

An Economic Evaluation of Climate Change Impact on the Sava River Basin

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Framework

- Country coverage: Albania, Bosnia and Herzegovina, Croatia, Macedonia, Serbia and Slovenia.
- A multidisciplinary approach : Different modeling techniques are combined to provide a robust effort in understanding the impacts.
- Different climate scenarios: Based on historic trends and future predictions, various scenarios have been developed with regard to temperature and precipitation.
- Achieved by technical analyses of historic meteorological and hydrological data trends and projections, General Circulation Model projections, and the formation of a hydrologic model of the basin for simulation of possible futures based on gained knowledge of trends in the SRB.

Crop modeling

- For countries; Slovenia, Bosnia and Herzegovina, Croatia, and Serbia for 30 years continuous data for selected climate variables.
- The methodology to determine the change is based on a historic regression between climate variables and crop production.
- An incremental change is applied to the climate variables and the regression is assumed to hold true for the production of the crop production. The change to the climate variable is a steady change over the time period to 2030.
- For example if precipitation is selected to decrease 20% over a 20 year period. The precipitation would decrease 1% annually from the original value so a net 20% decrease over the 20 year period exists.

CGE Modeling - Data Sources

- GTAP data for Slovenia, Croatia , Albania and the rest of SEE
- WB projections (2009-2015)
- IMF-World Economic Outlook (1990-2015)
- OECD – Slovenia (2004-2009)
- FAO crop data (1990-2009) : Slovenia, Bosnia Herzegovina, Croatia, Albania, Montenegro & Serbia.
- Observed data on temperature, precipitation and rainfall change for the last 30 years (Country Hydro Meteorological Institutions).

GTAP-CGE (16)

- Agriculture (8)
 - Paddy rice;
 - Wheat;
 - Other cereal grains ;
 - Vegetables, fruit, nuts;
 - Oil seeds;
 - Sugar cane, sugar beet;
 - Plant-based fibers;
 - Other crops.
- Forestry,
- Electricity,
- Water services (utilities),
- Trade,
- Air transport,
- Sea transport,
- Other transport,
- Rest of the economy.

CROPWAT-FAO (31)

Alfalfa, Artichoke, Banana, Barley
Beans, Cabbage, Citrus, Cotton,
Date Palm, Grains, Grapes, Grass,
Groundnut , Maize, Mango, Millet,
Pasture, Pepper, Potato, Pulses,
Rice, Sorghum, Soybean,
Sugarbeet, Sugarcane, Sunflower,
Melon, Tobacco, Tomato, Vegetable,
Wheat.

