

Working First Draft

Version 1

Theme C: Major Review

Water for Development and Ecosystems

Theme C: Water for Development and Ecosystems aims to understand the drivers and status of ecosystem degradation and the need for watershed restoration in order to improve water productivity across the Asia-Pacific region. Theme C also highlights the concept of environmental flows, which refer to water provided within a river, wetland or coastal zone to maintain ecosystems and their benefits where there are competing water uses.

General Working Outline

1. Introduction
 2. Trends in the Asia-Pacific region
 - 2.1 MDGs and development
 - 2.2 Water trends
 - 2.3 Ecosystem trends
 - 2.4 Stakeholders
 3. Global paradigm shift in watersheds
 4. Towards a typology of Asia-Pacific watersheds
 - 4.1 Physical and economic scarcity
 - 4.2 Irrigation and agriculture
 - 4.3 Dams and hydropower
 - 4.4 Urbanisation
 - 4.5 Environment
 - 4.6 The challenge of trade-offs
 5. Responses to watershed degradation in the Asia-Pacific region
 - 5.1 Established approaches
 - 5.2 Emerging approaches
 6. The transboundary imperative
 7. Options for moving forward
 - 7.1 Good policy
 - 7.2 Good science
 - 7.3 Good practice
-

Contact:
Nathan Badenoch
nate@iucnlao.org

1. Introduction

The Asia-Pacific region includes one of the most severe man-made ecological disasters in the world (the Aral Sea) and one of the world's few remaining large, free-flowing rivers (the Salween).

Natural watershed systems provide services such as water purification, sediment flux transportation and deposition, coastal and coral reef support and cultural and aesthetic services, which are crucial to human well-being. Other developmental benefits, such as dams for hydropower and irrigation, are expected from human society. But the inter-relationships between trade-offs are complex and require nuanced negotiation processes.

Challenge: balancing tradeoffs among stakeholders to achieve social equitable and environmentally sustainable outcomes

Why is watershed an important lens? Provides framework to address competing demands and tradeoffs at ecological and socio-economic levels

“Failing to take a basin perspective when implementing water conservation strategies, not only runs the risk of not saving water, but can also have a negative impact on water quality, drinking water supply, groundwater balance and downstream human and ecological users” (Comprehensive Assessment of Water Management in Agriculture 2003).

But implementation is difficult because of institutions of governance generally do not reflect the hydrological boundaries of watershed. At the national level, this usually requires coordination and cooperation across sectoral lines. At the international level, this requires national governments recognize limits to national sovereignty over natural resources.

Thinking:

Water for development vs water for ecosystems

Water for development and ecosystems

How to a) balance the tradeoffs, b) make them work for each other

2. Trends in the Asia-Pacific region

Diversity and dynamism are two defining characteristics of the Asia-Pacific region.

In preparation for the 4th World Water Forum, the participants of the Asia-Pacific Regional Preparatory Process presented three targets. First, investments in infrastructure to improve supply of water and improvement of sanitation should be accompanied by investments in education and capacity building. Second, human vulnerability to water-related disasters should be drastically reduced.

Finally, land-water interfaces should be conserved and restored to improve water productivity.

The Asian Development Bank, articulating a new perspective on development in the region, identified *environmental poverty* as the main form of poverty in the future. This type of poverty, a by-product of the rapid growth model the Asia-Pacific region has adopted, is evident in floods, landslides, declining natural resources base, droughts and urban population. These phenomena currently affect almost 2 billion poor and vulnerable people, and are predicted to adversely impact more and more urban and rural poor into the future (ADB, 2007).

2.1 MDGs and development

There is wide variation in the level of economic development in the Asia-Pacific region.

[present relevant data from Human Development Report, etc]

Rapid economic growth, demographic growth, urbanization

Diversity in socio-economic and political systems

- HDI
- Governance indicators

2.2 Water trends

Challenges for AP

Priorities by sub-region drawing on APWF summaries

The Asia-Pacific Water Forum preparatory data for the Asia-Pacific region was divided into five sub-regions, based on geo-politics.

- agricultural productivity for food security
 - gains to be made in efficiency, productivity not in expansion
 - transferring irrigation to local institutions
 - Asia 78% of global total, China and India together 59% (Irrigated Area Map of the World)
- hydro to power
 - power to supply demand
 - alternative energy
 - integration and energy as an export
- urban transition
- ecosystem protection

- transboundary cooperation/conflict

2.2 Ecosystem trends

The mix of competing demands for water in the Asia-Pacific region has had multiple, inter-related and far-reaching implications for the sustainability of many major ecosystems and their ability to support the region's vast population. Development trajectories may bring similar outcomes in basins that do not yet exhibit these signs of deterioration.

Managing rivers entails tradeoffs between ecological integrity and concern for human well-being. WWF's "rivers at risk" (WWF 2007) illustrates some of these dynamics, in terms of rivers where threats have already become tangible impacts, and those where the potential for increased impact in the near future exist. The threats identified are dams and infrastructure, excessive water extraction, climate change, invasive species, over-fishing and pollution. More often than not, these threats exist in combination within basins. A brief review of the Asian rivers at risk highlights these major ecosystem degradation dynamics.

