level.[13] (See the on-line Water Law data-base and analysis is available at www.oas.org/dsd/EnvironmentLaw/WaterLaw/home.htm.)

A recent proposal by Brazil envisages the convergence and harmonization of water policies in the Americas. The Strategic Water Plan has been presented by Brazil to the Latin American and Caribbean Forum of Environment Ministers in Venezuela in November 2005, and is formally available at the Fourth World Water Forum, through the support of a GEF-UNEP-OAS hemispheric-wide project supporting Integrated Water Resources Management. Work is underway now to identify opportunities for water policy convergence, and this issue will be a centre-piece of the First Inter-American Meeting of Ministers and High-Level Authorities on Sustainable Development, to be held in Bolivia in October 2006.

One example that demonstrates both the potential and operational complexity of water policy convergence is potable water. With global standards set out through the World Health Organization Guidelines for Drinking-Water Quality (GDWQ), all countries of the Americas have quantitative potable standards which can be compared. Analysis by the OAS shows that in the specific area of potable water, there is substantial variance among countries (see Box Two below); while actual levels inevitably vary even more widely, due to differences in regulatory enforcement of standards.[14] The challenge of policy convergence outside of potable water standards becomes considerably more challenging, given the absence of formal integrated water resource management laws in the large majority of countries of the region.

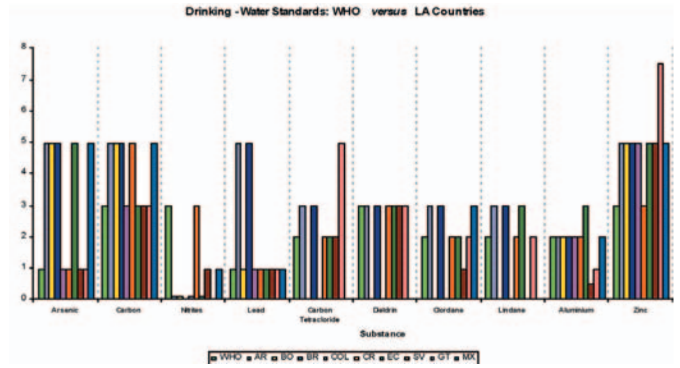
Securing Institutional Transparency and Meaningful Public Participation: One of the pillars of good governance is the degree to which water institutions are committed both to high levels of transparency, as well as ensuring meaningful input by civil society to policy formulation. Lessons from within and outside water policy clearly show that public policy cannot proceed without the engagement of the public. The Inter-American Democratic Charter and other commitments by the countries of the region reiterate the importance of transparency and public participation with regards to development. Transparency International, the UNDP Water Governance Facility and others point to the water supply and sanitation sector as being particularly plagued by the highest levels of corruption of any sector. By adopting a variety of transparency and right-to-know benchmarks covering land-zoning approvals, permitting, concessions, as well as supporting more systemic access-to-information and right-to-know commitments, transparent institutions decrease the role of corruption and, through public scrutiny, increase both equity and cost-efficiency.

The second part of the governance equation is ensuring that the public knows of policy options, and has a voice in the crafting of policy decisions. In Brazil, more than 7,000 stakeholders directly participated in the formulation of the Brazilian National Water Plan, which became the first Plan in the Latin American and Caribbean region to meet the commitments made at the 2002 Johannesburg Summit. Launched on March 3, 2006, the Plan – which included the hosting of a national "Water Parliament" – represents a unique pact among the government, water users, and civil society for the integrated management of the national water resources for the next 15 years.

At the project level, a central feature of OAS water management work is the role of public consultation. In the San Francisco River Basin project – supported by the GEF-UNEP-OAS-National Water Agency (ANA) of Brazil – some 6,600 stakeholders were directly involved in consultations leading to the establishment of the San Francisco River Basin Committee, which in turn supported public consultations during a four-year period, involving 217 public consultation events including more than 12,000 participants. In the GEF-UNEP-OAS Pantanal and Upper Paraguay River Basin projects, some 116 public consultation events involving 4,530 participants representing 258 federal, state and municipal institutions, private enterprises and non-governmental groups were consulted in the formulation of the Strategic Action Plan (SAP) for the basin. Similar outreach and public consultations processes were undertaken in the GEF-UNEP-OAS Procuenca San Juan project between Costa Rica and Nicaragua, and more recently, involving the GEF-World Bank-OAS Guarani Aquifer project.

