Do forests protect watersheds?

A short summary of current thinking on the links between land use, hydrological functions of watersheds and local livelihoods in Vietnam

Prepared by the Research Centre for Forest Ecology and Environment of the Forest Science Institute of Vietnam (FSIV) and the Forestry and Land Use Programme of the International Institute for Environment and Development (IIED)

Introduction

The upland watersheds of Vietnam are very important to everyone in the country, supplying freshwater for household consumption, agriculture, industry and hydropower. Therefore it is in the public interest to manage the watersheds so that they maintain reliable supplies of clean water.

The people who live in these upland watershed areas are mainly very poor. But they are asked to limit their land uses, or to give up land for watershed protection forest. These directives are based on the theory that using land in particular ways – especially retaining forest cover – helps to maintain reliable flows of good quality water downstream.

In this booklet we ask the question: what is the evidence for this? Are forests in fact better than other land uses on watersheds at providing reliable flows of good quality water downstream?

Forest Science Institute of Vietnam (FSIV) and International Institute for Environment and Development (IIED) Workshop on Links Between Land Use and Watershed Protection

This booklet is based on the presentations and discussions at the above workshop, which was held in Hanoi on 14 May 2002 and attended by about 50 research scientists, representatives of government departments and donors. Around 45 of the participants were Vietnamese. The workshop was held as part of the ongoing Sida-funded research project *Land Use and Sustainable Livelihoods in Upland Vietnam*, which aims to provide practical guidance to natural resource policy-makers in their efforts to reduce the economic inequality between the uplands and lowlands of Vietnam. One of the main concerns of these policy-makers is how to balance land use so that local residents have as much opportunity and choice as possible without compromising the ecological functions of watersheds that benefit the whole country. The FSIV-IIED workshop and associated research were designed to assist with these policy decisions. Full versions of the background research papers on socio-economic conditions, current land use policy, and hydrological evidence are listed in the reference list at the end of this booklet and are available in Vietnamese and English from FSIV and from IIED (see back cover for contact details).

Living conditions in watershed areas

Residents of upland watershed areas face the most difficult living conditions in Vietnam: long distances and poor roads to town centres and markets, little arable land, harsh climates, and cultural isolation from the rest of the country due to ethnic differences. Economic opportunities are limited (see box). Consequently, communes in the uplands are poorer than anywhere else in the country, as statistics show. The northern mountain region is the poorest area of Vietnam; over 30% of people are below the poverty line, and in the provinces of Lai Chau, Cao Bang and Ha Giang this rises to 45%[1]. Rural incomes in the ten northern mountain provinces range from 55-90% of the national average[2]. Not surprisingly, the Government of Vietnam's initiative to combat poverty, Programme 135, is concentrated on communes in the northern uplands.

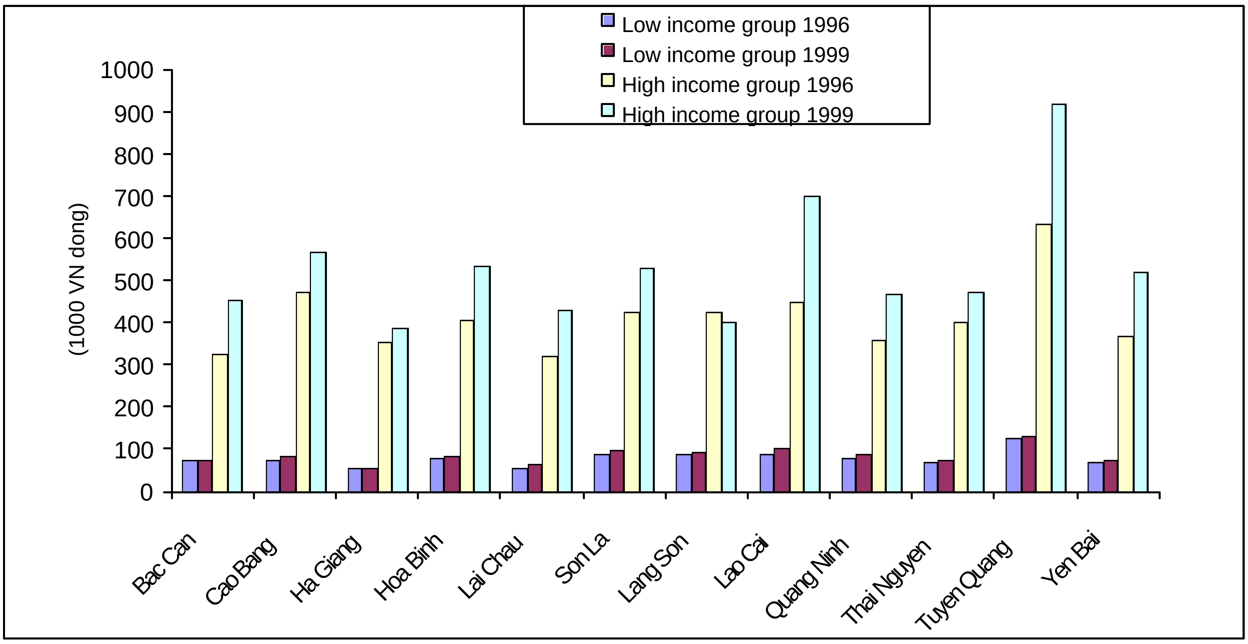
Limited opportunities for income diversification for many households in the uplands[3]

