

This can be done. It is not being done and it has to be; without it, we are only in the descriptive stage of this science.

Mr. DADDARIO. Present technology is conducive to it.

Dr. GATES. Yes. What could be done in the science of ecology is infinitely beyond what is being done.

Mr. DADDARIO. If you had available to you a sufficient number of theoretical ecologists to what tasks would you apply them? Not that you would have enough so you could apply them everywhere. You would have to establish priorities.

Dr. GATES. All right. Let me give you an example. We are proceeding in this direction now. We have worked out, for the first time, specifically how the environment, how the atmosphere, is coupled to a plant, how the wind specifically affects the plant, the air temperature, the humidity and the radiation. From this the plant responds by having a certain temperature and by transpiring and losing water at a certain rate. From the plant temperature and the amount of light, the physiology of the plant is driven, the enzymes system, the metabolic system. This is a long, complex, story that I can't obviously describe in detail here. But how the plant responds, how it grows, when it dies, how it is limited, how far up the mountain it can go, how far north it can go, why this plant is so specialized for this part of the country and doesn't grow elsewhere and then when you put these plants together, side by side, they compete with one another for the moisture, for the sunlight, for the wind and so forth. Now, we have worked this out. We are beginning to work out precisely how these factors are coupled to the plant and how this competition takes place. It hasn't been done before. Now, out of this, we can for the first time begin to predict for a given type of plant community, the water usage. We were in the West this last 3 weeks as I said, we were looking at the sagebrush of the arid zones of the West. We know now specifically how the environment, how the climate interacts with the plant moment by moment, hour by hour, day by day, because it is changing all the time, and with this sagebrush in this particular arrangement of density of plants, for the first time we can begin to compute and predict precisely the water usage of this stand.

This becomes of vital importance whether you are talking about sagebrush or the Ponderosa pine or the oak-hickory forest or the crop because this technique that we apply to ecology is also going to be applied to agriculture and in the whole matter of watersheds and the evaluation of transpiration of water by plants, for the first time in detail we can say what will happen and if the weather changes from sunny to cloudy, from hot to cold, or anything else—we can say what will be the response of this plant community. This is the direction we are working. This is where I would apply one of the great efforts; in addition to the matter of competition, there are many questions here, but this is an indication of the—I know almost exactly the kinds of lines, the type of line that we would follow in training people and in carrying out research projects.

Mr. DADDARIO. In your remarks you interspersed with your mountains, rivers, and lakes the problems of the highways and the cities. Would you apply some of theoretical ecologists to the problems of the cities and would it work out in the same way as you have just