Box Two.

COMPARING POTABLE WATER STANDARDS IN LATIN-AMERICA[15]



Source: Armonización de los Estándares de Agua Potable en las Américas. (Paola Truque, 2005)

By improving a common scientific understanding of the unprecedented challenges facing water management, by supporting basin-wide institutions that raise the possibility of regulatory and upwards policy convergence, and by ensuring high levels of transparency and public participation, there are small but encouraging signs that progress in the Americas is underway towards securing sustainable water management.

For further information, please contact the Department of Sustainable Development of the General Secretariat of the Organization of American States (OAS/DSD). *This DSD Policy Brief Series provides a forum for discussion on issues pertaining to sustainable development to help transfer good practices and lessons learned from project design and implementation. This is the ninth in a series that includes topics on:*

— Biodiversity Conservation
— Water Resources Management
— Transboundary Aquifers
— Natural Hazards Management
— Renewable Energy
— Trade and Sustainable Development

This special issue of the policy series has been prepared for the IV World Water Forum in Mexico City, March 16-22, 2006. The OAS/DSD supported the preparatory process towards the Forum with specific goals and concrete actions, as chair and member of the Operative Committee of the Americas (OCA).

13. Juan Cruz Monticelli (2005), "Road Map to Water Synergies in the Americas," Department of Sustainable Development, OAS. See: http://www.oas.org/dsd/Documents/Draft_water_convergence.pdf
14. Paola Truque (2005), Armonización de los Estándares de Agua Potable en las Americas. Department of Sustainable Development, OAS. See:http://www.oas.org/dsd/publications/classifications/Armoniz.EstandaresAguaPotable.pdf
15. Units:

Parameter	Unit	WHO	Argentina	Bolivia	Brazil	Colombia	Costa Rica	Chile	Ecuador	El Salvador	Guatemala	Mexico	
Arsenic	mg/100L	1	5	5	5	1	1	5	5	1	1	5	1000
Carbon	mg/m3	3	5	5	5	3	5	10	3	3	3	5	
Nitrites	mg/L	3	0.1	0.1	-	0.1	3	1	0.1	1	0.01	1	100
Lead	mg/100L	1	5	1	5	1	1	5	1	1	1	1	
Carbon Tetracloride	µg/L	2	3	-	3	-	2	-	2	2	5	-	
Dieldrin	µg/100L	3	3	-	3	-	3	3	3	3	3	-	10
Clordane	µg/10L	2	3	-	3	-	2	3	2	1	2	3	
Lindane	µg/L	2	3	-	3	-	2	3	3	-	2	-	
Aluminium	mg/10L	2	2	2	2	2	2	2.5	3	0.5	1	2	
Zinc	mg/L	3	5	5	5	5	3	5	5	5	7.5	5	

Note: Cadmium in Costa Rica has been divided by 10 and Zinc in Guatemala by 2.

www.oas.org/dsd

POLICY SERIES, NUMBER 9 — MARCH 2006

SPECIAL ISSUE FOR THE IV WORLD WATER FORUM, MEXICO CITY

Water Management and Climate Change: *Lessons from Regional Cooperation*[1]

SECTION ONE: ECOSYSTEM DEGRADATION AND WATER MANAGEMENT

In early 2006, two studies warned that Greenland's glaciers are melting far more rapidly than previously assumed. The first, by the Glaciology Group Research of Swansea University's School of the Environment and Society, concludes that Greenland's glaciers are undergoing "a sudden, dynamic response to climate change." The second, published in the February 2006 *Science* journal,[2] concludes that the rate of glacier melting in Greenland draining into the Atlantic Ocean has doubled in the past five years. These studies reinforce a growing body of empirical evidence of warming trends affecting both the Arctic and the Antarctic. For example, some scientists estimate that the total mass of Arctic sea-ice has declined by 60 percent in four decades, while a March 2006 *Science* article warns of similar warming rates affecting the Antarctic.[3] In addition, the Patagonian ice fields, which comprise the largest contiguous ice field in the Southern Hemisphere, are experiencing the fastest rate glacial retreat and the highest percentage of sea-level increase recorded for any mountain glacier.[4]

These empirical observations reinforce what climate models have predicted for years: one of the strongest signals of greenhouse warming is the loss of Arctic and other sea-ice.