For poorer households, and in the more remote upland villages, there are fewer options for households to diversify income. This is one of the main reasons for people's reliance on selling their labour to supplement food production. If we compare the northern mountain region with other regions of Vietnam, it is evident that this is the main constraint on development of the rural economy in areas such as Muong Khuong (in Lao Cai province). Remoteness, poor infrastructure and limited market capacity combine to make it difficult for farmers and district authorities alike to develop competitive economies of scale in cash crop and livestock production for external markets. The majority of both richer and poorer households have to rely on selling a similar range of farm products at local commune and district markets. Chickens, pigs, staple food crops and horticultural products remain the main source of farm income for the majority of households. There are, therefore, very few windows of opportunity for poorer households in particular to branch out into new areas of primary production.

Although agricultural conditions are far from ideal, most households rely on farming as the mainstay of their livelihoods. Agricultural production accounts for nearly 55% of the gross domestic product (GDP) for the area, and much of this is for subsistence use[4]. Among the 37 minority ethnic groups who account for 58% of the population of the northern mountain region[5], livelihoods are closely related to forests, and some traditional natural resource management practices are still maintained.

In recent years, farmers in the northern mountain areas have improved their incomes slightly[5], except in Bac Kan province, which has seen a simultaneous decrease in incomes and increase in forest cover[6]. Not all income groups in mountainous provinces have benefited equally from the general increase in incomes. In most cases incomes among the poorest groups are increasing more slowly than for the wealthier groups – the gap between better off and poorer households is widening (see diagram). Also important is the fact that provinces, districts and communes are not homogenous. Particular households, often those in transition (newly married or newly migrated) or those headed by women (due mainly to separation or divorce), tend to be poorer and more vulnerable than their neighbours[7].

Average income of lowest and highest income groups by province[8]



Land use in watershed areas

Land classification in Vietnam includes three categories of forest land: production forest, protection forest and special use forest. Almost all watershed areas in the uplands fall under the protection forest category – more than 95% of the total protection forest area is described as "watershed protection forests" and they cover a total of six million hectares. In practice, categorisation of forest land is based on a combination of factors, most importantly slope. Thus, protection forest areas vary in the type and extent of actual tree cover, with some areas not forested at all.

Nonetheless, protection forests are categorised as such in order to protect water sources and soil, to control soil erosion, to resist natural disasters, to regulate climate and to contribute to the preservation of the ecological environment. In order to ensure that they provide such protection services, the Government of Vietnam has placed certain land use restrictions on areas of watershed protection forest. The exact restrictions on land use, which are under review, depend on whether an area is designated as highly critical, critical or less critical (see table).

Permitted land uses in highly critical, critical and less critical protection forests in Vietnam[9]

Category	Location	Land use	Management
Highly critical	Steep slopes at high altitude, near to rivers and lakes, high risk of erosion, or high demand for water regulation.	Mainly for protection. Forest cover must be maintained at 80% (20% for agriculture, fisheries or eco-tourism). Felling prohibited but collection of dead wood and non-timber products allowed.	Under Forest Management Board.
Critical	Moderate slope, erosion risk and demand for water regulation.	Combination of forestry and agriculture. Minimum 50% forest cover.	Under Forest Management Board.
Less critical	Less risk of erosion and demand for water regulation.	Agro-forestry with a minimum of 30% forest cover.	Allocated to households under 50-year lease (land tenure certificates).

