but much of the nitrogen is taken out of circulation in the peat deposit. As a system for nutrient extraction from eutrophic waters, it might be more efficient to harvest the emergent biomass periodically, but not so frequently that it would result in the undue depletion of rhizome resources. Overcropping is known to weaken some temperate emergent plants; Conway (*J. Ecol.* **30,** 211; 1942) demonstrated such an effect in *Cladium mariscus,* which is reduced in its growth vigour if harvested more frequently than once every four years.

Just as the development of a peatland habitat acts as a sink for the major plant nutrients, so the destruction of a peatland often results in the flushing of such elements back into the environment. Such has been Israel's experience in the Hula Basin to the north of the Lake of Tiberias (Sea of Galilee). Here, extensive swamplands dominated by *Phragmites* have been drained in recent years and the peaty soils have produced rich agricultural land. As in the fens of eastern England, however, there has been a subsidence of the surface, ammounting to about 10 cm yr^{-1}, as a result of the drying and contraction of the peat and its gradual oxidation.

Avnimelech (2nd INTECOL Congress, Jerusalem, 1978) reported a further and more serious problem in the release of large quantities of nitrate from the wasting peat. It is estimated that 20,000 tons of nitrate nitrogen may be released from the area and up to 5,000 tons yr^{-1} have been carried by the Jordan into Lake Tiberias. Such eutrophication, it is feared, could influence the local fishing industry.

Attempts have been made to control floodwater from the Hula Basin, for the greatest movements of nitrate downstream are associated with floodwater. But the most successful measure adopted so far has been the encouragement of denitrification. Alternate wetting and drying of the peat stimulates microbial denitrification and the use of sprinkling has now reduced nitrate leaching into drainage waters by 50%. One of the main crops on the peatland is alfalfa, which is a surprising choice in view of its symbiotic nitrogen fixation. The use of a nitrogen demanding crop species such as rice would seem more appropriate from a nutrient cycling point of view, but is currently precluded by economic considerations. □

More on X-ray bursts

from A. C. Fabian

SPRING and autumn are the seasons of the rapid burster. This object produces up to several thousand X-ray bursts per day over intervals of 2-6 weeks in March/April and September/October. Its location near the Galactic Centre means that each burst, of but a few seconds duration, emits in X-rays as much energy as the Sun emits in all wavelengths in one day. Large X-ray detectors on the first High Energy Astronomical Observatory (HEAO-1) were pointed at the rapid burster on 31 March of this year, yielding the light curves shown on page 587 of this week's *Nature.* A collaboration of experimenters from Massachusetts Institute of Technology, University of California at San Diego and Goddard Space Flight Center have found evidence for spectral changes in the decay of rapid bursts.

A spectral softening is observed, but to a less marked extent than appears in other X-ray burst sources, where the burst interval may be many hours. The softening in these other sources may be interpreted as black-body cooling (see for example Swank *et al. Astrophys. J. Lett,* **212,** L73-L76; 1977), leading, with some assumptions as to the luminosities, to a measure of the size of the emitting region. This seems to be relatively constant and is consistent with the surface area of a neutron star (van Paradijs *Nature,* **274,** 650-653; 1978). The region responsible for the optical bursts seen coincident with bursts from MXB 1735-44 (Grindley *et al. Nature,* **274,** 567; 1978) is considerably larger.

There is at yet no detailed theoretical model of the rapid burster, although accretion instabilities in matter flowing onto a neutron star seem a likely candidate for the basis of any such model. The 6 month interval between periods when the burster is observed has also yet to be explained. SAS-3 observations to be published next January (Marshall *et al., Astrophys. J.* in the press) show that a trend in bursting behaviour occurs over the period for which the source is visible. This may imply that the 6 month timescale is intrinsic to the source and not, for example, due to obscuration by a binary companion.

Thermonuclear flashes near the surface of an accreting neutron star have been proposed as the source of the X-ray bursts that are observed to recur on intervals of hours. The flashes are due to a thermal runaway in the helium burning layer of accreted matter. Numerical computations of this process have recently been published by P. Joss (*Astrophys, J.* **225,** L123-L127; 1978) and demonstrate that X-ray bursts can be produced that bear a striking resemblance to the ones observed. The flashes occur at such a depth that heat is transported out fast enough by radiative diffusion that X-ray temperatures are achieved at the photo-

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Faint images revealed

from F. G. Smith

THE modern generation of optical astronomers now rely heavily on television and photon-counting techniques, so much so that photography seemed to be rapidly going out of date despite the introduction of sensitive fine grain films such as Kodak IIIa. Competition is, however, a powerful stimulus, and there are now some new photographic techniques giving astronomical photographs which cannot yet be equalled in sensitivity and detail by any new electronic device.

The first step was the hypersensitising of emulsions by soaking in dry nitrogen followed by hydrogen gas. This technique, which gives a large improvement in quantum efficiency, is routinely used in the southern sky survey at the UK Schmidt telescope in Australia. The second step is surprisingly simple, and involves only the method of taking contact copies from the new sensitised plates.

D. F. Malin of the Anglo-Australian Observatory, observed that the photographic grains in faint images are concentrated in the upper layers of the emulsion, while the background fog is distributed throughout the whole depth. He found that contact printing with a diffuse light could be arranged only to reproduce the upper layer, and thereby enhance the signal-to-noise ratio of faint images. He describes the techniques in a note on page 591 of this issue of *Nature* and shows some remarkable results on photographs of the extragalactic nebula Centaurus A and the supernova remnant in Puppis. Faint extensions of both objects are revealed for the first time.

These results are exciting for astronomy, and most gratifying as a further example of a widely useful technical advance stimulated by the needs of pure research.

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