MILLENNIUM ECOSYSTEM ASSESSMENT

Recent evidence of accelerating glacier melting underscores the view that climate change is no longer a distant threat. NASA confirms that 2005 marked the warmest year in a century. Moreover, the five warmest years recorded in the past 100 years were 1998, 2002, 2003, 2004 and 2005.[5] A key question entails how policy-makers should begin adapting to climate change, particularly at the regional level. One tool to help identify the complex relationship among ecosystems, and implications of their accelerating changes on human development, is the Millennium Ecosystem Assessment (MA). Over five years, the United Nations assembled some 1,400 experts from 95 countries, to conduct one of the most comprehensive global inventories of the state and fate of the planet's ecosystems.

The central finding of the Millennium Ecosystem Assessment is deeply sobering: of 24 major global ecosystem services on the planet, 60 percent are already degraded. Ecosystems that demonstrate varying rates of degradation include freshwater and water purification services, flood control, local fisheries and regional climate regulation. The MA Synthesis Report, published in January 2006, warns of increased risk of non-linear and unforeseen consequences of ecosystem degradation, "including accelerating, abrupt, and potentially irreversible changes… with important consequences for human well-being."[6]

CLIMATE CHANGE, WATER MANAGEMENT AND REGIONAL COOPERATION

One challenge facing the Americas is to understand complex linkages between climate change and efforts to secure sustainable water management. The Millennium Ecosystem Assessment, while cautioning against drawing links between single weather episodes like the record-breaking 2005 Atlantic hurricane season and climate change, concludes that

Nevertheless, there is evidence that climate change may already be causing long-term shifts in seasonal weather patterns and the runoff production that defines renewable freshwater supply.[7]

The question currently debated by scientists is whether warming trends registered in Greenland and the Arctic are affecting weather conditions thousands of kilometers away? Atmospheric circulation patterns and rainfall variability in the Amazon River Basin are affected directly by oceanic circulation patterns and sea surface temperatures (SSTs) in the Atlantic and Caribbean basins. Small changes in Atlantic sea surface temperatures and levels can affect local freshwater cycles, including precipitation patterns, rates of evaporation, overall soil moisture, and groundwater recharge rates and runoff in the Amazon basin.

Among the most surprising weather events of the record-breaking 2005 season was the severe drought that affected the Amazon River Basin.[8] For example, in the Rio Negro of Manaus, the drought was the most severe since 1902. More people, particularly poor people, were affected by the Amazon drought than in any previous episode. In many areas, local fisheries collapsed or were severely depleted, worsening rural poverty. The drought increased a number of human-health risks, including malaria, possibly cholera and other water-borne diseases, due to the decline in waste drainage functions that the river provides for many poor communities.

Compounding human and developmental impacts, the drought exacerbated a number of already severe ecological pressures. For example, forest-fires rates in the Acre State of Brazil tripled during the drought period, thereby adding new pressures to the rapidly shrinking tropical

1. This note has been prepared by Scott Vaughan and Jorge Rucks of the Department of Sustainable Development of the Organization of American States (OAS), with the collaboration of Amy Ricebeck, Claudia de Windt, Enrique Bello, Karin Rosales, Maria Apostolova, Michela Miletto, Rosa Trejo, Stella Zucchetti and Tomas Berguecio. The views expressed herein are presented for informational purposes only and do not represent the opinions or official positions of the Organization of American States its General Secretariat, or any of its Member States.
2. Science 17 February 2006: Vol. 311. no. 5763, pp. 963 – 964. Julian A. Dowdeswell. "ATMOSPHERIC SCIENCE: The Greenland Ice Sheet and Global Sea-Level Rise"
3. University of Wales, Swansea, "Greenland Glacier Suddenly Increasing", February 2, 2006. (http://www2.swan.ac.uk/news_centre/news_item.asp?news_id=11447); Rignot, E., Kanagaratnam, P., 2006. Changes in the velocity structure of the Greenland ice sheet. Science, 17 February 2006 Vol. 311, 986-990; D.A. Rothcock, Y. Yu and G.A. Maykut, (1999), "Thinning of the Arctic Sea-ice Cover," Geophysical Research Letters, Vol. 26, No. 23, 3469-3472. (December 1999)
4. Science 17 October 2003: Vol. 302. no. 5644, pp. 434 – 437. Eric Rignot, Andrés Rivera, Gino Casassa, "Contribution of the Patagonia Icefields of South America to Sea Level Rise". This study measured changes over 25 years in speed and volumes of the 63 largest glaciers in the Patagonian icefield, using digital elevation models and comparing conventional topographic data from the 1970s and 1990s with data from NASA's Shuttle Radar Topography Mission, flown in February 2000.
5. National Aeronautics and Space Administration, "2005 Warmest Year in Over a Century," January 24, 2006. www.nasa.gov
6. Millennium Ecosystem Assessment (2005). Ecosystems and Human Well-Being: Synthesis. Island Press, Washington, DC. 2005, World Resources Institute.http://www.millenniumassessment.org/proxy/Document.356.aspx
7. Millennium Ecosystem Assessment (2005). Ecosystem and Human Well-Being: Current State and Trends, Volume 1, editors: Rashid Hassan, Robert Scholes and Neville Ash. Chapter Seven: Freshwater,http://www.millenniumassessment.org//en/products.global.condition.aspx
8. While scientists have improved the accuracy in forecasting droughts – taking into account El Niño and La Niña periodicities – the 2005 Amazon drought was unexpected. By October 2005, many river levels in the basin hit their lowest levels in 35 years.