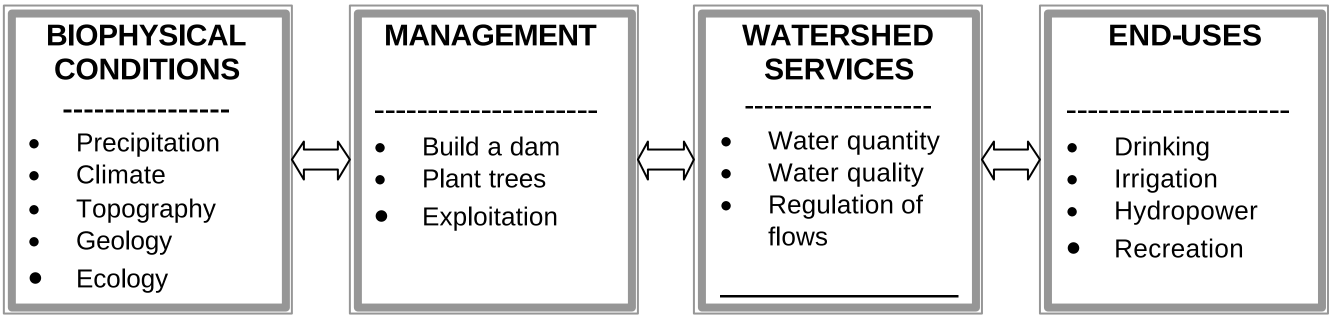
In all cases, local residents hold the bulk of the responsibility for day-to-day management of watershed protection forest. Areas of less critical protection forest are allocated directly to households. Highly critical and critical protection forests are overseen by Forest Management Boards, or sometimes State Forest Enterprises, but these bodies contract out the required planting and protection activities to local residents. These protection contracts are long-term, lasting 50 years. Contractees are paid annual fees in return for planting and carrying out forest management, for example maintenance of fire breaks. Households who have been directly allocated less critical protection forests that have less than the stipulated 30% forest cover also receive funds for replanting.

From the point of view of local residents, the capacity for expansion of agricultural land in mountainous areas is limited since there is very little unused flat land remaining. Thus sloping land has to be used; shifting cultivation, or crop rotation, is best suited to this. The total production area of the communes in Programme 135 is 1.3 million hectares. More than half of this – 0.7 million hectares – is under shifting cultivation, while the remaining 0.6 million hectares are used for paddy fields and other fixed cultivation[10]. National policy aims to stop shifting cultivation, but provincial governments make allowances locally as they recognise that this will take time.

Issuing of land tenure certificates (red books) to households for protection forest has been slow – to date less than 20% of the eligible area has been allocated. Among those who have received certificates, a survey of land use shows that out of an average allocation of just under seven hectares, natural forest comprises 42%, plantation 7% and "unforested land" 51%. "Unforested land" includes areas of shifting cultivation under fallow, but also natural secondary regeneration after forest clearance or loss through natural causes.

Facts and beliefs about forests and watershed protection

Water supplies can vary in quality (e.g. concentrations of minerals, pesticide residues, eroded soil), quantity (e.g. total annual flows) and regularity of flows (e.g. seasonality of flows; likelihood of floods). Therefore the most appropriate management for any watershed will depend on the exact set of watershed services required, which in turn will depend on desired end-uses (see diagram). Inevitably some trade-offs will have to be made, depending on what outcomes are prioritised. For example, in a watershed with a dam, reservoir or other control system, reduction of erosion and sedimentation may be the priority, while in rivers without control systems, flood control may be the most important function required of upstream watershed management.



Planting and maintaining tree cover is one of the most common management interventions for watershed protection, in Vietnam and throughout the world. Similarly, deforestation is often blamed for floods or other problems with the quantity or quality of water downstream. Beliefs about the effects of forest cover on watershed services include[11]:

- “Forests increase run-off”
- “Forests regulate flows”
- “Forests reduce erosion”
- “Forests reduce floods”

Most of us are familiar with some or all of these beliefs, and we have never thought to question them. However, as the next sections consider, we cannot always be sure that forests enhance the quantity, quality and regularity of water supplies in these ways. Internationally, hydrologists recognise that there are in fact big gaps in our scientific understanding of the links between land use and the water regime. There are also gaps between knowledge based on scientific evidence, and information that is used in policymaking.

What exactly do we mean by forests?

If we are comparing “forests” to other land uses, we need to be very careful what we mean by forest. Forest is a general term used to describe places with trees, but different observers and different policy statements have different views on precisely what percentage of tree cover is needed, what size of woody plant qualifies as a tree, and how big the area must be before it is a forest. Some viewpoints include plantations as forest, others only natural woodlands. Of course, all these differences in forest structure – mix of species, age distribution, understorey, whether tropical or temperate – will affect the hydrological functions of the area. In this booklet we use “forest” as an inclusive term for all the many varieties of tree cover, but readers should remember that hydrological functions are not identical for all forest types.

