in India. All Indians are never going to accept Hindi, let alone Tamil. But interestingly enough, they are developing a language of their own which you can call Hindish, which is English with an Indian accent and Indian definitions of the words. It's almost impossible to understand for a foreigner, for an American, these fourth generations of Indians after independence. For example, a word like probable; they call it probable.

Maybe there'll be another generation before they really decide that they should really concentrate on English. As they get more self-confidence, and more feeling of being a great power in the world, then this will be easier for them. And particularly as Hindish develops and becomes a unintelligible language to anybody else, it'll be a good thing too.

Sharp: They will see the drawbacks of it.

Revelle: Of Hindi.

The difficulty was, and is, that very few people actually speak English, or whatever you want to call this new language, Hindish. Only about 10 or 15 million people speak it. They are the governing class, the upper class, and particularly the south Indians all speak it. They are damned if they're going to speak Hindi and nobody understands --.

This helps them get civil service jobs. One of the principal reasons for getting an education in India is to get a civil service job. Of course, there aren't very many civil service jobs, so lots of people are disappointed. As time goes on, maybe that will be less and less of a problem as industry and business services develop, so there'll be many more opportunities for young people.

What one would say now I think is something like this, that about 100 million Indians are engaged in the modern world, in industry and other aspects of the international scene. India has become the seventh or eighth largest industrial power in the world in the last few years. Six hundred million Indians are still living in the Middle Ages. Not exactly in the Middle Ages, but with one foot in the Middle Ages.

You drive by a typical Indian village, for example, and it doesn't look it superficially, but it must look superficially now like it looked 2000 years ago. It isn't quite that way when you get in there. For example, they will have a covered well with a hand pump so they can get clean water. They have antibiotics, lots of antibiotics. They have a road going by. Otherwise you wouldn't be able to look at it! A lot of the young men have left the village and gone out to work in industry or work in the cities.

It depends where you are, the caste system is still very strong in some states, like Bihar, it's terrible. I remember about two or three years ago I took my grandson to India -- I usually try to take one of my grandchildren each time I go to India -- and we went to a village in Bihar. We first went to an untouchable village. There were two villages essentially contiguous to each other. The main village was a Brahmin village, and Brahmins aren't supposed to farm. It's against their religion to actually do farming. So the farming was done by these untouchables. The Brahmin boys all went to the neighboring sugar factory and became coolies. That was quite all right. But not to work on the farm.

I remember there was a little old woman that we were talking to in the untouchable village. She was quite small and quite pathetic looking. She said, "We never get enough to eat, the untouchables." Right there in the square, right next to us, was a bundle of cloth and under that cloth was a dying baby. The mother would look at it every now and then and see how it was getting along.

At an early age, the Brahmin kids and the kids all played together. My grandson, who was then about fourteen, was about twice as tall as any of them, and he was sort of like a Pied Piper because he had a camera, and they all wanted to have their picture taken. So as he walked along he had a cloud of about a hundred children surrounding him, both the untouchable kids and the Brahmin kids. You couldn't tell them apart. At least I couldn't, and he couldn't. They were all saying, "Please take my picture." Of course, he ran out of film after a while! He had to snap, pretend to take their pictures, it didn't matter.

Then we later had a little meeting in the square or the meeting place of the Brahmin village. I remember we talked to a little girl, a little untouchable girl of about eleven years old. She had quit school. There was no point in going to school. It would not help her any to get anywhere in life. She was stuck in that untouchable caste.

That would be different. Other parts of India are much less backward. That was a very backward part of India, socially and educationally. Punjab is different pretty much.

Sharp: So there are some very backward places and some very, very modern ones.

Revelle: That's right. Exactly.

Sharp: I would think trying to make recommendations for higher education, you would have such a mixed bag of what you would suggest because there are some more advanced places and some very backward ones.

Revelle: Oh yes, sure.

One of the things that the British had done was to start so-called federal universities or national universities. One of them was the Hindu University. Another one was Aligarh Muslim University in western UP, in Aligarh. The University of Delhi was a national university, and a couple of others. These were pretty good places, compared to many of the others; comparatively speaking, they were pretty good places. They could have been a lot better if there had been more emphasis on research.