The Yangtze River is the source of fully 40% of China's water resources. In this role, the river is responsible for 70% of Chinese rice production, 50% of grain, 70% of fisheries. All in all, the Yangtze contributes 40% of GDP in China. But agriculture, industry and transportation are major users of the Yangtze river. Industrial pollution, agricultural run-off, domestic waste from urban centers and sedimentation have reached critical levels. With the Three Gorges Dam completed, pollution problems are predicted to intensify. Water quality has major implications for the health of the 430 million inhabitants of the basin and the river's ability to continue to provide for the various competing uses.

The Ganges River basin is home to 8% of the world's population. The catchment area covers parts of Nepal, India, China and Bangladesh. With high biological diversity and significant cultural meaning to local populations, the Ganges also supports an extremely dense population and its agricultural activities. Water withdrawals, primarily for irrigated agriculture, have reduced overall water availability and quality, contribute to land degradation and increase dependence on ground water. Dry-season outflow to the sea is negligible, and the basin is highly vulnerable to climate change. Nonetheless, there are still plans for major water diversions and dams to increase water supplies to urban and rural areas and generate electricity.

The Indus River basin, shared by Afghanistan, Pakistan, India and China, is over 30% arid, but nevertheless is the source of 80% of Pakistan's irrigation. As much as 80% of the Indus' water comes from glaciers in the Himalayas, ensuring less variability in annual water flows. The current situation of over-extraction of water has resulted in salt water intrusion at the Indus delta, a site of important mangroves and high biodiversity. The existing threat from human use may be

seriously exacerbated by changes in the flow regime resulting from climate change and related alteration of glacial contribution to the river.

Australia's Murray-Darling basin is geographically large, but has only small and erratic discharge and surface runoff. This water is crucial to major urban populations, but supplies irrigation water to extensive areas of agriculture. Even though 30% of the basin is arid, there are 30,000 wetlands, including 12 Ramsar sites. Aquatic plant and animal diversity is high. But native fish species have been reduced to 10% of their levels before European settlement. While endangered and threatened local species are on the rise, so is the occurrence of invasive species. Both of these trends are driven by changes in water flow, thermal pollution, instream habitat degradation and obstructions to natural fish movements.

The largest basin in Southeast Asia, the Mekong includes the world's most productive fishery, upon which 55 million people rely for the vast majority of the protein in their diets. The diversity of aquatic life is important on a global scale, with as many as 1,700 fish species present, in addition to the critically endangered Irrawaddy dolphin. This tremendous wealth of resources is supported by the natural flooding cycles of the Mekong River. But exploitation is resulting in substantial declines in fish availability and size. At the same time, a cascade of planned dams on the mainstream and tributaries is set to further disrupt the natural processes supporting aquatic life and the livelihoods it supports.

The Salween River is one of the last large free-flowing rivers in Asia, and its catchment area is the second largest in Southeast Asia. The low level of development in the catchment area has meant that there has been no significant alteration of the ecosystem. Both China and Myanmar are looking to exploit the river's hydropower potential. If the plans for 16 dams in the catchment, nine of which are to be located on the main stem, are realized there would be significant implications for the rich aquatic biodiversity and watershed functions.

The stories of ecosystem degradation told by these river basins are meant to be representative of the challenges faced by the countries and peoples that live within them. For each, the dynamic links between food production, industry, domestic use, hydropower, biodiversity and climate change could be drawn out further yet.

3. Global paradigm shift in watersheds

Thinking on watersheds is central to the challenge of ensuring that water systems provide benefits for society while maintaining long-term capacity of ecological functions.

Application of subsidiarity principle: authority over natural resources management should be transferred to the level of decision-making that best represents the stakeholders potentially affected by those decisions.

Entails shifting of institutions of governance from the centralized state

- a) downwards to local government, watershed organizations and decentralized organizations/networks
- b) upwards to transboundary, international basin organizations and networks

Since the purpose is to manage the dynamic interactions between human and natural systems, application of subsidiarity should be considered as an on-going negotiation process.

This reinforces argument that scale, in terms of both natural and also social science, is crucial for understanding water-land interface. Better understanding of watershed science has not permeated the public and policy mindset (Bruijnzet and scale) [\[develop scale in watershed interactions\]](#)

The Sassari Declaration announced a new generation of watersheds that includes: multi-sectoral approaches, bottom-up and top-down balance, monitoring and evaluation, EIA, stakeholder networks, gender in decision-making, new approaches to knowledge and learning, sustainable finance, compensation mechanisms, capacity at all levels, demand management, extreme events/disaster preparedness, and integrated management of water, soil, vegetation and sediment.

Poverty and livelihoods has emerged as the fundamental organizing principle for watershed management, where previously hydrology, soil science and engineering had dominated. Elements of the new thinking in watershed management reflect growing concern for the resource governance, in addition to the resource management:

- Watershed natural resources management as part of local development
- Multi-stakeholder participation in pluralist consultative processes
- Sensitivity to local governance and adaptive flexibility
- Light institutions
- Upstream-downstream relations
- Balance of local and scientific knowledge
- On-going negotiation

With 40% of world's population now living in river basins under water stress (CBD 2005), conflict resolution and prevention have emerged as pressing objectives of managing watersheds. Indeed, the new generation of Asia-Pacific watershed management will need to provide a robust framework to address the social equity and acceptability of technical, financial and institutional interventions.

4. Towards a typology of Asia-Pacific watersheds

The immense diversity in ecosystem types, socio-economic development status and political systems is a defining characteristic of Asia-Pacific watersheds.

