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NEWS

Forests, Water and Livelihoods

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TROPENBOS INTERNATIONAL

World Agroforestry Centre
TRANSFORMING LIVES AND LANDSCAPES

FRP DFID Department for International Development

Dear readers,

As 2005 is ending, we are finishing yet another double issue of the ETFRN News, dealing with the multi-faceted theme of forests and water. The United Kingdom's Department for International Development's Forestry Research Programme (DFID-FRP) commissioned this issue, and provided most of the funding, in order to widely disseminate the results of recent research, publications and debate on the links between forests and water. Meine van Noordwijk of ICRAF generously provided his time as guest editor as an in-kind contribution. It was a pleasure to work with him. Patience Mayaki, a student from Nigeria on an Erasmus mundus scholarship, spent some of her internship with Wageningen University with the ETFRN Coordination Unit working on the publication announcements. We enjoyed her cheerful and committed presence. Erika van Duijl put more time into this issue than anyone else: she did most of the editing and correspondence with authors, while Blanca Mendez assisted her with the layout. Finally, the ETFRN Coordination Unit would not have survived, and this issue would therefore not have been published without the support from Tropenbos International. I extend my warmest thanks to everyone, including all the authors, who contributed to this publication.

Finally, very best wishes for 2006!

Kindest regards,

Willemine Brinkman, ETFRN coordinator

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EDITORIAL

FOREST, WATER AND LIVELIHOODS

By Meine van Noordwijk

Forest and water issues have hit the news headlines over the past months. "Down with Trees" became one of the slogans after the release of the DFID report "From the Mountain to the Tap" and the FAO/CIFOR publication "Forests and Floods". The excitement may be brought back to the simple observations that trees use water and that heavy rainfall causes floods.

The balance of public perceptions is swinging back and forth – from exaggerated expectations of what trees and reforestation can achieve (actively promoted as part of a 'conservation' agenda) and from false attribution of any downstream problem with water flows to the 'deforestation' activities by upland land users, we may go to the other extreme of ignoring the positive values of maintaining forested landscapes and well-buffered river systems with riparian forests and wetlands. Beyond the probably necessary shock effect of 'debunking myths', we get valid concerns over not throwing away baby trees with the bathwater. In this newsletter the different positions in this public debate are reflected.

The 'forest and water' debate is full of valid observations that are used to make generalizations at the wrong level, ignoring the effects of scale on many of the 'truths'. "Not seeing the forest for the trees" is a well recognized problem, but "not seeing the landscape for the forests" is equally problematic: the water flows at landscape scale are influenced by the patchwork of land cover plus the drainage system, in direct response to the spatial and temporal pattern of rainfall and conditioned by geology, slopes and subsurface flow conditions. However, it is boring if flooding can only be blamed on heavy rainfall and not on logging or deforestation.

Paragraph 23 of the Millennium Declaration calls ***"To intensify our collective efforts for the management, conservation and sustainable development of all types of forests."*** Because clean water is essential for meeting health-related Millenium Development Goals, and Goal 7 ('Ensure environmental sustainability') clearly links environment and poverty issues; the **management of upper water catchments** deserves full attention. Poverty in the more remote upper catchments can be substantial, and part of the poverty is linked to existing rules and perceptions about what land use is and what is not compatible with the environmental service functions. Equitable systems for capture and distribution of benefit (values) resulting from good upstream forest and land management need to start from an analysis of critical thresholds in the forest – agroforestry – agriculture continuum.

The articles in this newsletter are grouped under four headings:

1 Perception gaps around forest and water, and multistakeholder negotiations
2 Highlights in forest hydrology
3 Livelihood issues and payments for environmental services
4 Case studies, including the special cases of peat swamp forests and riparian forests interacting with fish production

Section 1 starts with a summary of DFID's synthesis 'From the mountain to the tap' by John Palmer and a 'rebuttal' by Nick Chappell, who lists the arguments for a re-valuation of what reforestation can achieve for water flows on the longer run. More nuances in the debate and distinctions between areas where water demand exceeds the supply (and additional water use by trees is a problem) and wetter zones (where supply exceeds demand) is needed. For the wetter part of the world, however, the 'floods' issue is important. Thomas Enters and Patrick Durst summarize the evidence that changes in forest cover matter less than we have all been taught at school. Peter Walpole reflects on the issue from a Philippines perspective; Vu Tan Phuong reviews the evidence for Vietnam. Bruno Verbist and colleagues describe how the perception of 'essential' forests lead to conflicts in the past and how data on actual river flows help to negotiate agreements. David Thomas describes how measurement and evidence is starting to play a role in basin management in northern Thailand, replacing a 'forest' centered dialogue.

The second group of articles provides some highlights of current hydrology: Nick Chappell reviews modelling approaches, Kurniatun Hairiah and colleagues describe the importance of the litter layer as primary control over water flows and Catherine Muthuri explains how the phenology of the tree determines the net effect on storm and base flows. Roland Koeck and colleagues describe the special importance of limestone soils and the influence of tree cover on snowmelt that influences 'regularity of flow'. The approach may be transferable to the tropics, the conclusions as such definitely not… Water and nutrients interact in many ways: rainfall brings nutrients along, while water outflows lead to transfers of nutrients downstream. Tellez and colleagues provide fresh data on nutrient loading of rainfall in the Amazone, and its sources.

The third block of articles describes current thinking and progress on various forms of 'payments for environmental services' related to forests and water. Bob Hope reviews lessons from Costa Rica, Ivan Bond gives an overview of lessons learnt in the IIED network; Horst Weyerhauser relates the challenges faced by the 'sloping land rehabilitation' program in China, that was initiated after the Yangtze floods. Daniel Murdiyarso and Ulrik Ilstedt focus on the role of forests in the provision of drinking water. In a contribution from the RUPES program the emphasis is on the various steps that are needed to bridge the different perceptions, illustrated with the case of Lake Singkarak. Brent Swallow describes the 'forests, flowers or flamingo' choices that are only now beginning to be understood in Kenya. Rowena Sorriaga reviews watershed governance in the Philippines and Bogliotti the re-focus on 'demand' issues in the Mediterranean region, as there isn't much that can be done about 'supply'.

The 'case studies' group provides further local context for the issues. Peter Gerritsen describes the Ayuquila watershed in Mexico, Eric Flores discusses reforestation in Panama, Elke Verbeeten analyzes the situation in Burkina Faso, Olavi Luukkanen and Ping Zhou the Yangtze river and Wim Douven the Mekong river in Yunnan close to its origin. Further downstream, the Mekong river feeds the Tonle Sap in Cambodja, where the primary concern is, however, over the disappearance of floodplain forests and

its effects on fisheries, as described by Patrick Evans. Forest roles in sustaining fish is also the focus in Colombia. One step further into wetlands, three articles describe the peat swamp forests as special case: Jack Rieley provides an overview, Henk Wösten describes the situation in Berbak (Sumatra) and Jolanda van den Berg provides a socio-economic context for the approaches to conserve such wetland forests while enhancing livelihoods.

Throughout this newsletter pleas are made to go back to the collection and interpretation of data. The public debate on forests and water in many countries is highly charged with expectations of public benefits of forests and attributions of blame to upland farmers using the landscape that are not based on analysis of facts and measurements. There is a need for 'new hydrology', but also for approaches that facilitate multi-stakeholder negotiations on what combinations of restrictions and 'rewards' will lead to the continued provision of water flows of desirable quality together with land use that allows 'uplanders' to make a living. There will certainly be an important role for forests and trees in this respect, once we get the 'myth-perceptions' sorted out.

Beyond these articles, the newsletter contains information on recent publications and upcoming events in the usual way. Happy reading.

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"FROM THE MOUNTAIN TO THE TAP", AN INTRODUCTION

By John Palmer

Every day we read, watch and listen to reports of environmental, human and economic disasters, which appear to have been caused by uncontrolled deforestation and unsupervised forest degradation. Floods and landslides, sedimentation of irrigation systems and silting of hydropower dam reservoirs are often attributed to the felling of trees. But is such simple association correct?

Some national agencies, with international co-funding, are spending immense sums of money on tree planting, soil and water conservation structures and allied measures, in the belief that they are attracting rainfall and/or facilitating recharge of groundwater. These huge schemes are found especially in the watershed development programmes in states of India and in the "environmental forestry" programmes of China. Many other countries have smaller schemes, but are impelled by the same belief, which originated in the eighteenth and nineteenth centuries when there was limited understanding of global weather patterns, cycles and variation.

The advent of improved instrumentation and data-logging, plus much more powerful computer modelling and geographic information systems, now enables these beliefs to be tested. Process hydrology enables the components of the water cycle, from atmosphere through vegetation to soil and streams, and back to the atmosphere,

to be studied in linked modules. The limitations of the previous "black box" approach, with measured input (rain) and output (streamflow) but only limited quantification of what happened to water between precipitation and river flow, have been substantially overcome.

The Forestry Research Programme of the UK Department for International Development has designed a cluster of related projects to make use of the improved instrumentation, better mathematical modelling and powerful geographic information systems to produce more reliable prediction of the association between vegetation (including forests) and dry season streamflows.

The various strands of biophysical and socio-economic research resulted into a series of lessons:

1 In arid and semi-arid catchments, there is no scientific evidence to support the view that forests increase or stabilise water flow.
2 Modelling based on "green water" data is an efficient and usable means of predicting the impact of land-use change on water flow. *(green water = water leaving the catchment through evaporation)*
3 Soil degradation can cause localised flooding during_rainy periods, and reduced dry season flows.
4 Uncertainty surrounding hydrological processes within and beneath the soil makes it difficult to quantify the amount of water provided by a specific land manager upstream to a specific water user downstream.
5 Integrated land and water resources management can only be achieved if governance is holistic and evidence-based.
6 Water alone cannot pull people out of poverty.
7 Market mechanisms linking land management and watershed services do not tend to address rural poverty.
8 Small-scale irrigated agriculture is unlikely to reach the majority of the rural poor.
9 What rural people want and what policy makers think they want are not necessarily the same thing.
10 Pro-poor benefits should not be an after-thought.

The policy implications of these lessons are:

1 If water shortages are a problem in dry countries, impose limits on forest plantations, especially of fast-growing evergreen species.
2 Implement "green water" instruments (based on data from plant transpiration) to control levels of evaporation from upland vegetation.
3 If upland forests are cleared for cultivation, provide farmers with guidelines of best agricultural practice.
4 Any market mechanism or tax system linking land management to quantified streamflow should ensure that scientific validation is possible at the scale of the operation.
5 Use decision support systems to assess the impact of alternative land management options on water resources, and alternative land-use and water management and policy options on different social groups.
6 Ensure policy instruments are equitable in terms of livelihood benefits, not just water allocation.
7 Ensure that any proposed market mechanism is adequately pro-poor.

8 Consider improvements in rain-fed farming (crop breeding, rainwater harvesting, mulching, conservation tillage, market access, capacity building) in preference to further investments in rural small-scale irrigation schemes.
9 Use negotiation support system techniques such as choice experiments to ascertain stakeholder preferences for policy agreements.
10 Tailor employment programmes to dovetail with other livelihood activities of the people which they are intended to attract.

This booklet summarises the information, some of it conflicting, which has contributed to the ten lessons. The research findings will be a disappointment to some enthusiastic promoters of schemes for payments for environmental services, which are one of the most promising avenues for putting reliable amounts of cash into the hands of upstream land managers. Unfortunately, it seems just now that models for reliable prediction of dry season streamflows in relation to the management of catchment vegetation upstream will not routinely support local payments for water services. This is because there may be too many uncertainties about the ways in which water moves through the soil and rock in any but fully leakproof catchments. So payment schemes may need to be operated on regional or national scales in order to avoid complex litigation at local scale.

The broad topic of the Forestry and Low Flows cluster is advancing with fast interactions between research and the shaping of policy. For example, by the time of publication, the debate on allocation of the benefits of water in South Africa will have moved forward significantly. These developments are affecting the livelihoods of literally tens of millions of people.

The potential implications of the research summarised in this booklet are immense, as they contradict some current tree-planting policies and environmental beliefs. Unless there is urgent action now, the looming water crisis will aggravate, and leave the most vulnerable, the rural and urban poor populations, ever more disadvantaged.

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The summary above is an adapted version of the foreword of the FRP publication: “From the Mountain to the Tap: how land use and water management can work for the rural poor” by Becky Hayward (2005). Please see the section “Publications” of this issue (p. 112) for more information about this booklet.

UNCERTAINTIES IN THE HYDROLOGY OF TROPICAL REFORESTATION: BEYOND "FROM THE MOUNTAIN TO THE TAP"[1]

By Nick A Chappell and Mike Bonell

Large areas formerly covered by tropical forests have been cleared and remain in an unproductive, environmentally unsustainable or degraded state[2]. The recent synthesis 'From the mountain to the tap' and follow-on publicity suggests that reforestation of such areas would have an overriding negative impact on people and the environment. 'From the mountain to the tap' is focussed on relatively dry areas and on the effects on volume flow of water and on relatively short time frames. In contrast, we would suggest that recent research findings within meteorology, hydrology and ecology indicate the longer term impact of tropical forestation to be more likely positive, to strongly depend on climatic conditions and certainly to be much more complex than commonly presented in current debate.

Not seeing the soil for the trees[3]

Ecological findings clearly show that by planting trees in degraded tropical areas, soil biodiversity is increased, which itself improves the soil physical properties thereby encouraging further biodiversity improvements[4]. This soil structural improvement also reduces infiltration-excess overland flow[5]. This is particularly important on steep slopes which have the potential to generate high rates of overland flow[6]. In such areas soil improvement arising from tree planting and growth might have the potential to reduce peakflows of streams during floods. Moreover, the reduction of overland flow certainly slows gully development[7]. This soil conservation benefit is further aided by avoiding the soil tillage normally associated with agriculture[8], and by adding a more protective vegetation canopy in comparison to some cropping systems[9]. The abstraction of subsurface water by trees with the resultant drying of soil and upper layers of regolith can also reduce the likelihood of landslides, particularly where the drift geology is shallow[10,11]. This positive surface drying effect is in addition to the beneficial effect of tree roots on soil shear strength[12]. The overall result of a more stabilised terrain is clearly seen beneath forests planted on formerly degraded terrain in south-eastern USA or central Japan.

Reduced sediment load of rivers

Once reforestation activities are complete, rivers draining from these areas show smaller sediment loads when compared to areas undergoing regular agricultural tillage or urban development[13]. Critically, where plantation management excludes pesticide use or downstream processing chemicals, then rivers are cleaned of the pesticide residues and industrial contaminants associated with former agricultural or industrial activities[14].

Water budget effects of plantation forestry

Most catchment studies in the humid tropics show that newly established tropical plantations evaporate more water directly to the atmosphere in comparison to non-forest vegetation[15,16]. There are, however, five critical issues that mean these findings cannot be simply extrapolated across the humid tropics. These issues are:

- Reduced impact when on deep aquifers

- Reduced impact with forest maturation
- Comparable water demand to the climax forest vegetation
- Reduced impact at large scales due to age mosaic and lower intensity of change
- Reduced impact at large scales due to climate feedbacks

The *first* issue is important given that almost all of these tropical evaporation studies have been undertaken within small catchments on non-aquifer rocks. Where major aquifers are present, water can percolate to great depths of perhaps 100 to 200 m before returning to the surface to generate streamflow. Where this is the case, then the water is soon beyond the depth that trees roots can extract the water to support transpiration. As a consequence differences between trees and more shallow rooted vegetation would be much less[17]. Water budget studies on tropical aquifers are needed.

The *second* issue arises because most tropical studies examining the effect of afforestation on the water budget are undertaken over only the first few years after planting[18]. During the initial phase of tree growth, water use can be very high, but as trees mature, their water demand falls. For example, eucalyptus, a tree with one of the highest water uses during the initial phase of growth, had a lower water use in comparison to non-forest vegetation when mature[19]. More tropical water budget studies are needed that follow plantation development to maturation.

Where plantations have been established in areas formally supporting a climax vegetation of natural tropical forest, water yields of the mature plantations are often similar or only slightly greater than the natural forest[20,21]. This *third* issue is pertinent to the ideas of environmental sustainability, where the goal might be to minimize the environmental differences between the modified land-use and the natural, climax vegetation.

The *fourth* issue relates to the scale of investigation of most water budget studies in the tropics. In this region there are few such studies undertaken on large watersheds perhaps 1000 km^2 in area. If the limited large scale data is examined, then it does indicate that the effect of plantation development on water yield at this scale is insignificant when compared with the natural cycles in the riverflow or evapo-transpiration caused by climatic variations[22]. In part, the forest effect is small because of the considerable range of stand age seen at this scale and the lower intensity of land-use change[23].

The effect of scale on climate feedbacks also adds uncertainty to our extrapolations from small-scale, tropical water budget studies. When water budgets are examined at very large scales of perhaps 10,000 km^2 or larger, the effect of changing vegetation cover on evapotranspiration can significantly affect the regional production of rainfall. This has been shown in recent simulations of Global Climate Models[24,25]. Large-scale deforestation of the West African forest region may have led to reducing rainfall[26]. The implication being that extensive forestation of such areas (once mature) would enhance soil-water, groundwater and riverflow through intensification of the hydrological cycle. Several studies note that the scale dependence of the forest – rainfall generation phenomena is partly related to the increasing heterogeneity of the land

cover[27].

The last hydrological benefit of plantations that we would like to highlight relates again to changes to the soil. Extensive and marked reductions in the soil permeability following industrial development, land degradation or some forms of agriculture could significantly reduce the infiltration and subsequent recharge of deeper strata, in comparison to permeable forest soils[28,29]. Where these soils overlie deep aquifers, then the enhancement of recharge by plantation development could be greater than the short term reductions in recharge due to a slightly greater transpiration. There are early indications that this effect is observed in the Western Ghats region of India. More aquifer recharge studies throughout the tropics are required to fully evaluate the sometimes competing effects of plantations on soil and canopy processes.

We would acknowledge that exceptions can be found to the beneficial effect of forestation cited here[30]. The lack of long-term and large-scale analyses of the hydrological impact of tropical forestation should, however, make scientists at least, more cautious about portraying tropical forestation as either wholly negative or wholly positive.

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QUESTIONING LONG-HELD BELIEFS ABOUT FORESTS AND FLOODS

By Thomas Enters and Patrick B. Durst

The driving force behind many environmental policies are powerful assumptions about the links between forests and water, particularly flooding. Each year, devastating floods affect the personal and economic fortunes of millions of people. Each catastrophic flood is accompanied by heart-wrenching images of shocked individuals sitting on rooftops, awaiting rescue or the receding of rampaging flood waters. Sympathetic people from all walks of life cannot help but to be moved by the stark scenes of desperation. Conscientious policy makers and politicians leap to identify and remedy the perceived causes of the devastation. Upland farmers and loggers – especially in developing countries – are typically blamed for clearing and degrading forests, which are widely believed to protect against such calamities.

In many people's minds, the use and abuse of forests in watersheds represents the main cause of massive lowland floods. The causal link between deforestation or forest degradation in the uplands and floods in the lowlands seems intuitive to many. Unfortunately, the reality of hydrological systems is far from simple and hard evidence of the link is sparse.

Hydrological systems are, in fact, extremely complex and it is difficult to disentangle the impacts of land use from natural phenomena. Although several scientific studies have been conducted on the relationship between forests and floods, the limited – sometimes also contradictory – results have often been used to make sweeping generalizations that are inappropriate, misleading, or patently wrong.

Little distinction is made between what we know and what we think we know, which greatly contributes to a general confusion on the issue. Much of this confusion has a long history and relates to the so-called "sponge theory", which appears to have been developed by European foresters at the end of the 19th century and rapidly spread to other continents.

According to this popular line of thinking, forests act as a sponge soaking up water during rainy spells and releasing it evenly during dry periods. The simplicity of the theory makes it intuitively appealing. Unfortunately, the popular theory fails the test of close scientific scrutiny. While forest soils usually have higher water infiltration and storage capacities than non-forest soils, it should be recognized that deep soils in general have higher water storage capacities than shallow soils irrespective of vegetative cover. Equally important is that much of the rain that falls on forests areas is consumed – quite extravagantly, in fact – by trees and does not serve to increase low, dry-season riverflows.

This is not to say that forests are not beneficial in hydrological terms. As early as 1905, Gifford Pinchot, the "father of forestry" in America, described the "good influence" of forests in reducing the severity of floods. On a small scale – up to 500 km^2 – the presence of forests can indeed affect peak riverflows and thus floods (Table 1). However, even in smaller basins, the extent to which forests can absorb excess water during heavy rainfall depends greatly on forest type and management, and even more importantly, on the underlying geological and antecedent rainfall conditions. In Pinchot's own words rain water "which falls after the forest floor is saturated runs into the streams almost as fast as it would over bare ground." In large river basins, the positive effects of forests in reducing catastrophic floods are negligible.

How about the notion that flood frequencies have increased? Floods have occurred throughout the world long before deforestation was a problem. For example, Hofer and Messerli (1997) unearthed records of eight major floods in Bangladesh between 1870 and 1922, and concluded that "there is absolutely no statistical evidence that the frequency of major flooding has increased over the last 120 years." In China, the Yangtze and Yellow Rivers have broken their banks, causing huge loss of life and changing the face of the landscape for centuries. And in Bangkok the floods of 1983, which inundated parts of the city for four months, were comparable to events in 1795 and 1831 (Terwiel, 1989), when three-fourths of Thailand was still covered by forests.

Similarly, there is no clear evidence that the

Table 1. The spatial dimension of land-use effects

Impact	Basin size [km^2]						
	0.1	1	10	100	1,000	10,000	100,000
Average flow	X	X	X	X	-	-	-
Peak flow	X	X	X	X	-	-	-
Base flow	X	X	X	X	-	-	-
Groudwater recharge	X	X	X	X	-	-	-
Sediment load	X	X	X	X	-	-	-
Nutrients	X	X	X	X	X	-	-

Legend: x = Observable impact; - = no observable impact
Adapted from Kiersch (2000).

intensities of floods have increased in modern times. Damage from floods, on the other hand, is greater than ever before due to economic growth, skyrocketing investment in floodplain infrastructure, a growing floodplain population, and the fact that many people and institutions have forgotten or discarded traditional approaches for coping with rivers and floods. New infrastructure development has expanded rapidly into flood-prone areas that used to be avoided, and urban sprawl has transformed formerly vegetated land into impermeable surfaces.

The science on the causes of floods and the effects of forests and good watershed management on floods admits uncertainty, imprecision and complexity. FAO and CIFOR (2005) have recently explored this issue and the scientific evidence linking floods and forests. The newly published review – entitled *Forests and floods: drowning in fiction or thriving on facts?* – reveals that much of the perceived wisdom cannot be substantiated by science. It is often little more than myth or is patently incorrect. In the case of massive floods, such "conventional wisdom" has often led decision makers to implement misguided policies that over-emphasize reforestation and logging bans at the expense of more holistic watershed and river-basin management.

Forests and floods distinguishes fact from fiction and recommends alternative approaches for effective watershed and floodplain management. It should appeal to everyone with an interest in escaping the quagmire of stale and dated paradigms. Ultimately, *Forests and floods* aims to better inform policy makers, development agencies and the media, and thus constructively contribute to the development of sound watershed and river-basin management.

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For more information about the publication "Forests and Floods – Drowning in fiction or thriving on facts?" (FAO and CIFOR, 2005), please see the section of publications, page 13 in this newsletter.

FORESTS AND FLASHFLOODS

By Peter Walpole

In November 2004 a major flood in Eastern Luzon, Philippines turned into a disaster with over 1,500 deaths and destruction of agriculture, fisheries, property and infrastructure worth over PhP 6 billion. The public debate focused on the notion that logging was the main cause of these losses of lives and livelihoods. Local governments and politicians, riding the media blitz, believed that the disaster was due to upland farmers logging for subsistence needs and to influential traders who had ways to move logs along the Pacific coast. The debate revisited the issues raised after the Ormoc disaster on Leyte (Visayas, Philippines) 15 years ago.

In Asia, many disasters resulting from landslides and flashfloods are similarly blamed on logging. Urban society increasingly identifies illegal logging as the main culprit. Many environmental advocates use these disasters to leverage greater government action to curb logging. The Thai government responded to the widespread flooding in 1989 with a total log ban, increased area for conservation forests, and tightened control over upland community resource use. While action must be taken against the high loss of forest cover in Asia, this will not prevent such disasters. What should be addressed is the social vulnerability of people living in (potential) flood plains and preparedness for "rare" but realistic flooding events (e.g. once-in-50-year rainfall episodes). These reoccurring "natural" events will be devastating if there is no focused action.

A recent study in the Philippines showed that 50% of the rainfall events are more intense than the current infiltration capacity of the soil. Overland flow of water causes erosion of bare soil. Flood waters carry away material from landslides and everything along channel sides and in flood plains – trees, debris, logs, soil, rocks and settlements. Major events clean up the river beds and sweep away the residue of fifty years of small events, depositing it in flood zones as alluvial fans, sand banks and in river mouths creating deltas. Logging generally exposes forest areas, even when there is no bare soil, as canopy gaps and logging residues make remaining vegetation more vulnerable, creating potential flood debris and increasing the potential for landslides, there being less hold on the soil. But with once-in-50-year rainfall events, there are major landslides even in primary forest.

The biggest problem with blaming illegal logging for disasters is that it diverts attention from addressing the security of people in high-risk areas. These people have to be relocated to lands not threatened, which requires money and a level of social redistribution of land. Governments tend to avoid such action and would rather blame poor people who will not be arrested for logging than responsibly tackle relocation.

National programs addressing illegal

logging will not prevent climatic or geological events from becoming disasters. Focussing on logging keeps the society away from taking appropriate action, such as reviewing or strengthening policies on land reallocation and development of major flood infrastructure. As a result local communities return to live in high risk areas, infrastructure that overrestricts river flows is not altered, and plantations are still being developed in flood plains. Furthermore, 'unnatural rains' are still being viewed as an act of God and not accepted as a normal returning event and political will and effective policies are still lacking for land identification for relocation. Fifteen years after the Ormoc disaster, these lessons have yet to be internalized by Philippine society.

In the region, the impact of the climate needs to be understood at three different levels to formulate an appropriate response.

Global Climate Change

Although deforestation does add to atmospheric carbon and increase in soil temperature, it does not affect significantly local rainfall amounts in an archipelago like the Philippines where the surrounding ocean determines the climate. Global climate change, however, may influence rainfall dynamics, as the world has observed with a high frequency and intensity of Niño events in the '90's. Sequestering carbon as an immediate action, plantations and reforestation are the primary responses in creating new 'forest'. Any forestry activity that locks up carbon and improves processing and recycling of wood preventing its return to the environment as carbon would contribute to carbon sequestration.

Late or Early Rains

In the Philippines during El Niño and the Southern Oscillation (ENSO), the wet season is delayed if not lost, followed by an extended rainy season in the next year. ENSO increases stress on ecological services, livelihoods & biodiversity. Less water is available in the form needed, when needed. Deforestation exacerbates these effects by increasing surface water flow (as against subsurface flow), decreasing aquifer infiltration, and increasing microclimate temperature. In this context, logging natural forests has the greatest negative impact on water management. The automatic policy response in the Philippines appears to be reforestation with alien fast-growing species, sometimes including the planting of fruit trees to augment local livelihood and to reduce cutting reforested areas. The best response, however, would be assisting natural regeneration of forests, but this has been insufficiently explored. Social programs must focus on developing livelihood options addressing the economic needs of the poor.

Exceptional Rainfall Event

A climate event is an "exceptional rainfall event", usually where two or more typhoons occur in an area within one week, bringing 30% to 60% of the annual rainfall. Such rainfall can liquefy and destabilize soil deeper than 10 meters (maximum forest root depth) – especially where a good soil structure allows for easy infiltration of water. The Philippines needs to recognize that these events reshape the fluvial landscape and therefore they should calculate when and where these events may occur. The government needs to recognize that flood zones are nutrient-rich and very tempting for farming communities to claim, and for squatters to settle on.

Actions needed

Simply put, different problems need different responses. While many are deeply committed to saving Philippine forests, the response to each geological and climatic event should focus on the primary problem.

Changes have to be made firmly and strategically with a whole new generation of programs that seal the past constitutional and policy changes with a greater understanding of social vulnerability. It will be difficult to rectify decades of marginalizing landless either in the uplands with no connectivity to markets or basic services, or those concentrated in disaster-prone urban flood zones and hillsides.

Government data are generally outdated and insufficiently accurate for the critical analysis that is needed for disaster related land management. The awareness and capacity for critical integration in governance as a whole is missing – especially at the local level. Local government, along with direct participation of the people on the land is fundamental in sustaining any lasting change. Illegal logging is an issue for biodiversity conservation, ecological services, sustainable livelihood and disaster management but to very different degrees. A whole new approach to disaster management in relation to the environment and society has to be established.

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LINKAGESBETWEEN FORESTS AND WATER: A REVIEW OF RESEARCH EVIDENCE IN VIETNAM

By Vu Tan Phuong and Jinke van Dam

In Vietnam forests still cover 36% of the country, mainly in the hills and mountains. The forested areas in the upland watershed are very important, as they supply freshwater for agriculture, industry and hydropower. Land cover in these areas plays an important role in controlling floods. The destruction of upper watershed forests is often seen as the cause of increased erosion, sedimentation as well as floods. However, evidence from studies in Vietnam, as elsewhere, indicates that the role of forests may differ from common public perceptions.

We will briefly review data from Vietnam on the effects of forests on three watershed functions: (i) Total annual water yield; (ii) Regulation of seasonal water flows; and (iii) Flood prevention. This paper is an output of the research project “Upland – lowland interaction in forest hydrology and benefits received from watershed forests”, which is implemented by Forest Science Institute Vietnam (FSIV) and ITC Enschede (the Netherlands) and supported by Tropenbos International Vietnam. The project, which started in 2004, aims at formulating recommendations for watershed management based on elaborate review of existing data on the relationships between forests and water.

Forests increase annual water yield?
The general assumption is that total water supply, or river flow, to areas downstream from forested areas is higher than from alternative land use areas. Total river flow is dependent on the balance of a large number of hydrological factors. In theory, forests may be associated with a greater capture of atmospheric moisture, especially where cloud forests are involved. Natural forests usually maintain high infiltration rates and water storage capacity of the soil which reduces river flow in the early part of the rainy season before the whole landscape becomes saturated with water.

Various studies in Vietnam showed a lower annual water yield when forest areas were compared with areas under agricultural crops with the same rainfall regime (Nguyen Ngoc Lung & Vo Dai Hai 1996; Thai Phien & Nguyen Tu Siem 1994). One study, for example, indicated that run-off under forests was 2.5 - 27 times smaller than run-off under agricultural crops (Thai Phien & Tran Duc Toan 1998). Another study showed that run-off from natural forests was 3.5 to 7 times less than the run-off measured in plantations (Vo Dai Hai 1996; Bui Nganh et al 1984).

In forested areas run-off is believed to be lower because the forest canopy intercepts rainfall. Under Vietnamese rainfall regimes, broad-leaved natural forest can intercept 15-19% of rainfall. For regenerated natural forests interception may be only 7.5% for and for bamboo forests about 5% (Nguyen Ngoc Lung & Vo Dai Hai 1996). However, it must be noted that the ability of the forest canopy to intercept rainfall depends strongly on the daily amount of rainfall and on the rain-intensity, complicating the interpretation of short term studies (Vo Dai Hai 1996).
As a next step in the hydrological cycle, the effects of land cover on infiltration primarily influence the time course of run off; it also influences annual water yield by supporting dry-season water use by vegetation. One of the studies indicating lower run-off in forested areas measured the highest infiltration rate under a natural forest with three storeys. In this case, the infiltration rate was about 16.8 mm per minute, as compared to about 10.2 mm per minute in forests restored after shifting cultivation and about 2.1 mm per minute for bush and grass land. (Hoang Niem 1994; Vu Van Tuan 2003).

Few of these studies have established annual water yield by integration over daily flow rates across the year and there may be confusion over the time scale of effects.

Forests regulate seasonal water flows?
Many people believe that water flow under forest cover is regulated seasonally: - compared to non forested areas, forested areas have an increased water flow during dry seasons and a decreased flow during wet seasons. In Vietnam the popular belief is that forests do regulate seasonal flows (Do Dinh Sam et al 2002) Many people living in a watershed area of Vietnam mentioned that “the forest can store water in the rainy season, while the dry season becomes more severe if the forest is destroyed” (FSIV & IIED 2002).

So far, research available on the impact of forest on seasonal water flows is limited. In Vietnam the debate is ongoing and research outcomes can be contradictory. Hydrological studies conducted in the basin of areas of 4 - 125 km^2 revealed that the dry flow index of the forested basin is bigger than that of the non-forested area (Vu Van Tuan 2003). Research in the Da River showed that with a 20% decrease of forest cover, the rainy

season flow increased from 20 to 40%. (Vu Van Tuan & Pham Thi Huong Lan 2004). On the other hand, research in Mu Cang Chai watershed showed that when the forest cover was reduced to 20%, the rainy season flow decreased by 15%. One might conclude that forest is one of several factors affecting the process of water flow and that the influences of forests on seasonal flows depends on the site and the alternative land use that is compared to forest.

Forests reduce floods?

In recent years floods have been severe and they appear to be more frequent. Deforestation is often believed to be the main cause. Generally people assume that forests contribute to reducing floods, since forest cover can regulate water flow and reduce the surface run-off. However, in Vietnam some views suggested that flooding may be linked more to weather conditions than to the existence of forests (FSIV & IIED 2002). Floods are considered to be a natural phenomenon, in which rivers discharge any excess water arising from occasional large rainfall events. The effect of land cover on the relation between rainfall and floods is expected to vary with the degree of saturation of the landscape, as higher infiltration rates are not effective in reducing surface flows if the subsoil cannot store any more water.

However, so far there has been limited evidence to substantiate these theories: the theories are still subject to an ongoing debate. In Vietnam, an important question in this debate is posed by Ministry of Agriculture and Rural Development (MARD). MARD would like to get a better insight in how much the forest cover in specific watershed areas contributes to control flooding.

Research in Vietnam conducted in the Da River showed that about 78% of discharge from the Da River happened 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 (Institute of Hydrology and Meteorology 1998).

For small-scale catchments, there is evidence that forest cover does indeed contribute to reducing volumes of floodwater downstream. For the largest, most damaging floods there appears to be no scientific evidence for a connection with deforestation (Tran Thuc & Huynh Thi Lan Huong 2003; Vu Van Tuan & Pham Thi Huong Lan 2004).In this context factors as climate (rainfall and rain intensity), terrain and geography are considerably more important.