Evidence for and against common beliefs about forests and water

Beliefs that are based on incomplete or false technical information can hinder rational decision-making. Here we will ask whether or not the above-mentioned four beliefs about the links between forests and watershed protection are based on good scientific information. In each case there is scientific evidence both from within Vietnam and internationally.

1. Do forests increase run-off?

What is the belief and why is it important?

Some observers believe that water flows, or run-off, from forested areas are higher than from areas under different land uses. This belief matters because of the effects of total water run-off on the overall supplies of water downstream, as well as the regularity of flows, which influence seasonal water supplies and floods. It may be desirable in some circumstances to reduce run-off, so that water supplies are regulated, or in other circumstances to increase run-off, so that downstream water supplies are increased.

What is the theory?

Surface run-off depends on the balance of a large number of hydrological factors, including interception, evaporation, transpiration, infiltration, water storage in the soil and groundwater recharge. In theory, forests may be associated with greater interception of rain, which would increase run-off. On the other hand, natural forests usually help to increase the infiltration and water storage capacity of the soil by providing a layer of fresh and rotting leaves. Higher infiltration and storage of water would mean reduced run-off.

What is the evidence?

The vast majority of the world's catchment experiments indicate decreased run-off from areas under forest compared with areas under agricultural crops. This knowledge has been gained from many different studies using a wide range of techniques. Research in Vietnam, for example, has found that run-off under forests is 2.5 – 27 times less than run-off under agricultural crops[12]. Vietnamese studies have also shown that natural forest is more effective than plantations in reducing run-off. Studies in other countries link the higher run-off in plantations compared to natural forest with the low quantities of leaf litter and humus, and the soil compaction by heavy machinery, which are typical of plantations.

One rare type of forest that can increase run-off is cloud forest at high altitudes, where the rough surfaces of the forest canopy can increase the amount of water deposited directly from clouds.

Conclusions and implications

The evidence here refutes the belief stated above. Generally, natural forests reduce surface run-off compared to plantations and agricultural land uses. We cannot assume, however, that run-off will always be lower under forests – because there are some important exceptions, such as cloud forest, and because some parameters, such as evaporation from different vegetation types, are difficult to measure accurately.

2. Do forests regulate seasonal water flows?

What is the belief and why is it important?

A widespread belief is that water flow under forest cover is regulated seasonally, such that there is greater water flow (compared to non-forested areas) during dry seasons and comparatively less flow during wet seasons. Common understanding is that forests act as "sponges", soaking up water during the rains and releasing it gradually over drier periods.

This belief is particularly important in areas with very distinct wet and dry seasons, such as in monsoonal climates, where there might be excess water during the wet season and insufficient water during the dry season. It is less important where rainfall is spread more evenly throughout the year. In Vietnam this belief is most relevant in the drier parts of the country with mean annual rainfall of less than 1000 mm, such as parts of the north-west, south-east and central highlands.

What is the theory?

Theory suggests that:

- increased transpiration in forests, and in particular increased dry period transpiration, will increase soil moisture deficits and *reduce* dry season flows
- increased infiltration under (natural) forest will increase storage of water in the soil and *increase* dry season flows
- for cloud forests increased cloud water deposition may *increase* dry season flows.

What is the evidence?

Taking the theory together, forests can increase or reduce dry season flows compared to non-forested land. Evidence collected in hydrological studies shows that the overall effect varies by location: it is difficult to predict the impact of forests on seasonal flow given that different, site-specific, often competing processes may be operating. For example, observations in the UK and USA indicate that drainage activities associated with plantation forestry increase dry season flows in the short-term. In South Africa, however, most observations indicate that forests reduce both dry season and annual flows, by about the same proportion, as compared with flows from grassland.

In Vietnam the popular belief is that forests do regulate seasonal flows. Many people living in a watershed area of Vietnam said that "the forest can store water in the rainy season, while the dry season becomes more severe if the forest is destroyed."[13] So far, there have not been any hydrological studies to investigate this belief in Vietnam.

Conclusions and implications

We can conclude that competing processes (of infiltration, runoff and recharge) may result in either increased or reduced dry season flows from land under forest. Effects on dry season flows are likely to be very site specific. It cannot be assumed that afforestation will increase dry season flows; indeed this is *not* generally true, and further research is needed to understand which factors are most important in explaining differences among sites.

3. Do forests reduce erosion?

What is the belief and why is it important?