There has been a broad acceptance of the principles of integrated water resources management (IWRM) in the region, and a significant level of political commitment to implementing IWRM is reflected in policy frameworks across the region. However, promotion of IWRM within a basin management context has been slower to materialize. In its 2006-2011 Water Financing Program, the Asian Development Bank has noted the importance of applying basin-level IWRM according to the specific conditions and requirements of each river basin (ADB 2006).

While commitment to the broad principles of IWRM should be considered a step towards more sustainable water management, IWRM has been criticized for being unrealistic and unachievable because the concepts involved are broad and ill-defined (Biswas 2005).

The logic of watersheds is different between developed and developing countries.

Differing Watershed Logics		
	Developed Country	Developing Country
Climate	Temperate climates, humid, higher river-stream density	Rainfall low, climate extreme, higher mean temperatures, lower stream density, water scarcity an emerging constraint
Demographics	Population concentrated in the valleys, downstream	Densely populated in both valleys and catchment areas; population high both upstream and downstream of dams
Water rights	Water rights based on riparian doctrine and prior appropriat	Water rights based on rights to rainfall or ground-water; people's notions of ownership relate more easily to rain than to large-scale public diversions
Water orientation	Focus on blue surface water: water found in rivers, and lakes	Focus on green water: water stored in the soil profile or blue water stored in aquifers
Water dependence	Most water users get water from 'service providers'; most water provision is in the formal sector-making water resources governance feasible	Most water users get their water directly from rain and from private or community storage without any significant mediation from public agencies or organized service providers. Because the bulk of water provision takes place in the informal sector, it is difficult to pass enforceable water legislation
Stakeholders	Small numbers of large-scale stakeholders	Vast numbers of small-scale stakeholders
Transaction costs	Low transaction costs for monitoring water use and collecting water charges	High transaction costs for monitoring water use and collecting water charges

Adapted from IWMI Policy Brief "Challenges of IRBM in India"

Diversity in levels of economic development and natural conditions across the Asia-Pacific region suggest that the different logic presented above is not so clear-cut. However, these criteria do provide a starting point for understanding the diversity in watersheds. [develop further]

Data on land and water resources is still compiled primarily at the national level, and analysis of watershed-level conditions and trends is not readily available. In the Asia-Pacific region, allocation and re-allocation of water among different users is becoming an ever more critical priority. The impacts of competing demands from water users play out most clearly and directly at the watershed level. *Watersheds of the World* and *A Pilot Global Assessment of Environmental Water Requirements and Scarcity* provides a useful starting point for establishing a broad understanding of watershed conditions and challenges.

4.1 Physical and economic scarcity

[Intro...] (Rijsbermann etc)

15 of the 36 Asia-Pacific watersheds analysed by *Watersheds of the World* are more than 40% arid. All of these, with the exception of the Murray-Darling Basin, are located in Central and South Asia.

Water availability per capita is an indicator for both domestic consumption and food production. One commonly used indicator establishes 1,700 m³ as the cutoff for minimum required per capita water availability. A threshold of 1,500m³ per capita, based on an analysis of water availability, food imports and food security, is the point at which cereal imports show a strong inverse correlation with its food imports. Ten of the Asia-Pacific watersheds have less than 1,500m³ per capita. At the national level, it is expected that Afghanistan, India, Iran, Korea and Pakistan will fall below this threshold by the year 2030 (Yang in Rijsberman 2004). Water availability in the Yellow River Basin of China is approximately 360m³ per capita, making it by far the lowest in the region.

The historical trend in water availability is as worrying as the current stressed levels if predicted demographic trends hold true. Between 1950 and 1995, there were major reductions in the amount of water available per capita across the sub-regions of the Asia-Pacific. South Asia and Central Asia saw drops of approximately 70%, while North Asia decreased by about 60% and Southeast Asia about 55% (ADB 2003).

Nevertheless, withdrawals are high as demand grows. Water withdrawals in Central Asia reach 85%. Somewhat lower levels are nonetheless striking in South Asia, at 48%, and 25% in parts of North Asia.

4.2 Irrigation and agriculture

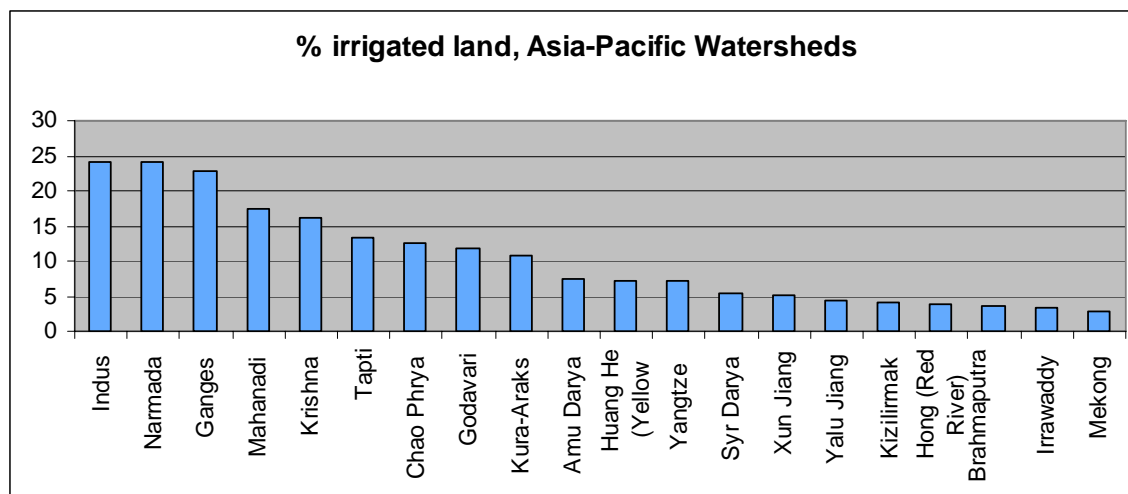
How water is managed to produce food for the region's growing population will be the determinant of secure livelihoods and robust economies. It has been stated that globally, "only if we act to improve water use in agriculture will we meet the acute freshwater challenges facing humankind over the coming 50 years" (Comprehensive Assessment of Water Management in Agriculture 2007: 2).