Conclusions

Based on these reviews, it can be said there has been not enough hydrological evidence in Vietnam to fully understand the linkages between forests and water. It is quite clear that forests do not increase annual water yield; usually forests reduce run-off, especially when the forests are in natural condition. However the role of forests in regulating seasonal water flow and controlling floods is still not certain, as it is very site specific. The occurrence of floods is more related to weather conditions, terrain and geography than forest cover. Therefore more research would be needed for a better understanding of these debates.

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NOT SEEING THE TREES FOR THE FOREST? FROM EVICTION TO NEGOTIATION IN SUMBERJAYA, LAMPUNG, SUMATRA, INDONESIA.

By Bruno Verbist, Meine van Noordwijk, Fahmuddin Agus, Widianto, Rudi HartoWidodo, and Pratiknyo Purnomosidh

Land use change, especially deforestation, is often blamed for the loss of watershed functions and still leads to much conflict. The association of 'forest' and 'water' is strong in the public perception. All too often, environmental arguments are used as 'a stick to beat the dog', without a good insight into what makes a landscape - and its various elements - function properly in providing environmental services. Sumberjaya, a large caldera of about 40.000 ha in the southern part of the Bukit Barisan mountain range of Sumatra, Indonesia, has seen a lot of conflict and it may represent possible future trajectories for many other watersheds in Southeast Asia.

In 1998, before ICRAF started working in Sumberjaya, the local government and its forestry department depicted the following problems and context: "Uncontrolled deforestation and conversion to coffee on the slopes have led to a tremendous increase of erosion and reduction of discharge of the Way Besai River. This negatively impacts operation of the newly constructed Way Besai hydro-power dam. Water availability for irrigated paddy rice downstream was reduced."

The Forestry Department was worried about the rapid expansion of coffee in the seventies, and its visible erosion. Protecting watershed functions was the main purpose to delineate "Protection Forest" in 1990. The enforcement of forest boundaries led to the eviction of thousands of farmers between 1991 and 1996. Evicted farmers were resettled on the infertile acid lowland peneplain or converted swamp forest of northeast Lampung. After the political change of 1998, farmers needing a living returned to the area, often under silent approval of the local government that needed income and was interested in economic development …

Integrated research

Responding to the problems described by the local government, ICRAF and partners aimed to develop a 'negotiation support system' combining a reconciliatory negotiation process with a toolbox that could clarify the likely consequences of plausible land use change. To do this properly, the right questions had to be asked first. Many preconceptions and myths existed as some questions had not been raised before. These included the following 5 points, the results of which are summarised below.

1 *How did current land tenure arrangements develop?*
Forest areas indicated on a Dutch map of 1939 were almost identical to areas delineated as protection forest in 1990. However, after independence large parts of the State Forest were abolished by President Sukarno and in the 1950ies many war veterans obtained official land titles and started growing coffee on these lands. After 1965, the 'New Order' government did not recognize these land titles as 'legal' as they had other priorities, which led to the logging of most of Sumatra's forests.

2 *What land use sequence appears after deforestation?*
Deforestation in Sumberjaya was rapid, responding to peaks in global coffee prices. However, since the late 1980ies a 're-treeing' phase started whereby farmers converted much of the monoculture coffee stands into mixed shade coffee systems. Ironically, coffee farms on private land now have a higher tree cover than the contested 'forest lands'. Insecure land tenure of the forest lands discourages farmers from investing in tree planting.

3 *Did river discharge decrease over the years?*
A time series of daily rainfall and discharge data showed that although on average rainfall remained constant over the years, the average discharge increased. Reduced evapo-transpiration of coffee gardens compared to forest is the likely cause. Perhaps coffee farmers should receive a reward, because with the land under coffee the hydropower scheme can operate more days per year at full capacity than if the watershed would be under forest cover!

4 *Did low flows decrease over the years due to land use change?*
A real decrease of low flows in the Way Besai in the dry season did occur; however, the number of years with a prolonged dry season also decreased. An increase of El Niño years (1976 vs. 1991, 1994 and 1997) induced the perception that dry season flows were reduced by local land use change rather than by global climate change.

5 *Under what land use types and practices is erosion problematic?*
Erosion under various landuse types (forest, bare soil, coffee with different degrees of tree cover) was measured on 80 plots in two locations between 2001 and 2005. Near the area where the Forestry Department carried out erosion research in the 1980^{ies} erosion rates between 4 ton ha^{-1} year^{-1} (forest) and 30 ton ha^{-1} year^{-1} (bare soil) were confirmed. However 6 km closer to the outflow, erosion rates ranged between 0.1 (forest) and 4 ton ha^{-1} year^{-1} (bare soil) under the same treatments. Thus, even bare soil plots yielded less sediment than forest plots in another area! In coffee gardens the erosion rates were in between those of bare soil and forest, depending on soil cover. Erosion was the highest in coffee gardens of 3 years old and then gradually declined as litter layers established soil cover. Discharge, turbidity and sediment concentration measurements in the Way Besai and its tributaries in 2005 showed large differences between catchments and thus confirmed the plot level research results. The old crater landscape has a high diversity of geological substrates. Even under dense forest cover some pristine headwaters can turn quite turbid. Research now focuses on the importance of roads and foot paths, and riparian filter vegetation as well as the geological background of the soils.

Future challenges

Collaborative research helped debunk some of the past myths. "Negotiation" has replaced "eviction" as key word. In 2000, a Community Forestry program was set up allowing farmers to obtain land tenure in return for protecting the remaining forest and planting trees in their coffee farmers. A Water Forum has been established to facilitate communication between the various stakeholders, such as farmer communities, government agencies, and NGO's.

However, translating these research results

into policy action takes time. It remains to be seen to what extent agencies can reinvent themselves and move from mere executors of blue prints into a mode of asking questions, looking for answers and solutions, distinguishing between symptoms and causes. Replacing the generic 'forest' concept by a set of quantifiable indicators of watershed functions will help, but this will require public support. The pool of trained people and the tool box with tested and relatively cheap methods to assess, for instance, water quality and erosion is expanding. Collaborative research between national and international institutes improves the prospects of correctly assessing the local context and opening doors to policymakers.

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BASIN MANAGEMENT IN NORTHERN THAILAND: EMERGING LESSONS

By David Thomas

In the discussion on deforestation, reforestation and forest conversion in the tropics water always plays a prominent role. By contrast, the European water framework directive gives guidance on how the quality of surface water should be managed, without explicit reference to forests or trees. In northern Thailand similar ideas are now emerging, after many decades of a forest-biased public debate.

The EU Water Framework Directive has the following key aims:

- water management based on river basins
- expanding the scope of water protection to all waters, surface waters and groundwater

- getting citizens involved more closely
- achieving “good status” for all waters by a set deadline
- “combined approach” of emission limit values and quality standards
- getting the prices right
- streamlining legislation

The directive specifies a single system of water management: River basin management. This was seen as the best model, rather than according to administrative or political boundaries. Initiatives in Maas, Schelde and Rhine river basins served as positive examples of this approach.

Lessons for river basin organizations

A review of the major lessons for river basin organization (RBO) that can be learned from international experience lead to the following conclusions:

Absence of a “blueprint” for RBOs

Scope of Integrated Water Resource Management

There is a growing amount of evidence that RBOs with relatively wide mandates are better able to attract and hold interest of major stakeholders, who feel they are involved with work that is relevant to their needs, especially in basins where there are multiple major problems.

Subsidiarity and decentralization

Subsidiarity is based on the key proposition that, especially in complex management systems, decisions are best made at the most local level where they are possible and viable. A corollary is that where local decisions are not possible or viable, they should be raised to the next higher level in the hierarchy, where the same principles are then applied. When decisions are made at their most appropriate levels, this favors efficiency, equity and accountability.

Stakeholder representation and roles

RBOs employing integrated water resource management principles clearly function best when the full range of stakeholders is represented and actively participating.

Information

Virtually all studies and assessments of experience agree on the need for high quality and openly accessible information. In some societies, this can be provided from a substantial range of sources with which the RBO can develop an alliance or collaboration. In many others, however, information and data are scarce and often of dubious quality, gaps are wide, expertise is low or highly concentrated in particular agencies or stakeholder groups, and public information access is not a cultural norm.

Coalitions and alliances

Increasingly, RBOs face a situation where they are expected to respond to broader mandates, but in a more decentralized manner. Experience confirms that, under the right conditions, this can increase stakeholder participation, accountability, efficiency and equity. But those ‘right conditions’ include needs for more capacity, tools, information, and other resources at local levels of distributed systems where such things are often scarce.

Application in the Ping river basin: confusion and uncertainty

In reviewing the current status of the application of these concepts in the Ping river basin we noticed an overall state of confusion and uncertainty felt by most

stakeholders – including government agencies – about the directions of the Ping River basin program and the status of the various committees, working groups, networks and initiatives that have been formed and are under development. This is resulting in a general feeling of tension that is usually somewhere on a continuum that runs from apprehension to frustration, that appears at all levels from the Ping River Basin to local communities. Stakeholders at different levels asked "Why is there a need for this project?" This is usually followed by, "Why doesn't the government just provide some of the funds they have promised for several years, and let us get started with activities we have already planned?"

Especially in the Upper Ping, there is now considerable confusion about the apparent continuing expansion of the mandate of river basin and sub-basin organizations and planning. The first round of committees and planning seemed to be focused quite directly on water resources. Then the second round of planning seemed to shift much of the focus to forest conservation, land use, agricultural chemicals and trash. Now this new project wants to add public health and poverty *cum* livelihood issues. Most local communities appear to have few problems about seeing how these issues are important, linked, and affect their lives, but they feel a need to get some clarity and definition so that they can do what is required and get on with their activities and their lives without spending so much time planning and re-planning. For government agencies, concern is even stronger because of the lingering questions about who is or will be the "owner" or "patron" of this program (and its budgets), and how are they supposed to act vis-à-vis other agencies.

And at a more specific level, there is also quite considerable confusion about the roles and status of the various existing levels of committees and working groups, as well as the plans they have already developed. A number of people have stepped forward to assume leadership roles, and some are beginning to wonder if they have been wasting their time, or if people at higher levels are for some reason not pleased with their performance. Perhaps even worse, some are wondering if the continuing lack of action in receiving support for the plans and projects they have worked to help articulate and develop will damage their credibility and social standing within their communities.

Problem identification by government officials naturally tends to be viewed through the lens of the mandate of their agency, whereas much local problem identification has been broader but unsystematic and often occurs too late to consider preventative measures. Empirical data-based analysis has generally been extremely rare, and unquestioned popularized general theories backed by emotional arguments are still featured prominently at most public discussions. Various interpretations of 'Forest' play a prominent role in these discussions. Issues often tend to be viewed as simply good or bad, rather than as involving situations where there are trade-offs that must be made between the benefits and costs accruing to different groups. Assessments of such trade-offs, however, would also often require information, data, and analytical tools that are frequently not available to or accessible by local leaders and communities.

That being said, more quiet progress toward more dispassionate and reasoned analysis is being made in various sub-

basins. Local leadership, sometimes assisted by staff from government agencies or academic or civil society institutions, often features prominently in these cases.

The type of progress we have seen in some sub-basins also demonstrates local progress toward development of a "negotiation mindset" that will be required to effectively develop and implement solutions to many, if not most problems. There are usually costs and benefits associated with all potential solutions to a problem, and their distribution is frequently not even or balanced across the range of stakeholders involved. Thus, in order to achieve sufficient participation, this distribution of costs and benefits needs to be negotiated among concerned stakeholders. A negotiation mindset shifts emphasis from a focus on 'winning' or 'losing' to seeking an outcome wherein concerned stakeholders (at all levels) incur various costs and benefits that are mutually perceived as equitably distributed, as they jointly seek a 'best possible' outcome.

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MODELLING TROPICAL FOREST WATERSHEDS: SETTING REALISTIC GOALS

By Nick A Chappell

Some rainforest watersheds in the tropics are natural buffers for water resources and ecology; others provide forest products, which sustain local livelihoods. The movement of waters containing chemicals and sediments needs to be known to underpin sound forest management practices; and watershed modelling is a key element in this learning process (Chappell *et al*., 2004b). We do, however, need to be realistic about what we can learn from these modelling results.

Forest hydrologists typically address one of four objectives when they model tropical rainforest watersheds. First, modelling can be used to test the consistency of existing theory and explore individual hydrological mechanisms in a systems context, addressing issues generic to the global hydrological community. These issues include how hydrological behaviour changes with watershed size, or how hydraulic characteristics can be measured over field-scales. Secondly, modelling can also show the relative importance of particular controls on hydrological behaviour within a particular setting; for example, the difference between watersheds with different rainfall regimes (e.g., cyclonic vs. non-cyclonic) or subsurface storage (e.g., aquifer vs. non-aquifer geology); these results can be used to help define simple conceptual models of watershed behaviour. Thirdly, models can be used to illustrate the impacts on hydrology of changes in land cover and/or rainfall regime.

Fourthly, modelling allows specific management questions to be addressed robustly; for example, how to define the width of stream buffer zones or roadside corridors. These four objectives have been addressed using a diverse (or bewildering?) range of watershed modelling approaches, each with their own advantages and limits.

Models can be 'static' being based on a long-term average behaviour; for example, the Revised Universal Soil Loss Equation (RUSLE) or NCYCLE model predict annual fluxes of sediment and nitrogen. Alternatively they can trace a daily (or shorter time-step) 'dynamic' being based on time-series measurements of frequently sampled variables such as rainfall, streamflow, transpiration or groundwater level. One might further classify dynamic watershed models in to: (i) physics-based, distributed models, (ii) conceptual, semi-distributed models, (iii) black box models, and (iv) data-based mechanistic (DBM) models.

Physics-based, distributed models are based on solving well-established hydrological 'laws' (e.g, Darcy, Chezy, Penman) while maintaining mass balance of water (and energy), and have model structures which allow measurements of distributed terrain characteristics to be utilised. Examples of these models include the Système Hydrologique Européen (SHE) model and IHDM. Given a local knowledge of the how terrain characteristics change with forest management (compaction, soil mobilization, etc) it is easy to see how such information can be incorporated within such models to simulate hydrological change. While computing power and the desire to make predictions of land-use change impact have increased over the past 20 years, we have become increasing aware that the terrain characteristics needed for our models are different to those we can measure. For example, any physics-based watershed simulation of rainfall-runoff response, nutrient export or erosion, demands measurements of ground permeability representative of lumps of the watershed perhaps 100x100 m in surface area. Our measurements on soil and weathered rock, in contrast, only include one hundredth of this, and are not readily related to the larger scale because of non-linearities in the hydrological system. Where fracture zones, natural soil pipes and gully systems are present this problem is magnified further (Chappell *et al*., 1998, 2004a). One might argue that the main success of these models is that they show the severe limitations of the data-sets of terrain characteristics available for watershed simulation.

Conceptual, semi-distributed models have much simpler model structures in comparison to physics-based models. This means that they simulate hydrological dynamics much more quickly than physics-based models and require less field data as input. These models have simple structures because they make prior assumptions about the dominant mechanisms operating and the nature of patterns of terrain characteristics. These models tend to be semi-distributed, in that the spatial distribution some terrain characteristics is incorporated (e.g., topography), while other characteristics are lumped in one or two dimensions (e.g., a single permeability profile or a two-layer subsurface model). Widely used examples of such models are TOPMODEL, BROOK, MAGIC, WEPP and HEC-HMS. The relative simplicity of such models has allowed them to be used to show the sensitivity of streamflow (or erosion or hydrochemistry) predictions to particular

controls (e.g., topographic shape) and data limitations. A key constraint on belief in the results of these models surrounds how well the model parameters (e.g., model transmissivity) and model structures (e.g., whether there is one dominant fast and slow runoff pathway) relate to the true field data. Rather than simply assuming, for example, that one dominant fast and slow runoff pathway is present, perhaps we should see if the relationship between monitored rainfall and streamflow data has two identifiable components?

Black box models are invariability statistical models which are used to obtain the most efficient hydrological predictions (outputs) from one or more inputs, notably rainfall or upstream flows. The primary aim of many of these models has been to forecast river behaviour during storm events to predict over-bank flows (floods). A good example of such models is the Unit Hydrograph model. Fully black box models do not consider the hydrological mechanisms forming the rainfall-riverflow relationship. This means that while they give some of the best (least uncertain) short-term predictions of hydrological behaviour, there is no basis to alter the internal workings of the model to represent land-use or management effects.

Data-based mechanistic (DBM) models contrast with conceptual models (and indeed with physics-based models) in that in that they do not make prior assumptions about the hydrological mechanisms or pathways (e.g., the presence of one fast and one slow runoff pathway) operating in a particular watershed. Instead, the DBM technique involves fitting a wide range of mathematical relationships (notably transfer functions) to watershed rainfall, streamflow, and other data. Some of these relationships or models are statistically valid; these are then assessed for their consistency with the hydrological mechanisms observed to operate within the simulated watershed. This approach, therefore, seeks to obtain a model which is statistically sound, is consistent with the local hydrology and has the least number of model parameters (Chappell *et al*., 1999, 2004b). The latter objective constrains the uncertainty in the predictions of, for example, streamflow, stream sediment delivery or stream chemistry in comparison to physics-based and (most) conceptual models. Secondly, the DBM modelling technique, produces possible water pathways and watershed characteristics (e.g., residence times) that allow tropical hydrologists to think about new ideas, rather than constrain themselves to the role of certain pathways (e.g., overland flow) or characteristics observed at other sites in the tropics or even in temperate climates. It, therefore, helps focus new monitoring needs, an important issue given the cost of hydrometric and water quality equipment demanded by today's scientists. Lastly, and perhaps most importantly, DBM more than any other technique, reinforces the importance of having good streamflow, rainfall, stream chemistry, etc. data on which to draw inferences after simulation. Within the tropics there are few data-series from case study sites (e.g., Babinda, Bukit Berembun, Bukit Tarek, Danum, La Cuenca, M'bé, Owena, Reserva Ducke) that allow us to generalise the natural behaviour of rainforest watersheds or quantify the impact of specific land management operations (Chappell *et al*., 2004b). In contrast, many other modelling approaches make very unrealistic predictions if compared with the limited number research observations that are available; sometimes giving the false impression that we fully understand the controls on tropical

hydrological mechanisms (Chappell and Sherlock, 2005) and how they change with land disturbance. While DBM model use rarely falls into this trap, DBM models do have their own limitations. Critically, to study differences between locations or management practices, case study data must be available to undertake DBM simulations. Thus where there are no case studies available covering a particular combination of location and management attributes, it is difficult and perhaps unrealistic to construct a DBM modelling scenario.

While the latest modelling technologies need to be more extensively applied to all global regions, perhaps a larger issue limiting application of hydrological science to forest management problems is the lack of case study data for tropical forests. In tropical forest regions we still lack watershed-scale data on, for example, the hydrological value of sustainable forestry, a classification of rainfall-runoff response across tropical regions, robust simulation of nutrient dynamics, and many more issues. Without these case study data from protected and managed tropical forests, quantifying those environmental impacts that threaten people's livelihoods or local environment lacks credibility. Some modelling approaches CAN be used to identify and justify data needed by scientists from academic institutions across the tropics (and the wider global hydrological community). This is a realistic goal, while complex distributed simulations in data sparse environments that purport to show clear results and solutions may not be.

Five of our papers illustrating these issues are listed below. The UNESCO review text of Bonell and Bruijnzeel (2004) *Forests, Water and People in the Humid Tropics* (Cambridge University Press) contains further discussion of modelling tropical forest watersheds.

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DEAD LEAVES IN THE LITTER LAYER RATHER THAN LIVE TREES CONTROL WATER INFILTRATION

By Kurniatun Hairiah

In the discussion on 'forest and water' the role of trees tends to focus on the aboveground canopies (that intercept water and use it for transpiration) or on the roots (that take up water from shallow or deep layers of the soil). An important part of trees, however, influences the flows of water by covering the soil (and protecting the soil surface from slash impacts) and by feeding the soil biota that enhance or maintain soil porosity, allowing water to infiltrate into the soil. From this perspective dead leaves may be the most important part of a tree; forests are not unique in providing litter, but they usually provide more, and more diverse, litter than other vegetation.

Forest conversion to coffee-based agroforestry leads to sudden disappearance of the litter layer and a decrease in the rate of litter fall, reducing food for ecosystem engineers such as earthworms. With time, however, a new litter layer is created potentially returning to forest-like conditions at the soil surface. As part of a broader analysis of watershed functions (see Verbist et al., this issue) our research quantified litter thickness, earthworm populations and soil macroporosity in response to land use change in the Sumberjaya benchmark area (West Lampung, Indonesia). We compared: (a) remnant forest (control); (b) multistrata shaded coffee with fruit and timber trees, as well as nitrogen-fixing shade trees; (c) shaded coffee (nitrogen-fixing shade trees, but less than 5 tree species per plot); and (d) sun coffee ('monoculture') with coffee forming more than 80% of total stem basal area. Plots were selected with tree ages of 7 - 10 years in three slope classes: (a) flat (0-10°), (b) medium (10-30°) and (c) steep (> 30°). The mean standing necromass was 6.1, 4.5, 3.8 and 3.0 Mg ha^{-1} for forest, shade coffee and sun coffee, respectively, without significant influences of slope. Fine, partly decomposed litter was 33-40% of total necromass, coarse leaf litter 14-16%, and twigs and branches comprised the remaining 43-52%. Soil organic carbon content (C_{org}) was highest in the forest. The largest annual litter input was found in the remnant forest (14 Mg ha^{-1} $year^{-1}$), followed by multistrata, shaded and monoculture coffee systems, i.e., 9.8, 6.6 and 4.0 Mg ha^{-1} yr^{-1}, respectively. The population density of earthworms in the forest was 50% lower than in multistrata coffee gardens (150 individuals per m^2), but its biomass (31 g m^{-2}) was twice that in the multistrata coffee gardens. The lowest population density of earthworms was found in the shade coffee system (150 individuals per m^2) with a biomass of 7 g m^{-2}. A simple model suggests that the standing litter in the various land use systems is consistent with measured litter inputs and decay rates, but that the soil organic matter content and macroporosity of the shade and multistrata systems are less than predicted. The recovery of a surface litter layer in sun coffee systems can provide protection from erosion with time, but will not be sufficient to restore macroporosity at the level of forest soils, leading to hydrologic alterations that favor overland flow.

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TREE PHENOLOGY AS DETERMINANT OF THE NET EFFECT OF TREES ON REGIONAL WATER BALANCE

By Catherine W. Muthuri

Two decades ago the 'Eucalyptus' debate emerged in India and other dry environments where drought tolerant, fast growing trees had been planted in a 'regreening' effort, but were found to use water. The fact that trees ***use*** water rather than ***generate*** it seems to still be a little surprising to popular and government audiences that are keen to have win-win solutions through both the local products and services that trees provide and through the presumed 'watershed services' that are generated for others. The shortfalls of the real effects of Eucalyptus were generally blamed on the fact that the tree is an '***exotic***' in the places where it is planted – not on the fact that all trees tend to use more water than shorter vegetation, the more so the faster they grow. Recent research in Kenya suggests that, apart from the growth rate, the phenology of the tree (evergreen or deciduous) has additional effects.

Increasing population pressure in Kenya and consequent shortages of arable land have resulted in considerable migration to semi-arid low potential areas. This has been accompanied by rapid clearance of natural forests to provide land for cultivation, supply timber products and meet basic community needs for commodities such as charcoal. This problem is particularly acute in the Naro Moru area west of Mount Kenya, where immigration has led to rapid changes in land use and increased demand for water. Having originated from high potential areas where water is not limiting, immigrant farmers lack knowledge of water conservation techniques. Small-scale mixed farming is the predominant form of land use, with 70% of the plots being between 0.25 and 1.6 ha; in such dry environments, these plots are too small to support a family at a sustainable level. Maize production in the area is water-limited, resulting in frequent crop failure. Another potential concern is the introduction of tree species such as grevillea by migrant small-scale farmers as boundary markers. Boundary plantings increase tree cover, fuel wood supplies and infiltration, protect against strong winds and reduce runoff. However, the increased tree cover generates competition for water between trees and crops such as maize in areas where water resources are already insufficient to meet the needs for livestock and human consumption. Moreover, irrigated and rain-fed crop production is rapidly expanding, with most of the irrigation supplies being obtained by illegal abstraction from rivers, leading to a serious decline in stream flow. Experience from South Africa shows that forest plantations characterised by evergreen canopies and deep root systems have a high potential for reducing stream flow on catchments compared to the short, seasonally dormant indigenous vegetation.

To test the hypothesis that the introduction of deciduous or semi-deciduous trees into agroforestry systems may reduce demand

for limited water supplies, the WaNuLCAS (**Wa**ter, **Nu**trient and **L**ight **C**apture in **A**groforestry **S**ystems) model was used to assess the influence of tree leafing phenology on crop performance and soil water balance. Modelling approaches are attractive because long-term studies of agroforestry systems in semi-arid environments are relatively rare due to the substantial financial, labour and time investments required. Three species with differing leafing phenologies were used; grevillea is evergreen, alnus is semi-deciduous and paulownia is deciduous. Elucidation of the leafing phenology of trees relative to the prevailing climatic conditions and growth periods of associated crops is essential for a full understanding of the functional aspects of agroforestry systems. The present study aimed to test the hypotheses that: 1) leafing phenology influences the water requirements of trees, the severity of competition for water between trees and crops, and hence crop growth and yield; and 2) the use of deciduous trees will greatly reduce demand for water in water-limited environments. The objectives were to evaluate the effect of differing leafing phenologies (i.e. evergreen, semi-deciduous or deciduous) on the soil water balance and tree and crop growth using newly developed tree leafing phenology routine in WaNuLCAS.

Three agroforestry species, grevillea (*Grevillea robusta*), alnus (*Alnus acuminata*) and paulownia (*Paulownia fortunei*), respectively providing evergreen, semi-deciduous and deciduous leafing phenologies, were intercropped with maize. WaNuLCAS simulations showed that altering leafing phenology from evergreen through semi-deciduous to deciduous decreased water uptake and interception losses by the trees, but increased crop water uptake, drainage and soil evaporation rates for systems containing all three tree species. Drainage was 17% greater in the deciduous paulownia system than in the evergreen grevillea, while evaporation was 14% greater in the former. Simulated water uptake and biomass accumulation by grevillea were more than double the corresponding values for paulownia, while crop water uptake in the grevillea and paulownia systems was reduced by 6% and 0.2% respectively relative to sole maize. The simulations imply that water use by paulownia was lower than for grevillea and suggest that leafing phenology is a key attribute affecting water use by trees. We expect that high water use during the rainy season can reduce peak flow of streams as it increases the water storage opportunities in the soil, while dry season water use by trees will tend to reduce dry season flows, except where dry season flows depend on water resources beyond the reach of tree roots.

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DRINKING WATER PROTECTION IN FORESTED KARSTIC HEADWATERS

By Roland Koeck, Barbara Magagna, and Eduard Hochbichler

Limestone or karstic areas are special. They tend to easily infiltrate water into aquifers. Up to 25 % percent of the global population are supplied with drinking water from karst water resources. The City of Vienna, for example, receives about 95 % percent of its drinking water supply from karstic springs in the northeastern Limestone Alps of Austria. Karst areas also provide drinking water in the tropics.

However, karstic areas are known for their vulnerable environment. Vegetation cover in the upland is considered to be critical for a sustainable supply of high quality drinking water and a balanced spring discharge. Forests on these soils require special attention, both because of the high levels of biodiversity associated with these soils and because of their hydrology. In the course of the KATER II project (Karst water research II, funded by the ERDF), the water protection functionality of forests was studied under the influence of silvicultural practices. The approach used may also be relevant for tropical conditions, but one part of the conclusions also refers to snow melt as a critical process. General statements in the public debate on the gradual release of water from forests may be at least partly linked to such effects which are restricted to the temperate zone.

Methodology

Hydrotopes are defined as areas with relatively similar forest-hydrological conditions. A GIS-supported system for the water protection area of the City of Vienna (32.500 ha) covers three information classes [a] geology and soils, [b] vegetation cover, [c] elevation and relief parameters. The potential natural tree species composition of each forest site could thus be determined. This can be compared to the actual tree species composition, crown cover percentage, structure of the forest stands, and vegetation cover on soil level, soil type and humus type. For each hydrotope, a silvicultural optimisation potential was analysed regarding the water protection functionality of the forest stand. The optimisation potential was based on forest hydrological knowledge based on international scientific publications and forest hydrological research activities carried out within the water protection zone of the City of Vienna. The local research activities compared different representative forest types on similar sites. In the course of these inquiries, a natural spruce-fir-beech stand was compared with a homogeneous spruce plantation and a clear-cut area (caused by wind blow-down) within the montane zone. In the subalpine zone, a krummholz stand (*Pinus mugo*) was compared with alpine pasture (subalpine grassland). On all of these sites, soil moisture, soil temperature, air temperature, air humidity, gross precipitation, crown throughfall, stemflow and snow cover were measured beside additional parameters. The silvicultural optimisation potential regarding water protection functionality of given forest stands was used as an integral part of a spatial decision support system, which applies to the whole water protection headwaters possessed by the municipality of Vienna.

First results and discussion

In the course of the local research activities, krummholz vegetation (*Pinus mugo*) proved to be an effective trap for snow in early winter, which could be related to the high interception capacity of pine needles for snow. The snow cover induced by this process led to a thermal isolation of the soil layers beneath krummholz vegetation, which prevented the soils in general from freezing, while on subalpine pasture areas the soils were frozen during all the winter seasons measured. During the snow ablation period in spring time, the melting water on krummholz areas could therefore easily percolate into the soil horizons, thus preventing or mitigating surface runoff on these areas. On areas of subalpine pastures, snow cover lasted longer in spring time than in krummholz areas.

Soil temperature beneath krummholz vegetation was significantly lower during summer season than on open alpine pasture areas. This could provide better water storage conditions during humid weather periods. These observations could not be compared with international research data due to lack of studies in this field.

In subalpine spruce forest communities, a natural structure (tree clusters mixed with small openings) improved the snow storage capacity of these forest stands compared with homogenous stands or schematic opened stands.

In the montane area mixed spruce-fir-beech stands appeared to have a higher percentage of net precipitation than homogeneous spruce forests. This can be attributed to the additional input of precipitation water to the soils from beech stemflow. In all seasons measured, the mixed stand with beech also had a higher soil moisture content than the spruce stand and the clear-cut area. Beech trees obviously have the capacity to take up nitrate from seepage water. This was reflected in lower nitrate concentrations in seepage water beneath the mixed stand than beneath the spruce stand. The results of the measurements in the montane zone were consistent with data published in various international hydrological studies.

The hydrotope system integrates local research data and international forest hydrological research data. In the montane zone and within the area of natural spruce-fir-beech forests communities, silvicultural optimisation of forest stands should guarantee, that the tree species composition includes a high percentage of broad-leafed trees such as beech or maple. Silvicultural measures should be carried out on small areas, removing only up to 20 % of the trees of a stand and should also provide more structure for forest stands. Clear-cuts are already forbidden in the water protection zone possessed by the City of Vienna due to their disastrous effects on forest hydrology.

The subalpine spruce forest communities may be optimised by creating a more natural structure, with clusters and small openings, in artificial homogeneous stands. This can substantially increase the snow storage capacity during the winter season, thus contributing to a more balanced spring discharge throughout the year. In the subalpine zone, krummholz can prevent soil erosion on vulnerable sites, but it should be mixed with alpine pastures in order to combine positive effects on hydrology of both vegetation classes.

Conclusions

The hydrology of forests in the humid alpine area of Austria is multidimensional and has to be studied as such. By stratifying the headwaters in hydrotope areas, forest hydrological research output can be related to the specific natural forest communities. Organising of all hydrotope information in a GIS, will create a basis for a spatial decision support system. Refined silvicultural measures can further improve the functionality of forests regarding water protection, in addition to existing guidelines for an optimal water protection forestry.

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ATMOSPHERIC DEPOSITION OF NUTRIENTS TO THE NORTHWEST AMAZONIAN FORESTS

By P. Téllez, C. Tobón and J. Sevink

Water outflows from forests are linked to nutrient outflows by leaching and sediment transport, but similarly, the inflow process is partially linked through the nutrient concentration of rainfall ('wet deposition'), complementing 'dry deposition'. There is, however, little data available for 'baseline' conditions of natural forests. Atmospheric deposition is a major source of nutrient replenishment for the Amazonian rain forest, since it grows in nutrient poor soils, with a low capacity to supply and retain nutrients, so that the vegetation has developed specific nutrient-conserving mechanisms to survive, among them the capacity to retain atmospheric nutrient inputs. Forest conversion by slash and burn may increase the nutrient loading of rainfall and may thus modify forest conditions at considerable distance. As part of a hydrological and nutrient cycling research in undisturbed forest ecosystems in Colombian Amazonian, we studied the nutrient inputs in rainfall in two sites, to analyse and provide quantitative data of atmospheric nutrient inputs and to characterize the spatial and temporal variability of rainfall solute fluxes to the ecosystems.

Study area and methods

The research sites were located in the Middle Caquetá area, Colombia (latitude 0° 37' - 1° 24' S and longitude 72° 23' W - 70° 43' W). Four landscape units can be distinguished: the alluvial plain of the river

Caquetá (Andean), its upland terraces (low and high terraces); the Tertiary sedimentary plain, with non to slightly consolidated, horizontally bedded clays and sands, which partly are of marine origin; and isolated units of hills and plateaus in Palaeozoic hard rocks (mostly quartzitic sandstone). The vegetation is a mature forest classified as belonging to the group of umbrophillous (i.e. shade loving) tropical forest. In the research plots the vegetation is composed by a large number of species and typical for a mature forest for the western part of the Amazon basin. Some differences in vegetation among landscape units, like the total standing biomass, species diversity and tree density occur.

Water samples were collected at two contrasting forest ecosystems during one hydrological year: the Tertiary sedimentary plain and the high terrace of the river Caquetá. A total of 34 and 30 water samples were collected and analysed from each ecosystem, respectively, during the period between January 1995 to August 1997, to determine their inorganic ion concentration (Ca, Mg, K, Na, NH_4, H, Fe, Mn, Cl, NO_3, ortho P , SO_4) and dissolved organic carbon. Sources of nutrients were also determined.