Everything about American universities could be adapted to India, with benefit to the Indians. The emphasis on research, the emphasis on liberal education, the emphasis on freedom of teaching, the emphasis on several years of non-professional training before you start on your professional education. All these things would, I felt, be useful to India.

Sharp: You were really advocating a pretty general restructuring, then, of the education system.

Revelle: Yes, more or less. And to some extent that has happened, as it has happened in European universities too, particularly the Dutch universities.

Sharp: It sounds as though you really love India.

Revelle: I would not say I "loved" it. I have often been asked that question. I find that I'm fascinated by it.

It's a kind of an exemplar or a universe of people which is just like mankind in general, but instead of four-and-a-half billion of them, there are only 700 million of them. There are so many Indians that whatever you say about human beings you can say about Indians. And it's true. They are bad and they are good. They are mean and they are generous. They are idealistic and they are very materialistic.

You know, they are just people, in every sense of the meaning of that word. They have many things that handicap them. Ignorance is one. Poverty is another. They are volatile, emotional -- uncontrollable crowds and rioting

whenever something like the assassination of Mrs. Gandhi takes place, basically because of poverty and hopelessness. And why the hell shouldn't you riot?

Sharp: There's nothing else.

Revelle: Nothing else to do.

I wish I could think of the name of that man who was the secretary. He died a couple of years ago. But I loved him. Although I didn't think much of his report. The problem with his report was that it had something in it for everybody. It was so mushy that you really couldn't make out what the recommendations were.

Sharp: Did you see any of your own recommendations in it?

Revelle: Oh yes, sure. But there were lots of others that worked in the opposite direction! You might look at the report sometime. I'm pretty sure you could find it in the Berkeley library.

Sharp: I will.

Revelle: Let me just say one other thing. This was a great educational experience for me. I learned more about India then than I could ever have in any other way, because I was traveling around the country and being on the inside.

One of the things that I remember very well was that at every university we would have a meeting of the students, without the faculty being present.

I would always ask them one question. "How many of you want to be university professors?" None of them wanted to be university professors. In the United States at that time, half the students would have wanted to be university professors because it was a very happy, prestigious, good thing to be, but not in India.

Sharp: Did they say what they did want to be?

Revelle: They wanted to work for the government, for the civil service, particularly the administrative service, the higher civil service. There were only 2,000 members of the whole group, I guess, and it only took maybe twenty applicants a year.

If you went through all the government services, which were more specialized than the old ICS --. The ICS was the original name of this high-level civil service. Those people are all very well educated, speak beautiful English. They are the cream of the cream of the Indian society. They get paid plenty too. But there were very few of them. That's what all these kids wanted to be, and only one out of a hundred could be in, or one out of a thousand.

Sharp: So most of them were looking to be very disappointed in what they were going to do.

Revelle: That's right.

I guess that's enough for the Indian Educational Commission. It was a tremendous experience for me.

Sharp: You were on it quite a long time.

Revelle: Two years. It was only two years. '64 and '66. It was an ad hoc commission, it wasn't a permanent commission. I still haven't thought of the name of the secretary.

What else do you have on your mind?

Pacem in Maribus and International Law Concerns

Sharp: Well, this is all tied together, but the Pacem in Maribus work and the International Ocean Institute, and then the Law of the Sea Conference itself. I have a lot of trouble figuring it all out. I am not really sure which thread to start on.

Revelle: Well, the important thing there of course was the UNCLOS, the third United Nations Conference on the Law of the Sea.

Sharp: Which started in '73.

Revelle: Right. I don't remember when the first Pacem in Maribus thing started. It was about the same time, wasn't it?

Sharp: Well, the earliest that I could see that you were involved was 1970, but I don't know if you were involved before that or not.

Revelle: Well, I was at the very first one. That was in Malta.

Sharp: That was 1970. We can talk about Pacem in Maribus a little bit, and then more generally about the Law of the Sea and some of the issues.

Revelle: Well, the principal issue, as far as I was concerned, always was, and had been since 1958, what we used to call "freedom of marine scientific research."