Approximately 84% of water withdrawals in Asia is for agriculture, more than 10% more than the global level of 71%. In South Asia, irrigation constitutes 92% of withdrawals, 77% in East Asia. More than 70% of agricultural water withdrawals in the region are in India and China, where the gross average water withdrawal per unit of irrigated cropping area is 7,500 and 9,200 m³/ha/year, respectively, compared to a regional average of 8,900 m³/ha/year. In some countries, this figure ranges between 15,000 and 31,500 m³/ha/year (Chen 2005).

In the Asia-Pacific region, a total of 365 million ha of land is irrigated. Broken down by sub-region, the importance of East and South Asia in the regional irrigation picture is clear, accounting for 86% of total irrigated area. In fact, more than 75 percent of all irrigated land is in China and India.

	'000 ha	% of total
Central Asia	18,530	5%
East Asia	158,312	43%
Southeast Asia	25,179	7%
South Asia	157,859	43%
Pacific	5,130	1%

Through the watershed lens, we see that on the high end South Asian watersheds such as the Indus, the Ganges and the Narmada have more than 20% irrigated land. Ten of the Asia-Pacific watersheds are more than 10 percent irrigated land, seven of these located in South Asia, where per capita water availability is lowest. Approximately 4 to 7% of land in China is irrigated.



The expansion of irrigated land since 1960 has been marked in many countries of the region. Table X shows total increase in irrigated area and average annual growth for the period 1962-1998.

Country	Increase in total irrigated area ('000 ha)	Average Annual Growth
Nepal	1062	40.2
Lao PDR	154	34.8
Bangladesh	3369	19.8
Bhutan	31	9.1
Cambodia	206	8.9
Korea DPR	960	5.3
Thailand	3131	5.1
Viet Nam	1767	4.9
Myanmar	1042	4.7
India	33255	3.7
Philippines	850	3.4
Sri Lanka	277	2.1
China	21736	1.9
Pakistan	6915	1.8
Malaysia	126	1.5
Indonesia	915	0.7
Korea Rep	0	0
Japan	-261	-0.2
ASIA	92609	2.6

India and China made massive advances in terms of area, although their average rate of growth was comparable to the regional average. Nepal, Lao PDR and Bangladesh saw exceedingly high annual growth rates. It is interesting to note that South Korea saw no increase, while the area of irrigated land in Japan was in fact reduced. It is generally agreed that future advances in food

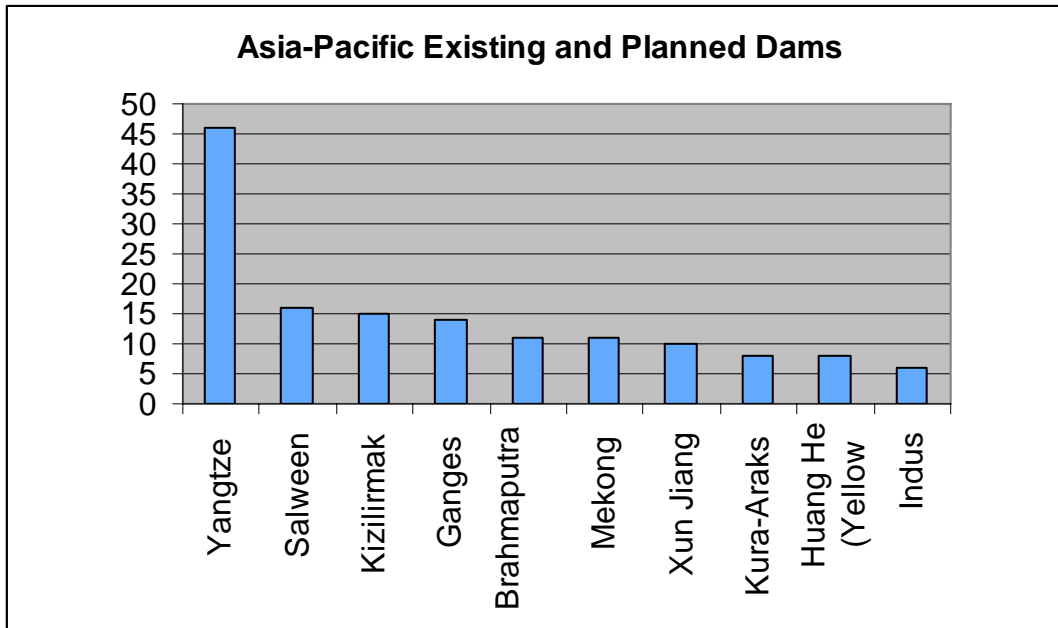
production in the Asia-Pacific region will not be achieved through expansion of area under irrigation, but rather through improving existing irrigation and expanding rain-fed agriculture.