Results and interpretation

Results indicated that there were no statistically significant differences in rainfall composition among landscapes. During the studied period, the sum of anion concentrations ranges from 24.0 μmolc l^{-1} to 134.7 μmolc l^{-1} and concentration cationic sum range from 23.7 μmolc l^{-1} to 111.9 μmolc l^{-1}. The SO_4 ion occurred in the highest concentration in the rainfall followed in descending order by Cl, Na, H, NH_4, K, Ca, NO_3, Mg, Si, Fe, ortho P and Mn ions. Annual deposition per ha was found to be 53.3 kg of SO_4, 30.5 kg of Cl, 24.3 kg of NO_3 + 7 kg of NH_4 and 1.15 Ortho-P. The pH mean value was 5.04, which lies in the range (4.7 to 5.7) of published Amazonian data. High temporal variability was found for most of the solutes, except for Ca, Na and Cl ions, which were relatively constant.

High Dissolved Organic carbon fluxes were present in the rainwater, according with high amount in the atmospheric boundary layer over the Amazon Basin. The dissolved organic carbon (DOC) concentrations ranged from 120 μmolc l^{-1} to 775 μmolc l^{-1}, with a mean value of 360.4 μmolc l^{-1} and a variation coefficient of 43%.

Correlations between solute concentrations and rainfall amounts were not significant for any solute, indicating that the dilution effect is unimportant. Temporal variability of solute fluxes depends on temporal rainfall patterns and the differences of the volume weighted mean concentration with other locations in the Amazon basin were explained by systematic differences in rainfall distribution patterns.

Samples were collected as bulk precipitation and the funnels were exposed to the atmosphere for a period before rain, thus dry deposition also contributed to the measured concentrations. However, there was no statistically significant correlation between antecedent dry period and the solute concentrations, and we interpret this as suggesting that dry deposition does not play an important role in the chemical composition of rainfall in the areas. Wet deposition was the main factor explaining the rainfall composition.

Analysis of the possible sources for nutrients showed that first 3 axes account

for 70.1 (43.8 + 16.5 + 9.8) % of the variability of solutes in rainfall. These axes likely reflect the 3 main nutrient sources by the combination of

1 biomass burning and natural biogenetic emissions, which explains the presence of NH_4, NO_3, Ortho P and Cl;
2 a marine source, which mainly explains the presence of Na, Cl and Mg;
3 a combination from biogenetic plant emissions and soil dust particulates, explaining the presence of SO_4, H, DOC, Si, Fe, Mn.

Biogenetic and human induced emissions, including biomass burning, were the main source of solutes in this study area.

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ARE THE UPLAND POOR BENEFITING FROM ENVIRONMENTAL SERVICE REWARD SCHEMES?

By Hope, R.A., Porras, I.T., Miranda, M., Agarwal, C., and Amezaga, J.M.

Payments for Environmental Services (PES) schemes are considered a potential instrument to mitigate environment and development challenges faced in many tropical countries. A strong appeal of PES is the opportunity to develop new and often local financing arrangements to contribute to biodiversity, climate change, resource management and/or poverty reduction goals. Underlining the PES approach is the role that forests, and changing forest trends, play in environmental integrity, economic growth and social development, particularly for poor, forest-dependent people. Findings from research in the Arenal area of northern Costa Rica contributes to improved understanding of the socio-economic opportunities and outcomes from PES. This work informs the development of a Negotiation Support System that will be tested in India to evaluate the replicability of more generic guidelines, methods and approaches for PES design.

PES and forests

While forest benefits have been acknowledged in terms of world heritage, eco-tourism and, more latterly, carbon fixation values, there has been growing interest in forest-based water services. One example is the Arenal catchment in the northern Tilaran range of Costa Rica, which is a tropical montane cloud forest zone with cascading benefits from water services to national

hydro-electric power production, irrigation, a wetland and an important estuary fishery. The Government of Costa Rica has long recognised the ecological (and increasing economic) benefits of forests through innovative legislation to conserve its natural resources. This includes the 1996 Forestry Law, which introduce the first PES programme by recognising forest land use benefits for 1) Landscape beauty; 2) Carbon fixation; 3) Biodiversity; and 4) Watershed (or catchment) services.

However, the effectiveness of the Costa Rica PES programme is questioned by at least three issues:

1 biophysical evidence of forest land use impacts on increased water flows compared to agricultural conversion (e.g. pasture);
2 economic valuation that accurately and defensibly estimates forest land use value with downstream water demand;
3 social opportunities and outcomes of the PES programme, particularly for the upland rural poor.

In relation to issue 1), a sister project led by the Free University of Amsterdam has conducted detailed hydrological experiments in the study area and will report later this year. While the economic valuation study waits to be informed by the hydrological study, details of the socio-economic findings are presented here.

PES and rural poverty

One aim of the PES programme is to reduce rural poverty by:

1 support and outreach for small and medium farmers and landowners, and
2 providing income and employment generation in rural areas.

Poor people tend to be found in rural areas in most developing countries. The social impacts of the PES programme in Costa Rica offer lessons for wider replicability and design. Key findings from the socio-economic study include:

1 Perceptions and beliefs of local people are that cloud forests (and lower altitude forests) increase and regulate water flows, and protect water quality;
2 Awareness, adoption and support of the PES programme by local people are constrained by little local presence of programme implementers and insufficient programme funds to meet demand;
3 Local people have significant reservations about entering into a land contract with the government, particularly a fear of losing their land;
4 Increasing bureaucracy and qualification criteria leads to high transaction costs - this fall hardest on poorer people and those living far from towns;
5 Experimental scenario analysis indicates large land owners (> 10 hectares) with land titles are more likely to be able to and willing to commit to the programme;
6 Respondent ratings to scenario analysis of payment levels indicate higher amounts will not necessarily result in higher participation. This is partly due to high opportunity costs from alternative land uses, particularly livestock or coffee;
7 The programme does not benefit people without land.

Lessons and policy implications

Four lessons emerge from the socio-economic study:

Lesson 1. Secure land rights are often critical to benefiting from PES schemes.

The poor and marginalised often have no or uncertain land claims in developing

countries. This weakens necessary institutional arrangements between downstream payments to upstream service providers. Examples illustrate here, and in other places, opportunistic elite groups forcibly and/or unfairly appropriating upland areas when land values increase as in the case of a new PES scheme.

Policy implication: if land tenure prevents PES benefits reaching poor groups, more integrative mechanisms should be considered such as wholesaling services from a community/zone and increasing community capacity through education with tangible benefits linked to improved access to credit and market support centres.

Lesson 2. PES will change land use incentives: scenario analysis should be included in a design phase.

One methodological advance in the study was the use of a stated choice method (Conjoint Analysis) to explore experimental scenarios of alternative compensation mechanisms (financial and other), which revealed that land owners were less influenced by cash than broader mechanisms, such as road improvements.

Policy implication: understanding land-decision making processes of farmers in highly variable tropical climates will benefit from careful pre-project design. Stated choice methods provide a flexible and rigorous approach to evaluating alternative scenarios in an objective, inclusive and comparative framework.

Lesson 3. Lack of trust may undermine a good PES scheme.

A clear message from qualitative studies revealed significant and wide-spread distrust of entering into any land contract with the government. While this may not matter for local institutional arrangements under a reward framework, it presents a challenge for more regulatory approaches that are premised on small-holders entering into legal contracts with government.

Policy implication: PES scheme should attempt to build community capacity or awareness to reduce participant misunderstandings or prejudices against scheme adoption. Financial rewards are only one potential constraint to reaching marginal farmers, others include trust, transaction costs, opportunity cost of land and information.

Lesson 4: Be realistic about poverty reduction impacts.

There may not be a close relationship between important environmental services and poor groups. If poverty goals are 'bolted-on' to attract wider donor funding poverty impacts may be limited.

Policy implication: PES schemes with a specific poverty reduction goal may include activities to directly reach the poor and landless. This may include initiatives such as 1) labour-based land management/ rehabilitation or 2) promote organic coffee farming as a high-value, labour-intensive land use that benefits the rural poor.

Future research

It is noted that these lessons are not necessarily representative of the wider national, regional or international context. To better understand the replicability of the lessons and applicability of methods, research is being conducted at the Bhoj wetlands, India, linked to IIED's Markets for Watershed Services programme. A Negotiation Support System will be

developed to better understand and provide new tools and approaches for PES schemes in relation to:

1 Applying stated choice methods to evaluate land use decision-making processes across experimental scenarios;
2 Economic valuation methods for environmental services;
3 Guidelines for institutional arrangements for environmental service incentive mechanisms.

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ACTION-LEARNING IN PRACTICE: FAIR DEALS FOR WATERSHED SERVICES

By Ivan Bond

Payments to farmers to maintain or enhance watershed services are attracting increasing attention as mechanism that can address poverty as well as resource management problems. From the limited experience to date, the payments for watershed services (PWS) tend to be made by governments to larger farmers with secure land title. The International Institute for Environment and Development (IIED) is working with 6 partner organisations in seven countries on a project to facilitate pro-poor PWS.

The purpose of the project is to "increase understanding of the potential role of market mechanisms in promoting the provision of watershed services for improving livelihoods in developing countries". The project has three outputs, these are:

- Action learning processes for the development of equitable market mechanisms for watershed services supported in five countries (India, Indonesia, Jamaica, South Africa and St. Lucia).
- Diagnostic plans and preparedness established in two further countries (Bolivia and China) wishing to adopt market mechanisms for watershed protection
- Knowledge of market mechanisms improved through networking, development of guidance and dissemination with other countries and institutions.

The project started in October 2003 and is due to finish in September 2006. The project is being funded by the U.K. Government's Department for International Development (DFID) and coordinated by the International Institute for Environment and Development (IIED). In each country, IIED is in a partnership with locally based organisations. The approaches adopted by the teams are broadly similar, but adapted to suit local conditions and opportunities, they include:

- Facilitating payments for watershed services in at least one selected site. The sites are extremely diverse in all characteristics. They range from micro-catchments in India to major watershed such as the Brantas River in Indonesia. In the larger watersheds, project partners are using pilot sites to test their innovations.
- Supporting the facilitation activities with a series of studies on landuse – hydrology relationships and livelihoods at all the project sites. These studies provide important baseline information for the research teams, serve to quantify the core problems and assist with developing options.
- Forming and facilitating "learning groups" to reflect on the lessons learned from the site level activities. Typically the learning groups are comprised of a range of interested stakeholders from government, civil society and where possible private sector partners.
- Conducting other relevant research, analysis and documentation. To support both the site level facilitation and the discussions of the learning groups, the research teams have identified key issues and problems that need to be addressed.

Through the activities of the project, two PWS like relationships have been established. At a micro-site in India (Kuhan Khas and Oach Kalan Villages, Himachel Pradesh) an agreement over abandoned lands and gazing access has been developed. This agreement is largely based on the exchange of materials and labour. In the Cidanau Watershed, a state industrial conglomerate KTI has agreed to pay a farmers group US$17,500 per annum for three years. In South Africa a complex set of options and partnerships are developing in the Ge-Selati River, Limpopo Province that involve commercial and communal farmers, protected area managers, the working for water programme (WfW) and mining companies.

Although the work at the sites is on-going, three cross cutting lessons are beginning

to emerge from the project. These are:
PWS and rural livelihoods: The relationship between poor people and the environment is important, complex and often site or resource specific. Further there are multiple drivers of poverty which very often extend beyond the immediate bio-physical environment in which poor people might live. The main livelihoods based lessons emerging from the project sites are that indirect benefits of PWS are likely to be more important than the direct economic impacts. Particularly in the Bolivian and Indonesian pilot sites, the development of PWS like mechanisms has empowered farmers and farmers groups with the confidence to engage and achieve better arrangement in other aspects of their lives.

The role of Government: Payments for Watershed Services do not take place in political or legal vacuums, but are shaped in part by prevailing legislative and administrative frameworks. The extent to which this happens depends on the nature and scope government on the one hand, and on the scale of the PWS scheme on the other. From the project sites, it appears that governments are relatively happy for stakeholders to look at local level solutions at the micro-sites (India and Bolivia). At the macro-level, there is however a tendency for governments to become both the facilitator and buyer of services (ie China). Facilitating PWS at the intermediate scale and reconciling the differences between stakeholders without a clear legal framework is greatest challenge.

Implementing PWS and transaction costs: Although paying for watershed protection services seems to be a simple concept, there is considerable complexity in implementing such schemes. Among the many implementation issues to consider the issue of transaction costs stands out. In the short-term these can be met by outside agencies such as donors, long-term this is unsustainable. Transaction costs are high because of the uncertainties surrounding the landuse – water relationships. Developing trust amongst the stakeholders, has in cases allowed them overlook the some of the uncertainty. Secondly, adopting an adaptive approach to landuse – water relationships reduces the need for detailed understanding of the systems before a PWS relationship is developed. It also creates opportunities for greater emphasis to be placed on monitoring especially participatory monitoring.

Further information on the project can be found at: http://www.iied.org.forestry/research /projects/water.html; alternatively contact Ivan Bond at: ivan.bond@iied.org

PAYMENTS FOR WATERSHED SERVICES AND LESSONS LEARNED FROM COMMUNITY BASED NATURAL RESOURCE MANAGEMENT (CBNRM)

By Ivan Bond

It is now widely recognised that natural landscapes produce a range of 'environmental services' including carbon sequestration, the maintenance of water quality and biodiversity (Landell Mills and Porras, 2002). Indeed, the absence of any remuneration or compensation for these services is generally considered to be a contributing factor to landuse change. However, disruption to environmental

services has tangible impacts, particularly on watershed services that can result in additional costs to consumers, for example through the changes in water quality. As a result there is increasing interest in generating payments for environmental services as an incentive mechanism for land management. Typically, downstream consumers of watershed services are expected to compensate upstream land managers, for either maintaining indigenous vegetation or implementing specific farming practices or on-farm conservation activities. Payments for environmental services can be publicly or privately funded. There are however many more examples of publicly funded or mixed (private and public) initiatives.

Poverty-environment linkages are highly complex and often site specific. Theoretically, pro-poor payments for environmental services can make direct and indirect contributions to the livelihoods of rural people. This potential win-win situation has led to a number of projects facilitating the development of pro-poor payments for environmental services. Examples of two current, multi country projects that both deal largely with watershed services are IIED's "Developing Markets for Watershed Protection Services and Improved Livelihoods" and ICRAF's "Rewarding Upland Poor for Environmental Services".

Community based natural resource management in southern Africa

Across southern Africa, colonial authorities expropriated both land and natural resources from indigenous farmers. Rather than protecting wildlife, this approach led to a situation where wildlife outside of protected areas had no value and was widely perceived to be a pest (Child, 2004). Cautious governments eventually returned control of wildlife to large-scale commercial farmers, with the result that in the semi-arid rangelands of Namibia, South Africa, and Zimbabwe, wildlife evolved into a substantial and significant landuse (op. cit.). The majority of poor farmers in southern Africa live on communal or common pool lands, often located in areas of marginal agricultural potential. Since the 1980s many of the governments in the region have been experimenting with a range of community based natural resource management (CBNRM) programmes. Although these programmes pre-date the current interest in payments for environmental services they share many common features. Critically, both PES initiatives and the wildlife based CBNRM programmes in southern Africa are primarily associated with changing the economic incentives for landuse.

CBNRM's financial/economic focus potentially provides valuable lessons for the development of PES particularly on the land use impact of direct and indirect payments to farmers. The scale of some of these payments has been significant. For example in Zimbabwe under the Communal Areas Management Programme for Indigenous Resources (CAMPFIRE), 110 communities earned about US$8 million between 1989 and 1999. This translated into a median benefit per household of between US$2.20 and US$5.80 annually.

There are potentially many lessons and experiences to be shared between PES and CBNRM practioners. Three of these include:

1 *Process:* The overwhelming lesson emerging from the CBNRM experience is that desired change is a continuous process in which flexibility and local adaptability are crucial. Although the

desired change and the accompanying incentives to achieve this might appear very logical, changing landuse patterns especially amongst poor risk-averse farmers will always take time. Equally challenging is nurturing the necessary changes within national and local governments, which allow rural farmers to benefit directly from relatively intangible commodities such as environmental services or wildlife.

The implications for supporters and facilitators of the payments for environmental services is that changes in landuse will not be achieved in under the short time horizons (three to four years) of the typical donor funded project. Changes in land use are a process and to be effective, PWS will need to be maintained over an extended period of time. Facilitators should avoid blue-print approaches and should encourage flexibility and diversity.

2 *Level of incentives:* Typically, communities with sufficient wildlife and wildlife habitat have competitively tendered the user rights (tourism or hunting) to these resources to private sector partners. Prices and income are therefore market based. Local authorities recognising a ready source of income have tended to heavily tax these benefits, with the result that less than 50% may actually accrue to the landholders. However, even if the benefits were not taxed, the direct and indirect benefits are seldom a sufficient incentive for farmers to substantially alter landuse. Consequently farmers and importantly immigrants, continue to use land for settlement and agro-pastoral activities.

The important lesson for PWS initiatives is that changes in landuse will only take place if there are considerable net benefits to the land manager. PWS facilitators need to be aware that farmers will incur both direct and indirect costs as result of landuse change. Further, when land and other resources are scare farmers will allocate their land in order to maximise their net economic benefit.

3 *Policy and legislation:* Most of the CBNRM programmes in southern Africa only developed once a supportive legislative policy environment was in place. Generally this was a compromise that did not transfer sufficient control to communities with wildlife. Two important lessons have been learned over the last 10 to 15 years. Firstly, substantial policy change is often opportunistic and is then followed by a long period of policy inertia or at worst a process of re-centralisation. Secondly, even though policy and legislation were changed there was often considerable resistance to the changes from national land local government bureaucrats.

Currently most PWS initiatives are in a pilot phase, working in very unclear legal and policy environments. The challenges of developing any tangible initiatives under this kind of a framework are significant. It also suggests that if and when there is an opportunity to change policy and legislation, it must be fully exploited. Publicly funded PES initiatives can play a role in developing policy and providing a model that potential private sector investors can follow.

Conclusion

Payments for watershed services are an attempt to compensate farmers and land managers for the services that they can provide by maintaining indigenous vegetation, re-forestation or the adoption of

specified tillage techniques. However, to date the most successful PWS initiatives appear to have been in countries with relatively small numbers of farmers characterised by secure land tenure (Costa Rica, New York City, USA,). This mirrors the adoption of wildlife as a landuse in southern Africa where initially it was the large-scale commercial farmers who substantially changed their landuse management as a result of the incentives offered.

In many cases PWS initiatives are just starting. The similarities between CBNRM and PWS process and the underlying assumptions suggest that there are important lessons and experiences that need to be exchanged. The PWS community needs to look closely at the CBNRM experience of long-term financial transfers to small-scale farmers and the resultant changes in landuse. Conversely, the CBNRM community, especially in southern Africa should consider some of the ideas emerging from PWS (such as contingency) that may serve to strengthen their own long-term initiatives.

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PAYING FOR ENVIRONMENTAL SERVICES IN CHINA: LESSONS LEARNED FROM A PROMISING APPROACH

By Horst Weyerhauser

China's mountains house the headwaters of many of its greater and lesser rivers; they are also home to a majority of its chronically poor. Here the tension between watershed conservation and poverty alleviation is probably more acute than almost anywhere in the world.

This divide between upland conservation and development priorities was aggravated following China's shift from a centrally planned to a more market-oriented, decentralized economy in 1978. The costs and benefits of maintaining environmental services provided by upland forests –flood prevention, erosion control, and water quality in particular– had traditionally been borne by and accrued to a centralized state, but state withdrawal broke the direct link between producers and beneficiaries. With declining government support and without incentives for households, businesses, and local government to conserve, deforestation in the uplands became widespread.

The notion of paying and charging for specific environmental services emerged in this context. To cope with declining revenues and worsening deforestation, local officials in Qingcheng Mountain –a tourist attraction in Sichuan Province– designed a system where part of ticket proceeds were used to pay for forest protection. Forests quickly recovered, and the scheme inspired an official dialogue

on payments for environmental services from 1989 and continuing throughout the early and mid-1990s.

Severe flooding on the Yangtze and Song Rivers in 1998 accelerated the Chinese government's growing recognition of the benefits provided by upland forests, as well as of the difficulties in using regulatory approaches to control the behaviour of resource-dependent smallholder farmers. Government then developed public payment schemes to compensate farmers' investments in forest restoration and protection. China's revised Forest Law (1998) and Water Law (2002) formally recognized the importance of compensating environmental service provision.

Most payment schemes for environmental services in China have been publicly financed. Large-scale, central government initiatives are best represented by two forest conservation programmes: the Sloping Land Conversion or "Grain for Green" Programme (SLCP), which pays farmers to convert their marginal farmland to forest; and the Forest Ecosystem Compensation Programme (FECP), which compensates farmers for reforesting and protecting forests. Provincial and local schemes cover a wide range of institutional innovations, such as electricity and water consumption fees dedicated to forest conservation, and direct payments to upstream farmers from downstream hydropower facilities. As limitations in public funding become increasingly apparent, private payment schemes will increase.

China's comparatively dense upland populations make watershed conservation difficult, but payments for environmental services are a particularly promising approach. Realizing this promise will require adequate time and resource commitments, but also high-level willingness to experiment, facilitate open and honest dialogue about the results and improve upon them. As part of this learning process, China's State Forest Administration, the Regional Development Research Center and the World Agroforestry Centre (ICRAF) examined payment schemes for environmental services in Anhui, Guizhou, Sichuan and Yunnan Provinces, and identified several principles and practices that could improve their design and operation throughout China.

Design: Function, Financing, and Scale

- *Reasonable incentives are key to maintaining environmental services over the longer term*. Upland farmers will only change their land use practices over the medium to longer term if they expect to benefit from the change. The continued ineffectiveness of logging quota in China shows how command-and-control approaches can drive innovation in legal circumvention rather than long-term changes in land use.
- *Payment schemes require adequate funding to ensure adequate levels of environmental services.* Paying for forest and watershed protection requires sufficient long-term funding to cover the costs of planting high-quality trees and maintaining them, as well as the opportunity costs of different forms of forestry vis-à-vis other land uses. Where financing is inadequate or not linked to specific quality indicators, farmers often revert to agriculture or plant low-quality trees with poor economic and ecological returns.
- *Clear objectives and evaluation procedures can help allocate scarce financial resources*. China's large-scale,

national payment programmes in particular demonstrate how the lack of clear, measurable objectives and means to evaluate progress can lead to programme drift and unintended uses of funds. National and provincial programmes typically have been paying to restore forest cover on the assumption that forests will be beneficial, rather than to reward measurable environmental services. The primary criterion of programme performance has been forest cover; payments have hardly been linked with the provision of actual environmental services.

Operation: Governance and Institutions

- *Ensuring stakeholder participation from the beginning can improve acceptability and lower transaction costs*. Despite increased overall stakeholder participation, the still limited participation by both local governments and residents in the design of payment schemes has impaired their willingness to provide and willingness to pay. Greater inclusiveness can improve programme design, strengthen linkages between producers and beneficiaries, lower enforcement costs and improve results.
- *Transparency in revenue use and valuation methods is key to gaining public acceptance and maintaining the quality of environmental services.* For both public and public-private initiatives, transparency in deciding how payments are calculated and how they are to be used can bolster public support and improve the links between payments and environmental service provision. Standardized, rapid means of measuring and valuing environmental services in China should be developed.
- *Government agencies and local governments should continue to play a central, facilitating role.* Government is currently the core actor in China's payment schemes for environmental services, and its role will become more important as more private payment schemes emerge. In lieu of a stronger, independent legal system, Government agencies and local governments play an irreplaceable role in facilitating fairer negotiations and effective contracts between producers and beneficiaries.

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MANAGING FORESTED WATERSHED FUNCTIONS AND SERVICES FOR THE BENEFITS OF THE POOR

By Daniel Murdiyarso and Ulrik Ilstedt

Watersheds need to be managed to provide environmental flows, defined as flows of water regime in the rivers maintaining the ecosystems and their services. This flow is influenced by land-use decisions made by stakeholders at various levels. When scientific information is lacking, or confusing, there is a pressure to impose public perceptions of the impacts of land-use on environmental flows. Often the

perceptions become myths which should be tested against scientific evidence combined with improved communication.

In some circumstances forests might improve water yields and quality (Calder, 2003). The circumstances could be natural, man-made or combinations of both that require detailed valuation at various spatial and temporal scales. This is particularly important if public policy-making is to be scientifically sound and if, at the same time, science is to be policy relevant. New research findings need an appropriate platform for effective communication with the end-users (Bruijnzeel *et al*., 2004)

The rural poor are often dependent on degraded conservation areas in the upland regions for their livelihoods. Conflicts over land-use often persist and cascade to downstream water users, and the rural poor in the uplands become perfect culprits for any detrimental changes on water resources. Upstream-downstream linkages, therefore, should be understood within the context of sharing the benefits of environmental goods provided by the functioning watershed services. Conservation activities should include benefits for the poor. The biggest challenge is bringing the most marginalized group of people and their institutions into policy (research) and practical decision-making. Exclusion from the process commonly limits their access to benefits.

This article attempts to outline the challenges for the forest and water research agenda at CIFOR within the context of alleviating rural poverty. It is intended to be pro-poor conservation, which is understood as optimizing conservation and livelihood benefits. This requires improving community-science-policy dialogues.

The challenges

We are challenged by the basic human need of proper quality water, faced with many tradeoffs, for example with respect to agriculture, conservation, hydropower and industrial uses, and this without sacrificing the poor who suffer the most. It is also an opportunity to promote conservation with a "human face" through a better understanding of ecosystem functions and biophysical characteristics of forested watersheds.

Research activities should be designed to scrutinize the myths behind public perceptions and to generate sufficient knowledge and understanding for policy interventions. An option would be to seek mechanisms of payment for environmental services (PES), while facilitating the involvement of communities living in the conservation areas. The mechanisms should be context-dependent and the non-participating landless dwellers could be the looser (Wunder, 2005).

Besides biophysical assessment of water regimes and ecosystem services, in-depth understanding of institutional processes and regulatory frameworks governing water resource and watershed management is required. Land-use decisions should ideally reflect the environmental, social and economic sustainability of the ecosystems. The interests of investors (donors) and partners are, of course, already part of the overall design. In addition, the breadth and wealth of the regions and ecosystems should be equally represented to be able to realize the goals of sustaining and enhancing forest ecosystems and watershed functions, increasing their resilience and ability to provide environmental goods and services. The information should be shared and

communicated across stakeholders. Eventually the bargaining power of the upland community where conservation area has been determined will be enhanced (Murdiyarso, 2005).

Key research questions

The following questions may be raised to guide and integrate research activities:

- *How do the "forested" upland regions determine environmental flows?*

  The fundamental biophysical research approach would naturally attempt to quantify basic understanding of watershed functions characterized by water regimes in terms of yields and quality and their spatial and temporal distributions. Here also development and use of appropriate indicators can play an important role. Promoting "community-based monitoring" of key indicators may improve scientific understanding and communication between stakeholders.

- *How do different stakeholders value these "flows"?*

  Further, socio-economic assessment would certainly help understanding how human institutions are directly and indirectly influencing water regimes. Social capital such as people's trust and participation in ecosystems management is an invaluable asset to be incorporated in the planning and implementation phases.

- *What are appropriate policy responses regarding watershed functions?*

  Therefore, integrating biophysical and socio-politico-economic properties would eventually enhance policy responses in terms of public environmental and development policy-making. Such policy would not confine to narrow-minded perspectives but should make room to uncover upstream-downstream linkages.

- *Mechanisms for payment transfer?*

  Restricting the upland poor's access to natural resources is no longer appropriate unless alternatives for their livelihoods are provided. Likewise, direct payments are not always appropriate, especially in a situation where the custodies or land husbandries are not clearly defined. The benefits may not be enjoyed by the appropriate groups. The needs to devise and test the transfer of reward or payment mechanisms are obvious.

A field test

As "Forest and Water" is a new research theme at CIFOR, we have kept the spirit of "a center without wall", and are concentrating on small, but targeted, studies carried out in cooperation with partners and students. We aim at building networks between policy makers, researchers and practitioners inside and outside the developing world.

A field test was established in Cicatih watershed (ca. 53,000 ha) in West Java, an area with an annual rainfall of almost 3,000 mm. The watershed is densely populated (more than 500 inhabitants/km^2) and the competition for water use in high due to domestic, agriculture and industrial demands. During the first year of the field test, our understanding of the effects of land cover change, including reduction of forest cover, on water yields was improved. However, the "agreed" environmental flows have (could) not yet been determined without having consulted a wide range of stakeholders. This gap of understanding will be identified in the second year and a "tool" to narrow the gap will be devised as our understanding of stakeholders' views

on the flows is improved.

The policy response is likely to be governed by national law on Water Resource Management but local government will play a very important role as far as taxation and financial mechanisms are concerned. These issues which are related to the last two questions are scheduled for future research.

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RAPID HYDROLOGICAL APPRAISAL (RHA) OF POTENTIAL FOR ENVIRONMENTAL SERVICE REWARDS: procedure and application in Lake Singkarak, West Sumatra, Indonesia

By Meine van Noordwijk

Forest protection as part of watershed management is often (still) considered to provide downstream benefits that may well exceed the local benefits. Especially where hydro-electricity schemes derive substantial economic benefits from the continued flow of water, the concept of payments for watershed protection services has become popular. However, as other articles in this newsletter highlight, there is no shared opinion between scientists, farmers and policy makers about what these services are, how they depend on the condition of the landscape (and the amount of forest that is part of it) and how payments or rewards can be made transparent (linking reward to delivery) and robust (surviving paradigm shifts)[1]. To bridge the 'perception' and 'communication' gaps that are likely to exist in the way the local 'forest and water' debate has developed, a form of 'rapid appraisal' is needed to judge how far apart the potential partners in a rewards mechanism are, and to help develop a mechanism that is transparent and robust.

A recent report[2] presents results of such a 'rapid appraisal' during a 6-months period of the hydrological situation in the Singkarak Basin in West Sumatera (Indonesia) in the context of the development of payments for environmental services (ES) that are aimed

at rewarding the upland poor for protection and/or rehabilitation of watershed functions. Lake Singkarak is one of six 'action research' sites of the RUPES network[3].

The local government unit (*Nagari*) of Paningahan, almost coinciding with the most forested of the lakeside subcatchments has become an action research site for the RUPES project. The main 'issue' is the relationship between the hydro-elec-tricity project (HEPP, PLTA Singkarak), the fluctuations in the level of the lake, the water quality in the lake and the land cover of the catchment areas that contribute water to the lake. Current payments made by the PLTA to the local government can, in part, be seen as rewards for maintaining or improving environmental services.

The appraisal (with a focus on cost-effectiveness) was based on five components:

- Search of the literature and web-based resources on the area and initial 'scoping' meeting with key stakeholders,
- Spatial analysis of the landscape based on remotely sensed imagery and available maps and digital data,
- Exploration of local ecological knowledge of the landscape, water movement and consequences of land use options,
- Discussions with a wide range of stakeholders and policy makers on issues of land use and hydrological functions,
- Modeling of the water balance and water use in the landscape to explore scenarios of plausible land cover change and their likely impacts on key performance indicators with the GenRiver model.

The major land cover types in the Singkarak Basin are rice fields (17%), agricultural crops (15%) and forest (15%). Rice fields occur in the lowland area, below 1000 m asl and with slopes of < 30%.

The main conclusions of the consultations are that there is broad agreement on '*objectives*' such as the need to maintain a clean lake, productive landscapes on hills and irrigated plains that meet the expectations of the high population density as well as produce electricity for the provinces of West Sumatera and Riau.

There is a widely held perception that the current landscape is ***not*** meeting all these expectations: the PLTA is not able to provide as much electricity as was expected, the fluctuations in the level of the lake are a concern to the people surrounding the lake, the water quality of the lake is a concern, the population of the endemic fish (ikan bilih) is declining and previous efforts to rehabilitate the Imperata grassland (alang alang) in the area have not been very successful.

Much of the debate is focused on *proposed solutions* and especially on the relative merits of 'reforestation' and the various alternative ways to achieve 'land rehabilitation'. While for many policy makers reforestation, either using the local *Pinus mer-kusii* or other fast growing tree species is the main approach, villagers in Paningahan are convinced that streams dry up in the dry season after reforestation with pine trees, while the natural forest is providing regular stream flows. The water balance model with the default parameter values for Pine tree confirmed a higher water use by canopy interception and transpiration compared to more open land-scapes, but

no substan-tial difference with natural forest. Impacts of land cover via soil properties may need to be further tested. Further hydrological distinctions between the lime-stone and granite parts of the landscape are needed as well

Overall the *water balance model* suggested that the possible performance of the PLTA is only mildly influenced by land cover within the range of scenarios tested. Compared to the current land use mosaic an increase of 5% or a decrease of 5% of the maximum electricity production can be expected, while the variation between 'wet' and 'dry' years of the 1991-2002 period is much larger. Details of PLTA lake management matter a lot. A change in mean annual rainfall under the influence of global climate change will have a strong effect on PLTA performance. Declining water quality in the lake leading to weed infestation will offset any gains in water supply that could result from 'land degradation'. Reforestation with fast growing evergreen trees will have a mildly negative effect on water usable by the PLTA.

A basic assumption for 'payments for environmental services' is that the supply of these services does depend on activities of those 'rewarded'. For the PLTA this assumption is not supported by much evidence… Payments made by the PLTA may have various types of rationale:

- Compensation for damage caused by the HEPP project, to the farmers along the Ombilin river whose waterwheel irrigation systems are disturbed and to farmers with rice fields surrounding the lake affected by increased flooding
- Shared responsibility for maintaining the water quality in the lake as the HEPP project modified outflow rates and increases debris accumulation
- Payments of tax to local government
- Goodwill enhancing payments to the local community
- Payments for environmental services conditional to the delivery of these services.

At this stage the evidence for the last component is relatively weak, and almost absent for the scale level of ***avoided degradation*** in a single nagari. Efforts of all lake-side nagari's will be needed to deal with the issues of lake water quality, while rehabilitating the other inflows to the lake need at least equal attention.

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with national partners in (currently) Indonesia, Philippines, Vietnam, China, Thailand, India and Nepal is supporting a network of 'action research sites' and 'national policy review' activities to facilitate such mechanisms. Specific attention is given to 'pro-poor' forms of ES reward mechanisms. Benefits to poor people can come both through the way rewards are channeled and the positive environmental impacts of the decisions they support. http://www.icraf.org/sea/networks/rupes

FORESTS, FLOWERS OR FLAMINGOS: what drives the water balance of Lake Nakuru, Kenya?