The first United Nations conference in '58 on the Law of the Sea established the concept of the continental shelf and the jurisdiction of the coastal state over the continental shelf. The continental shelf was not, as the oceanographers thought of it, a shallow water terrace an extension of the land. It was just a certain area off --.

Sharp: It was a political boundary more than anything else.

Revelle: That's correct. It had nothing to do with depth of water or distance from shore. The shelf was defined basically as that area adjacent to the coast which subject to exploitation. An interesting definition. So it didn't refer much to depth of water or distance from shore, either one.

Later in the third UNCLOS, the third UN Conference on the Law of the Sea, they dreamed up something called the Exclusive Economic Zone, which is 200 miles wide, extending from the baseline of the territorial sea. So it's essentially 180 miles beyond the territorial sea. Then, they decided that the continental shelf could extend beyond that sixty miles, or to a place where the thickness of sediments was more than a certain ratio of the depth or the distance from the end of the Exclusive Economic Zone. If the sediments were thinner than that, it was not part of the continental shelf or the national jurisdiction.

This can be thought of in historical terms as a great enclosure movement, very much like the enclosure movement in the English countryside, enclosing about 40 percent of the entire ocean and putting it under national jurisdiction. Not national sovereignty, but the coastal state has the exclusive right to exploit the resources. It doesn't have the exclusive right to lay cables there, or to navigate there, or to fly over it, or to do various other things, but exploiting both the living and the non-living resources, the exclusive prerogative of the coastal state.

Sharp: So drilling or something like that.

Revelle: That's right. Yes.

Sharp: Would not be within the prerogative of any other state.

Revelle: Any other state. And you can't put structures there for submarine cables or for other purposes, provided it doesn't interfere with the coastal states exploitation. I'm jumping ahead in the sense that this is the outcome of the Law of the Sea Conference.

In 1958, at the first UN conference, one of the provisions which was actually passed by a rather narrow majority, was that any marine scientific research could only be done with the consent of the coastal state. This was, from the standpoint of oceanographers, a disastrous provision because the coastal states would not always give their consent, oftentimes would not give their consent. They just threw the letters away. You would apply for consent and they would not reply at all.

So oceanographers particularly in the United States, and almost exclusively in the United States, I am sorry to say, tried to invent another system for doing marine scientific research, and this was a system we called a "Review of Rights and Obligations".

The rights were to be able to do research anywhere in the ocean, outside the territorial sea, without having to have a consent and without conforming to the regulations of the coastal state, but with certain obligations.

One obligation was to share all the samples and all the data with the coastal state. Another was to take somebody on board, a scientist, from the coastal state. A third was to give notice and present a plan to the coastal

state. A fourth in the long run turned out to be an agreement that you would help the coastal state interpret the results. In other words, you would the data with them and the samples, but you would also help them understand what it all meant because most of these countries hadn't any idea what it meant.

This was our proposal at the conference and opposed to the absolute consent regime of the coastal state. Another one of our rights was that we had the right to publish. Marine scientific research was in effect defined as research which would be published.

Well, none of this ever happened. What happened was that the Review of Rights and Obligations and the Consent Regime were both piled on the oceanographers! You have to agree to take somebody from the coastal states. You have to divide the samples with them, and the data. You have to help them interpret the results, and you still are subject to their giving consent. We have the worst of both possible worlds.

The American oceanographers, particularly Warren Wooster and Johnny Knauss and a group of us who formed something called the Freedom of Ocean Science Task Group in the Ocean Policy Committee all were members of the State Department Advisory Committee on the Law of the Sea, on UNCLOS particularly. Paul Fye was one also, John Craven, Bill Nierenberg, Tom --. He was the lawyer who later became ambassador for the State Department for negotiating fisheries treaties, the lawyer at the University of Miami law school, and concerned with marine law. Bill Burke of the University of Washington was also concerned with marine law.

Anyhow, several of us would go to each one of these UNCLOS meetings year after year, particularly Johnny Knauss and Warren Wooster, and I would go occasionally, and Bill Nierenberg would go occasionally. John Bryne, now president of the Oregon State University, was there some of the time. Until recently he was head of NOAA, National Oceanographic and Atmospheric Administration.

