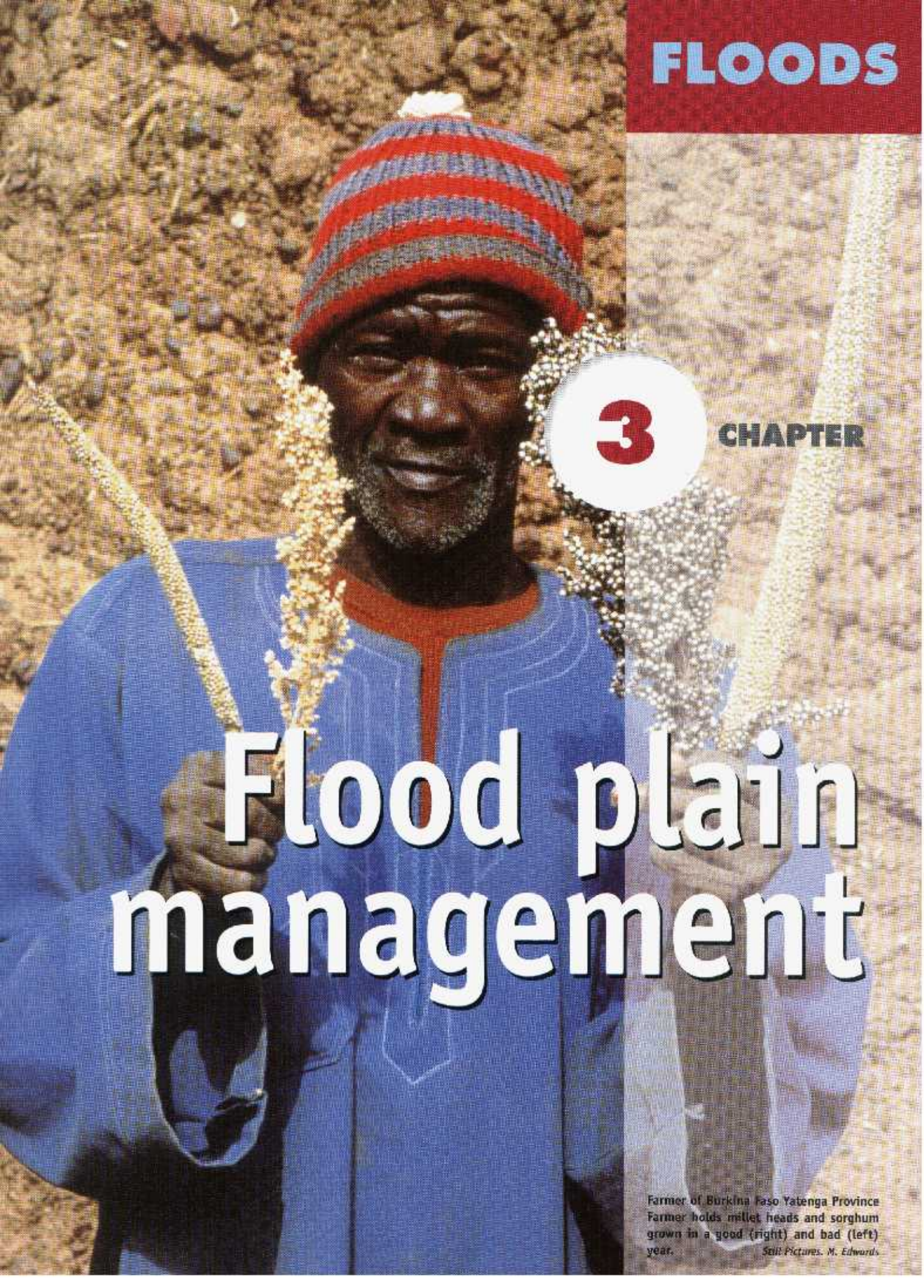
3 CHAPTER

Flood plain management



Farmer of Burkina Faso Yatenga Province Farmer holds millet heads and sorghum grown in a good (right) and bad (left) year. *Still Pictures. M. Edwards*

Flood plain management

The flood plain is the land subject to flooding next to a river. It is in this zone that the damage due to flooding arises and flood loss prevention measures are directed at reducing damage from flooding to installations there. This can be done by preventing inundation of the flood plain, or alternatively by controlling development on the flood plain so that flood damage is reduced. This latter alternative has become more popular in recent decades, particularly on environmental grounds, but may not always be practical. Because flood plains are generally flat, located near water and usually fertile they have been attractive places for human settlement and development since the dawn of civilization despite the risk of loss of property and lives from flooding. As an extreme case, consider the delta of the Ganges and Brahmaputra Rivers in Bangladesh. Much of this heavily populated area is frequently flooded, perhaps as often as every year, but there are no alternative areas available to house and feed the population, so development will continue on this flood plain.

