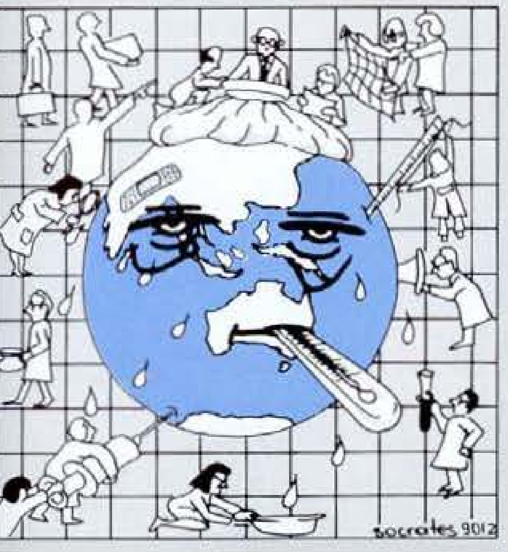
Big change study The study of global change is not confined to atmospheric scientists; biologists, geologists, geographers, and computer modellers are now getting involved.

To provide direction and focus for work on the many interrelated aspects of atmospheric and climate change, and avoid duplication, the International Council of Scientific Unions (ICSU) has devised a complex operation termed the International Geosphere–Biosphere Program (IGBP).

This comprises six vast core projects, plus a number of supporting activities, and ICSU has asked Australia to host and organise one of these — Global Change and Terrestrial Ecosystems (GCTE) — in recognition of the high regard in which Australian ecological research is held around the world. The leader of GCTE will be Dr Brian Walker, Chief of the CSIRO Division of Wildlife and Ecology in Canberra.

Headquartered in Stockholm, Sweden, IGBP spans the globe, with hundreds of participating scientists from dozens of countries. It is the largest and most ambitious research program that ICSU has undertaken. Launched in September 1990, its stated aim is to 'describe and understand the interactive physical, chemical, and biological processes that regulate the total Earth system, the unique environment that it provides for life, the changes that are occurring in this system, and the manner in which they are influenced by human actions'.

The five other core projects that make up IGBP cover atmospheric chemistry and its interactions with the biosphere, global changes that occurred in the past, the role of the oceans and the coastal zone, the hydrological (water) cycle, and analysis and modelling of the entire system, using the information that the project as a whole will glean.



Dr Walker is enthusiastic about IGBP and optimistic about his new role. Through GCTE, biologists hope to find out what effects the predicted greenhouse-induced changes will have on terrestrial ecosystems. Dr Walker says that this tricky task is made all the harder because the mechanism of climate change is itself influenced by the biosphere, which, in turn, is affected by any change in the climate, generating a complex feedback.

To come to grips with an enormous subject, the scientists have divided GCTE into three main areas: how increased levels of carbon dioxide and other trace gases, and changes in the climate and in patterns of land use, will affect the 'health' and functioning of terrestrial ecosystems and the cycling of elements between living things and the geosphere; how such changes will interact with one another to cause changes in the species composition and structure of ecosystems, and how to model this; and the direct consequences of increased CO_2 and climate change on agriculture and forestry, including the likely changes to yields, soils, and the range and activities of pests and diseases.

Dr Walker sees climate change as more or less inevitable, but maintains that it needn't be all bad news. 'It will bring a mixture of hazards and opportunities. We need to do the research now so that, next century, we can seize the opportunities and, as far as possible, avoid or ameliorate some of the hazards. If we know in advance what is going to happen, at a local scale, humans may escape with minimum trauma.'

Nevertheless, he believes that climate change is something the world could do without, as it is likely to bring far more drawbacks than advantages. 'The planet's systems and its biology will undoubtedly adapt in attempting to establish new equilibria, but these new states will not necessarily be so favourable for us, or many other species.'

IGBP has no finishing date; activities will be reviewed every 3 years or so. Most of the research will be funded by the countries concerned, with IGBP — through its core project offices — monitoring and co-ordinating the effort. Many aspects of IGBP involve CSIRO scientists, so watch this space over the coming years.

Fingerprinting fish We know less about the oceans that cover seven-tenths of our planet than we do about outer space. This is hardly surprising, given the difficulties of working in a medium we definitely don't call home. But we have learned that fish stocks are limited and that, if we are to feed the world's expanding population, we must utilise them wisely.

That means we must study the movements and life histories of economically important fish species: which takes us back to the difficulties of working at sea. We can, however, learn something of where fishes have been and what use they have made of their food resources, thanks to the study of otoliths.

Otoliths are small, usually disk-shaped bones that 'float' inside a fish's middle ear (see *Ecos* 44). Like the complex of bones and passages in a human's middle ear, they assist in balance and orientation. They also grow at a steady rate, adding 'rings' of aragonite and protein every day: in much the same way as it is possible to estimate a tree's age from the number of rings, we can tell an individual fish's age from the number of rings on each otolith.

In a co-operative venture with the Division of Mineral Products, Division of Fisheries scientist Dr Ron Thresher and his team used electron microprobe analysis to examine otoliths from southern bluefin tuna and morwong to determine in what part of the seas the fish were born — based on the characteristic 'fingerprint' created by a matrix of chemicals, ranging from molybdenum to sodium, found in varying quantities in different ocean locations and deposited in varying concentrations in otoliths.

By comparing the chemical fingerprints of otoliths from fishes caught in a number of locations, Dr Thresher and his colleagues hope to learn more about the origins and migration patterns of commercial fishes, leading to better understanding of their population dynamics... and better strategies for sustainable fishing levels.