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COSMO PIETERSE:

This week a report from Ghana on a fascinating plus unusual survey of land use and land tenure, population, food production and nutrition. But first we go to Zambia to hear of the work there of a team doing research into a new subject for University Report - namely space physics.

This space or astro-physics team comes from Imperial College, London University and its six year research project is now chiefly aimed at gamma ray astronomy. So, being aware of widespread interest in and our own ignorance of this kind of work, John Barnor spoke to Dr. Sood, a member of the research team; and he first asked him what this gamma astronomy research is:

DR. SOOD:

At Imperial College there is a very strong group engaged in space physics, and my particular interest is gamma rays coming from the sun and from the stars of the Milky Way. Now gamma rays are a type of radiation belonging to the family of radio waves, ultra violet waves, light waves, X rays, and gamma rays are one end of this whole spectrum. We are trying to look for this radiation coming from the sun, as I said, and from the stars of the Milky Way. Now this Milky Way is a band of stars which you can see in the sky any night.

JOHN BARNOR: Why did you decide to embark on this type of research?

DR. SOOD: Well we are using gamma rays to probe the universe or the galaxy. Now these gamma rays are produced only in high energy processes where high energy particles, atomic particles interact with each other and they produce gamma rays in only very specific ways. This is then directly concerned with the formation of stars with the amount of gas that there is in our galaxy. From the sun we are interested in gamma rays coming mainly from flares. Now these flares are quite a phenomenon which are very difficult to understand. You find that there is a great release of energy from the sun, one form of which can be seen on the earth in the form of radio noise. Sometimes when you are listening to overseas broadcasts, for instance the BBC, you find a lot of noise on your radio and you cannot pick up any stations, now this is one result of solar flares, and if we investigate gamma rays we should be able to find out exactly what produces this great release of energy.

JOHN BARNOR: Dr. Sood, you've just talked about measuring gamma rays. For my little knowledge of science I think it's almost impossible to measure gamma rays here on earth, it has to be done somewhere in the atmosphere. How do you go about measuring the gamma rays?

DR. SOOD: Well, there are two ways of measuring these gamma rays. First it must be understood that we are trying to measure gamma rays coming from outside the earth. Now these gamma rays are absorbed by the atmosphere of the earth so you have to have your detectors away from the atmosphere or right at the top of the atmosphere. There are only two ways of doing this, one, by using satellites, putting your instruments in the satellite and sending them away from the atmosphere. And the

DR. SOOD:

other method, which we use, is high altitude balloons. These are great big balloons about a million cubic feet which can carry these detectors to a height of one hundred and twenty thousand feet, which is much higher than aircraft can fly. Why we don't use satellites but use balloons is because it is much cheaper to use balloon-borne detectors. A satellite experiment could cost something in the region of ten million pounds, a balloon experiment, a similiar experiment, would cost about twenty thousand pounds. Well our detectors weigh something like one hundred pounds and the balloon weighs about one hundred and fifty pounds. We send the whole thing to the top of the atmosphere. We launch the balloons early in the morning, they take two hours to reach the top, and then we send our data back from the top of the atmosphere by radio. The instruments are analysing the radiation received from the sun and from the stars all the time, and this is sent back by radio which we then record on tape recorders. The information is fed into computers later. At the end of the day we try and bring our instruments down by an automatic cut-down procedure. We do not know where the instruments will land, but since we have the data on tape, recovery of instruments is not very important.

COSMO PIETERSE:

The team in Zambia has made progress which cannot be clearly defined in the terms of such a very academic or theoretical research programme. However, there have been positive results, as Dr. Sood explained when John Barnor asked how far the team had progressed:

DR. SOOD:

Well about two years ago we had our first positive results on gamma ray astronomy. We have detected this radiation and now we are trying to look at what energy these gamma rays have. Once we know what energy these gamma rays have, then we can answer some of the questions that have been puzzling astrophysicists for a long, long time. For instance, how much gas is there

DR. SOOD:

in the galaxy between the stars, what are the magnetic fields in the galaxy and in the stars, whether the cosmic radiation is the same in other parts of the universe as it is near the earth, and other related questions. Now this might take another five or six years, or it might take ten or it might take two. We don't really know the answer, we are just pressing ahead with the research.

JOHN BARNOR:

And what results do you envisage from the results of these experiments of value to us?

DR. SOOD:

Well at the moment most of the results are of a purely academic nature, just like I have mentioned about the various properties of the galaxy and of the universe. But there is one very important point here, this concerns the future high-flying aircraft like the Concorde. Now the Concorde flies at an altitude where some of this gamma radiation could penetrate into the level of the Concorde, and you could get some very intense bursts of this radiation from the sun. Now there is a theory that if you have these gamma ray monitors in the sky all the time, then you can forecast when you are going to get this harmful radiation, and by using these gamma ray detection instruments we should be able to tell the people flying the Concorde when it is unsafe to go up.