In addition to its value to society for development, the flood plain has a number of important functions within the ecology of the river system which need to be preserved, many of which also contribute to reducing flood levels. The resolution of these conflicting demands on the flood plain while reducing losses caused by flooding is the role of flood plain management.

The flood plain must be considered part of the river channel, even though the river occupies it only intermittently. The flood plain is a transition zone between the aquatic ecosystem of the river channel and the terrestrial ecosys-

Floods in Bangladesh, 1988

WATER RESOURCES

Natural Flood and Erosion Control
- Reduce flood velocities
- Reduce flood peaks
- Reduce wind and wave impacts
- Stabilize soils

Surface Water Quality Maintenance
- Reduce sediment loads
- Filter nutrients and pollutants
- Process organic and chemical wastes
- Moderate water temperature

Maintenance of Groundwater Supply and Quality
- Promote infiltration and aquifer recharge
- Increase base flows

LIVING RESOURCES

Support to flora
- Maintain high biological productivity of flood plain and wetland vegetation
- Maintain productivity of natural forests
- Maintain natural crops
- Maintain natural genetic diversity

Provision of Fish and Wildlife Habitat
- Maintain breeding and feeding grounds
- Create and enhance waterfowl habitat
- Protect habitat for rare and endangered species

CULTURAL RESOURCES

Harvest of Natural and Agricultural Products
- Create and enhance agricultural lands and pastures
- Provide areas for cultivation of fish and shellfish
- Create and enhance forest lands
- Provide harvest of furs

Recreation opportunities
- Areas for active and consumptive uses
- Areas for passive activities
- Open spaces
- Landscape values

Areas for Scientific Study and Outdoor Education
- Areas for ecological studies
- Historical and archaeological sites

Table 1. Natural and cultural resources and functions of flood plains. (After Thomas, 1995)

tem of the higher, surrounding land. As such it includes many interdependent natural phenomena that provide resources and functions important for human welfare (Frank H. Thomas, 1995).[1] Thomas divides these into functions related to water resources, living resources and cultural resources as shown in table 1.

The water resources functions are directly related to flood control. The spreading of a flood over the flood plain is an important part of natural flood attenuation and any attempt to prevent the inundation of a flood plain by canalizing the river using dykes or levees will result in increased velocities in the restricted channel and in higher flood levels reached more rapidly further downstream. The other functions are also of considerable importance to human society. Because the flood plain is frequently wet it provides a habitat for particular species of plants and wildlife, many of which are of economic value. For

1. Frank H. Thomas. (1995), Principles of flood plain management in J. Gardiner, O. Starosolszky and V. Yevjevich (eds.), *Defence from floods and flood plain management*, Kluwer Academic Publishers, Dordrecht.

Flood and slide barrier on road Jiuzhaigon, China. *WWF. J. S. Marsh*

example, river fisheries are an important source of protein in many countries and reed beds provide materials for traditional types of housing. The fertilization due to the deposition of silt by frequent inundation can make the flood plain of great agricultural importance, which humans have used for centuries. Indeed, early agriculture first developed on the flood plains of the Nile, the Euphrates and the Tigris rivers in the so-called fertile crescent and today these same flood plains are still feeding the vastly increased populations now living there.

In addition to supporting the values sketched above in their natural state, flood plains have proved to be attractive sites for industrial and commercial development and for housing because of the availability of flat land adjacent to water. For these developments, the floods that were originally responsible for creating the flood plain are a natural enemy, causing damage, leading to demands for flood hazard mitigation. It is tempting, but naive, to recommend that these developments should be banned from the flood plain, but they are of great economic importance to society as a whole, providing employment, living space, food and other necessary products and services. To leave the flood plain barren is not a feasible alternative. Flood plain management requires the balancing of the benefits of the different activities against the costs (monetary, tangible and intangible) of flood damage over time so as to arrive at a decision on the wise use of flood plain lands and waters.

How do we decide on "wise use"? Thomas's definition is that wise use occurs when the activities on the flood plain are compatible with both the flood risks to human life and property and to the risks, arising from human activities, to the flood plain's natural functions. The principal strategies for reducing loss of life and property are (1) modification of the flood to reduce its velocity and depth or to change its location, for example, by using a dyke or upstream flood control dam; (2) modification of the susceptibility to loss in the presence of a flood, for example, by preventing certain uses of the flood plain, by raising structures above flood level or by evacuating populations in times of flood; and (3) modification of the consequences of unavoidable losses, for example, by flood insurance or disaster relief assistance. Compatibility with the flood plain's natural