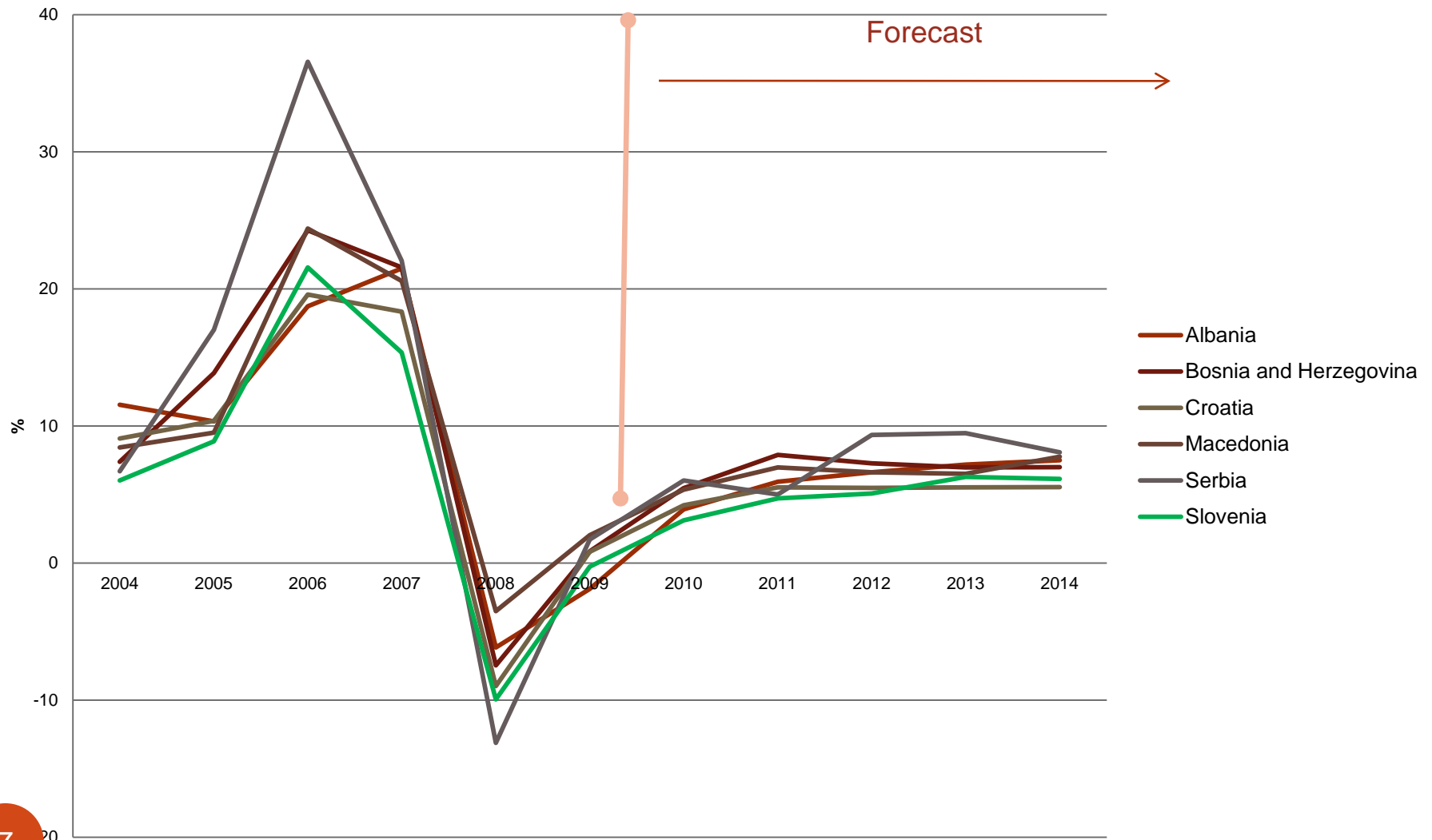
Mapping:

*Hertel et al. (2005), Economic