forest cover in the Amazon,[9] the center of the richest concentration of biological diversity on the planet.[10]

SECTION TWO: REGIONAL ACTION IN CLIMATE FORECASTING AND SUSTAINABLE WATER MANAGEMENT

AMAZON RIVER BASIN

Since the Third World Water Forum (March 2003), a number of efforts at the national and regional level have gained momentum to improve forecasting capabilities linking climate impacts with water management, as well as to identify adaptation priorities. Two regional efforts in the Americas are noted briefly below. The first, coordinated under the auspices of the Amazon Treaty Cooperation Organization (OTCA) whose member countries comprise Bolivia, Brazil, Colombia, Ecuador, Guyana, Peru, Suriname and Venezuela, is advancing on-the-ground capacities to understand the basin-wide effects of local climate change events, including climate-related risks of drought and flooding in the wider Amazon basin.

Among the programs of the OTCA, the Organization of American States (OAS) and the United Nations Environment Programme (UNEP), are involved in a two-year Global Environment Facility (GEF) Project Preparation for the Amazon basin that will focus on enhancing the riparian countries capabilities to assess vulnerability to climatic variations, through the development of a basin-wide hydro-climatology and soil-use forecasting system to:

- improve drought, flood and forest-fire forecasting,
- assess the effects of hydrological trends in the Basin and its principle sub-basins and glacier headwaters; and
- understand current sediment loads and surface discharges of the major rivers of the basin; and the effects of climate change on these variables.

Following the completion of this analytical and forecasting work, the Amazon basin project will support specific climate-adaptation activities at the community level, including focusing on drought management and response systems at the sub-basin level and Amazon headwaters regions.

LA PLATA BASIN

A second example in the international arena to improve understanding of the implications between regional climate change impacts and freshwater management is underway in La Plata River Basin. Since 1967, governments of Argentina, Bolivia, Brazil, Paraguay and Uruguay have cooperated under the Intergovernmental Coordinating Committee (CIC) to manage La Plata Basin Treaty.

Since 2001, two GEF-UNEP-OAS projects have supported efforts to establish a common scientific diagnostic of one of the largest and most important freshwater basins in the world – comparable to the Amazon – and to prepare a detailed analysis of the hydrological cycle of the basin. Specifically, the project has established a common way to assess the dynamic relationship among the hydrological cycle, the regional effects of climate change, and the impacts of changes on soil use dynamics.

During the project development process, a series of climate change scenarios were developed that indicated that climatic variability had a dominant influence over the hydrology of La Plata Basin. This is in contrast to the situation prevailing in the Amazon River Basin, located immediately to the north of the La Plata Basin, which is more severely influenced by anthropogenic factors. These climate change scenarios examined a 30-year period, during which precipitation in La Plata Basin was forecast to increase by 10-15 percent on average, with increases of up to 30 percent in specific areas of the Basin. These changes in rainfall affect land use and soil loss, and have the potential to upset the delicate balance between precipitation and evaporation in the Basin. At the Basin level, these changes have the potential to increase the risk of flooding, especially when rainfalls consistently exceed historical means. These scenarios are based on a variety of climate models, all of which demonstrated a consistency of output suggesting a trend toward increasing precipitation.