We would all go and do what we could to push our negotiating delegates. We were not negotiating, we were just advisors or experts or whatever you call them. The negotiating delegates were all government officials, not private people. Our particular delegate was a guy named Norman Wolf, who was a lawyer for the State Department and the National Science Foundation. Now I think he is with NOAA. A very nice man, very thoughtful, imaginative, a good man, effective man. But in spite of our best efforts, we never got anywhere.

Even most of the developed countries were against freedom of scientific research. The ones that were on our side were the Germans and the Dutch, and at one time the Russians. But the Russians, after a while, pulled out because they wanted to control people in their Exclusive Economic Zone.

When I was there the most effective chief delegate was Elliot Richardson, who is a great man. Before that it was John Morton Moore, and before that it was the lawyer for the State Department. **##**

-- did they really take marine scientific research seriously. He took it very seriously. He gave parties which us oceanographers went and tried to persuade people. He organized a cruise on an oceanographic ship off Manhattan, where we all went. Nothing worked.

Sharp: You were on this advisory committee for the Law of the Sea Conference for the State Department in '76.

Revelle: All the time, the whole time, right from the very beginning, from '72 on.

Sharp: There are a couple of letters you wrote to Richardson summing up some of your ideas. I wasn't sure really what --.

Revelle: Do you have those here?

Sharp: Yes, I have them here.

Revelle: Unfortunately, I haven't had a chance to go over this part of it very much.

Sharp: This is his letter back to you.* It's in '77, so it's later on in the discussions. [brief tape interruption]

Revelle: The problem about the islands is that there are so many islands, and no matter how small the island is, it had a 200-mile economic zone.

So if you look at the South Pacific, there's practically no water left in the South Pacific. It's all covered by economic zones of different islands.

The problem is less severe in the North Pacific.

In the Atlantic, one of the islands is Rockall, which is just a rock a hell of a ways off the coast of England. The English claim it's an island, that they have a 200-mile economic zone around it.

Elliot was certainly right, that there was nothing you could do about it, except it's a shame that islands have all these economic zones. That's where most of the economic zones come from, from the islands.

What he said here, which is quite important. I'm not quite sure how it turned out, and that is dispute settlement. That's where he placed his hope. At least at one time, whether this coastal state denied consent or not was not subject to dispute settlement. It was purely coastal state, what he called binding third-party settlement. What that means is you have an arbitration with somebody beside the two parties in dispute involved in it.

JUN 1 1977

DEPARTMENT OF STATE
AMBASSADOR AT LARGE
WASHINGTON

May 18, 1977

Dr. Roger Revelle
Richard Saltonstall Professor
of Population Policy
Director of the Center for
Population Studies
22 Plympton
Cambridge, Massachusetts 02138

Dear Dr. Revelle:

Thank you for you letter of April 27 and the stimulating ideas on the negotiation on marine scientific research. I apologize for not responding sooner but, as you know, your letter was given to me while I was traveling and I returned to Washington only a few days ago.

We raised the problems with the revised single negotiating text on scientific research at each of the stops on the trip to make it clear that the United States was not satisfied with the RSNT provisions. We had a lengthy discussion in Moscow which did not produce any immediate movement but which at least holds some promise for movement in the future.

I appreciate the concern you express regarding Article 60 and hope that we can achieve changes. The points that you suggest on limiting the regime for islands or for cutting off consent at the 200 meter isobath of the continental shelf may not hold much promise. The decisions regarding jurisdiction off islands and the extent of coastal State jurisdiction over the continental shelf will be made on resource grounds and it seems highly unlikely that we would be able to differentiate between the resource regime and the scientific research regime, at least in terms of the area of applicability.