By Brent Swallow

Lake Nakuru is a very shallow alkaline lake located in Kenya's rift valley, with a surface area of 44 km^2 and an average depth of 2.5 meters. The Lake is fed by one permanent river (Ngosur) and four seasonal rivers (Njoro, Nderit, Makalia and Lamudhiak), with a total catchment area of 1,800 km^2. The flamingos that give Lake Nakuru its distinctive pink shoreline are a major biodiversity and tourism resource for Kenya, with over 300,000 local and foreign holiday makers visiting the site each year. A completed fenced national park of 90 km^2 surrounds Lake Nakuru, providing a habitat to a number of threatened species, including the Black Rhino. Since 1990 the lake has been designated a Ramsar wetland of international importance. However, the lake is threatened by inflows from a number of pollutants and the level of the lake fluctuates: when it is low the flamingos move elsewhere, leading to less tourists. One possible cause of the degradation of the lake waters is the largescale conversion of forest lands in the catchment, particularly in the eastern Mau forest that forms the headwaters of the Njoro River. The River Njoro flows over 60 kilometres from the eastern slopes of the eastern Mau forest to Lake Nakuru. Its catchment measures approximately 280 km^2 and has a population of over 300,000 people, including 30,000 who live in Njoro town and 240,000 who live in Nakuru town, including Egerton University and a growing horticultural industry. Given the general debate on 'forest and water', the recent forest conversion in the Mau forest is held responsible for, or expected to result in, a loss of flamingo-based income. Should the park pay for forest conservation?

Land use and forest cover have also changed dramatically in this catchment. It has been estimated that between 1969 and 2004, the percentage of cultivated land in the upper catchment area increased from 13% to 70%, while a corresponding fall in woodland and grassland cover of 87% to 30%. Major changes in hydrology have been noted: the Njoro River has become seasonal instead of permanent and major boreholes have dried up. Annual rainfall in the 1980's and 1990's has been about 10% below the preceding decades, with shifts in the monthly pattern. Water abstraction for flower production is increasing around Lake Nakuru, as the export industry has exploited all water and land resources accessible at the nearby Lake Naivasha.

Nakuru is an '***endorheic***' system, as there is no outflow from the lake and in the long run all rainfall is lost by evapotranspiration in the catchment area. The lake is only a temporary storage, bridging between relatively wet and relatively dry periods. Increased demand for water in the middle reaches of the streams and forest-

dependent people in the upper reach in the Mau forest will directly influence the level of the lake.

No consistent water balance has been constructed that accounts for variations in inflow to the lake and the resulting lake levels, flamingo numbers and tourist income. The SUMAWA-CRSP (Sustainable Management of Watersheds Collaborative Research Support Project, co-led by Egerton University and the University of Wyoming) was initiated in 2002 to address this situation in the Njoro catchment, especially to demonstrate improved and integrated management of water and environmental resources in the Njoro catchment through local participation and action supported by scientific information and analysis. To date the project has provided scientific analyses but has not been able yet to move beyond differences in perceptions between stakeholders of possible solutions. The team at Egerton University and the World Agroforestry Centre (ICRAF) hope to start a new project on communication and perception gaps. A 'rapid hydrological appraisal' (see article on Lake Singkarak, Indonesia) is expected to clarify the various perceptions and to help obtain a shared understanding of the role of forests, rainfall and flower production in the provision of water to the lake and its flamingos.

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LakeNet Directory of World Lakes:
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FOSTERING WATERSHED GOVERNANCE IN VISAYAS, PHILIPPINES

By Rowena Soriaga

The Philippines was one of the first nations in Asia to enact policies decentralizing management authority over some natural resources to local governments. The Local Government Code of 1991 authorizes municipal governments to develop land use plans and levy fines to protect and manage resources. Also, community forest management has been adopted as a national strategy for sustainable forest management.

Water is a resource that needs to be managed by natural rather than political units. Unlike in many mainland countries, the watersheds on the islands in the Philippines do not face national boundary issues. Especially in the Visayas islands (central Philippines) the small sizes of watersheds allow local people to observe their watershed from the mountains to the

coast, perceive it as a possible unit of management and discuss concerns and options for its resource base. Municipal governments have started to develop land use plans and enact ordinances for natural resource management, but much should still be done to harmonize plans and policies within and between municipalities as well as with national initiatives.

The Visayas region includes six main islands covering 5.6 million hectares administered by 16 provincial governments. The Visayas have a porous, predominantly limestone base with occasional volcanic intrusions, so the soils are poorly suited to wetland rice and have limited water retention and capacity for sedentary cultivation. Poor soils, lack of available water, and steep slopes in many parts of the Visayas have made it necessary for people to grow a dryland crop as their staple. The eastern islands, Samar and Leyte, are greatly affected by typhoons and lack of a dry season, and have the highest forest cover. The central islands, Bohol and Cebu, under *Vitex parviflora* forests in past centuries, have much lower rainfall and a dry season. The western islands, Panay and Negros, have a long dry season and large grassland areas, sugar plantations and commercial crops. Visayas is the major region for mangrove and nipa palms (*Nipa fruticans*) in the Philippines, and has extensive coral reefs.

There are several watershed studies and management initiatives in the Philippines, but often the sites selected are in 'proclaimed' watersheds, areas seen by government as critical to the national interest –where the watershed has major infrastructure downstream. 'Local' watersheds –that do not necessarily figure in the national development agenda, but are critical to local sustainability– have hardly been studied.

Maasin and Carood are two typical degraded watersheds in the Visayas. Maasin (6 378 ha, parts of three mucicipalities) on Panay Island is the headwaters of the Tigum-Aganan watershed, with Iloilo City at the Jaro river mouth. Government proclaimed it as a critical watershed in 1923, put up a perimeter fence and got people to vacate the area. In contrast, Carood –the fifth largest watershed on Bohol Island, 20 472 ha in six municipalities–, is not known as a watershed. It is not seen to have any important resource that can be shared with a larger population in society, being mainly agricultural without major economic activities, with coastal fishing towns along Cogtong Bay near the river mouth.

After centuries of centralized natural resource management, the transition to stakeholder engagement in Maasin and Carood presents several major challenges:

1 The term 'watershed' evokes fear and insecurity in upland dwellers because government has traditionally used it in proclamations restricting resource access to an area by social exclusion and community displacement. Both Maasin and Carood have gone through a long history of conflict and resistance if not rebellion in parallel with town development and trade since the 1800s. Communities in such places have experienced tenure insecurity, dislocation, impoverishment and landscape degradation for generations. Many people and some local governments believed that an area cannot be called a watershed unless declared as such by the forest department.The communities now are the intended beneficiaries of the

national policy on CBFM.

2 Marginal upland areas belong to the lowest-income municipalities in the Philippines, inadequately reached by basic education, health and water services. It is difficult for local governments with such limited resources to look beyond their administrative boundaries and economic considerations when planning land use.

3 Reforestation has been the automatic response to enhancing watershed functions, but it remained unclear whether reforestation of barren areas was for production or for conservation. Agroforestry and natural regeneration have yet to figure more broadly in management discussions. With the policies on decentralization and community forest management in place, the main issues are no longer rights and tenure security (except for areas with tenure overlaps) but rather implementation responsibilities and management capacities.

These are some of the challenges being worked out by stakeholders in Carood and Maasin. Carood has an informal working group composed of mayors, planning officers, agriculturists, local legislators, academics, village heads, people's organizations, provincial government and line agency representatives. They have been getting together for the past four years and recently sought formal recognition from the provincial governor. Maasin has a federation of upland farmers who found new vitality in their management when a CBFM Agreement was awarded to them in 2002.

Important changes are taking place in the way people perceive their responsibilities and roles in resource management. Dealing with governance in a watershed context is helping stakeholders situate concerns over their resource base within land-water relations. With the increasing sense that declining ecological services somehow impact on local livelihoods comes a greater recognition of the need to find ways to stabilize local environments within available human and financial resources. This is providing the basis for a broader appreciation of how policy decisions, program actions and management practices impact on land use and the local economy. The working group and the federation are serving as a mechanism for broadening participation, improving transparency, and fostering accountability beyond administrative boundaries. The plight of people in remote upper catchments becomes more easily understood in political centers, often located downstream, when it is linked with water and livelihood. This growing understanding is enabling communities to take action and engage local governments in pooling and managing their resources to reverse the decline of their watersheds. Fostering watershed governance holds promise of de-politicizing land use decisions and improving harmony among land use plans in a way that contributes to the improvement of ecological services.

The stories of Carood and Maasin have been captured in *Communities in Watershed Governance in Visayas*, produced as part of the publication series on Community Forest Management Trends in Southeast Asia supported by the EU Tropical Forest Budget Line. The network report illustrates how meaningful interactions between concerned communities and local governments can foster watershed governance for terrestrial and aquatic resource use and protection.

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LANDSCAPE WATER MANAGEMENT IN THE MEDITERRANEAN: EXPERIENCE OF THE WASAMED PROJECT

By C. Bogliotti, N. Lamaddalena, and A. Scardigno

In Mediterranean landscapes water is a scarce resource which requires careful management of supply and demand. The WASAMED (Water Saving in Mediterranean Agriculture) project funded by the EU has explored options of managing water in arid and semi-arid area conditions. The Mediterranean basin is a very complex system due to its high diversity (environmental, economic and societal) throughout the Northern and Southern regions and the Middle-East countries. Water scarcity is a very complex issue, which is presently at the forefront of discussions on global sustainability and food security. The current pattern of water resources management in the Southern Mediterranean region is not sustainable and is dramatically affecting all dimensions of life. All this is a constraint for the future development of the entire basin and for Europe. During the last decades research and policies in the water sector have been very much oriented to the ***supply*** side in exploring new water resources to meet the increasing demand, in assessing water related natural hazards (drought and floods) and in monitoring water quality to protect the functional and structural characteristics of the ecosystem. Less research and policy analysis has addressed the ***demand*** side of integrated and sustainable management of the limited water resources, and the concepts of efficiency and performance in water management. However, the Mediterranean heritage includes considerable knowledge on the use of productive landscapes with limited water resources. There is not much that trees and forests can do to increase supply of water, so the key is in adjusting demand.

Water saving is an important water management option in scarce resource conditions. Although the concept of "water saving" is also extended to the civil and industrial sectors, in the Mediterranean context the management of limited water resources is strictly related to agriculture. The latter is considered to be the major cause of pressure on quality and quantity of natural water bodies. In relation to agricultural water management, existing research and experience provide information on local small- to medium-scale projects and assessment of different water saving opportunities such as: to improve water efficiency through agronomy, physiology, plant breeding and soil management; to ameliorate irrigation system performance; to provide incentives for use of unconventional water sources through experimentation on the re-use of recycled urban water, saline water, groundwater, drainage water and runoff water; to promote participatory approaches and socio-economic analysis.

Regardless of the type of water saving pathways, there is a clear need for more integrated efforts in water saving. The Mediterranean domain has few rivers and very few cross-border ones, but there still are cross-border issues in water management. Supported by national institutions and both regional and international organizations an integrated water resources management should focus on the following points: establishment and application of water management policies coherent with the emerging need of ensuring sustainable development; developing coherent national policies and regional strategies; improving public and private awareness and the efficiency of public administration at the local and central level; overseeing the promotion and enforcement of national legislation and guidelines for practices; appraising water saving actions from the point of view of the public health, socio-economics, environment; setting new and more coherent water pricing mechanisms. The participation of key stakeholders and appropriate incentive or income generating water saving is necessary to ensure the sustainability of the regional water management. Unfortunately, water management interventions (research, policies, methodologies, information, etc.) are fragmented in the Mediterranean, due to the difficulties of networking and communication among partners of the different countries.

WASAMED

The WASAMED project incorporates all these issues in its various work packages and intends to constitute a tool and a contribution to reduce pressure on natural waters through an improved and sustainable balance between water demand and water supply. It is a practical Mediterranean dialogue aiming to identify and share common objectives, approaches and strategies to integrate, technical and non-technical water saving options. The Network is built on a wide participatory base. It has a relevant critical mass of partners in terms of “category”, “profile” and “provenience” (20 research institutions, 11 decision-policy making institutions, 11 end-users) for a total of 42 Partners coming from 16 Mediterranean Countries (Algeria, Cyprus, Egypt, Germany, Greece, Italy, Jordan, Lebanon, Malta, Morocco, Palestine, Portugal, Spain, Tunisia, Turkey, Syria) (see also http://wasamed.iamb.it for the efforts of intra-discipline and intra-sector integration). Further, it is worth mentioning that the identification of alternative water saving options/strategies is pursued under the wide range of agro-climatic, technical and socio-economic conditions prevailing in the Mediterranean Region and in the context of different long-term socio-economic and climatic scenarios. Social, economical and environmental “costs” and “benefits” of such water saving options/strategies are evaluated in order to shape them out into policy guidelines. WASAMED is expected to give strong visibility to the work done within the Region (capitalizing on the existing knowledge); to build a comprehensive reference framework to address water saving under the different perspectives (…physical, biological, social, economical, environmental, …); to account for the aspects of scale (spatial and temporal); to reconcile the “site-specific” and “regional” dimensions of “water saving”; to handle “complexity”.

First results

During the workshops held so far, an interesting effort has been made by all partners to reach a consensus on goals and indicators to be used to assess the contributions that the different technical and non-technical water saving strategies and options can give to enhance the general objective of a sustainable water saving in Mediterranean agriculture. Wasamed partners agree that widespread adoption of participatory irrigation management, an improvement in the irrigation system performance and a spreading of non conventional water use can exercise an effective positive impact on sustainable water saving through: the reduction of conflict on resources; the improvement in the stakeholders' participation and local empowerment and awareness; the improvement of resource productivity; the introduction of more transparent mechanism of cost benefit sharing. At the same time some of these factors, such as the identification of a new model of governance and the adoption of new water pricing policies, are considered as more critical issues for achieving a sustainable water saving in Mediterranean agriculture. The key to landscape scale water management is thus on the demand side, adjusting to and accepting the uncertainties of supply.

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GLOBAL CHANGE, URBANIZATION AND NATURAL RESOURCE MANAGEMENT IN WESTERN MEXICO

By Gerritsen, P.R.W., C. Ortiz, J.-C. Bolay, S. Hostettler, L. M. Martinez, E. Santana, S. Graf and S. Garcia

Studying the local effects of global change has become increasingly relevant as the world's socio-environmental problems continue to grow. Moreover, the need for a multi-disciplinary perspective has become generally accepted.

In October 2002, a transdisciplinary research project was initiated to understand and develop strategies to mitigate the effects of global change on the livelihoods of people living in the Ayuquila watershed in western Mexico. This project was a collaboration between the Department of Ecology and Natural Resources-IMECBIO of the University of Guadalajara, Mexico and the Laboratory of Urban Sociology of the Federal Institute of Technology in Lausanne (EPFL), Switzerland. It is part of the research activities on social practices and empowerment in urban societies of the international research program of the Swiss National Centre of Competence in Research - North South (NCCR North-South). In Mexico, it is part of a local initiative to implement a sustainable regional development approach in the Ayuquila watershed that has been on-going for over a decade (Martínez et al., 2002).

The project contributes to the local initiative by implementing applied sociological and ecological action research, focussing on

urbanization and natural resource management. The project is innovative as it is explicitly developing an integrated rural-urban research approach focusing on the perceptions and strategies of local actors towards urbanization and natural resource management.

Urbanization, Natural Resources and Watershed Management

With the process of urbanization, we refer to the very rapid growth of urban settlements in developing countries with its spatial, material, social, ecological and economic impact (Bolay, et al., 2000). This impact consists of unplanned extension of built territories, fragmentation of spaces following social characteristics, informality of economic activities, a lack of basic infrastructure and service distribution, and, more generally, changing social practices. In turn, this may lead to a reconfiguration of rural-urban interactions with their economic, ecological, political and social dimensions (Tacoli, 1998). The overall effects of these changes in rural and urban use and management of natural resources within a given institutional context is of special interest in the Ayuquila watershed. Since the early 1990s, attempts were made to conserve the ecosytem, by involving, amongst others, both intermediate cities and rural communities within the watershed; a multi-level stakeholder approach was considered essential. The ongoing analysis of various decision-making platforms on natural resource management is of particular interest, as they appear to play a key role in the development and implementation of sustainable regional development strategies.

The Ayuquila Watershed

The Ayuquila watershed is one of the 43 most important watersheds in Mexico, because of its biodiversity, drinking water production, irrigation surface and the presence of the Sierra de Manantlán Biosphere Reserve (IMECBIO, 2000).

The watershed is home to several medium-sized towns and a large number of rural communities. In addition to water demands of irrigated agriculture, the towns also require increasing amounts of water, and they are responsible for increasing water pollution due to the absence of water treatment plants. This trend strongly affects the surrounding rural communities who depend directly on the natural resource base. This constitutes one of the most obvious negative urban-rural interactions in the study area. On the other hand, the towns provide economic opportunities, better education and health services.

Rural areas represent a cultural richness, due to both the presence of indigenous groups and rural communities each with their own traditions and the isolated and dispersed nature of many settlements. In general, conditions of poverty and marginalization prevail in rural areas. Maize cultivation continues to be important, but market prices have been low during the last decades. Other important crops include sugarcane, chili peppers, agaves (for the mezcal and tequila production), and tomatoes. Except for sugarcane, the crops are mainly grown for export. Cattle breeding has become more important since the 1970s and is considered today as one of the more important driving force of land-use change in the watershed (*ibid.*).

State of the Art

The current research project has produced new information contributing to a better

understanding of rural-urban interactions in the context of global change. Mitigation strategies will be developed in order to strengthen the ongoing watershed and natural resource management activities at the regional and municipal level.

So far, results suggest that globalization is a very advanced process in the study area, profoundly affecting urban and rural livelihood strategies and urban-rural interactions. Nonetheless, a number of new strategies can be identified to counteract the negative effects of globalization. Organic agriculture plays a key role in most of these new strategies. Despite the influence of globalization, the region is very heterogeneous regarding the different livelihood strategies. Broadly speaking, the municipalities can be divided into three groups according to the degree of urbanization: predominantly urbanised, intermediate and marginalised municipalities. Information on the types of livelihoods and the municipalities are valuable inputs for the design of new strategies for regional sustainable development. However, these strategies will only become relevant, when they are accepted into the on-going action agenda of the local Ayuquila watershed initiative.

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FARMS OR FOREST: CONSERVATION OF THE PANAMANIAN WATERSHED, A BULADA SUB-BASIN STUDY

By Eric E. Flores De G.

The Panama Canal represents huge economic interests, but every ship that passes through the locks costs water. The water supply to the canal in dry periods can no longer keep up with increased demand for transport.

One of the main priorities of Panamanian Environmental Law (ANAM, 1998) is the protection, conservation and management of upland watersheds. The goal is to maintain the natural water resources for future generations. To fulfill this goal,

management plans have to be developed based on an assessment of the natural, socio-economic and cultural features of each watershed. Important is the participation of all stakeholders (e.g. public institutions, local watershed committees) in the surveys and plan development.
The present study focuses not only on the water resources but also on the local livelihoods values. This approach should be considered when big reforestation plans are addressed to prevent lack of water supply in different basins, like in the Panama Canal Watershed. Dredging costs that result from the continous inflow of sediment are an issue that justifies active management of the agricultural landscape.

Study site

Based on this framework, an assessment was conducted of the Bulaba river sub-basin (BSB), located at 8° 32´ N, 81° 06´ W. The Bulaba River is part of the Santa Maria River Watershed, which is one of the most important watersheds in Central Panama. There are two types of climates: 'tropical moist' and 'highlands temperate very moist'. The sub-basin is located within the Talamanca Forest Eco-region, a region considered to be a global hot spot for biodiversity (ANAM 2000; Angehr, G.O 1998). The BSB contributes the highest volume of water per square kilometer to the Santa Maria River Watershed. According to UNDP-Panama (2002), the human development index for this area is one of the lowest in the country. Most of this area is part of the Santa Fe National Park (MEF, 2001). The park was created mainly to maintain the remaining forests and for the conservation of water resources. The settlement in this region dated from 1558, when Spanish colonists founded the Santa Fe village for the exploitation of gold mines.

Materials and methods

We compiled meteorological data, historic documents, maps, aerial photos, census, etc. A field survey designed for biodiversity surveys (Sheil et al. 2000) was adapted to a focus on watershed functions, local use of natural resources and legal aspects of land tenure. Maps on the delimitation of the sub-basin, hydrographic features, forest cover, relief, roads, villages, life zones, soils, administrative division were generated using Arc View GIS v3.2.

Results

The subbasin (total area 85 km^2) has 2 principal rivers and 23 streams with a total length of 95 km. The mean flow rate is 8.09 m^3/s, which corresponds with 8.2 mm/day or 3000 mm/year. In long dry periods, associated with ENSO events, flow is considerably less. While the maximum altitude is 1518 m above sea level (Saro Hill), 26% of the sub-basin has elevations between 600-750 m, with 72% of the territory on very steep slopes (15-40%). Forest cover is virtually restricted to the Santa Fe National Park which covers 66 % of the sub-basin. There are 3 villages inside the Park limits. Between 1992 and 2000 mature forest decreased by 4% (342 ha). In 1982 forest cover still represented 71% and shrubs/ pasture 28% of the land area. In 2000, there were 18 villages with on average 582 inhabitants; this population was stable for 2004. Since 1980 population increased in the north-east side of the BSB, mostly by influx of migrants. Smallholder agriculture is the principal source of income (corn, cassava, coffee and fruit trees). The majority (65%) of people consulted used steep slopes to cultivate. The main local soil management used is a fallow-crop rotation with slash and burn land clearing (without soil tillage) and a three year fallow period.

Discussion and recommendations

During ENSO episodes, water flow decrease dramatically. Infiltration is the key to a future integrated water resource management. Most of the local farmers use limited soil management practices. At 7 villages, it is urgent to develop soil and water conservation programs for the coffee and citrus culture. Creating local conservation commitees in these villages is desirable. The expectation is that by targeted interventions in the sub-basin, erosion in the existing 'hot spots' can be reduced. This way, local livelihoods can be maintained instead carrying out big reforestation programs only. The savings on dredging cost justify a considerable public investment in support for local soil conservation.

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PROMOTING INTEGRATED WATER RESOURCES MANAGEMENT PRACTICES IN THE VOLTA RIVER BASIN: INVOLVING LOCAL COMMUNITIES IN RESTORATION OF RIVER BANKS

By Elke Verbeeten, Olumide Akinsola, Kwame Odame-Ababio and Ludovic Tapsoba

The West African Volta River Basin remains one of the main transboundary watercourses in Africa without an international treaty. The countries Burkina Faso and Ghana depend on the water from the Volta Basin for electricity production, irrigation and municipal water supply. In the past years, the number of hydraulic and irrigation infrastructures has increased significantly. Since the late 1990s, there has been a growing debate in the basin on several issues including the magnitude and

causes of water deficits affecting the lower reaches of the river system and resulting in severe shortages downstream. Also water pollution, proliferation of aquatic weeds and high incidence of water-related diseases are issues of concern in the basin.

The IUCN (World Conservation Union) and Global Water Partnership (GWP), together with Ghana's *Water Resources Commission* (WRC), Burkina Faso's *Direction Generale de l'Inventaire des Ressources Hydrauliques* (DGIRH) and local partners have initiated a project to improve water governance in the Volta River Basin. The project activities include: (a) developing a decision-support knowledge base comprising water management options, (b) developing and implementing multi-stakeholder pilot Integrated Water Resources Management (IWRM) interventions together, resulting in a better understanding of the basin water resources and trans-border problems, and (c) promoting policy and institutional change.

Pilot interventions

The pilot interventions aim to promote IWRM water policies and co-operation between the two countries. The proposed interventions should also reduce tensions between the two countries and different communities.

Pilot interventions envisaged will: (a) contribute to institutional support and capacity building for DGIRH and WRC; (b) establish a stakeholder forum at the level of the targeted transboundary sub-basin; and (c) implement river bank restoration and re-vegetation to decrease erosion and siltation rates of the river channels. The selection of the pilot sub-basin was based on the following criteria: a high or increasing pressure on existing water resources; a large hydraulic infrastructure in the upstream; and local authorities and communities willing to cooperate.

Characteristics of the sub-basin

The above criteria informed the selection of a transboundary sub-basin of the White Volta River Basin, called the Nakambe in Burkina Faso. The selected sub-basin on the Burkina side extends from the Bagré dam southwards to Bitou and Zabré towards the Ghanaian border.

Since the existence of the Bagré dam small irrigated areas have been developed along the river banks of the Nakambe. Often these irrigation practices are very inefficient and tend to accelerate erosion and sedimentation in many parts of the river and flood plains. Increased erosion and sedimentation reduce infiltration and impede the recharge of the groundwater level. Recurrent bush fires also contribute to erosion through destruction of the vegetative cover.

Increased usage of chemical fertiliser and pesticides in agriculture aggravates this problem and also contributes to water pollution. As areas near the river banks are increasingly used for agriculture, the impact of the level of chemicals in the river on water for agriculture and domestic use downstream is becoming a point of concern. Since water is becoming a scarce resource, access to water is becoming an important potential conflict. In addition, during exceptional raining periods, extensive flooding occurs resulting in loss of farmlands (especially near the river banks), animals and sometimes human lives. Therefore, immediate actions are required to stop these negative developments.

Restoration of the riverbanks is an activity which requires commitment from both countries. In Burkina, it is forbidden by law (Code de l'Environnement 1997) to cultivate within a zone of 500 meter along the river banks. The law is often not enforced: people do cultivate these lands. The buffer zones should be restored to reduce siltation and pollution downstream. When people move out of this zone with potential for erosion, it would have the added benefit of diminishing the chances of river blindness infection.

Proposed activities

In order to proceed with the restoration of the buffer zones, the proposed areas will be delineated. Agricultural activities should be moved out of these zones. The government will be encouraged to re-allocate new land to farmers as compensation for the loss of land.

It is envisaged that these buffer zones will be replanted with local arboriculture trees, improving the livelihoods of the local communities. To be successful, tree species will be selected through a participatory approach with the local communities. While some communities may prefer fruit trees of economic interest, others may consider firewood species more important. For firewood, species such as *Detarium microcarpum* and *Combretum* species will be considered.

The overall success and participation of the local communities of the Nakambe will depend on how well-informed the communities are about the need for river bank protection. For example, they need to be aware of the relationship between the siltation upstream and the flow of the river downstream. Rapid rural appraisals are carried out to inform local communities, identify their problems and needs, and to propose solutions and work out action plans. Village committees were formed to implement these activities.

A dialogue has been initiated between relevant technical experts, local government institution representatives, water users associations, farmers groups, women groups and community organizations. In this initial phase, the project aims to gain the trust of the communities including all stakeholder groups in the community. The stakeholders will be identified and represented to the committees so that their interests, which may include multiple uses of the buffer zones, are taken into account by river basin decision makers. The stakeholder's consultative forum will act as a platform to disseminate information on different issues affecting the communities in the White Volta sub-basin.

Issues for reconsideration during project implementation

A major issue is developing activities that will respect stakeholders' opinions and needs *and* at the same time reduce erosion *and* not increase water consumption. Stakeholders may very well understand the local situation, but to what extent are they aware of the implications of their actions for communities downstream? Therefore, a good information flow is important, especially concerning erosion and water use of certain types of land use.

A species of economic interest may not be the best species to prevent erosion. To reduce erosion, species allowing reasonable undergrowth are preferred. Equally, economically interesting species might not have the most economic water

balance, because of deep rooting or inefficient water uptake. This calls for scientific input to assist stakeholders in the selection of the most favourable species and activities, respecting the livelihoods of communities both upstream as downstream.

Other risks include the willingness of riparian states and communities to cooperate. Without the cooperation of local communities the restoration of the river banks will be a very difficult, if not an impossible task: hence the consultation of all stakeholders is of utmost importance.

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MANAGEMENT STRATEGIES FOR FORESTS AND WATERSHEDS IN THE UPPER YANGTZE RIVER BASIN, SICHUAN, CHINA

By Olavi Luukkanen and Ping Zhou

The effects of forests on hydrology have been debated internationally for about 80 years. The “sponge theory”, “filtration theory” and “pump theory” described the effects as positive or negative. Although there is no final answer to settle the debate so far, forests certainly have the ability to enhance water quality, moderate peak flows and sequester carbon dioxide. Undoubtedly, the forests also play an important role in reducing soil erosion in mountainous watersheds.

The Yangtze River, the largest river in China and the third largest in the world, is a crucial lifeline that secures the sustainable socio-economic development of the nation. The Yangtze River basin provides 40% of the fresh water resources in China and meets the needs of over 400 million people. However, the Yangtze basin ecosystems have been damaged due to increased population, unsustainable and irrational development activities, natural disasters, and forest mismanagement.

The upper Yangtze River watershed, which has a drainage area of 1.04×10^6 km^2, is an ecologically and environmentally fragile area. The watershed is facing many environmental problems such as deforestation, land and soil degradation, earthquakes, soil erosion, mud- and landslides, flood, and growing desertification

of the surrounding mountainous areas. The forest cover has decreased dramatically in the last 50 years. The frequency of floods has increased, and the catastrophic Yangtze River flood in 1998 damaged thousands of houses. Large areas in the watershed have become degraded and drier.

It is known that only little soil erosion will occur, when the vegetation cover is over 80%. Watershed management especially calls for forest restoration or rehabilitation to improve soil stability. The management of forest ecosystems of the Yangtze River basin has drawn widespread attention from the Chinese government, river basin authorities, as well as domestic and international organizations and institutions.

Since 1989, the Chinese central and local governments have provided financial and policy support to soil and water conservation and forest ecosystem restoration in this region: large-scale soil conservation works took place as part of the "State key soil and water conservation project in the upper Yangtze River basin". Secondly, an ecological programme – "Conservation forest in the upper and middle reaches of the Yangtze River" – was launched in 1989, to protect the headwaters and to rehabilitate disturbed habitats. However, from 1990 to 1998, the natural forest area in the upper Yangtze River watershed continued to decrease, despite a repeated emphasis on sustainable development. Then in the wake of the 1998 floods, the policy was redirected towards rehabilitation of degraded forest ecosystems and imposing a ban on logging of natural forests. In 2000, the Chinese government launched a programme "Returning the farmland to forest and grass in the upper Yangtze River", which is known as "grain for Green", to enhance forest ecosystem restoration.

As part of Finnish-Chinese scientific cooperation, a project was launched in 2004, entitled "Trees for the Yangtze River: Watershed management and ecosystem rehabilitation in Sichuan Province, China (WAMEC)". The Viikki Tropical Resources Institute (VITRI) at the University of Helsinki and the Chengdu Institute of Biology (CIB) are the lead implementers. The overall aim of the project is to analyze the processes of land degradation and rehabilitation along the Min River, in an important sub-watershed of the Yangtze River basin near Chengdu in Sichuan. The study area covers about 23,000 km^2 and extends to 6,000 m elevation.

The following research activities are related to forests in this watershed:

- To analyze the effect of forest cover on soil erosion and sediment load;
- To determine the soil erosion rate as affected by slope and aspect, vegetation type, and soil type, using spatial data;
- To study the hydrological and other soil factors that are critical in determining the success of reforestation;
- To describe the indigenous woody plant species composition and its successional development as affected by land-use history in forest ecosystems with varying degrees of disturbance;
- To analyze tree species adaptation and performance during the process of watershed rehabilitation using physiological, anatomical and morphological markers in trees;

- To study the root system of nitrogen-fixing plants for their potential in reducing soil loss and mudslides and restoring the vegetation in critical zones;
- To study the involvement of local communities, community-based organisations, NGOs and schools in awareness-raising and participatory watershed management and conservation, in order to achieve improved management guidelines and recommendations.

Preliminary results on the following issues are available:

- Vegetation dynamics from 1970s to 2004, indicating changes in different vegetation classes such as forests, shrubs, agriculture crops and herbaceous plants;
- Selection of woody plant species for rehabilitation purposes: a total of 83 tree and shrub species were selected for different types of degraded watersheds, including five ecological zones ranging from 1300m to 5700m altitude, and three different soil types;
- Mapping: a digital map was developed, indicating priority areas for quick restoration, i.e. areas covered by shrubs and adjacent to the existing forests, and thus showing a high potential for forests restoration. The map also specifies the most difficult areas for vegetation restoration, i.e. areas with low precipitation as a limiting factor.
- Successional dynamics of natural and planted tree stands and the potential roles of degraded natural forests and tree plantations for watershed rehabilitation;
- Quantification of soil erosion loss under different vegetation cover, precipitation, soil erodibility, and slope and aspect; and
- Recommendations for soil and water conservation and forest rehabilitation.

It can be concluded that large-scale reforestation in severely degraded areas is an option for achieving sustainable watershed management. However, the regeneration potential of the existing natural woody vegetation should also be fully utilized. The present joint activities of Finnish and Chinese forest ecologists, economists and social scientists are expected to provide comprehensive management tools regarding trees in watershed conservation and management, for applications in the Yangtze River basin and elsewhere.

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INTEGRATED ECOSYSTEM AND WATER RESOURCES MANAGEMENT OF THE UPPER-MEKONG RIVER BASIN IN YUNNAN, CHINA

By Wim Douven and Peter van der Meer

The ecosystems of the Upper Mekong are under increasing pressure due to rapid land use changes and unsustainable land use practices. This pressure affects both the hydrological and ecological state of the Upper Mekong system through soil erosion, landslides, increased sediment loads, habitat fragmentation, and species loss. This has adverse consequences for the water flow regulation and ecosystems functions of the region, affecting both local and downstream transboundary areas. The different government departments of Yunnan Province are seeking to remedy this situation by developing integrated approaches to water and ecosystem management.

The project '*Integrated Ecosystem and Water Resources Management of the Lancang (Upper-Mekong) River Basin - a pilot research in Fengqing and Xiaojie Catchments*' was initiated mid 2003 to support Yunnan Province in this effort. This 18 month project was carried out by an interdisciplinary partnership of Chinese and Dutch institutes. The following institutes were involved: Yunnan University, South-West Forestry College, Yunnan Geo-environmental Monitoring Centre, Yunnan Bureau of Hydrology and Water Resources, UNESCO-IHE, Alterra - Wageningen UR and ITC. The project was funded by Partners for Water (The Netherlands), Yunnan Forestry Department and State Forestry Authority (China).