COSMO PIETERSE:

Dr. Sood, from the Imperial College, London University, talking to John Barnor about the astrophysical research that the Imperial College team was doing in Zambia.

COSMO PIETERSE: And now to research with more immediate practical application. This research, in the Northern Savannah area of Ghana, is being done by Dr. Benneh, a geographer from the University of Ghana, Legon.

When Christine Oppong spoke to Dr. Benneh in Legon for University Report, she first asked him what were the main areas of his work.

DR. BENNEH: Well the problem of producing enough food for the rapidly growing population of this country has been of special interest to specialists from different fields. But very often they look at the problem from a national sort of angle, and I thought I should select a village and study it intensively to find out how serious the problem is, and to find out the possibilities of finding a solution to this particular problem.

CHRISTINE OPPONG: Why did you choose that village in the Kusasi area?

DR. BENNEH: Well I chose it for a number of reasons. The villages located in the part of the country have a high population density of about 400 persons per square mile, has resulted in the shortage of agricultural land. Many of the farmers in this particular area have responded to technical innovations to increase production. It is therefore possible, I thought, in selecting this village, that one could show the effect of improved agricultural practices on the amount of food produced for consumption.

CHRISTINE OPPONG: What kind of data did you collect in your field study?

DR. BENNEH: Now we did a land-use map. We also had data on the number of men, women and children which make up each compound unit, and a number of people who have migrated, whether the food supply was adequate, whether the food stuffs were sold off the farm, the number of livestock kept by each farmer, and the types of goods taken in the wet and dry season, and a general study of the techniques of farming.

CHRISTINE OPPONG: How were you able to relate the demographic and agricultural data you collected to the problems involved in nutrition?

DR. BENNEH: Now we're trying to find out the density per each compound unit, the number of peoples in relation to the size of holdings, and then the types of food which people take in the village by selecting four compounds as a sample, and weighing the food. So we calculated the amount of calories which a farmer would get from taking the normal diet, and tried to relate this to the yield from his holdings, and compare whether if he depended only on the type of diet which we found out during the survey, he would have enough from his fields. And we discovered that the areas which supported high densities that people were not having enough food, because there was this pressure of population on the land. So in fact it was a study to relate land-use and then the type of food taken and the proteins and calories which they get from this food and find out whether they were, in fact, producing enough from those fields which they were cultivating.

CHRISTINE OPPONG: Since your available data then shows that the pressure of the population on the land in the area is too great for the people to be fed adequately using present

CHRISTINE OPPONG: farming techniques, are there any immediate remedies you yourself might suggest to help alleviate this dietary problem?

DR. BENNEH: Yes, because, in fact, you see we found that about thirty-nine per cent of the available land was not being cultivated because of the effect of erosion, and I thought that an Agency, or the government for that matter, or the Ministry of Agriculture would help the village by reclaiming the large part of land which was not being cultivated. The cultivation of this would, of course, increase population. Then also in Northern Ghana, we have the dry season which spreads for about five months, and during this time no work is done at all in the fields, so I think if water could be provided, and in this village there was an earth dam quite near with water, so if the farmers could be helped by bringing water into the village, which they could use for cultivating crops in the dry season, this would also be very important. Then we also found that there are rather poor storage facilities, and we interviewed some of the farmers in an attempt to find out the proportion of the harvest which is lost through wastage because of poor storage facilities, and it seems to be quite high. Probably it might be about twenty to thirty per cent. I don't think this will cost much money, I think one could try to improve upon these storage facilities, all these would add to the amount of food which would be available for the people in that village.

CHRISTINE OPPONG: Is there actually anything being done at the moment to solve these three problems of erosion, lack of water, and poor storage facilities in Northern Ghana?

DR. BENNEH:

Not very much. In fact before 1962 it was a policy of our government to help these farmers and some of these areas and the village which I studied for part of the land planning district of Northern Ghana. In these areas extension officers were sent and earth dams were built to check erosion, and farmers were persuaded to use fertilisers and all that. Now unfortunately, when the government decided to have a new policy in 1962, most of these services were withdrawn because there was the emphasis on the building of very large-scale dams and so-on and so-forth. So I was rather discouraged to find that some of the dams which has been built in the 50's has been eroded. But there are attempts to build earth dams in different parts of the Northern Region, so probably this problem might be solved. Definitely I think there is a change of emphasis, and the present government looks on the peasant farmer to produce enough food to feed the population.

COSMO PIETERSE:

Dr. Benneh, geographer from the University of Ghana, Legon, talking to Christine Oppong about his work in land use, land tenure, population food production and nutrition. And so having gone into space and its cosmic rays, and come back to solid earth, and food production this week's University Report has also run its full-cycle.