



DeltA Alliance

Comparative assessment of the vulnerability and resilience of deltas

Extended version with 14 deltas

Tom Bucz

DELTARES

Unit Policy analysis and scenarios
Division Climate adaptation and risk management

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Many delta stakeholders involved..

Synthesis report

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Work documents with Delta descriptions

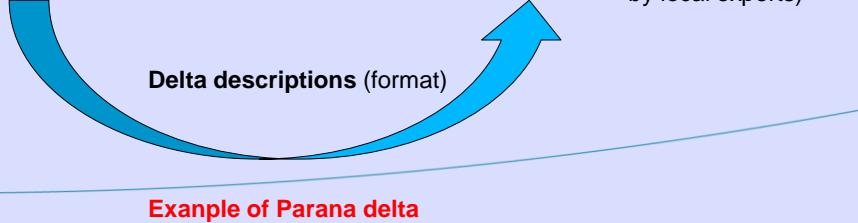
Ayeyarwady	Wim van Driel, Alterra Wageningen UR, The Netherlands Tjisse Nauta, Deltas, The Netherlands Arantza Pi Gonzalez Alterra Wageningen UR, The Netherlands
Parana	Zagare, Verónica M.E., Delft University of Technology / University of Buenos Aires Blanco, Daniel E., Machain, Natalia, Fundación Humedales / Wetlands International Carlino, Hernán, Instituto Torcuato Di Tella Quintana, Rubén, Universidad Nacional de San Martín / Fundación Humedales / Wetlands International Kandus, Patricia, Universidad Nacional de San Martín Ceballos, Darío, INTA (Instituto Nacional de Tecnología Agropecuaria)
Tana	Prof E. Odada, United Nations University Regional Centre for Water Education Kenya, Dr. Victor Langenberg, Deltas P. Odhengo, Ministry of Finances, Kenya
Zambezi	Omar Khan, MSc, Eduardo Mondlane University, Faculty of Engineering, Maputo, Mozambique Dinis Juizo, PhD, Eduardo Mondlane University, Maputo, Mozambique Susan Graas, UNESCO-IHE Institute for Water Education, Delft, The Netherlands
Nile	Shaden Abdel-Gawad, National Water Research Center, Egypt
Incomati	Antonio Hoguane, Eduardo Mondlane University, Mozambique Frank van der Meulen, Deltas, the Netherlands
Ganges-Brahmaputra-Meghna	Emaduddin Ahmad, Asif Mohammed Zaman, Zahir Haque Khan, S.M. Mahbubur Rahman, Institute of Water Modeling, Bangladesh
Yangtze	Wenwei Ren, Yi Yong, Xinghua Fu, World Wide Fund for Nature, China
Ciliwung	Jan Sopaheluwakan, Heru Santoso, Indonesian Institute of Sciences, Indonesia
Mekong	Le Quang Minh, Vietnam National University Ho Chi Minh City, Vietnam
Rhine Meuse	Bart Makaske, Alterra-Wageningen UR, the Netherlands Arjan Berkhuysen, World Wide Fund for Nature, the Netherlands
Danube	Adrian Stanica, Nicolae Panin, National Institute for Research and Development of Marine Geology and Geocology, Romania
California Bay-Delta	Peter Wijzman, Arcadis, USA
Mississippi	Anthony Fontenot, Princeton University, USA Richard Campanella, Tulane University, USA