The belief that forests minimise erosion is held all over the world. Soil erosion is a critical issue in Vietnam. For example, there are concerns over erosion from watersheds leading to sedimentation that threatens the efficiency of vital hydropower facilities. It is said that sedimentation in the Hoa Binh dam threatens to reduce the dam's life from 100 years to only 50 years. Since this dam provides 45% of the country's power, and other dams will play an ever larger role in supplying Vietnam's increasing power needs, means to control erosion and sedimentation have become key concerns. The most popular solution is to expand the area of the watershed under forest cover – it is common in Vietnam, as in other countries, to hear claims that forests help to reduce erosion. However, in the case of Hoa Binh, it is not clear what the source or the reasons for the sedimentation are, and there is a danger of making land use decisions without adequate scientific evidence.

What is the theory?

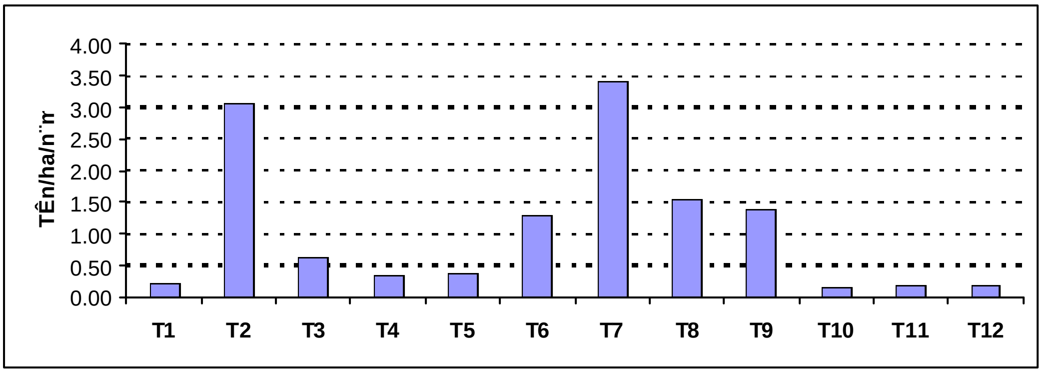
Theory suggests that:
- high rates of infiltration in natural forests reduce surface runoff and *reduce* erosion;
- reduced soil water pressure and the binding effect of tree roots enhance slope stability, which tends to *reduce* erosion;
- on steep slopes, forestry or agroforestry may be the preferred option, where conventional soil conservation techniques may be insufficient.

What is the evidence?

Establishing relationships between forest cover and erosion is extremely difficult. Different types of erosion come about in different ways; most of the scientific evidence concerns the role of forests in reducing sheet erosion while much less is known about the effect of forest cover on gully erosion and landslides. One of the biggest problems with studies on erosion is choosing what scale to investigate. For example, very high rates of soil loss may be recorded from a field of crops, but it may be found that the lost soil is simply accumulating at the bottom of the field, with minimal loss into rivers.

In very flat terrain or dry areas, where overland flow is low, the presence or absence of trees may have little effect on rates of erosion. On very steep slopes too, forest cover may not be able to control erosion. It is in intermediate situations of moderate slopes and rainfall that land use decisions and other human interventions can have the most impact on erosion. For example, in Vietnam, where meticulous studies have been carried out on rates of erosion at the local level, crops can reduce rates of erosion to around ten times less than on bare land. Similarly, one study of secondary forest found that on non-forested land, after logging, soil loss was 3.1 t/ha/yr compared to 0.23-0.28 t/ha/yr without logging. A noteworthy observation is that forest is not necessarily better than other vegetation types in protecting against soil loss, and nor are natural forests always better than plantations (see figure).

Soil loss under different vegetation types in Vietnam



T1: Mixed natural forest, cover70% – Huu Lung	T7: Poor natural forest, ground vegetation cleared – Central Highland
T2: Grass land – Huu Lung	T8: Bamboo forest, cover 70% – Central Highland
T3: Dense shrubs – Huu Lung	T9: *Imperata cylindri*ca – Central Highland
T4: Planted *Magletia glauca*, 16 years – Huu Lung	T10: *Acacia mangium* – Hoa Binh
T5: Planted *Melia* , 7 years – Huu Lung	T11: *Acacia auriculiformis* – Hoa Binh
T6: Mixed natural forest, cover 70-80% – Central Highland	T12: Planted bamboo forest – Hoa Binh

One important finding from international hydrological studies is that *management* of forests is just as important as *presence* of forests in controlling soil erosion. Adverse effects on erosion are more likely to be related to unsuitable forest management techniques rather than the actual removal of forest. Increased erosion may result from:[11]

- bad logging techniques which compact the soil and increase surface flow
- pre-planting drainage activities which may initiate gully formation
- windthrow of trees and the weight of tree crops reducing soil stability
- road construction and road traffic, which can initiate landslips, gullies and movement of sediment
- excessive grazing which leads to removal of understorey plants, soil compaction and greater erosion risk
- splash-induced erosion from drops falling from the forest canopies onto bare ground – some broad-leaved plantation species increase rather decrease erosion through this mechanism

Conclusions and implications

One of the most important conclusions arising from the evidence in Vietnam and other countries is that protection against erosion relies on *vegetation* cover rather than forest specifically. It may also be more important to concentrate on improving management techniques (for any land use) than to try to control erosion just by establishing or maintaining forest cover. The use of streamside buffer strips, and selective rather than clear logging, are the most important measures to control loss of soil during rains. "Filter strips" of vegetation may be fully effective in controlling soil erosion, allowing a patchwork landscape of agriculture and small-scale forestry[13].