Modelling (22), pp: 646-664.*

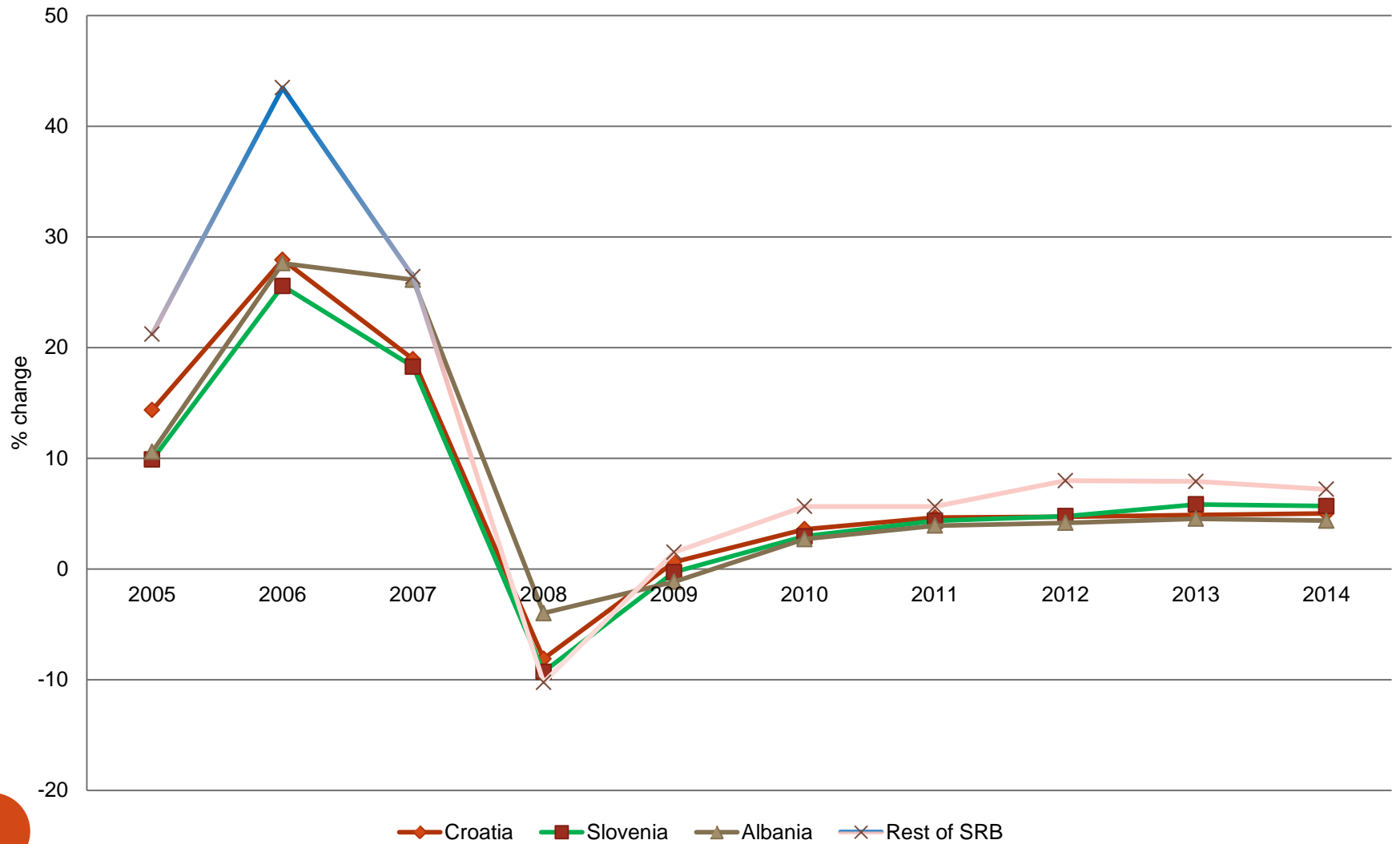
CGE - Economic Baseline (BAU)