Two catchments in the Upper-Mekong (Fengqing and Xiaojie catchment) were selected as study areas. They were selected for their location, near to each other, and similar natural characteristics. Both catchments are representative for a larger region of the Lancangjiang Basin as well as for other basins in this region. In both catchments, soil degradation is a problem as much of the original forest was cleared during the 1950's and 60's and most of the land-area, often including very steep slopes, was turned into agricultural land . Despite these similarities, one of the two catchments, Xiaojie, had very turbid (muddy) waters, while the other (Fengqing), which has a large nature reserve, had much clearer water.

The objectives of the project were:

1 To clarify the causes of observed differences in the interactions between water and environmental resources and their management between both catchments;
2 To recommend management measures for both catchments and assess their effects on water-soil-ecosystems conditions;
3 To develop an integral framework for integrated watershed management as a management tool in both catchments.

The project used a systems analysis approach. In this approach water resources, forest and agricultural ecosystems, soil erosion, landslides and watershed management aspects were linked through causal diagrams, map analysis and scenario analysis. This analysis was fed by data collected on the various aspects at

both the plot and the catchment scale.

Key findings

Degradation was a problem in both catchments. In view of the deforestation since 1950, human factors play a major role. Some degradation was also observed on abandoned terraces built for agriculture. Overall, degradation in Xiaojie is a larger problem than in Fengqing, which confirms the initial observation that the water in Xiaojie is more turbid. The main reasons are variations in land use and in geology. Land use, i.e. the presence of the nature reserves is the main cause for better ecosystems functioning in Fengqing, and is a contributing factor to differences in erosion and landslides between the two catchments. The other main factor is geology, and especially the distribution of faults, which are more prevalent in Xiaojie than in Fengqing.

Sediment load in the main streams was influenced by the occurrence of gully/surface erosion and landslides, and by the presence of forested areas. Slope terracing and rainwater harvesting facilities proved effective in conserving soil and water. Surface erosion measurements showed a strong relation between plant characteristics, slope, and rill-erosion. Pure tea gardens experienced substantial rill erosion, but this was reduced when tea was interplanted with *Alnus* sp. trees. Multiple regression analysis suggested that up to 99% of the variation in rill erosion could be explained by slope, basal area, canopy cover, and leaf area index (LAI). However, additional and more detailed measurements are required to verify this.

Gully erosion in the catchment with more nature reserves (Fengqing) was less severe than in the Xiaojie catchment which had a lower percentage of land area under forest and dense vegetation.

Preliminary data suggest that steep slopes may be partly stabilised by underground root systems in forested areas. The root system changes the underground hydrological characteristics, and plant cover reduces the surface erosion. This is expected to result in fewer and less severe landslides on slopes covered by natural forests. In general, woody plants seemed to have more effect on reducing landslides than herbaceous plants. However, more data are needed to confirm this.

Practical guidelines for improved water and environmental resources management were developed. The guidelines specifically focussed on water resources, soil erosion, landslides, ecosystems and integrated watershed management.

The different counties managing both catchments recognized the water-soil-ecosystem problems and are implementing several measures including reforestation programmes. However, the lack of an integral watershed management plan for the two catchments results in a lack of synergy between the various measures implemented.

The project proposed a management procedure to develop and assess integrated watershed management strategies (and measures) to local management and stakeholders to support the first steps of such an integration process.

Lessons learned

Project partners with different disciplinary

backgrounds worked together to develop an integrated systems understanding of the watersheds. This approach proved to be essential for the realistic assessment of present and proposed management measures.

Government representatives from the county and provincial level were closely involved in the project. They provided valuable input in terms of local knowledge on resource uses, management measures and stakeholder views. Involving government officers also raised their awareness on the importance of integrated management of land and water resources and helped create ownership of the results. Hopefully, this will contribute to successful implementation of the project results.

Several of the conservation measures proposed were already being applied in both catchments. Terracing is a frequently used traditional technology, and when properly executed it can be very effective. A nature reserve was established, and it provided improved biodiversity as well as good protection against erosion and landslides. A biogas programme was also effective in protecting forests, as the biogas was used instead of firewood. The study showed that these measures had a positive effect on water-soil-ecosystem conditions. A number of new actions with proven impact in similar regions were proposed in addition to existing measures.

Recommendations for the future policies and best practice

Management of the Upper-Mekong watershed was traditionally oriented along sectoral lines. Watershed management should recognize the multitude of functions watersheds provide and the need to meet multiple objectives such as flood prevention, erosion control, protection of wildlife habitat, agricultural production and provision of recreation.

Watershed management is not solely the responsibility of government agencies and conservancy districts, but also of the communities. Institutional and organisational structures in the Upper-Mekong region should be established to facilitate cooperation between different sectors while involving relevant stakeholders. Public and political awareness raising and capacity building programmes should support this.

In the project we studied two smaller catchments in the Upper-Mekong. Implementation of recommendations at this scale will not only have positive effects at the local scale but also at a larger (international) scale in terms of water quantity and sediment-load in downstream areas. Another way to reach basin wide impacts is to study the possibilities and limitations of up-scaling locally developed knowledge and recommendations from the project to other similar regions.

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FLOOD FORESTS AND COMMUNITY FISHERIES ON THE TONLE SAP GREAT LAKE, CAMBODIA

By Patrick T. Evans

Cambodia continues to struggle with poverty and food insecurity after decades of warfare and civil unrest. Peace finally came in 1998, however poverty and corruption continue to limit opportunities for the majority of the country's 12 million inhabitants. An estimated 80% of the population is still dependent on agriculture and/or access to forest and fish resources to provide their livelihoods.

Nestled in the heart of Cambodia is the Tonle Sap Great Lake. Unique in the world, this amazing body of water drains to an average depth of only 1 meter in the dry season with a surface area of some 250,000 hectares. However with the onset of the monsoon, the rising Mekong River causes the river that drains the Tonle Sap to stop flowing and to reverse flow back into the lake from June until October. During a period of 4 months the depth of the lake increases by some 9 meters and the surface area expands fivefold to cover some 1.25 million ha. As the water rises, millions of fish migrate back into the lake and onto the extensive floodplain, which provides habitat and food for some 140 fish species. This unique flood cycle and associated flood forest vegetation have resulted in what is considered to be the 4th most productive freshwater fisheries in the world.

Maintenance of the flood forest vegetation is considered essential to ensure the productivity of the fisheries. In the early 1990's, rapid clearing of forests for agriculture expansion and fuelwood collection resulted in the Government of Cambodia seeking outside assistance to help protect the flood forests and the fisheries of the Tonle Sap Great Lake. The Government of Belgium agreed to provide the financial support with the Food and Agriculture Organization of the United Nations (FAO) providing technical assistance.

The project "*Participatory natural resource management in the Tonle Sap region*" was initiated in January 1995. The early years focused on understanding the needs and opportunities of the fishing communities located within the province of Siem Reap on the north shore of the Great Lake. The project was extended into a second and subsequent third phase with an overall project objective: *"To establish responsible, productive, and sustainable management of forest and fishery resources by local communities to meet local needs and to stimulate local development within the province of Siem Reap".* Implemented through government counterpart staff of the

provincial departments of forestry, fisheries and environment, the staff went to the villages as facilitators to assist local people with protection and responsible management of the natural resources upon which their livelihoods depended. By late 2000, the project had 7 community fisheries organizations established for the protection and management of some 10,000 ha of flood forest fisheries resources.

An overriding constraint at the time was a commercial fishing concession system established in colonial times, which allocated the most productive fishing grounds to private operators. This "fishing lot" system provided 80% of the dry season lakeshore to only 18 men – and a total of some 240 men controlled nearly 1 million hectares of prime fishing grounds around the lake and rivers. The system was exploitative of the resources and rife with corruption. With the advent of peace in 1998 and start of community fisheries on the lake, fishermen felt secure enough to speak out against the injustices of the "fishing lot" system. As reported conflicts between fishermen and fishing lot operators increased, the Prime Minister paid a visit to Siem Reap in October of 2000. Having been briefed about community fishery development within the province, he agreed to the release of some 8,000 ha from commercial fishing lots for community protection and management. This initial offering opened the door and sparked a *fisheries reform process* which, driven by fishing communities, swept the country and resulted by mid 2001 in the release of some 536,000 ha from commercial fishing lots for local community management. This was an unprecedented event in the transfer of management responsibility from powerful individuals to local communities in the name of poverty reduction and food security.

The project was well positioned to respond to the need of community facilitation to ensure responsible protection and management of the fisheries resources. Between the years 2001 and 2004, the project assisted 116 villages of some 100,000 people to establish protection and management for 108,000 ha of flood forest, open lake, and associated brush fields / grass lands. The villages have now organized themselves into 15 community fisheries organizations – each of which has by-laws, rules / regulations and management plans to ensure effective management.

As community fisheries took off in Siem Reap province, numerous NGOs initiated activities with communities in other provinces around the Great Lake. However, an over-riding concern has been lack of legislation. A community fisheries sub-decree was drafted in 2001 and has undergone numerous revisions. A new Fisheries Law was drafted in 1999, which has since been revised to accommodate community fisheries. Both the new Fisheries Law and sub-decree are awaiting approval.

The project served as a pilot project for the government in development of both community fisheries on the Great Lake and community forestry in the upland communities. When the project came to an end on 30 April 2005, some 108,000 ha were under community fisheries management and some 20,000 ha under community forestry management. Recent emphasis has been on income generation through resource productivity enhancement

and effective management. Upland communities are now harvesting and selling wooden poles to fishing communities who are now selling increasing quantities of fish from improved management. Protection of the flood forest has been the central issue for the fishing communities along with control of destructive fishing practices as well as protection and management of fish sanctuaries in deep-water areas to provide refuge to brood stock during the dry season. Recently, the Government of Cambodia has taken a 10 million dollar loan from the Asian Development Bank to support and expand community fisheries around the Tonle Sap Great Lake. This new program has technical support from FAO and has initiated activities as the Belgium funded project came to a close. Both government staff and local communities are establishing new collaborative relationships for the long-term protection and sustainable management of the Tonle Sap with improved livelihoods for fishing communities being the central theme.

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SUSTAINABLE MANAGEMENT OF FISH RESOURCES IN THE YAHUARCACA WETLANDS, COLOMBIAN AMAZON

By Edgar F. Prieto and Santiago R. Duque

Fish diversity and local management following the rhythm of inundation

Riverine forests are an important habitat for fish: the forests provide the fish with food and they serve as safe breeding grounds. In the Yahuarcaca floodplains of the Colombian Amazon, the presence of fish is subject to seasonal changes in the water level.

Understanding local fishermen´s perceptions of seasonal changes in the functions of forests and water related to fish diversity is important for developing a sound natural resource management plan.

The Yahuarcaca floodplain, located near the city of Leticia in south Colombia, is one of the most important wetland ecosystems in the Colombian Amazon given its multiple functions. The lakes in the Yahuarcaca floodplain originated from remnants of former meanders (oxbow lakes) of the Amazon River, and serve as a source of drinking water for the city of Leticia. The area is important for tourism, but also popular as a place for people to settle. Moreover, the riverine forests are of vital importance to the indigenous people living in the area: they supply fish for local consumption and small scale commercialization at the local market.

Tropenbos International Colombia, in collaboration with the National University of

Colombia and the University of Sevilla (Spain), initiated an integrated study to increase the understanding of the ecosystem as a basis for a sustainable management plan for the Yahuarcaca floodplains.

The project gathered technical information on aquatic ecology, ichthyology, fish species composition, nutritional and reproductive characteristics of the fish species, as well as on population dynamics of some of the occurring species and on fisheries. One of the most ambitious challenges for the project was to design a management system that would include natural resources use, without compromising on conservation objectives.

Given the fishing activities and many other types of use of the Yahuarcaca lakes, the project required an interdisciplinary approach. In addition to biological and ecological studies, the project included anthropology and participatory research by the local communities. In collaboration with the local fishermen, a monitoring system was set up which included registering the fish caught for consumption and monthly sampling of the chemical composition of the water, phytoplankton and presence of fish species.

Two members of the of the local La Playa community were part of the research team as co-investigators: they were in charge of recovering historical and traditional information about the area and the fish species, based on testimonies from local wise men and experienced fishermen. As they both had a talent for drawing, they were asked to illustrate the functioning of the lakes in relation to the seasonal flooding, in order to demonstrate the seasonal changes in the lakes and on the higher dry lands. This resulted in a series of four posters and a booklet, which formed the basis for discussions about the current situation in the Yahuarcaca region, and for integrated analysis and thinking about possible solutions. In fact, the posters proved to be useful tools for both facilitating dialogue and environmental education.

The research and exchange of information between the project and local people led to a better understanding of the dynamics of the Yahuarcaca wetland system. This is essential to the ongoing process of defining sustainable management and conservation of the fish resources. The approach developed by the project, encouraging local people to clarify and register local knowledge by drawing has potential for further use. It may be developed as an educational tool, to strengthen local knowledge and awareness, and to recover and record traditions of indigenous communities in the Amazon region.

Below, the four illustrations depicting seasonal changes of the Yahuarcaca Lakes are introduced. For a reproduction of the drawings, please refer to 76 -77

Seasonal changes: water, forests and fish
The forest is very important for the indigenous people and for to the fish; during the period of rising, high and descending waters, the forests offer the fish shelter and food. The seasonal changes in waterlevel and presence of fish species are illustrated by the drawings made by Jezus Dámazo Yoni and Abraham Ipuchima.

Descending waters (May - July)
As the water level decreases the trees

become “sad” as their leaves become yellowish. Many fish species migrate to the Amazon River: thus this is not a good season for fishing.

However, there is some good news for the fishermen. In June, the icy winds (‘friaje’) coming from Brazil brings in cold weather, which forces the fish to the surface to breathe, making it easy for the fishermen to catch them with arrows.

Low waters (August – September)
The water levels are the lowest during the months August and September. The trees are cut off (stand separate) from the water and the swamp vegetation; grass and thorny bushes start to grow. The fish are a bit thin and hide under the swampy vegetation, making fishing difficult. In this season, the number of fish species is the lowest. Consequently, fishing usually gives poor results. Mainly nets are used for fishing.

Rising waters (October – December)
From October onwards, trees such as the *‘espino’* (a thorny tree) and the wild cherry start to grow leaves. Several fish species start to return to the lakes. Many fish lay eggs in this period. Though it is possible to catch fish, the catch is just enough to feed the family. Fishing is done with fibre and silk nets in all lakes.

High waters (January – April)
During high water levels, most trees have fruits or flowers. Many other fish species are returning to the lakes. Catching fish is easy: fishermen use hooks, fibre nets and arrows. In April and May, at the end of the high waters, fishing is even better. The ‘Mijano’ (reproductive migration of fish) begins in from the rivers of Brazil towards the origins of the Amazon in the months April and May. During these months, fishermen mainly use fibre nets for fishing. The richness in fish species is the highest in this period. Since fish is abundant, part of the catch is sold at the market in Leticia.

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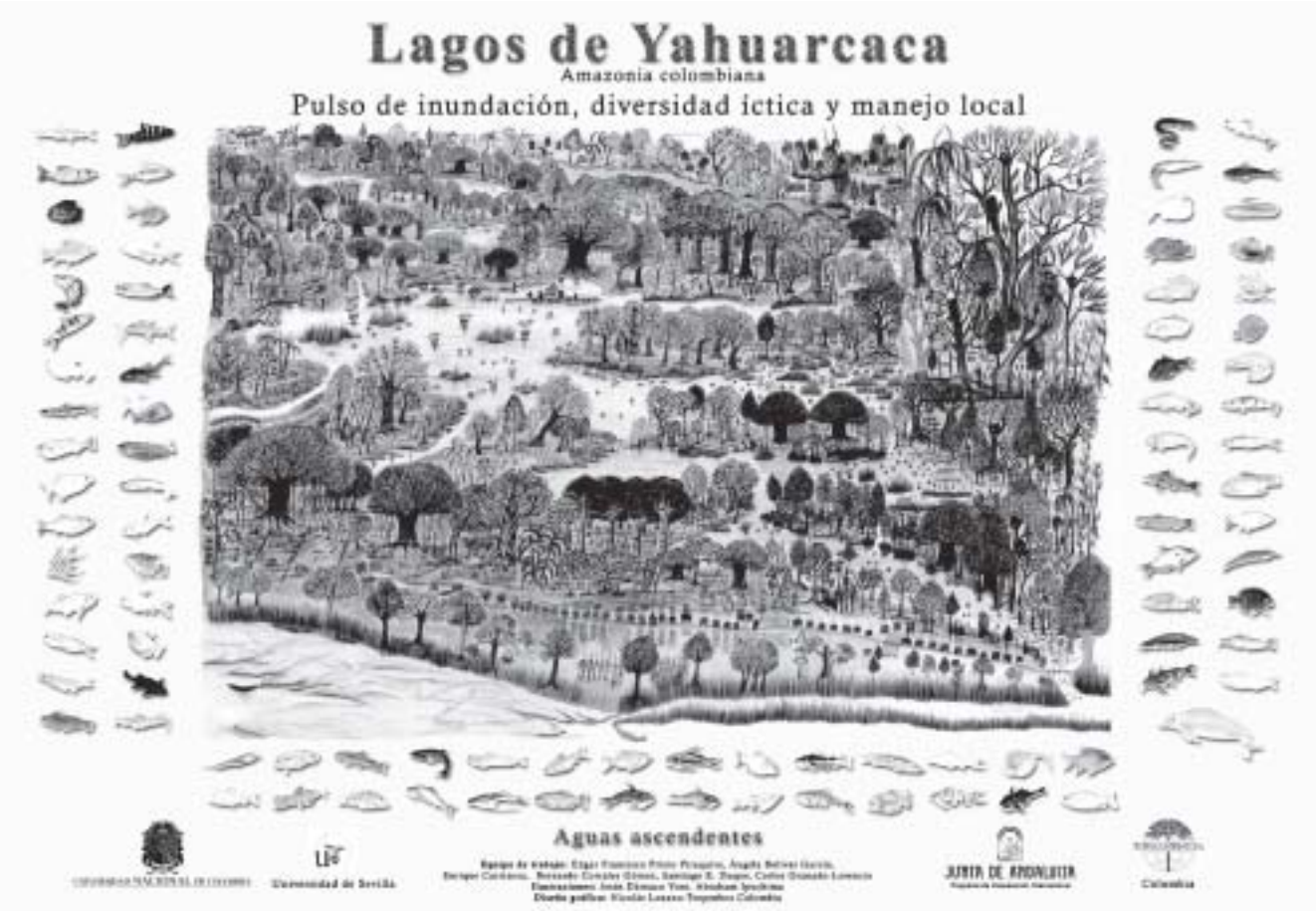
Lagos de Yahuarcaca
Amazonia Colombiana
Pulso de inundación, diversidad íctica y manejo local
Aguas bajas
Universidad de Sevilla
JUNTA DE ANDALUCIA
Colombia


Lagos de Yahuarcaca
Amazonia colombiana
Pulso de inundación, diversidad íctica y manejo local
Aguas ascendentes
Universidad de Sevilla
JUNTA DE ANDALUCIA
Colombia


Lagos de Yahuarcaca
Amazonia Colombiana
Pulso de inundación, diversidad íctica y manejo local
Aguas altas
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Lagos de Yahuarcaca
Amazonia colombiana
Pulso de inundación, diversidad íctica y manejo local
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JUNTA DE ANDALUCIA

PEAT SWAMP FORESTS OF SOUTH-EAST ASIA – DO THEY HAVE A FUTURE?

By Jack Rieley & S.E. Page

It is seven years since research commenced on the EU INCO funded projects on tropical peatlands in Southeast Asia. The first of these EUTROP (Natural Resource Functions, Biodiversity and Sustainable Management of Tropical Peatland) provided baseline scientific and socio-economic data on this important natural resource. This was followed by STRAPEAT (Strategies for Implementing Sustainable Management of Tropical Peatland) that focussed on stakeholder integration and produced vital documentation on 'Wise Use of Tropical Peatland'. These two projects have been completed and succeeded by RESTORPEAT, the key objectives of which are to:

1 Coordinate international activities that address global and regional issues of restoration, carbon balance, water management, biodiversity conservation and poverty alleviation related to sustainable management of tropical peatswamp forest and peatland.
2 Facilitate access to existing knowledge and expertise and conduct targetted research on restoration of tropical peat swamp forest to promote sustainable livelihoods of local people.
3 Provide a scientific and technological framework for knowledge transfer and human capacity development related to restoration of peat swamp forest and tropical peatland to the benefit of the EC and DCs.

As a result of our work to date with 14 partners in the EU and Southeast Asia we now know much about this important but threatened ecosystem. Unfortunately, over the past 15 years, tropical peatlands have become a target for natural resource exploitation and inappropriate, major land use change.

Natural resource functions, products and values

Tropical peatlands are composed of a number of physical, biological and chemical components, including organic soils, water, nutrients and plant and animal species. Processes that operate between and within these components allow peatlands to perform certain functions (e.g. carbon sequestration and storage) and generate products (e.g. forest resources). Tropical peat swamp forests are important habitats for endangered and rare wildlife and reservoirs of specialised biodiversity and genetic resources. Their unique, rainwater-fed hydrology and large water-storage capacity gives them an important role in the water cycle through their detention, retention and supply functions. They are also one of the last remaining wildernesses on this planet.

Biodiversity and Forest Resources

Several studies have highlighted the role that tropical peat swamp forests play in providing habitats for endangered, threatened and vulnerable species of plants, birds, fish, invertebrates, mammals and reptiles. Of particular conservation importance is the large population of orang utan (*Pongo pygmaeus*) within the peat swamp forests of Kalimantan. Peat swamp forests yield many important products such as timber and bark and secondary, non-timber products.

Hydrology
In tropical, ombrogenous peatlands, as in boreal and temperate bogs, there is a perched, often domed, rainwater-fed water table that remains close to the surface throughout the year. The surface peat layer (acrotelm) has an oscillating water table and a high hydraulic conductivity that facilitates rapid sub-surface flow towards the edge of the dome. The bulk of a tropical peat deposit (the catotelm) has more or less constant water content, a considerably lower hydraulic conductivity and, because of the large volume of many tropical peatlands, a very substantial water storage capacity.

Carbon
Tropical peatlands are one of the largest carbon stores on this planet. Once disturbed and drained, some of this carbon is released to the atmosphere as carbon dioxide, which contributes to the greenhouse effect. If maintained in their natural state, the peat swamps of Southeast Asia would continue to act as carbon sinks. The carbon accumulation rate of tropical peat exceeds the range of values attributed to temperate and boreal peats by a factor of between 3 and 6, indicating that tropical peatlands have played a more important role in this respect than is indicated by their area.

Livelihoods of local people
Peat swamp forest in Central Kalimantan (Indonesian Borneo) has been used by indigenous peoples for generations to satisfy some of their subsistence requirements. This has included gathering food, timber, firewood and medicinal plants, hunting, fishing, and shifting agriculture. In recent times some of these have become important as major sources of cash income to satisfy the market economy requirements of both indigenous and migrant communities. This increased and continuous utilisation is threatening the very existence of the natural resources of the peat swamp forests.

Sector uses and impacts

Agriculture
Large areas of tropical peatlands have been converted to agriculture, following forest clearance and drainage. Agricultural development of thicker tropical peats, beyond tidal influence, has been largely ineffective, mostly because planners consider peatlands to be just another type of land and do not to take into account the special physical and chemical properties of the peat soils. One of the largest projects to attempt to convert tropical peatland to agricultural use was the one million hectare Mega Rice Project in Central Kalimantan, which was brought to an early close in 1998, following a series of difficulties, not the least of which was the failure to produce a rice crop on the acidic, nutrient-deficient peat soils.

Forestry and illegal logging
Peat swamp forests with their valuable trees have been subjected to timber and non-timber exploitation. As species regeneration in peat swamp forest is slower than in other forest types, both legal (controlled) and illegal (uncontrolled) logging practices have had considerable impacts on both peat swamp forests and the peatland environment. In Indonesia, illegal logging threatens the integrity and long-term hydrological stability of the peat swamp forest ecosystem since timber extraction is largely by narrow, shallow canals that are dug into the peat. Law enforcement efforts are weak and sporadic at best and

government policy is ineffective.

Land use change
Peatland drainage can have a serious impact on water availability and quality. The Mega Rice Project, for example, led to severe water shortage in the dry season and flooding in the wet season, while the water in some of the channels became very acidic and therefore unsuitable for domestic and agricultural use.

Fire
Tropical peat swamp forest resources and natural functions are being damaged severely by fire and may be destroyed forever with potentially devastating consequences locally, regionally and globally. The failed Mega Rice Project disrupted the peat swamp forest ecosystem over an area of at least one million hectares and it became fire prone. Eighty per cent of this landscape burned in 1997 releasing about 0.15 billion tonnes of carbon to the atmosphere while peatland fires throughout Indonesia as a whole liberated 1-2.5 billion tonnes of carbon equal to 15-40% of the annual global carbon emissions from the burning of fossil fuels.

Global Implications

Contribution of Peatlands to Climate Change
The contribution of tropical peatlands to climate change comes about as a result of emission of several greenhouse gases, especially carbon dioxide and methane. These gases are released by natural peatlands but the amount is increased greatly when they are damaged or degraded. If the surface dries out for part or all of the year, or is subjected to drainage and/or cultivation, the peatland undergoes aerobic oxidation at its surface with release of carbon dioxide as a result of decomposition.

Impact of Climate Change on Peatlands
The main impacts of future climate change on tropical peatlands are likely to be through changes in temperature and water resources that could bring about replacement of some of the original peat swamp species by others, leading to alterations in their biodiversity and hydrology. Sea level rise may affect lowland tropical peatlands by replacing coastal freshwater habitats with saline or brackish ones or causing enhanced flooding further inland with the extension of swamp and peatland in the interior. Climate change may also affect the peatland carbon sink and store, although the direction of this change is uncertain owing to various climate related contributory factors, human interference and the number of possible responses.

The future

Unfortunately, Governments of developing countries in the tropics have higher priorities than maintenance of the natural resource functions of peatlands. It is essential, however, that future land use of tropical peatland takes fully into account the principles and practices of sustainable development and incorporates the 'wise use' approach. The wise use of tropical peatlands involves several elements, foremost amongst which is the identification of the benefits and values that these wetlands can provide and the adverse environmental and human consequences resulting from their disturbance. In this way, the role that tropical peatlands play in providing goods and services to society can be assessed properly and the scale and consequences of various impacts forecast.

Multiple resource use, involving stakeholders, is more likely to safeguard the range of functions, attributes and services that forested peatlands can provide to a wide range of users than single sector approaches.

References

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Further information on the outputs of the EU INCO Projects on tropical peatlands of Southeast Asia can be obtained from the following web sites:
- www.geog.nottingham.ac.uk/%7Erieley/eutrop/eutropmain.html
- www.alterra-research.nl/pls/portal30/docs/folder/strapeat/strapeat/default.htm
- www.restorpeat.alterra.wur.nl

WATER MANAGEMENT OF PEATLANDS IN THE AIR HITAM LAUT RIVER BASIN IN INDONESIA

By Henk Wösten

The Air Hitam Laut (meaning *"black water flowing to the sea"*) river located in Jambi province, Sumatra, Indonesia, is a typical river for Southeast Asian lowland peat swamp forests. The river bisects Berbak National Park, which was established as a Ramsar site because it is typical for peat swamp forest habitats in Southeast Asia. In the early 1990s Berbak National Park represented about 30% of the remaining relatively undisturbed peat swamp forest in Sumatra, but over the last decades the area was increasingly affected by fires. In 1981/82 fires in Berbak were concentrated in peat swamp forest areas affected by coastal agricultural encroachments and illegal logging, but in 1992 and 1997/98 fires destroyed over 16 000 ha of primary forest in the core zone of the park. Nowadays, tropical peat swamp forests are under tremendous pressure from agriculture and forestry. Hydrology is a key factor in the ecology of this increasingly threatened habitat, and thus water (and water

management) plays a key role in maintaining its support functions. The hydrology of the Air Hitam Laut river basin was modelled with the existing SIMGRO (SIMulation of GROundwater flow and surface water levels) model. Considerable effort was spent on collecting required input data such as elevation of the river basin (DEM), groundwater levels and rainfall data. The calibrated and validated model was used to evaluate possible consequences of three realistic future scenarios:

1 Expansion of oil palm plantation upstream
2 Expansion of agriculture downstream, and
3 Continuing fire damage.

Scenario 1: Expansion of oil palm plantation upstream

Expansion of oil palm plantations in the upstream area of the Air Hitam Laut river basin is ongoing and may eventually cover the whole area. Under the current plantation practice, oil palm cultivation requires drainage up to 70 cm depth, inducing subsidence of the peat surface. The model predicts that the impact of 50 years of drainage and associated peat subsidence will lower soil elevation inside the plantation by as much as 3-4 meters. Such subsidence will result in reduced water flow towards the Air Hitam Laut River as the gradient towards the river will become too low. As a consequence, the drainage direction in the plantation area will gradually shift from drainage towards the Air Hitam Laut River to drainage to the north towards the lower-lying Kumpeh River. In due course, the whole upstream area may be decoupled from the Air Hitam Laut watershed and become part of the Kumpeh watershed. This would result in much less water for Berbak National Park. Decoupling of the upstream area would also result in much less river water for the downstream coastal agricultural area. Shortage of good quality water will seriously decrease agricultural production in these coastal areas.

Scenario 2: Expansion of agriculture in downstream (coastal) areas

Areas under agricultural use downstream in the Air Hitam Laut river basin are expanding due to population growth in the coastal zone. An average subsidence over the whole area of about 4.5 cm/year would result in a total subsidence of more than 2 meters after 50 years. The mineral subsoil in the agricultural area is found at approximately 3 m above mean sea level. This would mean that peat in the agricultural area would have totally disappeared after 50 years in about 1/3 of the area, whereas 50% would have only a thin layer of peat left. The mineral subsoil is of marine origin and contains pyrite. It is therefore very likely that problems related to the occurrence of these acid sulphate soils, already encountered by the local people, will only increase in the future. Decreased discharge rates of river water caused by expansion of oil palm plantations in the upstream area would also increase the negative effects of salt sea water intruding the coastal agricultural areas. Both effects would make agricultural production in the coastal zone more difficult.

Scenario 3: Continuing fire damage

Fire damage in the Air Hitam Laut watershed is difficult to predict, but whatever fire prevention measures are taken, fires are likely to occur in the future. Photo: M.J. Silvius

To demonstrate the impact of peat fires a new surface map (DEM) was constructed, simulating the situation following the burning of more large areas. To construct this map, areas were selected that had a

groundwater level deeper than 1 m below soil surface during the dry periods in the El Niño year 1997. These areas were considered to be fire-prone and most likely to burn in a future dry year. The assumption was that fires would decrease the surface elevation of the affected areas by 1 meter. Combining these areas with the areas already burnt resulted in a new surface map (DEM). This new DEM was used to calculate groundwater levels and flooding patterns. The impact on the hydrology, and more importantly on the area affected by flooding, showed that especially the deeply flooded areas with more than 1.5 m inundation will increase by almost a factor 5. This would seriously hamper possibilities for restoration of peat swamp forests.

Overall assessment

The many human-induced land use changes observed in the Air Hitam Laut river basin all caused a lowering of groundwater levels due to drainage. The negative consequences included increased soil subsidence and fire susceptibility. Restoration and conservation of peat swamp forests in the Berbak National Park will require restoring the hydrological integrity of the river basin with groundwater levels at or close to the soil surface. Sustainable development of agriculture along the coast requires maintenance of the dynamic hydrological balance of the Air Hitam Laut river basin. The envisaged land-use changes in the upper part of the Air Hitam Laut river basin pose a huge and hitherto unknown threat to the downstream human livelihoods and biodiversity. The hydrological model has helped reveal this threat before it is too late to reverse it. This reversal will require conservation of the peat swamp forests in the upstream area and halting further conversion to agricultural systems requiring drainage. In addition, economic measures to improve the livelihoods of local people and effective law enforcement will be essential for restoration and conservation to be sustainable.

For references and further reading, please visit:
www.waterfoodecosystems.nl or
www.peat-portal.net

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COMMUNITY BASED PLANNING AND ACTION FOR SUSTAINABLE PEAT SWAMP FOREST MANAGEMENT IN INDONESIA

By Jolanda van den Berg

Although local communities may pose a threat to peat swamp forests, they are also dependant on the swamp forest resources for their survival. Therefore, collaborating with local communities can provide an opportunity to learn about swamp forest management.

In 2002-2004 a project was implemented to promote the river basin and ecosystem approach for sustainable management of South-East Asian lowland peat swamp forests. It was conducted as part of the Netherlands' Programme Water for Food and Ecosystems.

The project focused on the Air Hitam Laut river basin located in Jambi province, Sumatra, Indonesia. A large part of the river bisects the Berbak National Park that was established in 1997 to protect the peat swamp forest for its ecological and socio-economic functions, habitat and its biodiversity. Around two thirds of the total area of Berbak National Park consists of peat swamp (fresh water) forest. This type of forest is essential for the survival of local populations because it is a source of many forest products and it regulates flood and flow, preventing salt water intrusion in coastal agricultural areas and supplying fresh water for both domestic use and irrigation. However, the remaining peat swamp forests are threatened by the expansion of agricultural and settlement areas downstream of the Air Hitam Laut river and unsustainable exploitation of both wood and non wood forest resources in Berbak National Park. The article by Wösten (p. 81) describes the hydrological scenario development component of the project, indicating the real threats to people's livelihoods if forest destruction continues. The Agricultural Economics Research Institute of the Netherlands (LEI) and national partner organisations defined and implemented a socio-economic project component to deal with problems of uncontrolled forest exploitation. This component focused on facilitating exchange of lessons learned and best practices on peat swamp forest exploitation for local income and subsistence and on identifying and developing alternative income sources to reduce the pressure on wood and non-wood forest products.

The project organised trainings, workshops and study tours, involving all major stakeholder groups. It conducted community based planning and action research in two pilot villages, to develop options for increased community involvement in the management of Air Hitam Laut river basin and Berbak National Park. Activities focused on identifying and developing non-forest based sources of income, including promoting sustainable farming practices, and on increasing awareness on the importance of peat swamp forest conservation among local communities. Prior to these activities a multidisciplinary team carried out a diagnostic study. By using rural rapid appraisals (RRA) methods, they collected information, identified and became acquainted with the stakeholders and started consultations with these stakeholders. The team consisted of researchers from Jambi University, staff of Berbak National Park, and representatives of pilot village communities

and PINSE (Pinang Sebatang), the partner NGO working in the project area. LEI trained team members in using participatory research tools to initiate the process of diagnostic research.