Even under conditions where afforestation may well reduce erosion, it should not be seen as a quick answer to all the problems of erosion. In heavily degraded catchments (such as those of the Himalayas), so much eroded material will already have been mobilised that, even if all erosion from forestry activities were stopped immediately, it would be many decades before there was any reduction in the amount of material carried by the rivers.[11] Furthermore, choice of tree species is important in any programme designed to reduce erosion and catchment degradation. For example, trees with large leaves – such as teak (*Tectona grandis*) – are likely to aggregate rainfall into larger drops that will increase splash-induced erosion.

4. Do forests reduce floods?

What is the belief and why is it important?

It is a widely held view – particularly by foresters and the media – that forests are of great benefit in reducing floods. Recent years have seen frequent and increasing floods, both in Vietnam and elsewhere in the world. People believe that forest destruction is one of the reasons for flooding. In some cases, logging bans have been imposed, based on the belief that forest loss causes flooding. For example a ban was imposed in Thailand in the early 1990s following devastating floods. It is generally assumed that since forest cover can regulate water flow, and reduce surface run-off, forests contribute to reducing floods. However, although few in-depth field studies have been done in Vietnam, some researchers believe that flooding may be linked more to weather conditions than to the presence or absence of forest cover.

What is the theory?

Floods are a natural phenomenon, in which rivers discharge any excess water arising from occasional large rainfall events. All forests tend to have higher evaporation rates than other types of vegetation, and natural forests exhibit higher infiltration rates, due to porous soils and the existence of understorey and humus layers. The combination of these two factors generally contributes to lower runoff. Therefore during heavy storms, runoff (stormflow) should be lower from forests than other land uses during heavy rainfall, so that flooding is less likely. Some types of plantation forests may also increase infiltration rates by providing preferential flow pathways down both live and dead root channels.

What is the evidence?

Hydrological studies show that stormflow volumes are higher from logged slopes than forested slopes in small watersheds. These studies compare forest with bare clear-felled land. Long-term studies in Malaysia show that the relatively high stormflows from logged land diminish within a few weeks once secondary regrowth of the understorey occurs.[14] Field studies generally indicate that it is often the management activities associated with forestry – cultivation, drainage, road construction – that are more likely to influence the size and frequency of floods than the presence or absence of forests themselves.

Furthermore, while clearance of forest and other forestry operations can cause short-term increases in runoff, the relative magnitude of these events is inversely proportional to the magnitude, intensity or duration of the storms. Hence, little of the impact of floods from large storms can be attributed to changes in land use. For the largest, most damaging flood events there is little scientific evidence to support anecdotal reports of deforestation being the cause. Instead, flood events are more likely to result simply from climatic events. Evidence from Vietnam, for example, shows that about 78% of discharge from the Da River happens from June to October each year, and that regardless of changing land use, large floods occur every 8-9 years and very large floods every 23 years.

Conclusions and implications

At the scale of small catchments, there is good evidence that forest cover can help to reduce volumes of floodwater downstream. For the largest, most damaging, floods there appears to be no scientific evidence for a connection with deforestation – at these scales climate, most importantly total annual rainfall and frequency of large storms, is much more important. Also, the word "flood" has negative connotations, but in practice the *effects* of floods may be interpreted as good or bad, depending on the actors involved and the intensity of the flood event (see box).

Possible gains and losses from floods[15]

- Agricultural and fishing activities in lowland areas could benefit from mid-intensity floods that carry sediments and nutrients from the uplands; however, as the flood intensity increases the risks and hazards of destruction also increase.
- Forestry activities in upland areas could benefit from political support and funding for their activities in exchange for the *perceived* benefits that forests will have on reducing floods. However, big flood events can cause trees to fall during storms and block waterways.
- Wetlands located in lowland areas can benefit from the seasonal effects of floods.
- Engineers benefit from the creation of costly structures to alter the drainage system of the watershed.
- Scientists (hydrologists, agronomists, soil scientists, economists, and social scientists) benefit from funding for their research in the area (as long as there is a problem, there is a need for research).
- The media benefit from coverage and possible sensationalist stories related to the floods.