Climate-related increases in temperatures are likely to increase rates of evaporation in the basin, with the net effects, viewed in light of the expected changes in rainfall patterns, being an increased risk of extreme events, as runoff becomes more "flashy" or erratic. This increased periodicity in precipitation, reduction in available moisture due to higher evaporation, and reduced runoff has a significant potential to impact human economic activities dependent on rainfall and runoff. In particular, these likely decreases in mean annual runoff have the potential to seriously reduce the availability of hydroelectric power generation potentials. As hydroelectric power currently supports much of the economic development in the five Basin countries, the forecast changes in rainfall and runoff represent serious threats to sustainable economic development, as suggested by the data from the Parana River Basin in north-eastern Argentina.

In addition to helping policy-makers improve their understanding of climate-related impacts, the Amazon and Plata basin projects create unique policy "platforms" upon which to complement a number of other regional and specific activities that support integrated water management. Among those efforts, the OAS has been involved in the bilateral cooperation between Argentina and Bolivia in implementing the strategic action program for the management of the Bermejo River Basin; the cooperation among the governments of Argentina, Brazil, Paraguay, and Uruguay in the environmental protection and sustainable development of the Guarani Aquifer System, one of the largest transboundary aquifers in the world under a joint management plan; the project activities within the Pantanal and Upper Paraguay River Basin to support the integrated management of the largest wetlands on the planet; cooperation with the UNESCO Internationally Shared Aquifer Resource Management Programme (ISARM) which identified pilot-projects on transboundary aquifers of particular concern located in La Plata Basin, including the Yrenda-Toba-Tarijeno underlying the Andean foothills and Gran Chaco plains, and the Pantanal transboundary aquifer in hydraulic connection with the unique Pantanal wetland ecosystem.

Other activities in the basin include the UNESCO-IHP Integrated Hydro-Climate Forecasting System, and the GEF-UNEP-OAS project which focuses on the land and ecosystem degradation in the semi-arid region of Gran Chaco.[11]

SECTION THREE: GOVERNANCE, INSTITUTIONS AND POLICY INTEGRATION

Relatively new challenges like climate change are compounding a long list of familiar challenges associated with sustainable water management. However, progress in creating innovative water institutions that mirror the hydrographic characteristics of the freshwater basins within which they are tasked to manage creates the potential to better understand the effects of climate change and other pressures, and coordinate cost-effective responses. For example, at the national level, countries like Mexico, Honduras, Brazil, Costa Rica, Nicaragua, Argentina, and others have established water-basin committees and institutions. Water basin committees continue to emerge as innovative solutions to governance challenges, especially given important systemic transitions underway towards decentralization. For example, the San Francisco River Basin Committee, established in 2001, has the mandate under Brazil's National Policy on Water Resources to regulate water rights and water charges. The committee represents the interests of some 500 municipalities and encompasses seven state-level jurisdictions as well as federal authority, and comprising more than 13.3 million people who live in the San Francisco Basin.

New water institutions have the potential to identify and overcome jurisdictional competition and the lack of coordination among different ministries and agencies. Water basin committees and institutions are strengthened by an overarching jurisdictional perspective,[12] based on trends and pressures within the basin or wider catchment-area. Efforts in the Amazon and La Plata basins to understand the basin-wide implications of climate change on hydrological cycles, has the advantage of providing uniform and comparable data to all participating countries. Climate-related analysis will help countries work together to anticipate more frequent and severe weather events, changes in local soil moisture, and advance more cost-effective regional climate-adaptation plans linked to integrated water management.