With highly developed irrigation infrastructure already existing, Asia-Pacific strategies to meet the goals of meeting food security, reducing poverty and conserving ecosystems will need to focus on improving productivity, reallocating supplies and rehabilitating ecosystems (Comprehensive Assessment of Water Management in Agriculture 2007). There is some agreement that the existing irrigation systems could perform much better. The rapid pace of development in the region has entailed agricultural transformations and associated demands of water resources. Poor institutional arrangements and system design, degraded infrastructure and poor management have meant that irrigation systems have not been able to keep pace with the larger socio-economic trends. The focus has begun to shift from “efficient water use” to “improved water productivity”, where policy aims to improve irrigation and agronomic practices, encourage low-cost supplementary irrigation, promote integrated water resources management and continue with institutional reform. (Chen 2005).

The benefits for human well-being in terms of food production are obvious. In the period of 1990 to 2002, the proportion of undernourished was reduced from 20 percent to 16 percent in the Asia-Pacific region (FAO 2004 in Chen 2005). However, at the same time the development of irrigation has reduced the ability of many ecosystems to provide vital goods and services, including flood protection, water purification, food and fibre (Rijsberman 2004). Irrigation comes into conflict with wetlands, biodiversity conservation and hydropower development, underscoring the need for negotiation of competing demands at both the ecosystem and national levels.

4.3 Dams and hydropower

Primary development has not been powered by hydro, but hydro is a major priority because of high potential, linking of power grids, need to reduce air pollution.



As shown in the above diagram, existing and planned dams of 60 meters or more are a significant component of water management in 11 of the major Asia-Pacific basins.

[Hydro-irrigation conflict cases (Sri Lanka and Nepal)]

The World Commission on Dams introduced a set of guidelines to improve the outcomes of large dam building. The process by which the WCD guidelines were developed was a success in and of itself, as a truly multi-stakeholder group went through a process of exchange, negotiation and reached agreement. However, the failure of the World Bank, one of the original supporters of the WCD process, to endorse and promote the WCD principles was a major blow to the acceptance they received around the world. Given the number of dams planned for Asia-Pacific rivers, there is high potential for implementing the WCD principles. *What is the status of implementation across the region?*

4.4 Urbanisation

Urbanization is an undeniable reality in Asia, and the trend continues to gather momentum. By 2025, it is predicted that more than half of the Asia-Pacific population will live in cities and towns (UNESCAP 2005)

[Present info on megacities and their watersheds]

The percentage of developed land in the basins ranges from 0.1% (Indirgika and Sedik watersheds) to 9% (Chao Praya watershed).

4.5 Environment

Most assessments of global water availability have focused on understanding if human water needs can be satisfied by the total renewable water resources in a country or basin. A short-coming of this approach is the failure to consider freshwater-dependent ecosystems as users of water. Without adequate supply of water to these ecosystems, they lose their ability to support the people that depend upon them.

The *Pilot Global Assessment of Environmental Water Requirements and Scarcity* (Smakhtin et al. 2004) provided preliminary estimates of mean Environmental Water Requirements (EWR) for 128 major basins and drainage regions of the world. EWR. Environmental requirements are expressed as a percentage of mean annual runoff. This is the basic flow needed to maintain a system at “fair” on a conservation status scale of natural-good-fair-poor. In this state, the system has been moderately or considerably modified. The management perspective assumes multiple disturbances associated with socio-economic development needs, such as dams, diversions, transfers, habitat modification and water quality degradation. Basins to be managed for higher levels of ecosystem health would require higher EWRs.

The EWR for major basins and drainage regions in the Asia Pacific span a range of 21% to 38%.

Table X: EWR for Asian Basins and Drainage Regions

Basins or drainage regions	Region	EWR (%of MAR)
Borneo	SOUTHEAST ASIA	36
Indonesia East	SOUTHEAST ASIA	36
Philippines	SOUTHEAST ASIA	31
Indonesia West	SOUTHEAST ASIA	30
Zhu Jiang	SOUTHEAST ASIA	30
Mekong	SOUTHEAST ASIA	28
Thai Myanmar Malaysia	SOUTHEAST ASIA	28
Southeast Asia Coast	SOUTHEAST ASIA	27
Brahmaputra	SOUTH ASIA	27
Eastern Ghats	SOUTH ASIA	26
Sri Lanka	SOUTH ASIA	26
Cauvery	SOUTH ASIA	25
Chotanagpui	SOUTH ASIA	25
India East Coast	SOUTH ASIA	25
Indus	SOUTH ASIA	25
Brahmari	SOUTH ASIA	24
Godavari	SOUTH ASIA	24
Krishna	SOUTH ASIA	24
Ganges	SOUTH ASIA	23
Mahi Tapti	SOUTH ASIA	23
Sahyada	SOUTH ASIA	21
New Zealand	PACIFIC	37