On the other hand, I am optimistic that we will achieve a meaningful series of obligations on compulsory settlement of disputes arising over marine scientific research. The latest text on Part IV clearly includes scientific research as a subject for binding third party settlement (Article 17-1-c) and we expect to be able to eliminate any possible ambiguity from Article 76 of Part III on this point. Also, we might find that, subsequent to the conclusion of the treaty, a further

negotiation to define the meaning of scientific research "which bears substantially on the exploration and exploitation of the living or non-living resources" could produce useful guidelines for the actual conduct of research. The suggested involvement of the International Oceanographic Commission in the process of granting consent is probably not negotiable in the Conference but may be of practical significance in certifying projects once the treaty has come into force.

I agree with you completely on the question of publication of the results of scientific endeavors. Since we are willing to undertake to share data and samples with the coastal State and to assist in the interpretation of results, I see no reason why a coastal State should object to publication.

I appreciate your effort in formulating and sending your ideas to me. We will continue to work on this problem and hope that we will receive the continued cooperation of you and your colleagues to impress upon foreign scientists the importance of this issue and the necessity of change in the regime. I look forward to seeing you in New York.

Sincerely,

Elliot L. Richardson

Sharp: Well, part of what was finally settled in the 1982 text, one of the things anyway was this International Seabed Authority.

Revelle: When was that?

Sharp: Well, I'm pretty sure it was part of the 1982 final text.

Revelle: Yes, but it was decided long before that. The United States does not subscribe to the treaty, as you know, primarily because of that provision. The present administration has said, "We subscribe to most of the treaty. We believe most of it is customary international law. And we subscribe to the Exclusive Economic Zone concept. We will not require consent for marine scientific research in our exclusive economic zone." Interestingly enough.

This may change with the Defense Department getting more and more stuffy about classified information. It was not exactly a victory, but quite a remarkable agreement on the part of the administration that they don't require consent because they're very nationalistic. But they didn't because somebody got to them about our problems of scientific research, probably Bill Erb in the State Department. He probably had a lot to do with drawing up that proclamation.

Sharp: When the US declined to sign in 1982, one of the biggest stated objections that the US had was because of the deep seabed mining provision.

Revelle: That was the only objection. All the provisions which related to deep seabed mining, they were agin' 'em. That's the only part of the treaty we don't subscribe to.

Sharp: Much earlier than that, in '79, in your papers there were copies of some testimony that Elliot Richardson gave before the U.S. House supporting the House Resolution 2759 which would have established what was called an "interim regime" to allow some of that development to occur. I wondered what your perspective on all of that was?

Revelle: Well, the whole question is moot at the present time, and the reason it's moot is because the International Nickel Company can't even sell its newly mined land nickel. The price is below the cost of production, largely because recycled nickel is cheaper than newly mined nickel, and they can recycle it pretty well.

So, in other words, the nickel's demand is satisfied by recycling with no need to buy the new stuff. And certainly ocean mining is going to be more expensive than land mining.

So the whole problem has essentially gone into the same waste basket as the oil conservation and the synfuels corporation. Synfuels are just too expensive with the present price of oil. Manganese nodules are too expensive with the present price of nickel.

Moreover, my honest opinion is that the system proposed in the Law of the Sea is unworkable. I don't object, although the mining companies did object, to sharing their technology. They regard that as a secret, proprietary for their own company. It's primarily the technology of getting the metals out of the ores, extracting the nickel, cobalt, and copper from the nodules. There's a secondary problem of getting the nodules up to the surface, but I think that's not a very high-powered technology, I don't think, and I think they might be willing to share that.

The other much more serious problem, it seems to me, is that no United Nations agency is liable to be a very effective instrument for doing something as practical as mining. I mean, it would be all right if they could contract with some mining firm to do it, but to do it themselves is liable to be a fiasco. That's essentially what the deep-seabed mining provision is, that a company or a consortium can nominate two sites, and then the other "prize," as they call it, gets to choose one of those sites and the company gets the other. Then, somehow or other the enterprise has to raise the money to do the mining, get the technology, develop the equipment, or develop this managerial system and the equipment, and sell the product.

Revelle: It's just not the kind of thing that an agency as clumsy as the UN could possibly do, I don't think.

I think the developing countries are going to be seriously disappointed in it. I don't think anybody believed it was going to work very well, but Elliot was willing to go along with it because in fact it did also make provision for genuine mining companies to do part of the mining.