Recent efforts in water governance and water-policy integration with other sectors and disciplines suggest that there is no single "menu" or recipe of actions that will guarantee success. However, drawing on the analytical leadership of the Global Water Partnership, the Global Environment Facility, IUCN and others in water governance, coupled with decades of on-the-ground technical capacity building by the OAS Department of Sustainable Development, three aspects of water institutions at the regional level are of particular importance:

Building a Scientific Foundation of Consensus-Based Action: A key ingredient in building regional cooperation to transboundary water basins is to establish a common diagnostic baseline upon which water management priorities can emerge. The formulation of Transboundary Diagnostic Analysis tools (TDA) in all GEF-supported projects in which the OAS and other partners are involved are invaluable in forming the analytical backbone of international water projects. By setting out the parameters of diagnostic analysis at the outset, countries agree to undertake a common scientific analysis, replicating at the region-specific level similar policy-related actions, of which the Intergovernmental Panel on Climate Change is the most well-known. Diagnostic work help different sectors – from agriculture to hydropower and inland navigation activities – reach a common, basin-wide understanding of current hydrological cycles, estimated rates of changes in sources of contamination from the industrial, mining and agricultural sectors, probable changes in sedimentation or soil vulnerability, as well as climate-related changes. This commitment to science-based analysis creates a foundation upon which strategic action plans involving all countries in the basin are moving forward.

Supporting Regulatory Equivalence and Convergence: Since the signing of the treaty defining the uses of the San Juan River between Costa Rica and Nicaragua (1888) more than 25 treaties in bilateral water management have been signed in the region. *(See Box One below).*

Treaties, committees and institutions create the context within which targets and commitments can be implemented. More specifically, treaties and regional legal agreements create one context in which national and regional water standards, regulations and related approaches can converge towards higher levels over time. Work by the OAS in compiling existing water laws and regulations shows both a wide variance of water approaches and standards, as well as the absence of formal integrated water resource management plans at the national

Box One.
SAMPLE OF TRANSBOUNDARY WATER TREATIES IN THE AMERICAS

NORTH AMERICA	CENTRAL AMERICA & CARIBBEAN
Canada-USA Cooperation and Development Treaty on Water Resources in the basin of the rivers Columbia and Kootenai (1961)	**Costa Rica-Nicaragua** Treaty to define the water uses of the San Juan River (1888)
Mexico-USA • Convention on Transboundary Waters (1889) • Treaty about water uses of the Colorado, Tijuana and Rio Grande rivers (1944)	**Dominican Republic-Haiti** Treaty on peace and uses of water of the Artibonito Basin (1929)
Mexico-Guatemala Treaty to improve environmental protection in Usumancita River Basin (1987)	**Guatemala-El Salvador** Technical cooperation Treaty for establishing the boundary between Lempa and Paz River Basin (1938)
SOUTH AMERICA	
Argentina-Brazil Treaty for the development of water resources of the Uruguay River Basin and its tributary Peperi-Duazu River (1980)	**Argentina-Uruguay** • Agreement on uses of rapids on Uruguay River, near Salto Grande (1946) • Treaty on the boarders build by the Uruguay River (1961)
Argentina, Bolivia, Brasil, Paraguay and Uruguay Treaty of La Plata Basin, to promote joint efforts for the development of the entire La Plata Basin and its natural resources (1969)	**Argentina, Paraguay and Bolivia** Agreement establishing tri-lateral commission for the development of the Pilcomayo River Basin (1995)
Brazil-Uruguay • Convention on legal status of Mirim Lake, Brazil-Uruguay border (1933) • Treaty of the Lirim Lake and Jaguarão River. Cooperation protocol for the use of the natural resources and development of Mirim Lake Basin, and protocol of the Jaguarão River (1977) • Cooperation agreement for the uses of the natural resources of the Cuareim River Basin (1991)	**Bolivia-Peru** Creation of Autonomous Bi-national Authority of Lake Titicaca Basin, Desaguadero River, Lake Poopo and Coipasa Salt Pan system (1993)
French Guiana and Suriname Treaty to establish frontier between French Guyana and Suriname (1915)	

9. According to the government of Brazil, roughly 17 percent of the total Amazon forests have been cleared in the past three decades, largely for expanded agricultural production in such crops as soy. In addition, the problem of illegal logging of tropical hardwoods remains a critical problem throughout the region.
10. See Daniel Neptad et al. (2004), "Amazon Drought and its Implications for Forest Flammability and Tree Growth: A Basin-Wide Analysis," Global Change Biology: 10, 704-717. The Amazon basin houses the world's largest rainforest, is estimated to contain an estimated 30,000 plant species, 2,000 fish species, 60 reptile species, 35 mammal families, and 1,800 bird species.
11. See http://www.oas.org/dsd/waterresources.htm.
12. See: Daniel C. Esty and Geradin Damien (eds.) (2001), Regulatory Competition and Economic Integration: Comparative Perspectives. Oxford University Press.