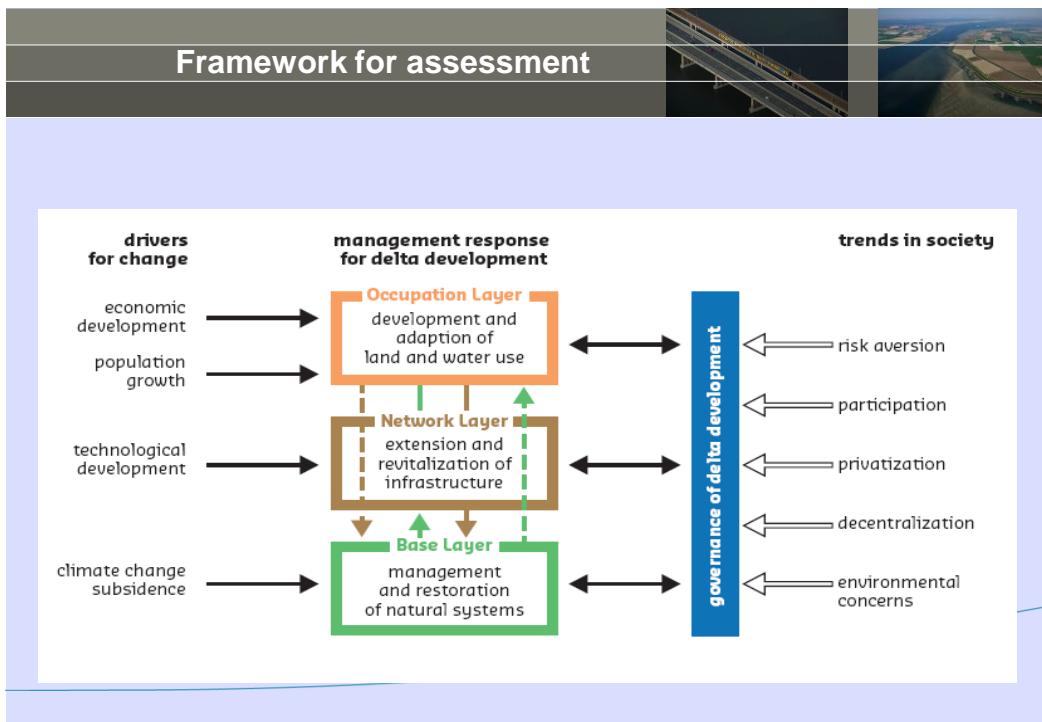
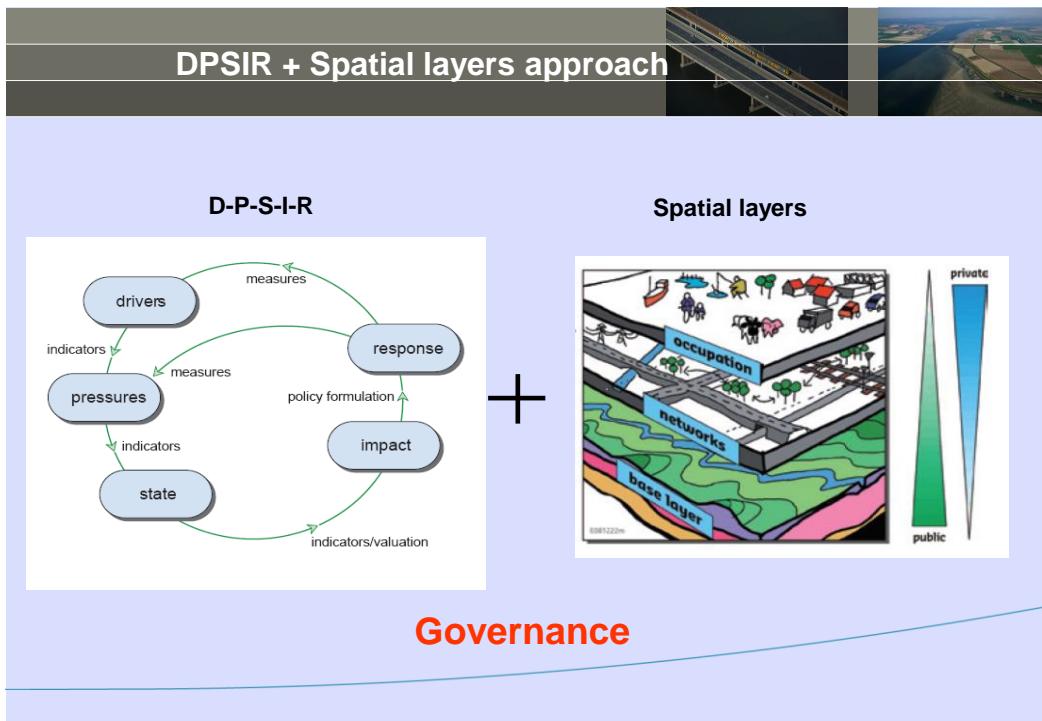
Approach of comparative assessment

- Same approach as in the first comparative assessment of 10 deltas
- Extended with 4 deltas: Tana, Zambezi, Ayeyarwady and Parana
- No updating of earlier 10 delta descriptions (except for some parts of Rhine-Meuse)
- Comparative assessment of all 14 deltas

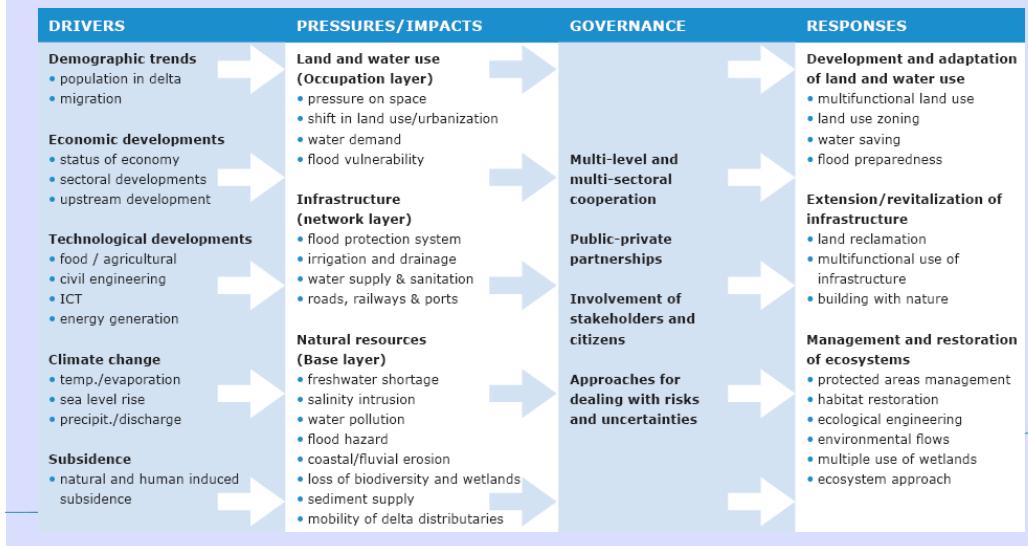
synthesis report, working documents at www.delta-alliance.org