Sharp: How is all of that going to end up with the way the Law of the Sea Conference is now?

Revelle: Well, they're still talking about it in the Ocean Studies Board with about as much hopeless resignation as ever! There's an agency in the State Department, the Bureau of Oceans, Environment, and Science, which has an assistant secretary at the head of it.

One of the divisions of that bureau is the Marine Affairs Division headed by a man named Bill Erb [spells name], now at least. It was formerly headed by Norman Wolf, the lawyer I spoke about. His principal job is to try to get consent from coastal states for American research vessels that want to do research there. Sometimes it works and sometimes it doesn't.

For example, the Geophysics Film Committee of the National Academy of Sciences has a project with WQED Pittsburgh to make a series of seven geophysical films. I know about this because I'm the chairman of the NAS committee that is supposed to be doing it. We made arrangements for the Woods Hole submarine Alvin to dive in the Guaymas Trench off Guaymas in the Gulf of California.

Just a few days before this operation was to take place, the Mexican government said, "No, you can't do it." We finally found a navy submarine that was going to go off Cortez Bank here and do something instead. So it hasn't worked very well, particularly with Mexico and with the South American countries.

It has worked very poorly with India, not at all with India. The Indians won't let any foreign vessel do any research in their economic zone. They just refuse consent. They are not supposed to. The Law of the Sea says that ordinarily the coastal state would give its consent. But they ignore that.

That's one of the interesting things about treaties, that countries don't really follow them; they just do what they want to do.

And we probably can't do much about the Indians. We can't very well sue them. So they are going to have to do their own oceanography, and they don't do a very good job of it. They are second-rate, third-rate oceanographers for the most part.

You seem to be sort of puzzled by this whole thing.

Sharp: Well, I am. It is political history more than it is almost anything else. There are so many issues that the developing nations have of their own, and scientists, especially from the developed countries, have things that they want to do and are stopped in their projects.

In some respects it's kind of like it's not the good old days anymore because you don't have the freedom that you did.

Revelle: It's sure not like the good, old days, that's right.

Sharp: How does Pacem in Maribus fit into all of this as a group?

Revelle: Well, Elisabeth Mann Borgese is the daughter of Thomas Mann. She was married to a University of Chicago professor. I think they have gotten divorced since then. She was with Bob Hutchins' Center for the Study of Democratic Institutions at Santa Barbara, and they had something called Pacem in Terris -- this was about twenty years ago --. So she invented Pacem in Maribus, peace of the seas, thinking that there were lots of ocean issues that were coming up.

And she was right. I didn't realize the first one, I believe, was in 1970.

Sharp: I think it was.

Revelle: That was subsequent to a famous speech by a man named Arvid Pardo, who was a Swedish lawyer or scholar. I'm not quite sure what his background is. But he managed to become the ambassador of Malta to the United Nations, not a Maltese at all. In the United Nations he made a famous speech saying that the ocean should be the common heritage of mankind and

the United Nations should take very seriously how it can be developed as the common heritage of mankind. The United Nations then formed a committee.

Sharp: The Committee on Peaceful Uses of the Seabed, is that the one?

Revelle: Something like that, yes, that's probably it. Right after he made his famous speech.

Sharp: And that was in '64.

Revelle: Was it in '64 that he made his speech?

Sharp: Yes.

Revelle: Nine years before the conference.

The committee did a lot of negotiating and developed a lot of principles for the proper uses of the ocean part of the surface of the earth.

They finally called a conference, the Third UN Conference on the Law of the Sea, which had its first meeting in Caracas in 1973. Many things had already been decided pretty much in this UN committee. The chairman of that committee was a Ceylonese with a long, complicated name. He was then the president of the UNCLOS, until he died. Very much of a diplomat, a very suave, impossibly dull speaker, but diplomats <u>are</u> dull speakers deliberately.

Sharp: Not to offend anyone?

Revelle: Partly. And partly not to say anything. [laughing] Never show your hand if you can avoid it. So he was <u>very</u> good at being president of the conference.