Community based planning and action in practice

The implementing NGO, PINSE, organised village meetings to discuss the status of peat swamp forest in the region and the constraints to local development. In both pilot villages, PINSE assisted two community groups in preparing local development action plans, overseeing the implementation of activities and negotiating sharing agreements, including defining participating members, responsibilities and tasks. For each village, a community worker was recruited to support these community groups. The project included on-the-job training for community workers and staff members of PINSE in basic concepts of participatory approaches and participatory development planning at the community level.

In both villages, community groups identified and prioritized development opportunities to address their most important problems during a two-day planning workshop. They also developed concrete and realistic plans. At subsequent meetings, the groups reached a consensus, selecting chicken breeding and coconut farming as focal activities. They also developed detailed working schedules. Leaders of the community groups and PINSE staff signed five years agreements on mutual contributions to the implementation of development activities. Working capital to implement these activities was allocated to the community groups under the condition that they would allocate abandoned ('sleeping') agricultural land, 2 hectares per community group, for tree growing activities. The community groups received training on tree growing, seedling preparation and nursery development and management. The participants selected the tree species to be planted through consensus.

The project organised participatory monitoring workshops at the village level, to learn about the problems of community group members related to the implementation of the focal activities and to formulate actions to address these problems. Project work plans and budgets were revised accordingly.

The project also organised study tours for representatives of community groups to raise awareness on threats to peat swamp forests and to demonstrate good practices of peat land management. At the community level, hands-on trainings, for instance on water level management, promoted sustainable farming practices and facilitated exchange of information and experience between community members, project researchers and community organizers. During the workshops, representatives of the villages, researchers, and governmental and nongovernmental representatives discussed negative consequences of current land use and explored future options for sustainable development.

Lessons learned

- Community based planning and action highlighted local livelihood issues and encouraged the participation of local communities in peat swamp forest management. Preliminary observations also indicated that the approach empowered local communities by improving their problem-solving capacity and building knowledge, skills and organisational capacity. However, the

process takes time.

- Working through community groups at the village level offers villagers an opportunity to communicate and learn from each other and from other stakeholders, including project researchers, technical experts, forest officers and NGO field staff. However, understanding the diversity within community groups in terms of gender, ethnicity and access to resources and decision-making is essential for the quality of project outcomes. For instance, landless people have probably not benefited from project activities because land contribution was a principal condition for participating in tree farming activities.
- The experience and capabilities of the community workers have a key influence on the direction and outcomes of the development activities. Careful selection, support and training are thus essential.
- Identification of sustainable alternative income opportunities is easier said than done in a context of poor infrastructure facilities and low agricultural production levels caused by acid sulphate soils. Local communities consider livestock production and tree farming, using species such as Durian (*Durio zibethinus*), Jelutung (Dyera spp./ Dyera consulata), and Pulai (*Alstonia pneumatophora)* as potential alternative income opportunities. Jelutung plantations, which are already commercially managed in the area, require no or minimal drainage and thus offer a key opportunity for achieving environmentally sustainable development.

Future actions

Continued external financial assistance will be needed with an emphasis on trust funds that enable community groups to compete for small grants or micro-credits to implement their own specific development action plans.

Key challenges to the future include:

a Access to markets should be improved. Development of successful marketing strategies and closer partnerships between community groups and commercial companies is important for developing agricultural, horticultural and forest products; this is indispensable for long-term success. Companies should be approached as they have easy access to markets, capital, skills and technologies.

b Enhanced cooperation between local and regional levels and non-governmental and governmental sectors is crucial for empowering communities in decision-making processes. This may be achieved by strengthening existing platforms in the field of water resources management or establishing new ones for integrated resource planning at the river basin level, giving particular attention to the representation of local communities.

For references and further reading, please visit: http://www.waterfoodecosystems.nl

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By Dineke Romeijn

The FAO's Water Resources, Development and Management Service provides a wealth of materials such as databases, training material, software tools, documents and news. **http://www.fao.org/landandwater/aglw/index.stm**

Interesting resources at FAO can also be found at: **http://www.fao.org/ag/agl/aglw/wdeci.stm**

Land-Water Linkages In Rural Watersheds is FAO's programme on hydrological services in watershed management. **http://www.fao.org/ag/agl/watershed/watershed/en/mainen/index.stm** It contains reports and background information on forums and workshops, such as the FAO E-workshop "Land-Water Linkages in Rural Watersheds" (held in 2000).

For the synthesis report of this workshop see: **http://www.fao.org/ag/agl/watershed/watershed/papers/paperewk/pewrken/synthesis.pdf** And for the case studies: **http://www.fao.org/ag/agl/watershed/watershed/en/caseten/indcaten.stm**

"Land Use and Water Resources Research" is a free online journal on the water resource, ecological, economic, climate change, socio-economic, policy and sustainable development issues related to land use. **http://www.luwrr.com/**

Forest Trends, the Katoomba Group and the World Resources Institute have published two papers on innovative financial mechanisms for water services. The first, "Case Studies of Markets and Innovative Financial Mechanisms for Water Services from Forests" (2001) describes nine cases from around the world selected to represent various types of financial mechanisms in various settings.
http://www.forest-trends.org/documents/publications/casesWSofF.pdf

The second, "Developing markets for water services from forests" (2001), examines the cases presented in the first paper and distills common issues and lessons. h**ttp://www.forest-trends.org/documents/publications/Developing_Markets_for_Water_Services.pdf** Both articles have been summarized in a technical forestry brief: h**ttp://www.forest-trends.org/documents/publications/tech_briefs/1watershed.pdf**

The UNESCO water portal offers information on UNESCO water programmes as well a searchable database of water events, links and news. **http://www.unesco.org/water/**

The Convention of the Protection and Use of Transboundary Watercourses and International Lakes (Water Convention) of the United Nations Economic Commission for Europe has a website with much information on past seminars and workshops complete with documents, as well as many other downloadable publications. **http://www.unece.org/env/water/welcome.html** An interesting seminar e.g. is "The role of ecosystems as water suppliers". **http://www.unece.org/env/water/meetings/ecosystem/seminar.htm**

"Developing markets for watershed protection services and improved livelihoods" is a project of the International Institute for Environment and Development (IIED) Forestry and Land Use Programme. The site features project information and downloadable publications.
http://www.iied.org/NR/forestry/projects/

water.html

The International Rainwater Harvesting Alliance (IRHA) was created during the World Summit for Sustainable Development (WSSD) in Johannesburg. Rain is often overlooked as water supply option and it's IRHA's mission to raise awareness on- and stimulate the use of this resource. Their website offers information on activities as well as a full text newsletter.
http://www.irha-h2o.org/

The site of Asian Development Bank has many interesting reviews covering issues such as: water conflicts, water rights, river basin organizations, intregrated water resources management, participation in water management, and water and poverty. **http://www.adb.org/Water/Policy/default.asp**

The US Environmental Protection Agency provides free online training modules in watershed management at:
http://www.epa.gov/watertrain/

The World Resources Institute (WRI) Earth Trends provides access to databases and maps on different subjects such as climate, marine ecosystems, biodiversity, forests and grasslands and water resources.
http://earthtrends.wri.org/

The Development Gateway offers a topic page on water resources management with news, events, publications, projects etc. **http://topics.developmentgateway.org/water**

The International Program of Trees, Water & People focusses on community reforestation, forest conservation, watershed protection and appropriate technologies in Central America.
http://www.treeswaterpeople.org/

"Public-Private Partnerships for Water Supply and Sanitation" is a Swiss initiative to support the Millennium Development Goals. On the website you will find background information on the initiative, electronic versions of the instruments and references to other supportive materials.
http://www.partnershipsforwater.net

Other sites of interest:

- The International Water Management Institute - **http://www.iwmi.cgiar.org**
- UNESCO-IHE Institute for Water Education - **http://www.unesco-ihe.org**
- IDRC, the Canadian International Development Research Centre, has a dossier on Water: Local-Level Management - **http://web.idrc.ca/en/ev-34476-201-1-DO_TOPIC.html**
- The International Land Coalition - **http://www.landcoalition.org/**
- Water for Life is the website of the EU Water Initiative - **http://europa.eu.int/comm/research/water-initiative/index_en.html**
- 4th World Water Forum, Mexico, 2006 - **http://www.worldwaterforum.org**
- World Water Week, Stockholm, August 21-27, 2005 http://www.worldwaterweek.or**g/**
- SIWI : Stockholm International Water Institute especially the downloads & resources center **http://www.siwi.org/**
- The WBCSD's Water Facts and Trends is a brief and informative overview of what's happening to the world water supply - **http://www.wbcsd.org/web/publications/Water_facts_and_trends.pdf**
- ETFRN "Forests and water" topic page **http://www.etfrn.org/etfrn/topics/water/index.html**

AFRICAN FELLOWS PROGRAMME (AFP), ROTHAMSTED INTERNATIONAL

Rothamsted International is a UK non-profit organisation working for sustainable agricultural development in under-developed countries around the World. The aim of the African Fellows programme is to support sustainable agriculture in sub-Saharan Africa by using innovative solutions to achieve food security. Projects should aim to develop lasting partnerships and strategic alliances that will help build local scientific capacity relevant to sustainable agricultural production.

African scientists will carry out research projects in a partner European research institute or university for periods of 4-12 months. Fellowships are awarded on a competitive basis in a two-stage assessment process. Research projects need to: (1) focus on solving an agricultural problem or constraint; (2) demonstrate a clear path from research to application; and (3) benefit African small-holder farmers and the rural economy.

Examples of potential project areas include integrated crop/livestock management, crop nutrition, soil fertility, post-harvest technology and alternative crops. The programme CANNOT support field work in Africa and projects on food processing will NOT be funded. Applicants will have experience appropriate to that of a 'mid-career' scientist. MSc and PhD studies are outside the remit of the programme.

The next deadline for pre-proposal concept notes will be on **3 March 2006**. Please note that Pre-proposals can be submitted at any time and will be considered in the following round of submissions.

Applicants should obtain further details and guidelines from the Rothamsted International website at http://www.rothamsted-international.org/HTML/Fellowships/AFP_main_page.html

If you have any problems in downloading or accessing any of these documents, then E-mail: paresh.shah@bbsrc.ac.uk for assistance.

Contact:
rothamsted.international@bbsrc.ac.uk for further advice and information on how to apply. Or write to:
AFP Coordinator,
Rothamsted International,
Harpenden,
Hertfordshire, AL5 2JQ
UK.

Source: SciDev.Net Weekly Update July 2005.

THE INTERNATIONAL FOUNDATION FOR SCIENCE (IFS): GRANTS FOR YOUNG SCIENTISTS

IFS is a research council with international operations and the mission to build the scientific capacity of developing countries in sciences related to the sustainable management of biological and water resources.IFS believes that the interests of both science and development are best served by promoting and nurturing the research efforts of promising young science graduates, who have the potential to

become leading scientists in their countries. Since 1974, they have provided support to more than 3500 IFS Grantees in some 100 developing countries in Africa, Asia and the Pacific, and Latin America and the Caribbean.

Applications for IFS Research Grants are welcome from young scientists in developing countries to do research on the sustainable management, use or conservation of biological or water resources. This broad statement covers natural science and social science research on agriculture, soils, animal production, food science, forestry, agroforestry, aquatic resources, natural products, water resources, etc.

Applications are accepted all year and are to be made on an IFS Application Form. For more information about eligibility criteria, the application procedure and application forms, please visit the website (www.ifs.se) or contact: International Foundation for Science (IFS), Karlavägen 108, SE-115 26 Stockholm, Sweden.

CPF SOURCEBOOK ON FUNDING FOR SUSTAINABLE FOREST MANAGEMENT

The Collaborative Partnership on Forests has set up the online CPF Sourcebook on Funding for Sustainable Forest Management to help users efficiently locate global funding sources for sustainable forest management projects.

The sourcebook compiles information on funding sources, policies and delivery mechanisms, with particular focus on projects in developing countries. Advice on writing project proposals is presented as well. The contents come from various sources: donor agencies and countries, CPF members, international forest-related organisations and instruments, development banks, private sources, regional processes, foundations and international non-governmental organisations.

A major component of the sourcebook is a database of funding sources, containing information on more than 600 funds: a valuable starting point in the search for funding opportunities. The sourcebook also provides a simple, moderated online discussion forum where users can post queries related to forestry funding, share information, and network with other forest actors.

You can find the sourcebook at: http://www.fao.org/forestry/site/7148/en or you can contact CPF-Sourcebook@fao.org for more information.

TFT JOURDAIN SCHOLARSHIP FUND

The Tropical Forest Trust's goal is to increase the area of sustainably managed forest in the tropics. In 2000, TFT established the Jourdain Scholarship Fund to increase the number of local foresters and policy makers in the tropics who understand the practice of sustainable forest management and who are committed to promoting it in their countries. The Jourdain Scholarship Fund allows tropical foresters to study at leading international

forestry departments, and on other specialist courses.

The fund is open to graduates with a Bachelors or Masters degree in forestry that are a citizen of one of the following countries in Southeast Asia and the Congo Basin Region: Cambodia, Indonesia, Laos, Malaysia, Vietnam, Cameroon, Central African Republic, Democratic Republic of Congo, Gabon, Republic of Congo.

A candidate must have already been accepted on an appropriate Masters program or other course. Appropiate courses are: a) a Masters level forestry course or short-term training course/ workshop; b) courses offered by a department or training centre with recognized expertise; and c) courses that focuses on practical questions of forest management and administration in tropical countries.

For more information and the application form: http://www.tropicalforesttrust.com/home/jourdain.htm Or contact: c.stein@tropicalforesttrust.com

NETHERLANDS COMMITTEE FOR IUCN SMALL GRANTS

The Netherlands Committee for IUCN has small grants available for conservation projects, mainly in the tropics and implemented by NGOs.

The funding programmes are based on the Ecosystem Approach Principles that were accepted by the Convention on Biological Diversity (CBD).

Maximum amount available per project is 85,000 Euro.

Tropical Rainforests Programme (TRP)
The Tropical Rainforest Programme (TRP) supports projects in the field of conservation and sustainable management of tropical rainforests, set up and implemented by non-governmental, local organisations (NGOs). TRP is financed by the Dutch Ministry of Foreign Affairs (DGIS) and contributes to the implementation the Tropical Rainforest Policy of the Dutch government.

More information:
http://www.nciucn.nl/english/funds/trp/english/fswhatistrp+.htm

Purchase of Nature Programme
The Small grants for the Purchase of Nature (SPN) supports local nature conservation organisations and finances strategic purchase of biodiversity in tropical countries. SPN is financed by the Netherlands Postcode Lottery. Deadline each year is August 1.

More information:
http://www.nciucn.nl/english/funds/purchase/engels/fsindexpurchase+.htm

An overview of these and other funds are presented at: http://www.nciucn.nl/english/funds/index.htm

Note that there are no open calls at the moment in any of the funds not mentioned here. There may be more funding opportunities later in 2006.

JOHN ASPINALL FOUNDATION - COORDINATOR PROJET LESIO-LOUNA, CONGO

The John Aspinall Foundation has been working with national partners in the Republic of Congo since 1986 for the conservation of the western gorilla in particular, and of other endangered species in general.

JAF is seeking a Coordinator Projet Lesio-Louna who will be based in the Lesio-Louna Reserve, Republic of Congo, and in Brazzaville, to co-ordinate the management of the Lesio-Louna Reserve and the south-west Lefini annex, in partnership with the Congolese Reserve Manager and other members of the management team.

Tasks and responsibilities:

- Liaison with Congolese government officials and with the John Aspinall Foundation for the management of the Lesio-Louna Reserve and other JAF activities in Congo.
- Liaison with other NGOs in and out of country.
- Liaison with local communities.
- Responsibility for the welfare of the gorillas under the care of the project.
- Ensuring logistics, administration and purchasing for the project.
- Report and grant writing.

Experience and skills required:

- Fluent in French and English. The ability to speak Lingala would be a bonus but is not essential.
- Extensive overseas experience, and at least 2 years at a management level.
- Work within the non-profit or NGO sector is of particular relevance.
- Experience within the conservation sector would be an advantage but is not essential.
- Ability to negotiate with government officials.
- Computer literate with word and excel fluency the minimum. MapInfo or similar and Access an advantage.
- Fit and healthy and have the ability to withstand high temperatures and humidity.
- ·Ability to work under pressure for long hours in a less than secure environment and to be able to work in isolated areas.
- Leadership skills, but also the ability to be a team member.
- Veterinary or medical background advantageous but not essential.
- Good report writing skills.
- Book keeping or basic accounting and office management skills.

Conditions: Salary will be negotiated with relevant skills and experience being taken into account One round-trip ticket back home provided per year BUPA medical insurance provided 70,000 FCFA in country weekly food allowance.

For applications contact:
Amos Courage
Port Lympne
CT21 4PD, Hythe
UK
E-mail: amosc@howletts.net

There is no deadline for applications, vacancy remains open until fulfilled.

HYDROLOGICAL SCIENCES FOR MANAGING WATER RESOURCES IN THE ASIAN DEVELOPING WORLD (International Conference)

An International Conference on "**Hydrological Sciences for Managing Water Resources in the Asian Developing world"** will take place in Guangzhou (China) between 8-10 June 2006. The meeting is organised, amongst others, by the Department of Water Resources & Environment of Zhongshan University. The conference will focus on: (1) Hydrological science and engineering for solving water problems; (2) Management of water environment; (3) Sustainable water resources management. A few of the themes that will be discussed are: floods and other water-related hazards; human induced hydrological alternations; hydrological impacts of climate change; integrated watershed management; and water management experiences of developing and developed countries.

Please see the website for further details:**http://cwre.zsu.edu.cn/mwra/**
Or contact: Dr. TAO Jiang (eesjt@zsu.edu.cn) and Ms. YANG Yin (yangying300@sina.com).

Department of Water Resources Environment
Zhongshan University
Guangzhou 510275
P. R. China
Phone: +86 20 8411 5902 (or 5903)
Fax: +86 20 8411 4575

With thanks to Nick Chappell (Lancaster University, UK)

FOREST AND WATER IN A CHANGING ENVIRONMENT (International Conference)

An international conference on "**Forest and Water in a Changing Environment**" will take place in Beijing, China, between 8-10 August 2006. The meeting is sponsored and organised by the Chinese Academy of Forestry, Beijing Forestry University and USDA Forest Service (Southern Research Station).

The following themes will be discussed: (1) basic and integrated forest hydrologic processes; (2) global change impacts on eco-hydrology from the local to regional scale; (3) scaling eco-hydrology using remote sensing, GIS and modelling; and (4) watershed restoration effects on water quality and quantity.

Please follow the link below for more information and registration: **http://www.caf.ac.cn/fwce/fwce_e.cfm**

(With thanks to Nick Chappell)

UNDP WATER GOVERNANCE FACILITY AT SIWI

The United Nations Development Programme (UNDP) in collaboration with Stockholm International Water Institute (SIWI) is launching a new programme – The UNDP Water Governance Facility at SIWI (WGF) - to support developing countries to improve water governance.

"Prudent water management is crucial for reaching national development objectives and for improving the livelihoods of poor people," says Mr. Håkan Tropp, Project Director for the UNDP Water Governance Facility at SIWI. "*It is also a vital component of actions to improve environmental sustainability, by maintaining the integrity of ecosystems, and by bringing together stakeholders around a key resource that could either unite or divide societies."*

For individuals and organisations from governments, civil society and other stakeholders working with water governance related work in developing countries, the UNDP Water Governance Facility at SIWI will provide strategic support for:

- Improved water governance to advance socially equitable, environmentally sustainable and economically efficient management of water resources, including water and sanitation services;
- Implementation of integrated water resources management (IWRM) at local, national, and regional levels; and
- Achieving the MDGs and the WSSD targets for water supply and sanitation.

For more information and to access the services of the UNDP Water Governance Facility at SIWI, please visit their website (**www.watergovernance.org)** or contact:

Håkan Tropp
Project Director, SIWI
Hantverkargatan 5
SE-112 21 Stockholm
Sweden

Phone: +46 8 522 139 74
Fax: +46 8 522 139 61
E-mail: watergovernance@siwi.org

Joakim Harlin
Water Resources Specialist, EEG,BDP
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304 East 45th Street, 9th Floor
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USA
Phone : +1 (212) 906-5863
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E-mail: joakim.harlin@undp.org

BAMBOO TOUR INTEREST

In May 2005, INBAR organised a successful Bamboo Tour in Zhejiang, in collaboration with ICRAF (**http://218.249.14.230/news.asp?vpid=15)**. The succes of the tour resulted in an invitation for INBAR to conduct a feasibility study on bamboo development for East African countries.The Bamboo tour also introduced bamboo products and processing machines to participants, including several companies.

As INBAR frequently receives individual requests to visit the bamboo sector in China, they are considering another tour in April-May 2006: these months are the best time to see bamboo shooting. Therefore INBAR would like to have an indication of the number of people interested in participating. If you are interested, please contact Fu Jinhe at **jfu@inbar.int**. If there are enough participants, INBAR will organise the tour. Please note that all particpants should cover their own costs.

Depending on the participants interests, topics to be covered may include:
Bamboo weaving and handicrafts, Bamboo

charcoal, Bamboo flooring, bamboo-based panel, concrete form, Bamboo curtain, mat, rug, Bamboo shoot processing, Bamboo products and market, Bamboo plantation, Bamboo botanic garden, Bamboo for landscape, Bamboo museum, and Bamboo and giant panda habitat.

ICUC MOVES TO SRI LANKA

The International Center for Underutilized Crops (ICUC) and the International Water Management Institute (IWMI) are pleased to announce the relocation of ICUC's Headquarters from the United Kingdom to Sri Lanka, last April, 2005. The ICUC is now co-located and hosted by IWMI at its Headquarters in Colombo, Sri Lanka.

Established in 1992, the International Center for Underutilized Crops (ICUC) is an autonomous, nonprofit, scientific research and training center. The Center focuses on increasing the use of underutilized crops for food, medicinal and industrial products, and also for environmental conservation. It provides expertise and acts as a collaborative institute for tropical, sub-tropical and temperate crop development. The ICUC operates through regional offices and works in close collaboration with national partners for sustainable technology development for products and marketing of underutilized crops.

The ICUC and IWMI will develop a partnership of mutual cooperation. The global program of ICUC will continue to be run through its existing network in Africa, Asia, Europe and Latin America.

For more information on the ICUC Program, please contact Dr. Hannah Jaenicke, Director of ICUC at h.jaenicke@cgiar.org or visit the ICUC web site: **www.icuc-iwmi.org/**

International Centre for Underutilised Crops (ICUC)
PO Box 2075, Colombo
Sri Lanka
Phone: +94 -11 2787404
Fax: +94 - 11 2786854
E-mail: icuc-iwmi@cgiar.org

ISNAR MOVES TO IFPRI

The International Service for National Agricultural Research (ISNAR) ceased its operations in The Hague, the Netherlands on March 31, 2004. The ISNAR Division at IFPRI, based in Addis Ababa, incorporates some of the research responsibilities of the former ISNAR. Research activities are based on three broad strategic themes: (1) Institutional Change and Innovation Systems, (2) Organization and Management of Agricultural Research, and (3) Agricultural Science and Technology Policy.

Research involving a range of disciplines is envisaged on these themes, in collaboration with stakeholders and partners. This will include case studies, action research and syntheses that will distill lessons for adding value to the training and capacity building activities of the ISNAR Division. The division will continue to provide support to NARS and other agricultural R&D institutions.

More information about ISNAR Division

activities can be found in the ISNAR brochure, which can be downloaded from the website: **http://www.ifpri.org/divs/isnar.htm**. The website also links to ISNAR Outputs and to the Learning and Capacity Strengthening Program, which is managed by ISNAR.

For additional information, contact:
Wilberforce Kisamba- Mugerwa
Director, ISNAR Division
w.kisamba-mugerwa@cgiar.org

ISNAR Division
IFPFI
P.O. Box 5689
Addis Ababa, Ethiopia
Phone: +251-1-46 32 15
Fax: +251-1-46 29 27
Email: ifpri-isnar@cgiar.org

Website: **www.ifpri.org/divs/isnar.htm**

For activities prior to April 2004, please visit ISNAR's archived website at **www.isnar.cgiar.org/index1.htm**

CMAD: Centre for Mountainous Areas Development

The Centre for Mountainous Areas Development (CMAD) is a recently founded NGO located in central China.

CMAD aims to develop activities to alleviate poverty in mountainous areas. Using participatory methods, the organisation explores ways to develop the economy and improve income of the poor. Furthermore, CMAD works towards improving the overall functions and economic benefit of land resources, as well as developing an ecologically sound and sustainable natural resource management system. In these activities, the protection of ethnic minorities' cultural heritage and cultural diversity are respected. Watershed management, rehabilitation of mountainous areas, and exploring compensation mechanism for watershed functions are also part of their agenda. If you would like to know more about CMAD, or would like to co-operate with them, please contact Li Weichang (Director) or Zhang Wanhua (Deputy Director).

(CMAD Headquarter)
Zhang Wanhua, Deputy Director
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Hefeng County, Hubei Province, 445800
P. R. China
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Fax: +86-718-5282423
E-mail: hbcmad@tom.com

(CMAD Beijing Office)
Li Weichang, Director
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WOCAN: Women Organizing for Change in Agriculture & NRM

A new global network WOCAN has been formed for women professionals working in agriculture and natural resource management to build an alliance of women (and men who support them) to support a process of change for gender equality in

programs of governments, national and international agencies. A fundamental principle of this network is that organizations themselves need to become gender sensitive in order to promote sustainable development for rural communities.

Since the WOCAN's call for members on January 1, 2005, over 260 women and men of 73 countries have applied, with the numbers increasing daily. Of those accepted, 67 members are from Africa, 75 are from Asia, 5 are from the Pacific region, 15 from Latin America, 9 from the Middle East, 27 from Europe, 40 from North America, and 14 from international organizations.

Members have offered their voluntary contributions as trainers, consultants, researchers, fund raisers, proposal writers, hosts for meetings, time to act as focal points, sources of expertise on gender relations in their countries, etc.
If you qualify for membership, agree with our Guiding Principles, and would like to join us, please fill out the application form on our website: **www.wocan.org.**

Jeannette D. Gurung, PhD,
Director, WOCAN
jeannettegurung@wocan.org;
jeannettegurung@yahoo.com

DISCCRS: Climate change network for recent PHD graduates

The **DIS**sertations initiative for the advancement of **C**limate **C**hange **R**e**S**earch (DISCCRS) provides interdisciplinary training for recent Ph.D. graduates addressing climate change and its impacts.

DISCCRS (pronounced "discourse") was founded in 2002 to meet the specific challenges involved in building successful interdisciplinary careers dedicated to understanding climate change and mitigating impacts. New PhD scholars from the natural and social sciences, humanities, mathematics, engineering and other fields may participate. Graduates from all countries are invited to join the DISCCRS Program and apply to be a DISCCRS Symposium Fellow.

DISCCRS manages a public web page to introduce graduates to the larger community and to provide resources for early-career development. The website includes information on information on DISCCRS symposia, dissertation abstracts of registered graduates, and career-development resources.
Everyone who has registered their PhD dissertation with DISCCRS, receives the Electronic Newsletter weekly. The newsletter contains: updates on climate-change research; education and policy updates; forum section; and job and other announcements of opportunities. The newsletter is archived on the web page for public use.

Furthermore, DISCCRS organises symposia to bring together recent Ph.D. graduates across the spectrum of natural and social sciences, humanities, mathematics and engineering. The goal is to help new professionals meet the specific challenges involved in building successful interdisciplinary careers dedicated to understanding climate change and mitigating impacts.

Please visit the web site for more information at: **http://aslo.org/phd.html**
Or contact:
C. Susan Weiler
Whitman College
Walla Walla, WA 99362
USA

Phone: +1 509-527-5948
Fax: +1 509-527-5961
E-Mail: disccrs@whitman.edu

CCB STANDARDS LAUNCHED

The Climate, Community and Biodiversity Project Design Standards (CCB Standards) were launched at the Carbon Expo by the Climate, Community and Biodiversity Alliance (CCBA) in May 2005. The CCBA is a global alliance of leading NGOs, research institutions and companies, promoting integrated solutions to land management. The CCBA has spearheaded the development of triple-benefit voluntary standards to identify land management projects that simultaneously minimize climate change, support sustainable development and combat the loss of biodiversity.

The CCB Standards evaluate land-based carbon mitigation projects in the early stages of development, and foster the integration of best-practice and multiple-benefit approaches into project design. The Standards: (a) Identify projects that simultaneously address climate change, support local communities and conserve biodiversity, (b) Promote excellence and innovation in project design; and (c) Mitigate risk for investors and increase funding opportunities for project developers.

The CCB Standards will be beneficial to Project Developers, Project Investors and Governments. The Chinese State Forestry Administration, for example, announced in May 2005, that it will use the CCB Standards to guide the development of new CDM forestry projects in the Yunnan and Sichuan provinces.

For more information or to download a copy of the Standards, visit: **www.climate-standards.org**

John O. Niles
Project Manager, CCBA
C/O Center for Environmental Leadership in Business
1919 M St, NW, Suite 600
Washington DC 20036
USA

Phone: 1-202-912-1438
Fax: 1-202-912-1047
Email: info@climate-standards.org

Source: Climate Change Info Mailing List (19 May 2005); http://www.iisd.ca/email/climate-L.htm

GLOBAL DEVELOPMENT NETWORK (GDN) JOURNAL SERVICES

Free Journal Access Portal
GDN has teamed up with Project MUSE, one of the academic community's primary electronic journals resources, to relaunch the GDN Journal Access Portal. This portal enables social science researchers based in developing or transitional countries to access a full-text online database of more than 120 well-known social-science

journals, free of charge.

Eligible GDN-registered researchers can download full-text articles at no cost to themselves or their institution through the GDN Journals Access Portal. Journals in the collection include Demography, World Politics, The Journal of Democracy, Anthropological Quarterly, Technology and Culture, and several regional-studies journals.

The service is only available to GDN organisation contacts in developing and transition countries. This service is provided to research institutes and not individual researchers.

Further details of journals services, eligibility and how to register are given on the website: **www.gdnet.org/online_services/journals/**
And: **www.gdnet.org/online _services/journals/gdn_journal_services/journal_access_portal/**

GDN/BLDS Document Delivery Service
The Global Development Network (GDN) and the British Library of Development Studies (BLDS) have teamed up to offer a **Document Delivery Service** to meet the information needs of research institutes in the South.

The GDN/BLDS Document Delivery Service allows you to search the huge BLDS online catalogue of development related resources from your desktop, then request copies of articles you and your research colleagues need at the click of a button. A 'real-life' BLDS librarian will receive your request, then photocopy or scan the article or book chapter you need and will send it to you via post or email. The costs of delivering the documents are covered by GDN so you there are no costs to you.

BLDS holds Europe's largest research collection on economic and social change in developing countries. It has over 1000 journals, 4000 serials and over 80,000 monographs concerned specifically with development. A particular strength of the BLDS collection is its extensive coverage of Southern publications, particularly from Africa and South and East Asia. The collection represents a unique source of primary information, including grey literature, much of which is not digitally available.

Find out more and sign up for this service at **www.gdnet.org/online_services/journals/journal_services/document_delivery/**

QUEEN'S AWARD FOR FORESTRY

The winner of the Queen's Award for Forestry 2005 is Dr Bentval Ravindra Prabhu of CIFOR, Zimbabwe. Dr Ravi Prabhu was presented with Award by Her Majesty Queen Elizabeth II last February. The Queen's Award for Forestry is presented every four years to an individual who has made an outstanding contribution to understanding forests and their management.

Dr. Ravi Prabhu's contributions to work on the Criteria and Indicators of Sustainable Forest Management were outstanding. He has also been a pioneering champion of moving from a rule based approach of forest management to an adaptive approach,

where forest management changes over time as the objectives, context, and condition of the forest change. Dr. Prabhu has a firm commitment to and belief in transforming public sector forestry institutions into more dynamic, transparent and accountable, learning–based organisations.

Well known in international circles, he was appointed to be a member of the task force on environmental sustainable of the United Nation's Millennium Project, established by Koffi Annan and led by Jeffrey Sachs. Although he has worked with industrial forestry, community forestry, and government bureaucracies, he is at his best when he works on how to bring these different groups together. He is truly creative and is always looking for new 'out of the box' ways to do things, which often prove successful.

Dr. Prabhu has spent most of the last ten years at the Center for International Forestry Research (CIFOR), where he is widely acknowledged to be one of the Center's leading figures.

For further details contact cfa@cfa-international.org or call 01865 820935

Source: Commonwealth Forestry Association (CFA): press release

Permanent forest plots: CTFS-AA new site for Asia program

CTFS-AA "Tropical Forests of Asia: A Gateway to Forest Science", **www.ctfs-aa.org** was launched in January 2004 by the Centre for Tropical Forest Science (CTFS)-Arnold Arboretum Asia Program.

CTFS works with national partners all over the tropical world to build, maintain and analyze large-scale permanent forest plots. Within each plot, every tree over one centimeter in diameter is identified according to species and monitored through time. CTFS is now monitoring more than 3 million trees of 6000 species, at least 10% of all known tropical tree species. **CTFS-AA** focuses on the plots in Asia and is co-sponsored by the Arnold Arboretum of Harvard University. CTFS-AA has a regional base at the National Institute of Education (Nanyang Technological University) in Singapore.

The website will contain information about the permanent plots in Asia, including background information on the Forest Reserve: history, lists of tree species and bird species. One of the highlights of the website will be a regional flora of South and Southeast Asia containing a searchable database of plant descriptions, images, and maps. Other website features will include a publication list and people database. As the web site is still being developed, not all the options are available yet.

Web address: www.cfss-aa.org

AJOL: African Journals OnLine

AJOL, the African Journals OnLine (**www.ajol.info**) has moved to African management. The National Inquiry Services Centre (NISC) South Africa has taken over the management of African Journals OnLine. Launched in 1998, the online aggregation of published African academic research was previously run by the International Network for the Availability of Scientific Publications (INASP) in the United Kingdom.

The website gives access to more than 200 scholarly journals published out of Africa, and includes over 15,000 articles. AJOL provides information about each participating journal, including aims and scope, contact details and general information. It also includes Tables of Contents and abstracts (where available), as well some full-text articles for all participating journals.

