

We are bringing in a system of our own, actually a socioeconomic system, imposing it on top of a preexisting natural system, and somehow we should try to understand how these two get along together.

Dr. REVELLE. These are both ecosystems.

Dr. SMITH. Yes. Well, one of the best things about an ecosystem is you cannot exclude man from it. It is defined as a hunk of material in space and time and man is there, he is part of it. You cannot pretend he is not there.

Dr. BYERLY. Mr. Chairman, I would like to laud Dr. Smith as one of the best systems analysts in ecology.

Perhaps one of the things that has intrigued me is the probability of weather modification during the next few years. He spoke of natural ecosystems, and the time is here or this capability seems about to appear when we need to know the baseline system and to make models which can be tested, perhaps be verified, of what will happen when weather modification comes about. This is one of the big changes that is likely to happen.

Dr. SMITH. That change is practically upon us, I guess, and in this particular case I would hope that we can study the effect of weather modification upon the surrounding ecosystems in the total way, find out what the full consequences of changing the pattern of rainfall are.

As far as the use of models for prediction are concerned, we do not—right now we don't know that much, but models are very useful right now for discovering what we don't know.

As I just said, you put together what you think you know and it produces a model that simply doesn't look like nature at all.

Mr. DADDARIO. And you would hope, however, when you put together those models that you had enough information that it would work in the way that you predicted, but when it does not then you know you are in real serious trouble. Would that be a correct conclusion?

Dr. SMITH. Yes. It gets even worse in some cases. Some of the concepts that we have been trained to have a lot of faith in which operate very nicely if you only look at a single population turn out to be rather disastrous ideas in terms of the whole network of populations. The system has properties that single populations simply do not have.

This is exactly parallel to what has happened in industry, and the whole field of industrial dynamics which has exploded in the last few years is able to cope with this multilevel complex system. And this kind of analysis, the systems approach, seems very suitable to the ecological systems. But it is only the mathematical representation of it; the models are only as good as the information that goes into them. And in order to get anywhere with the models we would have to do an enormous amount of research, field research.

Mr. DADDARIO. This worldwide program helps to put together the information to make it more readily available for the development of such models; you are stepping in the right direction by supporting this program.

Dr. SMITH. Well, particularly since several different countries have proposed to study whole ecosystems. I should point out nobody has ever studied whole ecosystems. It has never been done.

Mr. DADDARIO. You had a point here?