The conference always operated by consensus, as they called it, never took a vote. The reason they didn't take a vote was that that would have allowed some voting blocks to do logrolling, and particularly the group of countries called Landlocked and Geographically Disadvantaged States, the LLGDS.

These states were effectively frozen out of all the deliberations of the conference. If they had had a vote, if the conference had operated by votes, they could have logrolled and traded something that they wanted for something that one of the other side wanted. But with the consensus business, you couldn't do it. And they didn't. So they just got thoroughly screwed throughout the whole meeting!

They organized the conference in three committees: the committee on the territorial sea and the exclusive economic zone, the committee on the deep-sea bed, and the committee on marine scientific research and the environment. Sort of what was left over was in this third committee.

Each of these committees had a chairman, and the

chairman would write up what he considered to be the position that had the most support in each session, or in each group of sessions. These write-ups were then stitched together to be something called the preliminary text or the negotiating text, something like that. These guys were all lawyers, so-called international lawyers.

International lawyers are a very interesting group of people because they aren't really lawyers, they are word choppers. They try to be quite precise when it's desirable to be precise, and quite vague when it's desirable to be quite vague. They invent what are called "terms of art." For example, traditionally in admiralty law is something called the "right of innocent passage," which is the right to go through the other guy's territorial sea, as long as you just go on through without stopping, and as long as you have peaceful intentions. They invented a term for this business of going through straits called "transit passage," "the right of transit passage." "Transit passage" was the right to overfly, to fly over the strait, or under it in a submarine, or on the surface, all three. Whereas with the innocent passage, you can only go on the surface.

The reason why this had to be invented was that with the extension of the territorial sea from three miles to twelve miles, many straits were completely covered by the territorial sea of the states on the two sides. Like the Strait of Gibraltar was, for example, and the Straits of Babel Mandab and many other straits, the Straits of Sumatra. They were all covered within the territorial sea of the coastal states. So you had to develop a system for navies and military vessels and planes to go through them without hindrance. That was one of the important things the United States wanted, was the right of "transit passage".

Another term of art was the "archipelagic state." This was like Indonesia and the Philippines and Hawaiian Islands, which said that the waters within the outermost boundary of the islands that made up that country were archipelagic waters.

They were parts of the territorial sea. But there were certain passages where you could have the right of "transit passage" as well as innocent.

Sharp: In the archipelago?

Revelle: Within the archipelago, yes. And so forth.

The chairmen of these committees were these international lawyers who wrote articles, one after the other, which would get the most agreement, but by no means unanimous. It was what they call "consensus." You can define "consensus" to suit yourself. It meant what they thought they could get by with. I mean, not putting forth a particular point of view, but what the majority of states would agree to.

Of course, this was very largely the positions that

were adopted by the Group of Seventy-Seven. At every conference the Group of Seventy-Seven met everyday all by itself and decided what their position was going to be. That was the position that was pretty much adopted because there were so many of them.

Well, we started by talking about Pacem in Maribus. Elisabeth had the idea that maybe we could get together a bunch of people from different countries and more or less talk over what these problems were and what should be done about them before the Law of the Sea Conference began.

One of the people there I remember was later the foreign minister of Mexico, whose name began with C. Not Cassandra, not Casanova, but something like Casanova.

Do you have a lot of other things you wanted to talk about?

Sharp: No, I don't. This is it actually. So I thought we might bring this to a close.

If you look at the Pacem in Maribus efforts and then the larger issues that the Law of the Sea Conference had to address, what looked to you as the biggest unresolved issues so far? Scientific research?

Revelle: No, that's probably not unresolved. That is resolved, but in a way that oceanographers don't like. It has been certainly resolved. It's better than having no resolution.

As I said, the deep-sea mining is, at the moment at least, a non-issue because nobody is going to do it. Twenty years from now it may however become an issue again.

Fisheries management and fisheries development is in a state of great flux because of the Exclusive Economic Zone development which gives the coastal states a right to fish in areas which were traditionally fished in by other people, like off our coast. **##**

The Grand Banks and the Georgia Bank, but particularly Grand Banks, was fished by Portuguese for 500 years, and now they are frozen out. It's part of the Exclusive Economic Zone of Canada. So that there has certainly been a considerable upheaval in fisheries management and fisheries development in a way that nobody really understands how it will work out.