DPSIR + Spatial layers approach => indicators => delta scorecard (expert judgement by local experts)





Towards indicators of change



Delta description - format

- Drivers of change
- Pressures / potential problems
 - Land and water use (occupation layer)
 - Infrastructure (network layer)
 - Natural resources (base layer)
- Governance (institutional and organisation aspects)

- Adaptive measures
- Technical methods and tools
- Research gaps and opportunities for knowledge exchange
- Lessons learned

Delta Scorecard



Current situation	Land and water use (occupation layer)	Infra-structure (network layer)	Natural Resources (base layer)	Governance	Resilience & Sustainability Indicator		
					Current	Moderate Scenario	Extreme scenario
Nile delta	--	0	-	0	-	-	--
Tana	-	-	0	-	-	-	--
Incomati delta	0	-	-	-	-	-	--
Zambezi	+	-	+	-	0	0	-
Ganges-Brahmaputra-Meghna delta	--	--	--	0	--	-	--
Yangtze delta	-	+	-	0	0	0	--
Ciliwung delta	--	--	--	-	--	--	-
Ayeyarwady	-	--	--	-	-	0	-
Mekong delta	0	0	-	0	0	+	0
Rhine-Meuse delta	+	++	0	+	+	0	-
Danube delta	+	+	+	0	+	0	0
California Bay-Delta	0	-	-	0	-	0	-
Mississippi River Delta	0	0	-	0	-	0	-
Parana	+	0	-	0	+	0	-

resilience/sustainability: ++ (very good), + (good), 0 (medium), - (low), -- (very low)



Comparative overview of delta score cards - Conclusions
For most of the deltas current resilience and sustainability is not satisfactory
Reasons differ per delta but some general mechanisms:
<ul style="list-style-type: none"> ■ Imbalance between demands and supply with regard to land and water use ■ Inadequate or ageing infrastructure in the delta ■ Disruption of the natural delta processes ■ Inadequate governance to address problems and implement solutions

Research gaps and opportunities for knowledge exchange and collaboration

	Nile	Tana	Incomati	Zambezi	Ganges-Brahmaputra	Yangtze	Ciliwung	Ayeyarwady	Mekong	Rhine-Meuse	Danube	California Bay-delta	Mississippi River delta	Parana
Occupation layer														
Socio-economic scenarios (9)	●	●	●			●	●	●	●		●		●	●
Water use and treatment (9)	●	●	●	●	●	●	●	●	●	●				●
Integrated spatial planning (9)	●	●	●	●	●	●	●	●	●	●				●
Ecosystem services (9)	●	●	●	●	●	●	●	●	●	●	●			●
Land-use change modelling (8)	●	●	●	●	●	●	●	●	●		●		●	●
Adaptation to salinisation (4)	●	●												
Network layer														
Freshwater management (11)	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Dikes and dams (7)	●	●			●		●	●	●	●	●		●	
Transport (5)	●	●	●					●	●					
Flood forecasting/early warning systems (5)	●	●	●	●				●						●
Base layer														
Effects of changes/ eco-system functioning (13)	●	●	●	●	●	●	●	●	●	●	●	●	●	●
Building with nature and natural safety (10)	●	●			●	●	●	●	●	●	●		●	
Monitoring changes (11)	●	●	●	●	●	●	●	●	●	●	●			●
Predicting changes (11)	●	●	●	●	●	●	●	●	●	●	●			●
Base-layer data management (7)	●	●	●	●	●	●	●	●	●		●		●	●
Governance														
Governmental roles and arrangements (10)	●	●	●	●				●	●	●	●	●	●	●
Integrated delta management (10)	●	●	●	●	●	●	●	●	●	●	●			●
Communication/capacity building (6)	●	●	●	●	●	●		●	●					
Financial arrangements (6)	●				●		●	●	●		●		●	
River basin cooperation (3)		●			●			●						
Policy impact studies (3)		●					●	●	●					