Papua Oceania	PACIFIC	37
Eastern Australia Tasmania	PACIFIC	29
Murray Australia	PACIFIC	27
Central Australia	PACIFIC	24
Ob	NORTH ASIA	38
Lake Balkhash	NORTH ASIA	37
Lower Mongolia	NORTH ASIA	34
Upper Mongolia	NORTH ASIA	33
Hual He	NORTH ASIA	32
Huang He	NORTH ASIA	31
Japan	NORTH ASIA	31
Changjiang	NORTH ASIA	30
Songhua	NORTH ASIA	30
Amur	NORTH ASIA	28
Hail He	NORTH ASIA	28
Yili He	NORTH ASIA	28
North Korea Peninsula	NORTH ASIA	27
South Korean Peninsula	NORTH ASIA	27
Lancang Jiang	NORTH ASIA	26
Syr Darya	CENTRAL ASIA	27
Western Asia, Iran	CENTRAL ASIA	24
Amu Darya	CENTRAL ASIA	27

From Smakhtin et al. (2004)

Averaging by region shows that highest EWRs are in North Asia and Southeast Asia, and the Pacific, each at 31%. Central Asia and South Asia have somewhat lower EWR, at 26% and 24%, respectively. However, combined with water availability and total use Central Asia, most of South Asia and parts of North Asia are appear as “environmentally stressed”, while Southeast Asia and the Pacific are less stressed (with the notable exception of the Murray-Darling Bain in Australia). With increasing withdrawals of water, it is likely that more river basins will approach more critical “environmentally scarce” conditions if improvements in water productivity of agricultural and allocation of water for environmental flows is not adopted at the basin level.

One critical justification for greater concern for aquatic ecosystem health is the dependence of the region on fisheries as a source of food and local economy. The contribution of fish to the animal protein supply is particularly striking in Bangladesh (52%), Cambodia (57%), Indonesia (57%) and Sri Lanka (51%). Fish are an important component of food security and health in South Korea, Lao PDR, Malaysia, Myanmar, the Philippines, Thailand and Viet Nam as well (WoW). Numerous and valuable fish species... Ramsar sites...

Downstream populations are particularly vulnerable to changes in flow regimes of river basins. Fishermen in southern Lao and Cambodia have enormous stakes in upstream development activities that may change causes changes in annual flow levels, seasonal fluctuations, and sedimentation, for example. But threats can be localized as well. The proposed Don Sahong dam in Siphandone region of

southern Lao, will have impacts on local fishermen on both sides of the Lao-Cambodian border. The dam is also threatening to derail the Ramsar accession process in Lao.

Trade in fish and fisheries products in the Asia Pacific makes up approximately 30% of the global total. Asia-Pacific nations are both importers and exporters. Over-exploitation of fisheries resources has also become a concern in the region...

Water allocations to ecosystems are to maintain the natural systems that support human life. The values are tangible, immediate and fundamental, but the process to achieve water for ecosystems are politically charged and economically biased.

4.6 The challenge of trade-offs

With the intensifying challenge of negotiating trade-offs between competing uses of water at the basin level, it is helpful to consider a number of indicators in combination.

[present indicator combinations from WOW]

At basin level:

1. Arid land and landscape modification
2. River fragmentation and fisheries
3. Irrigated area and developed area

Etc...

Such indicator combinations begin to capture some of the interactions that occur at the basin level. But the outcomes of managing tradeoffs will depend upon the decision-making processes that underlie them. The majority of decision-making still done within the framework of national governments, and is driven by the macro-level priorities of water allocation at the national level. Thus, a combination of governance and water indicators at the national level are another important perspective on the challenges.

At national level:

1. governance and water availability

Although the combination of watershed and national-level indicators provides useful information for understanding the challenges at the Asia-Pacific level, there is a need to collect a more nuanced selection of indicators at the basin level. One limitation to watershed-level data is that it is often created to feed into global level analysis of macro-trends. Collection of watershed data at the regional or sub-regional level could be a useful tool for decision-makers, direct stakeholders and public interest groups.

IWRM at the basin level is concerned with managing upstream-downstream conflict, quality and quantity issues, surface and groundwater interactions, and the land-water interface. Increasingly, however, the challenges of IWRM require a focus on governance, particularly watershed governance. The processes of decision-making – who is involved, who sets the agenda, who has access to information, who is accountable to whom – hold major implications for the outcomes of watershed management.

5. Responses to watershed degradation in Asia-Pacific region

Globally, and in the region, there are signs of a general shift to a more balanced combination of technical and institutional approaches to protecting, developing and rehabilitating watersheds. New approaches have begun to place more importance on governance issues, while the need for technical, financial and institutional interventions remain high priorities.

Responses to water scarcity can be grouped into three categories. Supply responses focus on increasing the amount of controlled water and tapping new sources. Conservation responses entail increasing efficiency in use, without increasing the sources of water supply. Allocation responses consist of transferring water from one use to another, within or across sectors. These three responses occur at the individual and basin levels. Individual users may take measures to enhance water storage, improve delivery of irrigation water or switch crops. All of these will have different impacts at the basin level. Similarly, basin-level responses may have implications for the availability of water at the local level. The micro-macro interactions are the frontier where interdependence at the basin level is played out (Molle 2003).

5.1 Established approaches

Common approaches to addressing watershed degradation include a range of interventions.

Since the halt in large-scale irrigation expansion in the 1980s, **irrigation modernization** has been a major thrust in water management in Asia-Pacific. Modernisation seeks to upgrade irrigation system capacity to enable appropriate responses to water service demands, considering current and future needs through a service delivery orientation (Facon n.d.). Malaysia, Indonesia, Thailand, Viet Nam, India and China have made significant efforts to improve on-farm water management, strengthen governance, reform institutions and rehabilitate irrigation infrastructure (Chen 2005), although full commitment to comprehensive modernization is less common. An important element of the modernization approach has been participatory irrigation management or irrigation management transfer, in which authority to manage irrigation systems is transferred to water user associations (Facon n.d.). Further changes in the

governance of irrigation are the most urgent response to the future challenges of food production (Comprehensive Assessment of Water Management in Agriculture 2007).