For more information, please contact: Margaret Crampton (info@nisc.co.za)

AJOL
19 Worcester St, PO Box 377
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South Africa

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Fax: +27 46 622 9550
E-mail: info@ajol.info
Website: http: www.ajol.info

EC Access and Benefit Sharing Portal

The European Commission Environment Directorate General is funding the project: "*Development of the Access and Benefit Sharing (ABS) Section of the EC Biodiversity Clearing House*", implemented by the International Union for the Conservation of Nature (IUCN). The project aims to improve the flows of information and to facilitate discussions on the use of genetic resources among stakeholders in the European Union

One of this project's outputs is the establishment of a web-based platform containing pertinent information on ABS in the European Union, such as legislation, policies, best practices, voluntary instruments, etc. Moreover, the web-based platform (the "EC ABS Portal") will host a discussion forum where members can exchange views and experiences on various issues related to the use of genetic resources.

The aim of this portal is to help the EC achieve the objectives of the Convention on Biological Diversity, especially the Bonn Guidelines adopted at the 6th Conference of the Parties in The Hague in 2002. It provides access to up-to-date information on EC policy and legislative measures related to ABS as well as links to web pages of international organizations active in this field. Furthermore, it includes details of contact points in all the Member States of the European Union and links to information on ABS in the Member States. Stakeholder profiles will be added in the near future, to

allow visitors to assess if and how ABS issues would be of interest to them. It is envisaged that a number of European stakeholders will register on this portal and post their policies, codes of conduct, and other relevant documents which relate to ABS. The portal aims to raise awareness and to allow stakeholders to present their work in this field.

For more information and to become a member, please visit the website: **http://abs.eea.eu.int/**

CTA BRUSSELS WEBLOG

The Brussels office of the **Technical Centre for Agricultural and Rural Cooperation (CTA)** now produces an online daily news bulletin in French and English to keep CTA staff and ACP- EU officials informed on the key issues discussed and decided within the ACP-EU arena: **http://brussels.cta.int**

The objective of the CTA Brussels Weblog is to share the information produced by CTA Brussels as well as information from other groups on agricultural and rural development with a wider audience, specially focusing on the ACP partners and beneficiaries of CTA's services and programmes.

The weblog is divided into three parts: (1) a "News" section, updated daily; (2) "Resources" section which include information on the EU, the ACP group, joint ACP-EU bodies and other organisations. This section also contains a calendar of events in Brussels; and (3) the programmes and activities organised by the CTA Brussels office with the respective documents.

Finally, there is also a possibility of a weekly Email alert by subscribing online. We welcome any contributions in form of comments, new information to be added or ideas on how to improve this weblog.

Contact:
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Head, Brussels Branch Office CTA
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B-1000 Brussels
Belgium

Phone: + 32-2- 513 74 362
Fax + 32-2-511 38 68
E-mail: ctabxl@cta.int
Web-site: **http://brussels.cta.int**

CIFOR's MLA website upgraded

The Multidisciplinary Landscape Assessment (MLA) improves our knowledge of biodiversity and what biodiversity means to local people. An MLA approach leads to better informed decisions on policy, land use and payments for biodiversity services.

CIFOR efforts to increase the awareness of the importance of understanding local perceptions of biodiversity in collaborative conservation initiatives have been boosted with a major upgrade to CIFOR's MLA Website. The updated version is available in English, Spanish, French and Indonesian. New features include: an

improved database from Indonesia; downloadable datasets from Bolivia and Cameroon; information on extension materials from Kalimantan, presenting grass-roots perspective of biodiversity; and reports on new projects (Vietnam, the Philippines and Gabon).

MLA Website: **www.cifor.cgiar.org/mla/_ref/home/index.htm**

EASYPoL: on-line resource materials for policy making

EASYPoL is an on-line repository of resource materials for policy making.
EASYPoL materials are developed and maintained by the Agricultural Policy Support Service of the Policy Assistance Division (TCA) of FAO. The purpose of EASYPoL was to facilitate access for different stakeholders to relevant resource materials for capacity building in policy work in agriculture, rural development and food security.

The materials are presented by topic, type and training paths. EASYPoL targets all audiences involved or interested in policy making.

New materials are continuously being developed and added to the existing collection. Please check the EASYPol news page to see the new issues.
We hope you find EASYPol a useful tool. Feedback and comments are welcome and should be addressed to easypol@fao.org.

Website: www.fao.org/tc/easypol/

WETLAND FOR LIFE

Wetland for Life: an online network of naturalists has been launched. Wetlands for life is a forum to bring conservationists, researchers, students, professionals and interested persons together for sharing, discussing and generating ideas, issues and experiences in the natural resource management sector. Please visit **http://groups.yahoo.com/group/wetland for membership.**

Contact person:
Gandhiv Kafle
Institute of Forestry
P. O. Box: 203
Pokhara, Nepal
E-mail: gkafle@hotmail.com

GOOGLE SCHOLAR

Google Scholar enables you to search specifically for scholarly literature, including peer-reviewed papers, theses, books, preprints, abstracts and technical reports from all broad areas of research. Use Google Scholar to find articles from a wide variety of academic publishers, professional societies, preprint repositories and universities, as well as scholarly articles available across the web.

See: **http://scholar.google.com/**

Source: Forest Information Update (FIU)

LIBERIA FOREST INITIATIVE (LFI): NEW WEBSITE

The Liberia Forest Initiative (LFI) is an informal mechanism for coordination of activities amongst several national and multilateral government and non-governmental organisations working on forestry in Liberia. The aim of the LFI is to promote sustainable forest management by: (a) supporting the rehabilitation and reform of Liberia's forestry sector; and (b) enhancing cooperation and coordination of activities in Liberia.

LFI support to Liberian forestry sector reform is organised around three main themes: commercial forestry; community forestry and conservation. In addition, the LFI works on cross-cutting issues, such as: governance and the rule of law; transparency and information management; policy development; legislation; capacity building; and security.

For anyone interested in forestry in Liberia or forestry in post-conflict countries more generally, information and a comprehensive collection of documents can be found on the:

LFI website at: **www.fao.org/forestry/site/lfi.**

With thanks to Adrian Whiteman (FAO) [Adrian.Whiteman@fao.org]

APFORGEN

The Asia Pacific Forest Genetic Resources Programme (APFORGEN) aims to promote more equitable, productive and sustainable management of tropical forest genetic diversity in the member countries in the Asia Pacific region.

The main activities of the Programme are: (1) Promoting the establishment and strengthening of national programmes on forest genetic resources, (2) Locating forest genetic diversity, (3) Developing and applying appropriate conservation methods and strategies, and (4) Increasing the level of management and use of tropical forest genetic diversity in the participating countries.

APFORGEN also facilitates regional activities, including information exchange, development of regional conservation strategies and action plans, country-to-country technology transfer and exchange of forest germplasm. The Programme focuses on priority forest species identified by the participating countries. Lists of priority species may be found on the APFORGEN website: **http://www.apforgen.org**

APFORGEN has currently published nine Priority Species Information Sheets on the website, which can be easily and freely downloaded. The sheets cover the following species: *Acacia mangium, Pinus merkusii, Shorea leprosula, Tectona grandis, Hopea odorata, Azadirachta indica; Pterocarpus indicus; Dalbergia cochinchinensis, and Eusideroxylon zwageri.*

Several publications, Country status reports, regional status reports and the workshop proceedings of the Inception Workshop held from 15-18 July 2003 in Kuala Lumpur can also be downloaded from this site.

Please contact APFORGEN at:

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JOIN THE IUFRO ON-LINE DIRECTORY OF EXPERTS

International forestry faces an over-abundance of definitions and a shortage of clear information about differences in use among languages and regions. The International Union of Forest Research Organizations (IUFRO) has been addressing these issues, as users of scientific and technical vocabulary, e.g., scientists, wood and forestry professionals, students, politicians, journalists, and translators, may benefit from expert assistance on how particular terms and definitions are used locally.

The IUFRO Working Group on "Trends in forest terminology" has developed a Directory of Experts, which includes experts in forest-related fields who are willing to answer terminological questions. This Directory is supported by IUFRO and maintained by the Swiss Federal Institute for Forest, Snow and Landscape Research WSL__**http://hermes.wsl.ch/didado/lterpw.searchfterms**.

If you would like to pose a terminology question to an expert, please visit the IUFRO On-line Directory of Experts at **www.wsl.ch/forest/risks/iufro/**. To join the Directory as an expert, please download the subscription form, fill it out and mail it to the Working Unit coordinator (iufroterm@wsl.ch).

240 experts in forest-related fields have now joined our Directory. Together they represent 42 languages and 395 fields of expertise. The searchable Directory is available via the Web, but the questions and answers are exchanged on a person-to-person basis. Please feel free to use this Directory. Details about languages and fields of expertise are available at: **www.wsl.ch/forest/risks/iufro/directory_update.ehtml**

We will gladly welcome you as a new member of our Directory of Experts. We need experts in all languages and all forest-related disciplines!

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THE GLOBAL FIRE MONITORING CENTRE (GFMC)

The Global Fire Monitoring Centre (GFMC) was designed as an information and monitoring facility, for national and international agencies involved in land-use planning, fire and other disaster management, scientists, and policy makers to utilise in their planning and decision making.

In many ecosystems fire is an essential, accepted and important element in natural ecosystem processes and sustainable and productive traditional land-use systems. However, excessive use leads to ecological destruction. Climate variability adds to the severity of fire impacts. Projected demographic and climate change scenarios suggest that this situation will become more critical during the next decades. The state of fire science in most vegetation types provides sufficient knowledge for decision support at fire policy and management levels. However, in many countries this wealth of knowledge and expertise is either not known or is not readily accessible or available for developing fire policies and management. The GFMC was established to fill this gap.

The GFMC provides a web-based, publicly accessible global portal for wildland fire documentation, information and monitoring. The regularly updated national to global wildland fire products of the GFMC are generated by a worldwide network of cooperating institutions. The online and offline products include:

- Early warning of fire danger and near-real time monitoring of fire events;
- Interpretation, synthesis and archive of global fire information;
- Support to develop long-term strategies or policies for wildland fire management;
- Serving as advisory body to the UN system
- Emergency hotline and liaison capabilities.

The GFMC is an Activity of the UN International Strategy for Disaster Reduction (ISDR). For more information, visit the website.

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EARTHWATCH: Tropical forest research

Results from tropical forest research sponsored by the Earthwatch Institute are now available on the internet. The website: **www.earthwatch.org/results/tropforests.html** gives a concise overview of three decades of Earthwatch results covering themes such as canopy research, forest fragmentation, sustainable forest use, tropical forest restoration, and creatures of the forest. The site also

contains a full list of peer-reviewed publications resulting from tropical forest research supported by Earthwatch Institute. Information on grants for scientists, educators, students and others is also provided.

Earthwatch's mission is to engage people worldwide in scientific field research and education to promote the understanding and action necessary for a sustainable environment. Earthwatch Institute has supported over 100 scientists in the frontiers of tropical forest research, with field grants totalling more than $3.8 million, resulting in more than 200 peer-reviewed publications. In addition, Earthwatch has facilitated more than 5,000 volunteers, including more than 500 teachers, 310 African fellows, and 36 students to conduct forest field research alongside both distinguished and innovative young scientists.

Website: **www.earthwatch.org/results/tropforests.html**

CDM MANUAL FOR PROJECT DEVELOPERS AND POLICY MAKERS - 2005

The "*CDM Manual for Project Developers and Policy Makers - 2005*" is now available on the website of Global Environment Centre Foundation (GEC): **http://gec.jp/gec/gec.nsf/en/Publications-Reports_and_Related_Books-CDM-Manual-2005**

The CDM Manual is the comprehensive guide for the Clean Development Mechanism (CDM), both for Annex 1 countries and non-Annex 1 countries. The CDM Manual includes the CDM-related rules and procedures about Normal Size CDM, Small Scale CDM, and Sink CDM (Afforestation/Reforestation). The first version of the CDM Manual was publicised on the occasion of COP10 held in 2004, in Buenos Aires, Argentine. The 2004 version of the manual is also available online: **http://gec.jp/gec/gec.nsf/en/Publications-Reports_and_Related_Books-CDM-Manual-2004.** The updated 2005 version was released at COP11 and COP/MOP1 in Montreal, Canada, and it reflects the discussion and decisions made by the CDM Executive Board (CDM-EB) between COP10 and CDM-EB20 (July 2005). GEC believes that the updated CDM Manual is useful for a wide range of stakeholders, especially CDM developers and policy makers, to promote further CDM projects.

Another GEC publication is "CDM Methodologies Guidebook" (Naoki Matsuo, 2004) which can be downloaded as pdf file containing the full text (11.6MB) or in parts (chapters: 1 to 5 MB pdf files) URL: **http://gec.jp/gec/gec.nsf/en/Publications-Reports_and_Related_Books-CDM_Meth_Guidebook**

The Guidebook outlines the theoretical basis for CDM Methodologies, discussing issues such as baseline scenarios, main elements of the baseline, the relation between methodology and Project Design Document (PDD), and monitoring methodology, and much more. For those who are dazzled by CDM terms, the terminology pages at the end of the document can be very useful.

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PARTICIPATORY BIOLOGICAL MONITORING

"**Broadening Participation in Biological Monitoring: Guidelines for Scientists and Managers**." by David Pilz, Heidi L. Ballard, Eric T. Jones. (2005)

This publication is one of the outputs of a one year project and is intended to advance participatory biological monitoring in forest management. One of the project's goals was to synthesize the literature and stakeholder knowledge on participatory monitoring and provide a tool (guidelines) that will help forest managers and scientists: 1) broaden participation to meet biological monitoring needs while maintaining scientific standards, and 2) build positive long-term relationships with participants and their local communities. The guidelines are designed as a reference tool to work with any type of project whether bottom-up or top-down, large or small, volunteer or small contractor. While oriented toward natural resource managers and scientists in the U.S., the guidelines may be useful to anyone interested in participatory processes and biological monitoring.

The online version of this publication, published by the Institute for Culture and Ecology (IFCAE), is available at: **www.ifcae.org/projects/ncssf3/welcome.htm.**

ONE PLANET, MANY PEOPLE

UNEP releases Atlas: **"One Planet, Many People: Atlas of our Changing Environment" (2005)**

"A picture is worth a thousand words"
The UNEP Atlas provides visual evidence of environmental changes taking place around the world. This colorful and approachable atlas contains photographs, satellite images, maps and narratives providing insights into the many ways people around the world have changed, and continue to change, the environment.

The United Nations Environment Programme (UNEP), in cooperation with the National Aeronautics and Space Administration (NASA), United States Geological Survey (USGS), and the University of Maryland launched *One Planet, Many People: Atlas of our Changing Environment***,** in celebration of World Environment Day on June 3, 2005.

The focus is on the status and trends over several decades, both in physical and human geography. The 334-page hardbound atlas documents visual evidence of global environmental changes resulting from natural processes and human induced activities, including changes in land use, biological diversity, and climate. The atlas provides, among others, a collection of spectacular "before and after" satellite image pairs on various themes for 80 sites around the world.

You may access the Atlas on line at **http://www.na.unep.net/** . Please note that downloading chapters from the website requires a reliable internet connection and some patience, due to all the satellite images and photographs. But it is worth it: the pictures are impressive!

Paper copies may be purchased from Earthprint at **www.earthprint.com**

UNEP, 2005
Hardback ISBN: 92 807 2571 8
Price: USD 150.00 + shipping costs (20 USD for Europe; 30 USD to the rest of the World)

ID21 NATURAL RESOURCES HIGHLIGHTS

The Natural Resources Highlights is a new publication from id21. id21 is a free service that communicates the latest UK-based international development research to decision-makers and practitioners working in developing countries. It aims to be part of the process of putting international development policy into practice. Id 21 is one of the family of knowledge services from IDS and enabled by the United Kingdom's Department For International Development (DFID).

The Natural Resources Highlights are easy to read, offer practical policy solutions to development problems and direct the reader to the original researchers and research reports. These highlights are produced on six themes: water, forestry, agriculture, rural livelihoods, land and conservation. They will be published once a year. Paper versions are available free to people living in countries or regions with limited internet access. PDF versions are available for free to all users. To access these documents, please visit: **www.livelihoods.org/post/id21-postit.html**

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For more information about id21 services, please visit: **www.id21.org**

Please note that the id21 issue on water includes an article on how protecting forests can improve water management, with reference to payment schemes for environmental services. See: **www.livelihoods.org/post/Docs/id21water.pdf**

The issue of forestry 2005 has several articles on how forestry can reduce poverty, with themes including forest products, forest markets, forest policies and the potential role of environmental services payments.

INFOSYLVA E-BULLETIN.

INFOSYLVA covers forestry news from FAO and the world. It is a new free electronic information service from FAO. Infosylva includes news from FAO as well as links to selected forestry-related news clippings from newspapers and journals published around the world and available online in English, French or Spanish. The aim of this e-bulletin is to keep readers informed of forestry events reported by the media around the world and to encourage discussion. To subscribe, please send an e-mail to **mailserv@mailserv.fao.org,** the subject should be left blank, and the message text should read: subscribe INFOSYLVA-L

RAINFORESTS: A NEW MAGAZINE

Rainforests is a quarterly magazine disseminating information throughout the world in the hope that a greater understanding and appreciation of rainforests will lead to their increased protection. The objective is to help other organisations and individuals raise awareness on rainforests by publicising the work of the many conservation groups throughout the world.

The articles in the magazine pay special attention to the wildlife of the rainforests, and are illustrated with beautiful pictures. The first issue covers topics such as orangutan rehabilitation work, elephant conservation, and birdwatching.

For subscriptions: online at **www.naturalert.org;** or contact:

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FORESTS, WATER AND PEOPLE IN THE HUMID TROPICS: past, present and future hydrological research for integrated land and water management.

M.Bonell and L.A.Bruijnzeel (eds.) 2005

This massive tome (2.8 kg, 275x215x42 mm), resulting from the 2000 UNESCO-IHP and IUFRO workshop in Malaysia, with some added chapters, is an up-to-date, rich compendium of papers: 9 on hydrological processes in undisturbed forests (332 pp); 8 dealing with forest disturbance, conversion and recovery (186 pp); and 8 describing methods for detecting and evaluating effects of land use change (166 pp). In these three technical, central parts of the volume, specialists in a wide range of fields such as hydrology, meteorology, geomorphology, remote sensing, ecology, forestry, land use planning and management, economics and social sciences will find contributions in their own field and in other fields with relevance to theirs – many also providing broader understanding and context for the others.

Current trends and perspectives on people-land use-water issues are discussed in the first 150 pp, and best management practices are discussed and "do not clear" warnings for specific types of natural land cover argued in the last part (69 pp). These first and last parts, about a quarter of the total, are aimed at a wider range of readers and deal with developments, issues, perplexities (such as the economic reasoning–resource conservation conundrum) and solutions in the web of relationships among the land and water, the natural forests and the other, largely human-induced, land cover types, the local people and the people and institutions elsewhere with an interest in the land or decision-making power over it.

A critical note: In part one as well as in the conclusion authors state that the main causes of forest degradation are unplanned: due to the subsistence and energy demands of rural populations, and that the main causes of immediate conversion of forest to other land uses are planned: government-driven programmes to stimulate resettlement, cattle ranching and permanent agriculture and commercial plantations. These statements curiously ignore another major cause of forest degradation or disappearance: the large-scale, often illegal or semi-legal (unauthorized) timber extraction, both selective and clear-felling, that has been taking place in a number of tropical countries with and without government planning or permission.

The extensive (20 pp), thoughtful conclusion largely serves as an executive summary of the whole volume; to do justice to the wealth and variety of information and views a similar length of text would have been needed for a proper review. The core conclusions relevant to local populations and local and national political and economic decision-makers are in the last few pages: outstanding economic and institutional issues and concluding remarks on, inter alia, the prime importance of increasing the involvement of local communities in the entire resource management decision-making process, the proposed establishment of regional (long-term) demonstration forests in which local people would have a major role, the need for in-depth research and long-term monitoring to clarify the widespread and

societally important low-flow problem, and the encouraging spread of a people-centred, bottom-up approach to the process from setting a research agenda to joint field testing and evaluation by the land users.

A reader wishing to follow up some of the abundant references (after each paper) will need a good university or national library, as will the prospective reader without a ready US$ 300 in hand. A low-cost reprint would significantly improve access to this book in many countries. A simple brochure on the basis of the 20-page conclusion might also be useful for a much wider, less technically oriented readership, including decision-makers in national and local government and civil society.

Reviewed by Dr. Robert Brinkman

International hydrology series,
Cambridge U.P. xvii + 925 pp. hb,
ISBN 0521829534. £175 or US$300.

More information available on the Cambridge University web site at:
http://www.cambridge.org/uk/0521829534

Besides a description of the book, the website includes the table of contents and an excerpt containing the introduction.

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FROM THE MOUNTAIN TO THE TAP: how land use and water management can work for the rural poor

Becky Hayward (2005)

"Trees overvalued in water management"

This report is a summary of a series of research projects commissioned by the Tropical Forestry Research Programme (FRP) of the UK Department for International Development (DFID). It presents an overview of research conducted by the Centre for Land Use and Water Resources at the University of Newcastle upon Tyne, and the Free University of Amsterdam with partners in Colombia, Costa Rica, Germany, Grenada, India, South Africa, Sweden, Switzerland, Tanzania, the Netherlands, the UK and the US.

The potential implications of the results from this 4-year multi-country collaboration in Costa Rica, South Africa, Tanzania, Grenada and India are immense as they contradict current tree-planting policies and environmental beliefs. Trees, if planted in water scarce environments, may reduce dry season flows and therefore worsen the living conditions of the poor. The research results point to the need for water managers and policy makers to base decisions on tree planting schemes on scientific evidence appropriate for the site. Unless there is urgent action, the looming water crisis will aggravate, and leave the most vulnerable - the rural and urban poor populations - ever more disadvantaged *(Source: FRP website)*

The booklet is available as hard copy from FRP through Katelijne Rothschild-van Look

(k.rothshild@nrint.co.uk.) and a pdf version can be obtained at the FRP website: http://www.frp.uk.com/assets/Water_book.pdf

For further information on the research, please contact the project lead researchers, Ian Calder (i.r.calder@newcastle.ac.uk), Sampurno Bruijnzeel (sampurno.bruijnzeel@geo.falw.vu.nl) Rob Hope (Robert.hope@newcastle.ac.uk), Ashvin Gosain (gosain@civil.iitd.ernet.in).

More information about the forestry research programme is available at http://www.frp.uk.com

FOREST AND FLOODS: drowning in fiction or thriving on facts?

FAO and CIFOR (2005)

This booklet explores the scientific evidence linking floods and forests. It reveals that much of the public perception on the links between the two cannot be substantiated by science and is often little more than myth or is patently incorrect. *Forests and floods* distinguishes fact from fiction and recommends alternative approaches for effective watershed and floodplain management. In this way, it constructively contributes to the development of sound watershed and river-basin management and improved flood-mitigation policies.

The article by Thomas Enters and Patrick Durst on page 11 refers to this paper.

RAP Publication 2005/3 and Forest Perspectives 2

ISBN 979-3361-64-6
Full text available at:
http://www.cifor.cgiar.org/publications/pdf_files/Books/BCIFOR0501.pdf
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BLUE REVOLUTION: integrated land and water resources management

I.R. Calder (Second edition September 2005)

In the first edition of The Blue Revolution, published in 1999, Ian Calder dispelled much of the mythology that has hindered rational land use and water resource decision-making in the past. The Blue Revolution is an essential guide to recent breakthroughs in water resource management.

The revolution essentially concerns the ongoing major shift in the approaches and objectives in the way land and water are managed. This book discusses new findings on how land use impacts on water resources; new approaches, methods, tools and concepts such as integrated water resources management along with a new policy agenda informing water resource management strategies. This is illustrated

with several case studies, highlighting the complexity of the processes. Therefore, it remains difficult to generalise about the relative impacts of different vegetation types upon the catchment water balance. The book focuses on the role of forests in water management: myths and mother statements about the relation between forests and water are discussed.

This update to the Blue Revolution provides further evidence of the need to integrate land management decision-making into the process of integrated water resources management. It presents the key issues involved in finding the balance between the competing demands for land and water: for food and other forms of economic production, for sustaining livelihoods, and for conservation, amenity, recreation and the requirements of the environment. It also presents means and methodologies to address these issues.

A new chapter, Policies, Power and Perversity, describes the perverse outcomes that can result from present, often myth-based, land and water policies which do not consider these land and water interactions. New research and case studies involving Integrated Land and Water Resources Management concepts are presented for the Panama Canal catchments and in relation to afforestation proposals for the UK Midlands.

Order details:
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Ordering online at:
http://shop.earthscan.co.uk/ : the book is listed under category of water and resources.

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THE ASIA FOREST NETWORK - RECENT PUBLICATIONS

The Asia Forest Network (AFN) is dedicated to supporting the role of communities in protection and sustainable use of Asia's forests. AFN is comprised of a coalition of planners, policy makers, government foresters, scientists, researchers, and NGOs. One of AFN's main activities is facilitating exchange of information through publications.

The Research Network Reports include a series called: **Community Forest Management Trends in Southeast Asia**. This is a regional case study series covering five countries: Philippines, Viet Nam, Cambodia, Indonesia, and Thailand.

Below several recent AFN publications dealing with forests and water issues are presented.

Communities for Watershed Protection-Mae Khan, Thailand
by Chaleo Kanjan & Jessada Kaewchote (2004)

This paper summarizes recent experiences in formally establishing community-based forest management in the Mea Kahan Watershed, Chiangmai. It examines the practices among highland, upland and lowland communities in the Mae Wang sub-watershed. The publication explores how different traditions of resource management could be integrated into emerging local government natural resource management planning strategies. A variety of tools and techniques utilized to facilitate community decisions are described.

Flood Forests, Fish, and Fishing Villages-Tonle Sap, Cambodia
by Kiran Paudyal and Patrick Evans

This study describes the experiences of the Kompong Phluk, a community that has been attempting to protect its flood forests and fishing grounds for the past fifty years. It examines how the community has formalized indigenous resource management systems.

The experiences are summarized by Patrick Evans on page 71.

Communities and Watershed Governance – Visayas, Philippines
by Sylvia Miclat, Rowena Soriaga and Peter Walpole.

A case study of two watersheds in the Visayas provides insights in how upland and coastal communities are interacting with local and national governments to develop their own unique approach to resource use and conservation.

Rowena Soriaga presents a summary of this paper on page 53.

Working paper series

Approaches to Controlling Illegal Forest Activities: Considerations from South East Asia *by Akiko Inoguchi, Rowena Soriaga and Peter Walpole (2005)*

This paper reflects ten years experience working with local people and bureaucracies in South-East Asia. The first section describes illegal forest activities in South-East Asia: the different levels of illegal forest activities; the relation between poverty and illegal forest activities; and conditions invoking illegal forest activities. The second part discusses community forest management as a critical approach to control illegal forest activities. Further tasks that should be addressed to enhance the effectiveness of CFM are identified. The third section criticises illegal logging being blamed for natural disasters such as floods. Although illegal logging should be stopped, this does not prevent such disasters, unless they also address more critical problems what actually causes human disasters.

The paper concludes with discussing the European Union's approaches to address illegal forest issues. The EU policy package includes the "FLEGT Action Plan" and funding guidelines for the "Programme on Tropical Forests and other Forest in Developing Countries. The AFN offers recommendations to close the gaps seen in the current approaches of EU policies towards illegal forest activities and the realities of forests, forest communities and the forest sectors of South-East Asia.

Illegal ogging and disasters (part 3) is also discussed by Peter Walpole on page 14.

Ordering Information:
Publications from the Asia Forest Network can be downloaded at: http://www.asiaforestnetwork.org

For those interested in paper copies, please contact Ms Liezl Samonte-Bunda at the Asia Forest Network.

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WATER: FORESTRY AND LAND USE PERSPECTIVES

N. Abdul Rahim (ed) (2004)

This document contains selected papers from the seminar organised by the Forest Research Institute Malaysia (FRIM), the Regional Humid Tropics Hydrology and Water Resources Centre for Southeast Asia and the Pacific (HTC-Malaysia), and the World Wide Fund for Nature (WWF) – Malaysia. The seminar was held in Kuala Lumpur, Malaysia in March-April 1999.

The first papers present an overview of current and future water needs (Johari & Rusnah); the impact of climatic phenomena on water resources (Lim & Ooi), such as severe drought (Shaaban et al); and outline various issues of mountain hydrology (Bonell). The next four papers discuss the role of trees and forests in more detail: rainfall interception by rainforests (Saberi & Rosnani); sub-canopy rainfall and wet canopy evaporation (Bidin & Chappell); impacts of forestry and land use (Abdul Rahim & Zulkifli); and the runoff of peat swamps forest (Zulkifli et al).

Technical Documents in Hydrology series no 70, published by the International Hydrological Programme (IHP), UNESCO, Paris (115 pages)

The publication is available online:
http://unesdoc.unesco.org/images/0013/001379/137954e.pdf

Due to the limited number of print copies available, we highly recommend online consultation and/or downloading of the publication.

For those with limited internet access, orders for UNESCO/IHP publication titles (non-commercial series only) may be placed through the IHP Documentation Center :

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RIVER RESTORATION IN EAST ASIA

F. Parish, M.B. Mokhtar, A.R Abdullah and O.M.Chew (eds.) 2004

Proceedings of the East Asia Regional Seminar on River Restoration (Kuala Lumpur, 2003) Global Environment Centre & Department of Irrigation and Drainage, Kuala Lumpur, Malaysia. (242 pages)

Poor management of land and water resources in many river basins has led to major floods, water shortages, pollution and loss of biodiversity. Restoration of rivers and associated wetlands and biodiversity in Asia is a relatively new practice and is still in an experimental stage. The Malaysian Government and its partners organised the East Asia Regional Seminar on River Restoration in January 2003 to share experiences and lessons learned on issues and challenges in river management and restoration.

The seminar brought together more than 165 representatives from government agencies, research institutions and NGOs. An important output of this seminar was the 'Kuala Lumpur Statement on River Restoration in East Asia', which was presented at the 3rd World Water Forum in Kyoto, Japan in March 2003.

The proceedings of the seminar include 40 papers covering four main topics: Planning and Management; Restoration Techniques and Experiences; Research and Development and Community Participation. The publication presents experiences with the rehabilitation of river catchments to reduce floods and maintain dry season flows, including reforestation of upper watersheds. It discusses the restoration of reclaimed tropical peat basin as well as restoration of mangrove forests. Prevention of water pollution and methods to improve the water quality are also reviewed. The last eight papers examine the involvement of local communities in river restoration. As Faizal Parish points out in a keynote paper, local people, especially fishing communities are very supportive of rehabilitation projects as they can see direct benefits from improved fish habitat, coastal protection as well as a source of wood products.

The publication can be downloaded from: http://www.riverbasin.org/ev_en.php?ID=3954_201&ID2=DO_TOPICISBN 983-3377-00-9

The proceedings (hard copy and CD-ROM) are available from the Global Environment Centre for US$10.00 (excluding postage).

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Website: www.gecnet.info

MANUAL ON PEAT SWAMP FOREST REHABILITATION AND PLANTING IN THAILAND

David Lee and Tanit Nuyim (2005)

The original version of the manual was written by Mr. Tanit Nuyim from the National Park, Wildlife and Plant Conservation Department (NPWPC). With the collaboration between Global Environment Centre, Wetlands International Thailand, and the NPWPC Department under the joint support from the UNEP-GEF's Integrated Management of Peatlands for Biodiversity and Climate Change project and CIDA funded Climate Change, Forests and Peatlands in Indonesia project, this manual was translated into English and published in May 2005.

The manual starts by giving an overview and scenario of the peat swamp forest in Thailand, including some basic characteristics and features of the peat swamp in the country. Chapter 3 provides a list of plant species that was tested for suitability in peat swamp replanting. This programme was a product of a long research conducted from 1988 to 2002. The manual also describes in detail the steps and methodology for seedling preparation, nursery set up, as well as information on plant growth studies. This book is a useful reference in any future attempts to replant peat swamp forest species.

Web address Peat Portal:
http://www.peat-portal.net/ev_en.php?ID=3640_201&ID2=DO_TOPIC

To request a copy, you should sign up to the peat-portal, and then you can request a copy for free.

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HYDROLOGICAL IMPACTS OF FOREST, AGROFORESTRY AND UPLAND CROPPING AS A BASIS FOR REWARDING ENVIRONMENTAL SERVICE PROVIDERS IN INDONESIA

Fahmuddin Agus, Farida and Meine van Noordwijk (eds) 2004

This publication presents the proceedings of a workshop held in Padang/Singkarak, West Sumatra, Indonesia, during 25-28 February 2004: a workshop involving researchers and policy makers from district, provincial, national and international levels. The chapters are preceded with a reader-friendly executive summary. It revamps some 'myth understanding' of land use changes and hydrological relationships. The chapters include: forest and watershed function relationship; the role of agroforestry in maintenance of hydrological functions; criteria and indicators for evaluating the success of watershed management; farmers' practices worth rewarding; recognizing and rewarding of watershed services; institutional arrangements for

watershed management; and reward mechanisms of environmental services. Results of group discussions are included. The final parts show the picturesque photos of Singkarak and Maninjau lakes and their catchments illustrating an example of the challenges and opportunities to Implement the RUPES Program.

This Proceedings may be downloaded from www.worldagroforestrycentre.org/sea

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World Agroforestry Centre,
ICRAF-SEA, Bogor, Indonesia

PAYMENTS FOR ENVIRONMENTAL SERVICES: SOME NUTS AND BOLTS

Sven Wunder (2005)

Payments for environmental services (PES) are part of a new and more direct conservation paradigm, explicitly recognizing the need to bridge the interests of landowners and outsiders. Theoretical assessments have praised the advantages of PES over traditional conservation approaches. Some pilot PES exist in the tropics, but many field practitioners and prospective service buyers and sellers remain skeptical about the concept. This paper aims to help demystify PES for non-economists, starting with a simple and coherent definition of the term. It then provides practical 'how-to' hints for PES design. It considers the likely niche for PES in the portfolio of conservation approaches. This assessment is based on a literature review, combined with field observations from research in Latin America and Asia. It concludes that service users will continue to drive PES, but their willingness to pay will only rise if schemes can demonstrate clear additionality vis-à-vis carefully established baselines, if trust-building processes with service providers are sustained, and PES recipients' livelihood dynamics are better understood. PES best suits intermediate and/or projected threat scenarios, often in marginal lands with moderate conservation opportunity costs. People facing credible but medium-sized environmental degradation are more likely to become PES recipients than those living in relative harmony with Nature. The choice between PES cash and in-kind payments is highly context-dependent. Poor PES recipients are likely to gain from participation, though their access might be constrained and non-participating landless poor could lose out. PES is a promising conservation approach that can benefit buyers, sellers and improve the resource base, but it is unlikely to completely outstrip other conservation instruments.