Conclusions: Are forests the best land use for watershed protection?

Just from these four examples, we see that hydrological evidence linking forests and watershed protection functions is not yet well developed either in Vietnam or internationally. Although we cannot generalise for all watersheds under all conditions, our current "best-bet" knowledge is that:

- Forests do not increase run-off – in fact forests usually reduce run-off
- Forests may or may not regulate seasonal water flows
- Forests are no better than other vegetation types for reducing erosion
- Forests are not as important as climate in controlling floods, but can help in small watersheds

Although our understanding of the links between forests and watershed functions is not well developed, there are a number of useful points of watershed management advice that we can draw out from the available scientific evidence:

- In general, if forests are compared to bare land, then their positive effects on watershed protection are clear and substantial. But compared to other types of vegetation cover, such as grassland or shrubs, the relative benefit of tree cover is less apparent. One of the most important lessons from hydrological studies is that *"vegetation cover" more than "tree cover"* is critical for regulating water flows and erosion.
- "Forest" can mean many different things (according to whether natural forest or plantation, mix of species, age distribution, etc.). Effects of *different types of forest* on hydrological functions vary widely. The effects of different forest types on erosion, for example, can be as great as the differences between forest and other types of vegetation.
- *Aspects other than land use and vegetation cover* are often far more important in determining certain hydrological effects. For example, soil type may be the principal factor determining the extent of erosion and downstream sedimentation, while the volume and distribution of annual rainfall has more influence than forest cover on the frequency and intensity of floods.
- At a local level, *specific management interventions* sometimes have greater effects than broad land use on hydrological functions. For example, careful siting and construction methods of roads and drainage ditches can have more positive impacts on erosion than whether the land is under crops or trees.
- While hydrological data point to the above observations, *generalisations are risky*. Managing watersheds for hydrological functions remains a very site-specific task. Scientific uncertainty reflects both complex natural relationships and the technical challenges of rigorous hydrological studies.

Forests do not offer a universal solution to the loss of watershed protection services. The success of forest-based solutions will depend on a range of site-specific factors. In many cases, forests may be best incorporated as a component of a larger watershed protection strategy involving other land uses. To address the increasing, and sometimes competing demands for watershed protection, there is often a need to make trade-offs between particular types of land use and the need for watershed functions.

At the same time, it is important to consider not only the downstream "end-uses" of watershed services, but the more immediate needs of those communities charged with managing land in upper watersheds. Changing the type of land use and vegetation cover may provide improved watershed services such as reduced flooding or enhanced dry season flows, but if such changes are to the detriment of upland livelihoods they will not be sustainable. Here is the need for compromise between desirable watershed functions and the requirements of upland livelihoods. Some of Vietnam's upland communities are extremely poor and do not have the capacity to risk new and different forms of land use. Their livelihoods must be taken into account in any watershed protection initiatives.

Looking at much of the international evidence, it appears that over-simplification of the relations between forests and water have led to a state of mind in which the scapegoat of land degradation is linked to a reduction in the amount of forests, and watershed conservation efforts are almost always designed in terms of planting more trees. Challenging some of the commonly held beliefs regarding land use and watershed protection may raise questions as to whether afforestation is in fact the best strategy.

Ways forward

Policy makers in Vietnam are concerned with how to achieve the best balance of trade-offs between local livelihoods in the uplands and protecting watershed functions. Interrogating some of our deeply held assumptions about the links between forests and water through a closer look at hydrological data, as this booklet has done, raises some new questions and considerations for policy makers:

- Watershed functions cannot always be affected through land use change or other human interventions. For example, floods tend to happen on a periodic basis when rainfall is unusually high. Interventions such as tree-planting may have little effect on the likelihood of flooding, but on the other hand they do provide local employment and may have longer-term economic benefits. Policy makers may want to reassess how the financial and other resources invested in watershed management compare to alternatives for optimising water supplies and local development.

- One major policy focus has been planting of "unforested lands". Hydrological studies show that natural vegetation, including secondary regrowth, offers similar, and sometimes better, benefits in regulating water flows and erosion when compared to plantations. Policy makers may want to consider actually reducing interventions on "unforested land" that are carried out in interests of watershed protection and rely instead on regeneration of natural vegetation.

- A recent policy shift has been towards allowing greater freedom of land use options on less critical protected forest. Hydrological studies suggest that allowing agriculture in important watershed areas does not necessarily compromise watershed functions, and thus support this policy shift. Data from scientific studies also suggest that specific interventions such as placement and building methods for roads, or terracing of fields, may be have just as much impact as overall land uses on factors such as erosion. These types of issues are already an important focus of government extension services – perhaps even more emphasis on developing local solutions could be useful for both watershed protection and local livelihoods.

