Water Futures and Solutions
Towards Innovative Solutions through Integrative Water Futures Analysis

IIASA
December, 2014
Research Question

• What water-related policies & management practices can be implemented today that will be robust at improving human well-being through water security, across a range of possible futures & associated uncertainties we face?
Challenges: Uncharted Waters

- Water cannot be managed at a single sector or scale.
- Water management is risk based, but how are risks changing?
  - Large uncertainties
    - Data
    - Scenarios
    - Models
  - No stationarity
    - Robust, flexible solutions?
Increasing uncertainty
Decreasing knowledge
Objectives:
Inspire and Enable Creative and Innovative Solutions Across Scales and Sectors

• Water futures:
  – Develop jointly with stakeholders across sectors and world regions.
  – Maintain **consistency** with other global scenario processes
  – Develop and provide **harmonized** databases.
  – Multi-model assessment of current and future balances
  – Provide stakeholders with the numbers to help set management priorities, assess synergies, and understand risks and uncertainties.

• And Solutions:
  – Assemble and make available information on sector and water management options and assess the robustness of portfolios of options
  – Reveal combinations of options that work **consistently** across scales and sectors.
  – Uncover opportunities for innovative solutions by assessing the socio-economic and biophysical conditions in which they succeed.

• Provide a knowledge hub maintaining continuity of information, data and tools and connection to wide knowledge networks
Contribution

The aim is for WFaS to be a continuing effort over the long term providing:

Harmonization
of data, methods, tools

Consistency
across sectors and scales

Continuity
decision support information that is maintained and updated indefinitely
Water Futures and Solutions Project Structure

Consists of three major coalitions

Organized into the following groups

- Governing Board
  - Sector Actors Group
  - WaterFutures4 the World
  - Scenario Focus Group
  - Project Team
- Secretariat
- External experts

Sponsor Coalition
Science Coalition
Stakeholder Coalition

ensuring consistency & usefulness of outputs
“Fast track”

While networks, partnerships and funding are being developed:

• Use ongoing research to develop (preliminary) quantitative water scenarios that are consistent with IPCC SSPs and climate model projections for the IPCC RCPs;

• Undertake rapid assessment with preliminary scenarios to indicate the locations and magnitude of future water challenges to support WFaS stakeholder consultations and test the information flow and model linkages of the multi-model water scenario assessment approach;

• Explore existing water-related methodologies and data used in current integrated assessments, climate impact and development modeling studies to define and propose enhancements for implementation in stakeholder-led WFaS scenario analysis;
Water Futures and Solutions

World Water Scenarios Approach
Hydro-Economic Classification, 2000

Hydro-economic Development Challenges

Coping capacity

low

Complexity

high

HE-11

HE-12

HE-13

HE-21

HE-22

HE-23

HE-31

HE-32

HE-33

Low complexity

High complexity

Economic-Institutional Capacity

0.0

0.1

0.2

0.3

0.4

0.5

0.6

0.7

0.8

0.9

1.0

NAM

EUR

CAM

LAM

OCE

AFR

NAF-MEA

ASIA
### Quantitative Assumptions

#### Table 3: Qualitative technological changes on water use intensities in the domestic and industry sectors according to HE-regions.

<table>
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<th>L</th>
<th>M</th>
<th>H</th>
<th>M</th>
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<tbody>
<tr>
<td>socio-economic capacity</td>
<td>poor</td>
<td>rich</td>
<td>Rich</td>
<td>Poor</td>
</tr>
<tr>
<td>hydro-climatic complexity</td>
<td>low</td>
<td>low</td>
<td>high</td>
<td>high</td>
</tr>
<tr>
<td>HE-1</td>
<td>HE-2</td>
<td>HE-3</td>
<td>HE-4</td>
<td></td>
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<tr>
<td>H</td>
<td>SSP1</td>
<td>Sustainability Quest (SSP dominant)</td>
<td>HL</td>
<td>B</td>
</tr>
<tr>
<td>M</td>
<td>SSP2</td>
<td>Business as Usual (SSP as HE)</td>
<td>ML</td>
<td>D</td>
</tr>
<tr>
<td>L</td>
<td>SSP3</td>
<td>Fragmentation (HE dominant)</td>
<td>LL</td>
<td>E</td>
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#### Table 4: Applied annual efficiency change rates as derived for different classes.

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>C</th>
<th>D</th>
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<tr>
<td>1.2%</td>
<td>1.1%</td>
<td>1%</td>
<td>0.6%</td>
<td>0.3%</td>
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highest lowest
Note: The map shows the ratio of multi-model ensemble mean annual runoff over a 30-year period 1971-2000 using outputs of six hydrological models and five CMIP5 climate models at 30 arcmin latitude/longitude, bias-corrected for impact and adaptation analysis by the ISI-MIP project.
Municipal Water Withdrawal (km$^3$/year)

Source: WaterGap (Flörke et al., 2012; WFaS runs, November 2013)
Transforming Mauritius sugar-processing plants to produce second-generation ethanol is a positive, improving trade balances, energy security and reducing emissions, while maintaining land productivity.

But, if rainfall is reduced as under the worst climate scenario, energy costs and emissions would increase to deliver the required water to all uses.

Integrated systems analysis across scales and sectors is needed to assess these synergies and tradeoffs and develop innovative solutions that are effective and consistent.
Ongoing Coordinated Research

- Water Futures and Solutions ‘Fast-Track’ Analysis. (Austrian Development Agency)
  - Contributors: IFPRI, NIES, PBL, Kassel, UMD, Wageningen, Utrecht, PIK
- Sustainable solutions against groundwater salinization in Coastal Areas (USAID/Sida/MFA-NL)
  - Partners: IWA, Arcadis, KWR
- Sustaining and Improving Rural Livelihoods through Adaptive Approaches to Land, Soil Nutrient and Water Management (TIFAC and IIASA)
  - Partners: Institute of Rural Management Anand, India; National Institute of Hydrology, India; Centre for Water Resources Development and Management, India
- Joint Research Partnership on Flood Resilience  RPV, WAT, ESM (Zurich Foundation)
  - Partners: Zurich Insurance Group, Switzerland; Wharton School, USA; Practical Action, UK
- GAEZ v4 (FAO)
- GWP/OECD Task Force on Water Security and Sustainable Growth
- Nature-II: Future Threats to Human Water Security and River Biodiversity
  - Partners: CUNY, Wageningen, Rensselaer Polytechnic - Funder: NSF
- Integrated Modeling of Water-Food-Energy Nexus in Asia and the Pacific (ADB)
- Integrated Solutions for Water, Food, Energy and Ecosystem Security under Rapid Global Change (GEF)
Partners Needed!  
Get Involved

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If we focus our attention on problems, we will find problems.  
If we focus our attention on solutions, we will find solutions.