CIFOR Occasional paper (24 pages)

http://www.cifor.cgiar.org/scripts/newscripts/publications/detail.asp?pid=1760

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PAYMENT SCHEMES FOR ENVIRONMENTAL SERVICES IN WATERSHEDS

FAO (2004)

This document presents the results of the *Regional Forum on Payment Schemes for Environmental Services in Watersheds* held during the Third Latin American Congress on Watershed Management (Arequipa, Peru 9 -12 June 2003)

Payment schemes for environmental services (PES) are innovative instruments for natural resources management which are increasingly being applied in Latin America. In a watershed context, PES schemes generally involve the implementation of market mechanisms to compensate upstream landowners in order to maintain or modify a particular land use that is affecting the availability and/or quality of the water resources for downstream users. The Regional Forum on Payment Schemes for Environmental Services in Watersheds was held to exchange experiences with these schemes in Latin America and to formulate recommendations for the economic valuation of water-related services, as well as the design and execution of PES schemes in watersheds. This report summarizes the lessons and recommendations of the forum. The complete documentation, including 19 papers, 22 presentations and case studies, is included on the CD-ROM that accompanies this publication.

Regional Forum, 9-12 June 2003
Land and Water discussion paper 3, FAO, Rome 2004

View in HTML: http://www.fao.org/documents/show_cdr.asp?url_file=/docrep/006/y5305b/y5305b01.htm

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Readers from developing countries with limited access to the internet may request a copy of the report free of charge. Please write to land-and-water@fao.org indicating the title of the report and your mailing address.

ELECTRONIC FORUM ON PAYMENT SCHEMES FOR ENVIRONMENTAL SERVICES IN WATERSHEDS

FAO and REDLACH, August 2004

This report is a summary of the discussion at the Electronic Forum on Payment Schemes for Environmental Services in Watersheds, held from 12 April to 21 May 2004. The forum was organised by FAO and the Latin American Network for Technical Cooperation in Watershed Management (REDLACH).

Over the last years, the concept of Payment Schemes for Environmental Services (PES) has received much attention in various Latin American countries as an innovative tool for the financing of sustainable management of land and water resources. FAO and REDLACH have promoted discussion and exchange of experiences on this issue by organizing the Regional Forum on PES at the Third Latin American

Congress on Watershed Management, held in Arequipa, Peru, 2003.

The E-Forum was a follow-up to the Arequipa conference with a view to validate conclusions and recommendations, as well as to compile experiences with design, implementation, and assessment of PES schemes in watersheds in Latin American and the Caribbean. During the 6 week discussion, 215 presentations of 118 professionals from 26 countries were made addressing the following issues: (a) definition and scope of PES in watersheds; (b) design of PES schemes; (c) execution of PES schemes; (d) impacts of PES schemes; (e) PES, sensitization and awareness raising, and (f) PES and legislation.

Besides summarizing the contributions of participants on these issues, this report highlights recommendations to different groups of PES-related actors. Additionally, it presents a list of concrete experiences with PES including contact details and links of pdf reports on these experiences.

For more information visit the website:
Land-Water Linkages in Rural Watersheds: FAO's programme on hydrological services in watershed management
http://www.fao.org/ag/agl/watershed/watershed/en/mainen/index.stm

The report can be downloaded at:
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A KNOWLEDGE AND ASSESSMENT GUIDE TO SUPPORT THE DEVELOPMENT OF PAYMENT ARRANGEMENTS FOR WATERSHED ECOSYSTEM SERVICES (PWES)

Sylvia S. Tognetti, Guillermo F. Mendoza, Bruce Aylward, Douglas Southgate and Luis Garcia (2004).

This Assessment Guide focuses on identification and quantification of watershed services found in a specific context, highlighting Rules-of-Thumb that emerge from a review of research and case studies. Following an overview of existing initiatives, the Guide identifies the kinds of information needed from a site-specific assessment and provides a framework for organizing it in a way that is relevant and useful for decision-making. Special attention is given to estimation of the water-balance, as a basic framework for investigating ecosystem processes that underpin specific services, and for estimating their magnitude and direction. A subsequent section discusses the use of this information to estimate economic significance of these processes, without which they cannot properly be considered "services", and for evaluating trade-offs. This is then placed in the context of institutional challenges, although these are not a key focus of the report. The Rules-of-Thumb are only meant to provide a working hypothesis, and thereby serve as a point of departure for the assessment of payment initiatives. Given the broad range of relevant knowledge and perspectives needed to consider the contribution of watershed processes to human well-being, in a

specific social and economic context, and large spatial and temporal scales making it often difficult to link multiple causes and effects of watershed degradation and thereby identify threats to watershed services, this guide should be regarded as preliminary, to be further developed and improved as lessons are learned from implementation. The Flows Bulletin will supplement the guide by covering special topics in assessment as new information emerges, identifying lessons learned from their implementation, and considering their implications for practice.

Document prepared for the World Bank Environment Department with support from the Bank-Netherlands Watershed Partnership Program, Washington, DC.
To be downloaded from:
http://www.flowsonline.net/data/pes_assmt_guide_en.pdf

LIQUID RELATIONS: CONTESTED WATER RIGHTS AND LEGAL COMPLEXITY

D. Roth, R. Boelens, M. Zwarteveen (eds.)(2005)

Water management plays an increasingly critical role in national and international policy agendas. Growing scarcity, overuse, and pollution, combined with burgeoning demand, have made socio-political and economic conflicts almost unavoidable. Proposals to address water shortages are usually based on two key assumptions: (1) water is a commodity that can be bought and sold and (2) "states," or other centralized entities, should control access to water.

Liquid Relations criticizes these assumptions from a socio-legal perspective. Eleven case studies examine laws, distribution, and irrigation in regions around the world, including the United States, Nepal, Indonesia, Chile, Ecuador, India, and South Africa. In each case, problems are shown to be both ecological and human-made; the locally specific outcomes of social, political, and environmental histories. The essays also consider how gender, ethnicity, and class differences influence water rights and control.

In the concluding chapter, the editors draw on the essays' findings to offer an alternative approach to water rights and water governance issues. By showing how issues like water scarcity and competition are embedded in specific resource use and management histories, this volume highlights the need for analyses and solutions that are context-specific rather than universal.

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NEWSLETTERS

FLOWS

FLOWS: News on payments for watershed functions

This E-bulletin provides a monthly review of issues around the effectiveness of payments for watershed services. Gathering information from different sources, FLOWS gives voice to a range of perspectives and highlights the gaps between theory and practice.

Each issue features: a review of special topics, a resource guide, reader commentary, and announcements of relevant new reports, papers, and upcoming events. Flows is produced by Sylvia S. Tognetti, in collaboration with the International Institute for Environment and Development (IIED), and the World Bank through the Bank-Netherlands Watershed Partnership Program (BNWPP).

To subscribe, please email
join-flows@list.flowsonline.net

For more information visit http://www.flowsonline.net/

PEATMATTERS

Newsletter of the Integrated Management of Peatlands for Biodiversity & Climate Change Project undertaken by Wetlands International and Global Environment Centre

PeatMatters is distributed free to peatland and climate change-related forums, networks, researchers, experts, scientists and interested individuals. To subscribe or receive a free issue, please email to david@genet.po.my or visit http://www.peat-portal.net

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Second Issue Vol. 2 July 2005 (12 pages).
Download at:http://www.riverbasin.org/TEMPLATE/c_21/docs/com_mat/PeatMatters_Vol2.pdf

ASB POLICYBRIEFS NO 07: EMPOWERMENT THROUGH MEASUREMENT.

ASB Policy Brief no 7 is a special issue on tropical forests and water.

ASB Policybriefs is published by the Alternatives to Slash-and-Burn Programme. The series aims to deliver relevant, concise reading to key people whose decisions will make a difference to poverty reduction and environmental protection in the humid tropics.

This issue can de downloaded from: http://www.asb.cgiar.org/PDFwebdocs/PolicyBrief7.pdf

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RUPES NEWSLETTER

RUPES is a Program for developing mechanisms for **R**ewarding the **U**pland **P**oor in Asia for the **E**nvironmental **S**ervices they provide.

The Goal of the RUPES program is to enhance the livelihoods and reduce poverty of the upland poor while supporting environmental conservation on biodiversity protection, watershed management, carbon sequestration and landscape beauty at local and global levels.

The Rupes Program will build working models of best practices for successful environmental transfer agreements adapted to the Asian context. By conducting action research at a number of sites across the region, it will try to get answers to:
a) What are the environmental services?
b) How can they be measured?
c) What mechanisms can be used to anticipate and prepare for changes to environmental services?
d) Who should be rewarded?
e) Who should pay these rewards?
f) In what form should they be collected?
g) What amount or form is appropriate?

The Rupes Project will undertake action research on testing rewards or potential rewards and reward mechanism at a number of sites throughout Asia. RUPES action research sites have been established in Indonesia, the Philippines, and Nepal and will expand to other countries such as southern China, Vietnam, Laos, India, and Sri Lanka.

The RUPES project team also publishes a

newsletter to highlight current activities of the project as well as to report on interesting information on aspects of rewards for environmental services. Besides new achievemnets of the RUPES research sites, the newsletter contains announcements of conferences and workshop in the Asian region that are particularly relevant to RUPES.

For more information on RUPES or if you would like to be involved in the RUPES program please contact:

RUPES program
c/o The World Agroforestry Centre, Southeast Asia Regional Offica
PO Box 161
Bogor, 16001
Indonesia

E-mail: rupes@cgiar.org
www.worldagroforestrycentre.org/sea/Networks/RUPES/Index.htm

THE OVERSTORY

The Overstory edition # 157:
Soil Erosion and Water Infiltration by Rolf Derpsch

In this article Rolf Derpsch discusses the how cultivation methods effects the processes of soil erosion and water infiltration. On sloping land, he points out, inappropriate farming practices cause erosion, not slope of rainfall intensity. He explains how erosion starts with the impact of raindrops on bare soil. Falling raindrops breaks the soil into very fine particles, which clogs soil pores and create a surface seal that impedes water infiltration. Due to surface sealing, only a small portion on rainwater can infiltrate the soil, most of it runs off the soil surface. But when the soil is covered with living plants or plant residues, the plant biomass absorbs the energy of falling raindrops.
Rolf Derpsch is a strong advocate for conservation agriculture, using no-tillage methods, being the most effective strategy to control erosion.

To get a copy of this article, send an email to ov157@agroforestry.net , and you will receive an immediate reply with the Overstory #157.

To download other back issues (1-100) and for subscription information, please visit the Overstory web site at : < http://www.overstory.org >

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DFID/FRP PRUNINGS 2004 Publications on forests and water

"Prunings" from the UK's DFID Forest research programme are a compilation of one-sheet human interest stories or little prunings taken from the project outputs. You may download the 2003 and 2004 versions, each containing 10 prunings from the ETFRN website. Several examples are summarised below.

A brick cannot die!

Researchers from the University of Newcastle, the South African Centre for Science, Industry and Research (CSIR-Environmentek) and the University of Durham have contributed significantly to water allocation reform in South Africa. Through rigorous field studies in South Africa, Grenada and Tanzania, they have come up with reliable, and rather surprising, data. The researchers point out that more water alone does not improve welfare for the poor, although it does improve people's livelihoods in general. Upgrading rural water supplies from groundwater pumps to a communal street tap results in no livelihood improvement. Instead, householders prefer the convenience of a private house tap.

Close collaboration of the research team with officials at the South African Department of Water Affairs and Forestry (DWAF) has helped promote a new perspective on water resource management.

R7937: Catchment management and poverty alleviation: the role of economic instruments and compensation mechanisms in water resource and forest management

DFID/FRP Prunings 2004

For more information about this project contact FRP Senior Administrator, e-mail: k.rothschild@nrint.co.uk, or the Project Leader: Dr Ian Calder, e-mail: i.r.calder@nlc.ac.uk, or Mr. Robert Hope, e-mail: r.hope@ncl.ac.uk

The head in the clouds?

Central America is not a region usually associated with droughts. Yet, in many countries in the region, water supplies are in danger of being depleted, leading to an unreliable supply of electricity through the countries' national grids. This change has come about as cloud forest areas are increasingly converted into agricultural lands for more "economical" enterprises, in particular coffee plantations or pasture for cattle.

A research team led by Amsterdam's Free University in close collaboration with King's College London and various institutions in Costa Rica is using advance technology to measure differences in the levels of water flowing from forested and deforested areas and develop a prediction model. "Cloud catchers" are installed in high up canopy towers, together with rain and stream water level gauges and computer equipment on the ground.

R7991: Hydrological impacts of converting tropical montane cloud

DFID/FRP Prunings 2004

For more information about this project contact FRP Senior Administrator, e-mail: k.rothschild@nrint.co.uk, or the Project Leader: Dr Sampurno Bruijnzeel, e-mail: sampurno.bruijnzeel@geo.falw.vu.nl

Vote for water!

Researchers from Newcastle University and the Indian Institute of Technology in Delhi are studying the effects of trees on water in Himachal Pradesh and Madhya Pradesh. The researchers have found that too many trees on the hill slopes –and elsewhere in the catchment- actually reduce the water output of the well. And too many deep wells have been drilled already. What is needed more than anything else is good governance of the area, keeping the water barons at bay and allowing the poor access to water at affordable prices.

This project is contributing to the national debate on trees and water. It is supplying geo-referenced information and a simple modeling tool that show how water tables have changed over past years in relation to deforestation and afforestation measures, groundwater mining for dry-season irrigation and other watershed interventions.

R8171: Low base-flows and livelihoods in India

DFID/FRP Prunings 2004

For more information about this project contact FRP Senior Administrator, e-mail: k.rothschild@nrint.co.uk, or the Project Leader: Dr Ian Calder, e-mail: i.r.calder@nlc.ac.uk, or Dr Ashvin Gosain, e-mail: gosain@civil.iitd.ernet.in

HYDROLOGY IN THE GUIANA SHIELD AND POSSIBILITIES FOR PAYMENT SCHEMES

Rosales, J. (2003)

This report is the third in a series of documents to be published by the Guiana Shield Initiative (GSI) of the Netherlands Committee for IUCN (NC-IUCN). The Guiana Shield provides hydrological services not only to its own population and nature, but also to the global community. It is estimated that the Guiana eco-region contains 10-15% of the world's fresh water reserves and the Shield is, of course, part of the larger Amazon Basin – the largest fresh water reserve on earth.

NC-IUCN/GSI Series 3

For more information contact:
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Websites: http://www.iucn.nl; http://www.guianashield.org

SLASH-AND-BURN AGRICULTURE: the search for alternatives

Cheryl A.Palm, Stephen A. Vosti, Pedro A. Sanchez, and Polly J. Ericksen (eds.) 2005

Striking an equitable balance between the legitimate interests of rural tropical households and the equally legitimate global concerns over the environmental consequences of tropical deforestation is one of the major challenges of the next decades. The Alternatives to Slash-and-Burn (ASB) consortium - now comprising over 40 organizations spread across the humid tropical belt - was established in 1992 by a group of concerned national and international research institutions and non-governmental organizations to address this challenge.

This book synthesizes the first decade of ASB's work, with contributions from agronomists, foresters, economists, ecologists, and anthropologists. It assesses the environmental, economic, and social impact of deforestation and identifies the costs and benefits of alternative uses of forests and cleared land. Throughout the volume, the contributors present new conceptual tools and a rich compendium of empirical analyses needed to formulate viable alternatives to slash-and-burn agriculture.

The first paper provides the introduction to slash and burn activities and the overall framework used by ASB, including its tradeoff matrix. The second section focuses on the different environmental, agronomic and socioeconomic dimensions, including chapters on carbon dynamics, greenhouse gas emissions, above-ground and below-ground biodiversity, agronomic sustainability and macroeconomics. The third section focuses on specific best-bet alternatives to slash and burn at a sub national scale, including community forest management, jungle rubber, shade coffee and reclamation of degraded grasslands. The fourth section provides the perspective of the main countries involved, Brazil, Indonesia, Cameroon, Peru and Thailand. The final section compares the different sites, and assesses the tradeoffs among the environmental, agronomic, and economic functions of the forest and alternatives to slash and burn systems.

"*This remarkable volume addresses the sustainable management of tropical forests with unstinting sophistication, moving the analysis beyond clichés to the true complexities of the challenge. . . . [It] is a landmark on the path to sustainable development." (Jeffrey Sachs, from the foreword)*

For more information about this book, please contact asb@cgiar.org

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IN SEARCH OF EXCELLENCE: Exemplary Forest Management in Asia and the Pacific

Patrick B. Durst, Chris Brown, Henrylito D. Tacio and Miyuki Ishikawa (eds) 2005

This book presents – in an easy-to-read and entertaining style- the results of a new study highlighting the positive side of forestry in the Asia-Pacific region. While usual media coverage of forests are filled with doom and gloom stories, this book gives plenty of examples that not all is hopeless: there are lots of people and organizations out there, largely unheralded, that are successfully battling against deforestation, environmental degradation and poverty among forest dwellers.

In search of excellence: exemplary forest management in Asia and the Pacific highlights the brighter side of forestry in a much-maligned region. A widespread call for nominations identified 172 forests in 21 countries that were perceived to be "well-managed." After careful vetting, 28 forests were selected for detailed case study analysis.

The result is a kaleidoscope of ideas, approaches, inspiration and perspiration that tell the stories of people dedicated to building sustainable livelihoods through careful management of their forests. This publication describes stories of people overcoming some of the very basic challenges in sustainable forest management: how they improved situations which others took for granted. The stories encompass a broad spectrum of management challenges. From the "miracle" of the Kalibo mangrove reforestation project, which describes the conversion of a bare mudflat into a mangrove ecotourism site, to the "minimal impact" helicopter logging operations of Forever Beech in New Zealand, these case studies lend hope for the future of forests.

Published by the FAO Regional Office for Asia and the Pacific (FAO/ RAP) and the Regional Community Forestry Training Center (RECOFTC).

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LIFE AFTER LOGGING: Reconciling wildlife conservation and production forestry in Indonesian Borneo

E. Meijaard, D. Sheil, R. Nasi, D. Augeri, B. Rosenbaum, D. Iskandar, T. Setyawati, A. Lammertink, I. Rachmatika, A. Wong, T. Soehartono, S. Stanley, T. O'Brien (2005)

The book *Life after Logging* is the output of a research programme carried out in Borneo, Indonesia. It assesses and reviews both ecological and life history information on a range of Bornean wildlife species, addresses the impact of timber logging activities on the survival of these species and offers recommendations for forest managers and government on sustainable forest management and planning related issues.

The book describes approaches to determine the sensitivity of species to logging and fragmentation of the rainforest. It also indicates how forest management can be improved to allow timber extraction and wildlife conservation to be more compatible. The publication concludes with identifying knowledge gaps which should be addressed in future research work.

An Indonesian language edition of the book is currently being developed and should be available soon.

Publisher: CIFOR, Indonesia
ISBN: 979-3361-56-5; 345pp

To order copies please contact:
Nia Sabarniati (CIFOR)
n.sabarniati@cgiar.org

The book is also available online as a 2.6Mb PDF file at
www.cifor.cgiar.org/scripts/newscripts/publications/detail.asp?pid=1663"

INSTRUMENTS FOR SUSTAINABLE PRIVATE SECTOR FORESTRY

IIED Publication series CD-ROM (2005)

The role of the private sector is increasingly important in the production and distribution of many forest goods. However, the price of this involvement includes degradation of the environment and an increase in social inequalities. Therefore understanding private sector motivations, identifying effective market and regulatory instruments and providing practical guidance on sustainable management of forest resources by the private sector has become very relevant.

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certification and audit, partnerships between companies and communities and markets for forest environmental services. It contains detailed analyses of private sector involvement in forestry in countries such as South Africa, Brazil, China, India, Malaysia and Papua New Guinea.

Some of the publications are also available in Spanish and Portugese.
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TROPICAL FOREST ECOLOGY: The Basis for Conservation and Management

Florencia Montagnini and Carl F. Jordan (2005)

Tropical Forest Ecology discusses the importance of tropical forests and the development of management strategies that would help decrease the pressure on the world's remaining tropical forests.

In the first four chapters, the book examines structures, ecological characteristics, classifications and functions of tropical forests, which are vital for sustainable forest management. Key issues highlighted include species diversity, energy flow, nutrient cycling and implications for forestry. The effects of deforestation on various spheres of development are also discussed.

The other chapters discuss socio-economic factors that have become major driving forces in tropical deforestation; cultural norms affecting local management decisions; and different approaches for implementing sustainable management techniques. One of the approaches discussed is the Reduced Impact Logging (RIL), a management tool that reduces logging damage as compared to conventional logging techniques; RIL may also lead to economic savings through increased efficiency, minimal skidding costs and reduced wastage.

The publication emphasizes the need to focus on the potential of plantation forestry as areas under tropical forests are decreasing globally. Efforts should be directed towards planning and managing plantations in the bid to optimize their productivity for environmental and socio-economic benefits.

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27	Latin America	Mar-May 1998
28	Arid and Semi Arid Areas	Summer 1999
29	Biodiversity	Autumn-Winter 1999
30	Participatory Forest Management	Spring-Summer 2000
31	Countries with Low Forest Cover	Autumn-Winter 2000
32	Non-Timber Forest Products	Winter 2000- 001
33	Forests and Water	Spring-Summer 2001
34	Biotechnology	Autumn 2001
35	Innovative Financing Mechanisms for Conservation and Sustainable Forest Management	Winter 2001-2002
36	Forest Resources Assessment	Spring - Summer 2002
37	Forest Use and Soil Quality	Winter 2002/03
38	Mountain Forests	Spring-Summer 2003
39/40	Globalisation, localisation and tropical forest management	Autumn/Winter 2003
41/42	National Forest Programmes	Autumn 2004
43/44	Forests and conflicts	Winter 2004-2005

Issues 19 -44 are available online at http://www.etfrn.org/etfrn/resource/news.html

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The European Tropical Forest Research Network is a network of European organisations and researchers involved in forest research in the tropics, sub tropics and Mediterranean.

For further information on ETFRN, please contact your National Focal Point (see inside back cover) or the Coordination Unit (address below).

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Contributions to the ETFRN News are always welcome.

Theme for the next issue:

Forests and the Millennium Development Goals

ETFRN International Calendar

Also on the ETFRN Homepage at: http://www.etfrn.org/etfrn/resource/frames/agenda.html
Main Sources: Invitations or announcements received by the ETFRN CU or the Tropenbos Foundation; ITTO Tropical Forest Update; IUFRO Newsletter

January 2006

30 January- 2 February	Wetlands, Water and Livelihoods Workshop St. Lucia, KwaZulu-Natal, South Africa	Kemi Awoyinka, Maria Stolk Wetlands International, Wetlands, Water and Livelihoods Secretariat PO Box 471 6700 AL,Wageningen, The Netherlands Phone: +31 317 478854 Fax: +31 317 478850 Email: wetlands.livelihoods@wetlands.org http://www.wetlands.org

February 2006

13-24	Sixth Session of the United Nations Forum on Forests (UNFF6) New York, USA	UN Forum on Forests Secretariat United Nations Department of Economics and Social Affairs One UN Plaza, Room DC1-1245 NY 10017, New York, USA Phone: +1 212 963 3401 Fax: +1 917 367 3186 E-mail: unff@un.org http://www.un.org/esa/forests/session.html

March 2006

1-2	The Sustainability Challenge Toronto, Canada	Jean-Pierre Kiekens ForestLeadership Phone: +1 514 274 4344 E-mail: info@ForestLeadership.com http://www.ForestLeadership.com/
5-10	International Precision Forestry Symposium Stellenbosch, South Africa	Pierre Ackermann Stellenbosch University Department of Forest and Wood Science Forest Engineering

		Private Bag XI 7602 Matieland, South Africa Email: packer@sun.ac.za http://academic.sun.ac.za/forestry/pf2006/
6 - 8	Practice Change for Sustainable Communities: Exploring Footprints, Pathways and Possibilities Beechworth, Victoria, Australia	Happenings Australia Pty Ltd Australasia-Pacific Extension Network Suite 4, Level 1, 14 Queens Road Vic 3004, Melbourne, Australia Phone: +61 3 9866 6288 Fax: + 61 3 9866 6313 E-mail: event@happenings.com.au http://www.apen.org.au/events/2006conf
7 - 9	Towards Sustainable Livelihoods and Ecosystems in Mountainous Regions Chiang Mai, Thailand	The Uplands Program (SFB 564) Chiang Mai University 50200 Chiang Mai, Thailand E-mail: uplands@loxinfo.co.th http://www.TheUplandsProgram.net.ms
7 - 9	Planning for the Future: Climate Change, Greenhouse Gas Inventories & Clean Energy Linkages San Francisco, California, USA	Amy Klaus Air & Waste Management Association Phone +1 412 232-3444 ext. 3119 E-mail: aklaus@awma.org http://www.awma.org/
15 - 17	World Congress on Communication for Development (WCCD) Rome, Italy	Chris Morry Communication Initiative, World Bank's Development Communication Division, FAO E-mail: cmorry@comminit.com http://www.comminit.com
16 - 22	World Water Forum: Local Actions for a Global Challenge Mexico City,Mexico	Rafael Lopez 4th World water Forum Secretariat Av. Insurgentes Sur No. 2416, 4th floor 04320 Mexico City, Mexico Phone: +52 55 51 74 44 80 / 81 Fax: +52 55 5174 44 75 E-mail: feedback@worldwaterforum4.org.mx http://www.worldwaterforum4org.mx/home/cuartow

22 - 24	GTZ Symposium: Relevance of Genetically Modified Crops in Developing Countries. Bonn, Germany	Katharina Yanez GTZ E-mail: katharina.yanez@gtz.de
26 March - 2 April	The DISCCRS II symposium: Climate Change Pacific Grove, California, USA	Susan Weiler DISCCRS, Whitman College Whitman College WA 99362, Walla Walla, USA Phone: +1 509 527 5948 Fax: +1 509 527 5961 E-mail: disccrs@whitman.edu http://aslo.org/phd.html

April 2006

3- 7	Managing Forest Ecosystems: The Challenges of Climate Change Palencia, Spain	Felipe Bravo Email: iufro2006@palencia.uva.es
7 - 8	Conservation and the Agricultural Frontier: integrating forests and agriculture in the tropics , New Haven, USA	Yale ISTF Conference c/o Tropical Resource Institute Yale School of Forestry and Environmental Studies 210 Prospect Street, New Haven, CT 06511, USA Website: http://www.yale.edu/istf/ E-mail: istf@yale.edu
17 - 21	21st session of the Asia-Pacific Forestry Commission Dehradun, India	Patrick Durst FAO Regional Office for Asia and the Pacific 39 Phra Atit Road 10200 Bangkok, Thailand Phone: + 66 2 697-4319 Fax: +66 2 697 4445 Email: patrick.durst@fao.org
23 -30	Brazil Forest Study Tour III Curitiba, Porto Seguro	Mark Willhite World Forest Investment, Inc. Fax: +1 503 695 6419 E-mail: mark@worldforestinvestment.com http://www.worldforestinvestment.com/

ETFRN International Calendar

May 2006

9 -12	Climate Change Technology - Engineering Opportunities and Challenges in the 21st Century Ottawa, Canada	Engineering Institute of Canada 1895 William Hodgins Lane K0A 1L0 Carp, Ontario, Canada Phone: + 1 613 839 1108 Fax: +1 613 839 1406 Email: EICCC2006@ieee.org http://www.CCC2006.ca/
10 - 12	3rd Annual Carbon Expo Cologne, Germany	Robert Dornau Conference Director ETA/World Bank Phone +41 79 689 22 42 Fax +41 22 839 31 81 E-mail: donau@carbonexpo.com http://www.carbonexpo.com/

June 2006

8 -10	Hydrological Sciences for Managing Water Resources in the Asian Developing World Guangzhou, China	Dr. Tao Jiang & Ms. Yang Centre of Water Resources and Environmental Research E-mail: eesjt@zsu.edu.cn http://cwre.zsu.edu.cn/mwra/

July 2006

9 - 15	18th World Congress of Soil Science Philadelphia, USA	18WCSS Registration Soil Science Society of America 677 S. Segoe Road Madison, WI 53711 Phone: 608-273-8095 Fax: 608-273-2021 www.19wcss.org

August 2006

8 -10	Forest and Water in a Changing Environment Beijing, China	Ms Meiyang Wang Chinese Academy of Forests (CAF) Division of International Cooperation Phone: +86 10 62889090 Fax: +86 10 62884229 E-mail: mwang@forestry.ac.cn http://www.caf.ac.cn/fwce/fwce_e.cfm

September 2006

5 - 9	Forest Governance and Decentralization Yogyakarta, Indonesia	Thomas Enters FAO Regional Office for Asia and the Pacific 38 Phra Atit Road 10200 Bangkok, Thailand Phone: +66 2 697- 4328 Fax: +66 2 697 - 4445 E-mail: thomas.enters@fao.org
26 -27	Conference: Patterns and Processes in Forest Landscape: Consequences of Human Management (IUFRO Division 8.01.03 Landscape Ecology) Locorotondo, Barl, Italy	Dr. Raffaele Lafortezza Dip. Science delle Produzioni Vegetali, University of Bari Via Amendola 165/A 70126, Bari, Italy Phone: +39 080 544 3023 Fax: +39 080 544 2976 E-mail: r.lafortezza@agr.uniba.it www.greenlab.uniba.it/events/iufro2006

October 2006

2 - 6	Managing Forests for Poverty Reduction: capturing opportunities in forest harvesting and wood processing for the benefit of the poor Ho Chi Minh City, Vietnam	Thomas Enters FAO Regional Office for Asia and the Pacific 39 Phra Atit Road 10200 Bangkok, Thailand Phone:+ 66 2 697 - 4328 Fax:+ 66 2 697 4445 E-mail: thomas.enters@fao.org
10 - 13	Sustainable Forest Management with Fast Growing Plantations (IUFRO 4.04.02) Charleston, South Carolina, USA	Chris Goulding Ensis, New Zealand E-mail: chris.goulding@ensisjv.com www.ncsu.edu/feop/iufro_plantations
22 - 26	IUFRO Working Group 2.08.03: Improvement and Culture of Eucalyptus Durban, South Africa	Gill Slaughter Turners Conferences PO Box 1935 Durban 4000 South Africa Phone: +27 31 3321451 Fax: +27 31 3686623 E-mail: info@iufrodurban.org.za www.iufro.durban.org.za

COURSES

February 2006

8 - 10	Impact assessment: How do we know we are making the difference? London, UK	Training and Logistics Administrator International NGO Training and Research Centre PO Box 563 OX2 6RZ, Oxford. UK Phone: +44 1865 263 040 Fax: +44 1865 201 851 E-mail: training@intrac.org http://www.intrac.org/
27 February - 7 April	Agroforestry Trees of the Drier Tropics with World Forest Resources Bangor, Wales, UK	CAZS Natural Resources University of Wales, Bangor Deiniol Road Bangor LL57 2UW Gwynedd, Wales, UK Phone: +44 (0)1248 382346 Fax. +44 (0)1248 364717 E-mail. CAZS@bangor.ac.uk http://www.cazs.bangor.ac.uk/Teaching_and_training/Course%20Info%202005_06/aftd_si06.pdf
27 February - 7 April	Agroforestry Trees of the Drier Tropics with Soil and Water Conservation Bangor, Wales, UK	CAZS Natural Resources E-mail. CAZS@bangor.ac.uk http://www.cazs.bangor.ac.uk/Teaching_and_training/Course%20Info%202005_06/aftd_swc06.pdf

May 2006

1May - 2 June	Formulating Successful Project Proposals for Energy, Environment and Climate Change Enschede, The Netherlands	Ms. Wendie Klieverik University of Twente Department of Technology and Sustainable Development PO Box 217 7500 AE, Enschede, The Netherlands Phone: +31 (0)53 489 3545 Fax: +31 (0)53 489 3087 E-mail: cstm-courses@bbt.utwente.nl http://www.bbt.utwente.nl/leerstoelen.nl

8 - 26	International Training of Trainers on Wetland Management: facilitating of multi-stakeholders processes and curriculum development (ICWM-TOT) Wageningen, The Netherlands	Esther Koopmanshap International Agricultural Centre (IAC), Wageningen UR PO Box 88 6700 AB Wageningen The Netherlands Phone: +31 317 495251 Fax: +31 317 495395 E-mail: Esther.koopmanschap@wur.nl http://www.iac.wur.nl/iac/courses/applform_88_05_2006.cfm
29 May - 10 June	Forest Policy Short Course Bangkok, Thailand	Thomas Enters FAO Regional Office for Asia and the Pacific 39 Phra Atit Road 10200 Bangkok, Thailand Phone:+66 2 697 4328 Fax: +66 2 697 4445 E-mail: thomas.enters@fao.org

June 2006

12 - 16	Second Latin-America Short Course on Biological Control of Weeds Managua, Nicaragua	Dr. Julio Medal University of Florida (USA) & Universidad Nacional Agraria (Nicaragua) E-mail: medal@ifas.ufl.edu http://biocontrol.ifas.ufl.edu/materials/corsonic06.p
25 June - 1 July 2006	Computable General Equilibrium Modeling in Environmental and Resource Economics Venice, Italy	Ms Angela Marigo Fondazione Eni Enrico Mattei Phone: +39 41 2711468 Fax: +39 41 2711461 angela.marigo@feem.it http://www.feem.it/ess06

September 2006

1 September 2006 - 15 August 2007	MSc one-year course: Climate Science and Policy, New York, USA	Fax: +1 212 854 9896 E-mail: climatesociety@ei.columbia.edu http://www.columbia.edu/cu/climatesociety

N o v e m b e r 2006

27 November - 8 December 2006	Interactive Forest & Nature Policy in Practice, Managing multi-stakeholder learning in sector wide approaches and national forest programmes Bogor, Indonesia	Ir W.L. Hijweege International Agricultural Centre P.O. Box 88 6700 AB Wageningen, The Netherlands Phone: + 31 317 495 495 Fax: + 31 317 495 395 E-mail: Training.iac@wur.NL http://www.iac.wur.nl/forestpolicy/?page=1490