The **hydrological relationship between forests and rivers** is a dominant theme in watershed management in the region. The loss of upper catchment forests has been identified as a major source of watershed degradation in many countries across the region. The a common perception that more trees in the uplands means more water in the lowlands has been reflected in many national responses to watershed degradation that focus on reforestation. State-directed planting of industrial and indigenous species has been widespread. In recent years, major flood events in China, Pakistan and Thailand were attributed to deforestation in upper catchments. The policy response was a ban on logging in upper catchment forests and major reforestation efforts.

Governments have tried to **control watershed degradation through restrictions on land use**. Discussion of watershed degradation in many areas place local communities at the center of the problem. Shifting cultivation, collection of fuel and fodder, and small-scale logging are frequently blamed for the deforestation resulting in watershed degradation. To address these problems, some governments have banned or severely restricted shifting cultivation and closed the forests. These approaches are common across South and Southeast Asia. Governments, development agencies and research institutions have invested heavily in promoting soil conservation, as well. In some other cases, such as Nepal, communities have been entrusted with rights to manage their forests. Less frequently heard in the national discourses on watershed management is the role of illegal activities such as logging, which governments are unable or unwilling to control.

Legal protection of upland areas as the source of water, in the form of protected areas is a reinforcement of approaches to maintain the forest-water relationship. In Lao, for example, protected area management and dam development are being planned in tandem. Management of reservoir catchment has direct and tangible benefits for the profitability and longevity of dams. A new element to this approach is the potential to harness financial resources from the sale of electricity to fund desperately needed protected area management. Another example from Lao, the World Heritage site Luang Prabang is sustained by the watershed forests of the Nam Et Phou Loei protected area located upstream from the city.

Recognizing the institutional aspects of managing land and water resources at the basin level, some governments have moved to **create river basin organizations**. RBOs are a way to centralize planning and management functions at a decentralized level fitting the relevant ecological boundaries. Another motivation for establishing RBOs is to facilitate upstream-downstream transfers for ecosystem goods and services. River basin organizations exist in

China, Vietnam, and... Thailand has gone through an instructional process of establishing river basin organizations which are to be linked to local watershed networks in a multi-layering of institutions. As RBOs tend to cross administrative and sectoral boundaries, a common difficulty with RBOs is creating effective relationships with other stakeholders. Transboundary RBOs, such as the Mekong River Commission,...

Another approach to watershed protection has been **resettlement of communities** out of upland areas or out of flood areas. Communities have been resettled to release pressure in critical watersheds and to facilitate government support to communities through social services and other infrastructure. Communities have also been resettled as a part of irrigation and dam projects. The social costs of resettlement are high, but for the most part have not been incorporated adequately into decision-making.

Interbasin transfer: 'interlinking of rivers' scheme – 37 rivers, all Himalayan rivers – to provide stale drinking water supplies to urban and rural populations and harness 34,000MW of electricity (WWF); Ing-Nan-Kok plans

Urban river revival – Japan and Korea

5.2 Emerging approaches

Governments of the region have by no means discarded the common approaches outlined above. However, actors around the region have begun to look at new ways of addressing watershed degradation.

E-flows is an approach to water resources management that explicitly recognizes the trade-offs between competing demands in a river basin. Development priorities are placed together with ecosystem priorities in a process of negotiation. As promoted by "FLOWS: the essentials of environmental flows" (Dryson et al. 2003), the e-flows approach is a methodology, contributing to a larger package of negotiation processes that aim to improve not only ecological and economic sustainability, but also has a social justice objective that emphasizes the role of stakeholders' involvement in decisions that affect their livelihoods. Interest in e-flows is rising in the Asia-Pacific region. Currently 20 countries in the region are undertaking some activity related to the e-flows approach (E-flows review). The adoption and implementation of e-flows has been most successful in where national legislation and policies place e-flows firmly within a framework for IWRM and catchment-level natural resources management plans. A key strategy in mainstreaming the e-flows approach has been the translation of FLOWS into Asian languages.

Payment for environmental services, have been discussed in the past years as a way to achieve social equity and financial sustainability in watershed management. The challenging questions have been: What is the service? Who

are the buyers? Who are the sellers? Public and private institutions are testing mechanisms around the world. Implementation has posed a multitude of problems, as the institutions to enable payments and other transfers are complex. In China, payment for environmental services has been publicly financed. The Sloping Land Conversion Programme and the Forest Ecological Compensation Programme were an explicit recognition of the impracticality and ineffectiveness of mandatory forest protected strategies. These focused instead on providing incentives in the form of subsidies, rewards and tax breaks to farmers located in critical upland catchment areas of important river basins. To enable these mechanisms, the policy framework must provide secure tenure, political space for multi-stakeholder dialogue and transparent, inclusive and accountable institutions (He 2006).

