the impact of grazing by a certain number of these economically productive animals upon the total energy and nutrient budget of the biome.

The IBP biome studies are going on all over the world. Each country funds its own. There are, for instance, grasslands studies in Canada, Poland, Australia, Czechoslovakia, Mexico, South Africa and Norway. The biomes being studied range from tropical savannahs to near tundra. Dr. George Van Dyne, director of the Colorado study, has proposed an "international grasslands synthesis center," which would correlate the data from all the projects and provide training in biological modeling for scientists.

In addition to biome studies, IBP is also studying human populations in several areas, to learn about cultural adaptations to environment. One study by United States scientists of a South American Indian tribe has focused on, among other things, how cultural patterns have influenced the genetic evolution of tribe members.

The IBP programs are by no means the only interdisciplinary, systems-oriented environmental projects in progress. Another NSF program, Interdisciplinary Research Relevant to the Problems of Our Society (IRRPOS), has studies under way to monitor the genetic effects on humans of pollutants, to correlate the technical, economic, social and political aspects of environmental quality, to devise systems of solid waste disposal, and to examine lead pollution.

And this week, scientists of the National Aeronautics and Space Administration and other agencies got together to try to take a total look at how Chesapeake Bay might be studied, with special reference to the use of remote sensing from aircraft and satellites. □

TWO U-2'S

Scientific spy eyes for NASA

USAF

U-2: Two of the high-flying spy planes will keep watch on the environment.

One of the more salable programs of the National Aeronautics and Space Administration in this era of ecological concern is earth observations. Although the program is not new, recent demands for more accurate information about the earth's environment and natural resources have focused attention on the capabilities of remote sensing from both aircraft and satellites. Instruments such as infrared scanners and radiometers, for example, can sense water temperatures, pollutants, diseased crops and mineral resources.

This week NASA acquired on loan from the Air Force two U-2's which will bring to five the total aircraft used in NASA's remote sensing program. (Others include a modified Electra, a C-130 B Hercules and an RB-57F.) The U-2's are unique. Capable of sustained flight at altitudes of 68,000 feet, they will provide a platform to photograph areas up to 500 square miles.

The aircrafts' primary job is to lay a foundation for two earth resources projects to be launched in 1972: the Earth Resources Technology Satellites and the manned orbiting workshop, Skylab. Four sites have been selected for a comprehensive study at varying altitudes and during different seasons: Arizona, for analysis of arid land; the Feather River and San Francisco-Los Angeles areas, for hydrology and agriculture, and 20,000 square miles of the Chesapeake Bay area, for ecology and oceanography. In this way, analysts can establish, for example, at what altitude diseased corn can be detected, and what it looks like.

The U-2's will be used to photograph sites simultaneously with the passes of both ERTS and Skylab. □

PRINCETON-PENN ACCELERATOR

Heavy ions for cancer

The late Dr. E. O. Lawrence, who constructed the first cyclotron, occasionally got funds for developing particle accelerators by pointing out their usefulness for cancer therapy. Since then particle accelerators have continually been used for radiation therapy, mainly as sources of more intense and powerful X-rays than ordinary X-ray tubes could produce.

Lately scientists have become interested in the possibility of using more exotic forms of radiation—mesons, neutrons and heavy ions—in tumor therapy. These particles promise to be better at killing deep-seated tumors than X-rays because they lose very little energy as they pass through tissue until they are slowed to a stop. Then they give up almost all their energy. X-rays give up large amounts of energy all the way through the body, and thus cannot be used in doses strong enough to kill deep-seated tumors for fear of seriously damaging skin and other outer tissues.

The promise of heavy ions for cancer therapy is extending the life of the Princeton-Pennsylvania Accelerator. The PPA was built as a proton accelerator of 3 billion electron-volts (GeV) energy and served about a decade in that capacity. Last year, in an economy measure the Atomic Energy Commission decided to stop the PPA's operating funds and the accelerator was scheduled to be closed down this year.

This week Dr. Milton G. White, director of the PPA, announced that the accelerator had received a grant of $230,000 from the Fannie E. Ripple Foundation of Newark, N.J., which gives money for equipment to treat cancer and heart disease. The money will be used to equip the accelerator to accelerate heavy ions and to do basic studies in the effects of heavy ions on tumors. It will keep the accelerator running until Aug. 31. Dr. White continues to seek more money elsewhere.

Of particular interest are nitrogen ions and possibly neon ions. At energies of three to five GeV, these ions ought to be even better than neutrons or mesons at penetrating and killing deep-seated tumors and thus be far superior to X-rays. The heavy ions should also do the job in smaller numbers, says Dr. White. It would take 100 billion pi mesons to kill a 100-cubic-centimeter tumor, but it should take only one billion neon ions. All these suggestions are based on theoretical calculations, says Dr. White, and "you can't guess what will happen in the real world." The experiments should tell. □