My own opinion is that fisheries are not going to develop very much beyond the present total catch of about 70 million tons a year; that's safely about what the ocean can provide. Agriculture is far more important than fisheries. Aquaculture is very promising as a way to increase the marine harvest and the ocean harvest. The problem with aquaculture is a place to do it. There are so many conflicting uses of the coastal zone that there's no real room for the ocean farmer in many areas.

The problem of better exploitation of what are called "trash fish" is an important problem. This is probably not an international problem, this is a technical problem and an economic problem. For example, shrimp boats probably throw away and kill 3 to 6 million tons a year. They are perfectly edible fish. When they are trawling for shrimp. The reason they throw them away is they haven't got any space for them in the hold. The shrimp are a much more valuable product than the fish. Somehow the only way to really solve that problem is to have vessels right there while the fishing is taking place so the trash fish can be transferred and frozen, processed maybe right there.

The military problems of the ocean were not involved really at all in the Law of the Sea negotiations.

Sharp: Yes, I didn't see any mention of that. They just say the ocean should be used for peaceful purposes, and it isn't entirely for peaceful purposes. Pious declarations.

Revelle: Marine pollution is a serious subject of in-shore waters, in estuaries, for example, and in coastal waters, not much of a problem in high seas. An example of the problem is in Santa Monica Bay where for quite a long time the city and county of Los Angeles were dumping sewage. Twenty years ago there was a good deal of DDT in that sewage, and the result was it just about killed all the ocean birds, not to mention a lot of other animals. DDT has pretty much disappeared and the whole thing is probably getting better.

Sharp: The stuff that I saw from the Pacem in Maribus, they spent a lot of time on pollution.

Revelle: Yes.

Sharp: Some of the recommendations that they were wanting to make to the UN Committee on Peaceful Uses of the Seabed, that was really a big topic for them.

Revelle: I have never been very excited about ocean pollution, basically because I'm a high-seas type oceanographer, not an estuarine type. I think that Jacques Cousteau is off his rocker when he says that the ocean is dying. That's complete nonsense.

The ocean is the world's greatest hole in the ground, and it has been receiving the waste from the land for the last 3 billion years. The wastes are a little bit different now than they used to be, but the ocean is probably just about as good a place to dump them as any.

Sharp: We've talked about this kind of in passing, but the BEAR Committee and its recommendations on radioactive waste, in things you have mentioned really in passing like the expandable bathythermograph. So the idea of using the ocean as a place to dump all kinds of things is acceptable, is all right?

Revelle: Well, it's acceptable, I think, if you look at the world realistically, many things you have to get rid of somewhere,

what are you going to do with it? And many wastes are damaging to the groundwater on land and to land areas which may be perfectly safely disposed of at sea.

I mean, we live on a finite planet and it has finite resources, and our problem is to make the best use of those resources for human happiness. If you define human happiness broadly enough, this is probably a reasonable statement. We want to be sure that we preserve other creatures as well as ourselves, not just to end up with nothing but human beings. It would be a rather dull earth. So the preservation of other species is important. We don't want to endanger them.

But we do have limitations, and the limitations about wastes are, you have got to get rid of them somewhere. Unless you can recycle them. Sometimes you can. There's much less waste in a country like India than there is in the United States, of some kinds. But other kinds, there's more, and more because the technology is not good enough to use them.

Sharp: And the more advanced countries, technologically speaking, actually create quite a bit more waste.

Revelle: Oh yes, oh sure. They produce more per person. Sure.

Sharp: Well, I think I have run out of questions for the time being!

Revelle: Okay. I have run out of ideas too! But I wish I could think of the name of the secretary of that committee, that commission.

Sharp: This is the Education Commission?

Revelle: Yes. He was such a wonderful man. It was not Pau and it was not Lau, it was not Yosh. I'll probably think of it after you go. **##**

TAPE GUIDE -- Roger R. Revelle