Decentralization, in one form or another, is a common theme across the region. **Empowering local government** to play a larger role in development is hoped to bring more responsive, appropriate and sustainable interventions. Because of the mismatch between watersheds and local administration, linkages between the two have been difficult. Some lessons from experience in India indicate that while lower levels of government, in this case Zilla Parishads, Panchayat Samithis and Gram Panchayats, can play a central role in implementing watershed management projects. However, watershed institutions still do not have powers or authority beyond the watershed project, while at the same time, local government still does not have full responsibility for development planning.

Watershed management has provided a stage for the **development of new civil society organizations** to focus on the local dynamics of watersheds (Badenoch 2006). In Thailand, for example, conflicts over water in upper tributary watersheds of the north resulted from the shift from opium to temperate vegetables. As tensions rose, watershed networks were established at local appropriate scales to mediate conflict over the land-water interface in the mountains. These networks have struggled to solve their problems, but they have also been engaged in the larger process of establishing basin and sub-basin organizations as representatives of local water users (Thomas, 2006). An on-going challenge, is to engage with the local sub-district administration organizations, which have been undergoing a push of democratization.

In post-Soviet Uzbekistan, privatization of agriculture has produced **smaller-scale private and cooperative farms** that achieved higher yields of cotton and wheat, 40% and 60% respectively, reduced salinity, increased profits and boosted workers' income by 125%. This phenomenon, known as "bright spots", occurs within the larger context of the Aral Sea basin that was decimated by soviet irrigation policy. The improvements observed have occurred in a number of settings, driven by indigenous forces unleashed by the provision of private property rights. If the strategies employed in these bright spots, such as improved on-farm irrigation management and judicious use of water for salt leaching, were employed at a larger scale, it is believed that there is potential for

improving the situation at the basin level. The technical improvements, including use of organic soil amendments and improved agronomic practice, were facilitated by institutional adjustments enabled by networks of trust and reciprocity among local communities (Noble, ul Hassan and Kazbekov 2005).

Conservation responses may include improved coordination among users, often through innovative institutional arrangements (Molle 2003). Innovative approaches being implemented in the Asia-Pacific appear to be investing more and more in this type of response to increasing water scarcity.

6. The transboundary imperative

One basic assumption about ecological systems is that they do not conform to the boundaries imposed by social systems. River basins are a prime example of this basic mismatch. Transboundary water has emerged as a priority for the sustainability of economies, the stability of international politics and the integrity of regional ecosystems.

The threat of coming water wars is still debated. Tension between countries sharing rivers is a daily reality.

Of the region's 30 major river basins, 18 are shared by more than one country. The Mekong River has six riparian countries, while the Kura-Araks and Amu Darya flow through five. The need for international cooperation is particularly acute in the South Asia sub-region, where the shared waters of the Brahmaputra, Indus and Ganges are intensively used by riparians. With the breakup of the Soviet Union, the transboundary nature of the Amu and Syr Darya rivers has assumed new political and economic meaning for the Central Asian countries.

Watershed	Countries within the Watershed (number)	Number of Transboundary Treaties
Mekong	6	5
Kura-Araks	5	2
Amu Darya	5	..
Ob	4	1
Brahmaputra	4	..
Ganges	4	14
Syr Darya	4	..
Indus	4	9
Irrawaddy	3	..
Amur	3	3
Salween	3	..
Sepik	2	1
Fly	2	1
Yalu Jiang	2	..
Hong (Red River)	2	..

Yenisey	2	..
Xun Jiang	2	..
Lake Balkhash	2	..
Tarim	2	..

The institutional response to increasing transboundary water competition is not yet sufficient to meet the challenges of international cooperation. Transboundary treaties, where they exist, have been difficult to implement. Cooperation that requires countries to recognize limits to national sovereignty demands levels of political commitment that has not been forthcoming (Hirsch et al. 2006).

In practice, transboundary institutions are overwhelmingly inter-governmental, which has meant that technocratic and opaque decision-making has dominated. Even with increasing acceptance of the need for broader participation in international river basin management, civil society is developing in different forms and at differing rates across the region. Further political commitment to implementing Principle 10 (access to information, participation in decision-making and access to justice in environmental matters) is needed. In the meantime, more general principles such as 'do no harm' and notification should be implemented.

[Sesan case]

[MRC case] [Brahmaputra case]

7. Options for moving forward

Investing in ecosystems

For the Asia-Pacific region watersheds provide many critically important ecosystem goods and services that benefit society at local, national and regional levels. In this region investment in infrastructure is considered to be the core of economic growth and poverty reduction. This belief is reflected in government policies and the agenda of regional development agencies such as the Asian Development Bank.

Ecosystems are infrastructure for development as well, although they do not receive anywhere near the same level of investment that physical and other infrastructure do. If development planners consider ecosystems to be an integral part of the infrastructure, valued in the same way as physical infrastructure, that needs to be developed, maintained and protected, it may be possible to mobilize the political commitment for allocating resources (Emerton 2006).

Investing in ecosystems as infrastructure is not just a technical exercise. It will require support for changing the way we think about policy, science and practice, and how they interact....

There are many opportunities to improve the managing tradeoffs through good policy, good science and good process

Good Policy

- Application of subsidiarity principle
- Application of Principle 10
- Application of principles of WCD
- Conflict prevention before conflict management

Good Science

- Improved water productivity to improve equity and sustainability
- Modernized irrigation
- Data collection at watershed level
- Demand management

Good Practice

- Application of E-flows
- Construction of light institutions: Coordination over centralized integration, prioritizing broad stakeholder involvement
- Dialogue to cross borders
- Development of transboundary governance