- Land allocation is a developing area of policy in Vietnam. Hydrological studies emphasise one important challenge: matching the scale of land allocation to the scale of watershed management. To maximise benefits at the catchment level, it may be more useful if the management unit has rights and responsibilities at this geographic scale. For instance, it may be more appropriate in terms of watershed management to allocate protection forest areas to communities rather than individuals or households. Hydrological studies also indicate that at the landscape level, for example within a watershed management area, a mix of land uses may be equally effective for watershed protection as block planting of forest.

- A common worry among policy makers is that when local people are granted rights to use forest resources, they will overuse that right and damage the forests. Thus a strict mechanism of control over forest products has been functioning since before the introduction of protection forest contracts. Perhaps in the new era of a forestry economy with multiple actors and functioning market incentives, it is time to reappraise the system of external control over forest management and marketing of products?

- Vietnam could benefit from stronger hydrological evidence to back-up and provide guidance for management interventions in watershed protection forest. More practical, policy-focussed research is needed – the main priority is better data on the effects of land use on seasonal water flows.

- Policy makers and practitioners need to increase awareness and understanding of the roles of watershed protection forests in water regulation, flood mitigation and prevention of soil erosion, especially among those tasked with day-to-day management of those forests (e.g. forest management boards, state forest enterprises and small-scale farmers).

- New mechanisms for financing watershed protection would benefit Vietnam. At present some water users, such as the hydro-electric facility at Hoa Binh, pay fees towards watershed protection, but there are not yet mechanisms in place to distribute these funds in an efficient and accountable way to support upland land management practices proved to benefit water supplies downstream. Now is the time for the various stakeholders involved to formulate and test workable financing mechanisms to maintain watershed functions.

Note: Further technical research on watershed protection and hydrological functions is being conducted by the Institute of Meteo-Hydrology of Vietnam and IIED. More information is available from IIED.

File: q/forestry/Vietnam/FSIV watersheds/FSIV watersheds booklet4

[1] Vu Long, 2002. *A summary of national policies on watershed protection and current policy implementation in the northern mountain areas of Vietnam*. Paper prepared for the workshop: Links between land use and watershed protection, Hanoi, May 2002, FSIV and IIED.

[2] General Department of Statistics, Government of Vietnam, 2001.
[3] Vietnam-Sweden Mountain Rural Development Programme (MRDP), Vietnam-Sweden Health Cooperation Programme (SDA) and World Bank, 1999. *Lao Cai Province Participatory Poverty Assessment*.

[4] Le Quang Trung, 2002. *Livelihood and economic status of farmers in the northern mountainous area*. Paper prepared for the workshop: Links between land use and watershed protection, Hanoi, May 2002, FSIV and IIED.

[5] General Department of Statistics, 2001.

[6] Jason Morris, IUCN, contribution to workshop, Links between land use and watershed protection, Hanoi, 14 May 2002.

[7] Vietnam-Sweden Mountain Rural Development Programme (MRDP), Vietnam-Sweden Health Cooperation Programme (SDA) and World Bank, 1999. *Lao Cai Province Participatory Poverty Assessment*.

[8] General Department of Statistics, 2000.

[9] Research Centre for Forest Ecology and Environment, Forest Science Institute of Vietnam. 2001. *Principles for land use systems in watershed protection areas*. Unpublished manuscript.

[10] Vu Long, 2002. *A summary of national policies on watershed protection and current policy implementation in the northern mountain areas of Vietnam*. Paper prepared for the workshop: Links between land use and watershed protection, Hanoi, May 2002, FSIV and IIED.

[11] Calder, Ian. 1999. *The Blue Revolution*. Earthscan.

[12] Do Dinh Sam, Ngo Dinh Que and Vu Tan Phuong. 2002. *Links between land use and watershed protection in Vietnam*. Paper prepared for the workshop: Links between land use and watershed protection, Hanoi, May 2002, FSIV and IIED.

[13] Laxman Joshi, ICRAF, contribution to workshop, Links between land use and watershed protection, Hanoi, 14 May 2002.

[14] Walsh, R. 2000. *Royal Society South-East Asia Rainforest Research Programme*. Paper presented at the Edinburgh Centre for Tropical Forests meeting "The role of science in forest policy in Malaysia and Indonesia", Edinburgh, 20 October 2000.

[15] Calder, I.R. 2002. Integrated watershed and flood mitigation management. FAO report.