- Agricultural baseline:
GTAP data mapped to FAOCROP statistics.
- Environmental baseline: Rainfall data estimated on the basis of the historical trends.
- Economic baseline. 3 steps:
 - Population growth is used as an input; a shock corresponding to the annual population growth is applied to the base year population data for each country represented in the GTAP database,
 - Total Factor Productivity growth estimates (from the literature),
 - Capital accumulation parameter is adjusted in order to reach the GDP growth estimate developed by the IMF.

BAU - Growth in SRB countries



BAU - Consumer Demand for Electricity

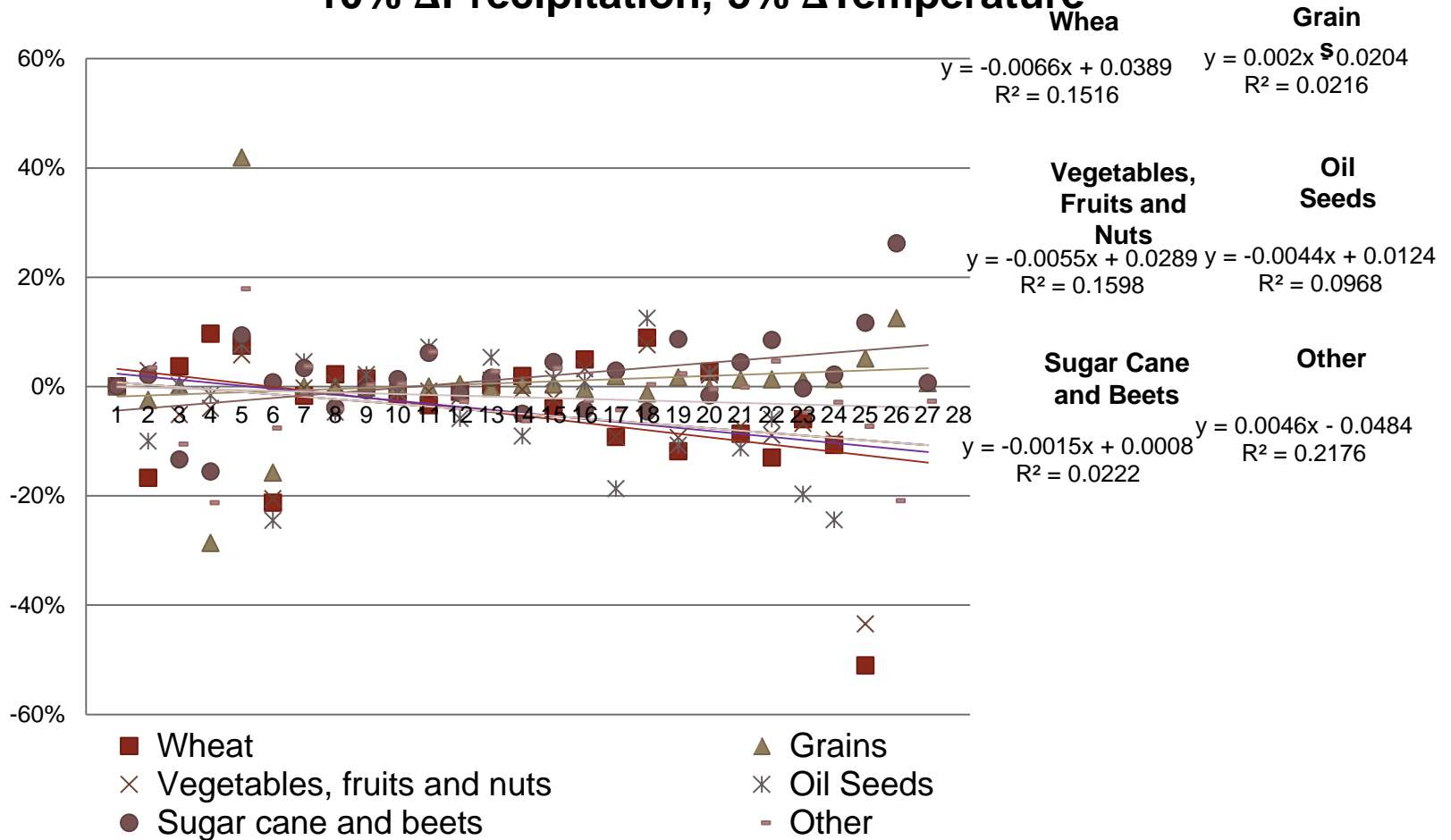


BAU - Household demand for water services



Case study 1: CGE & Trends analysis

-10% ΔPrecipitation, -5% ΔTemperature



Impact on Real GDP & Sectoral production- CGE

Real GDP	BAU	CC simulation
% change		
SVN	2.38	-0.05
ALB	3.11	2.9
HRV	3.6	3.35
XEE	0	-1.2
XER	3.54	3.45

Expected % change in crop production in 2030 - Trends analysis	
-5%	Wheat
1%	Grains
-4%	Vegetables, fruits and nuts
-4%	Oil Seeds
2%	Sugar cane and beets
0%	Plant based fiber (Cotton, etc)
-2%	Other
-10% Precipitation Change and -5% Temperature Change	

Sectoral outputs						
% change in ppt in 2030						
	ROW	SVN	ALB	HRV	XEE	XER
wht	0.12	-5.37	-6.9	-4.66	-1.63	-5.07
gro	-0.01	0.69	1.05	0.74	-1.08	1.57
v_f	0.03	-4.96	-1.74	-4.97	-1.6	-1.34
osd	0.02	-2.88	-0.98	-4.57	-1.67	-1.45
c_b	0	1.24	0.09	1.12	-1.17	0.04
pfb	0	-9.6	-0.31	-0.58	-1.16	-0.36
ocr	0	-2.91	-0.18	-3.31	-1.15	-0.01
frs	-0.01	-0.89	-0.09	-0.1	-0.9	-0.03
ely	-0.01	-0.91	0.08	-0.14	-1.14	-0.04
wtr	0	-0.77	-0.11	-0.21	-1.17	-0.06
trd	0	-1.43	-0.16	-0.14	-1.25	-0.08
otp	0	-0.56	-0.1	-0.04	-1.02	-0.06
wtp	0	-1.44	-0.02	-0.08	-0.95	-0.01
atp	0	-0.48	-0.02	0.15	-0.11	0
Other	0	-1.22	-0.08	-0.09	-1.14	-0.02

Private Consumption – CGE Simulation

% change in 2030 wrt BAU				
Consumption	HRV	XER	ALB	
pdr	-0.15	-1.61	-0.15	
wht	-0.45	-1.64	-0.45	
gro	0.15	-1.68	0.15	
v_f	-0.81	-1.68	-0.81	
osd	-0.98	-1.72	-0.98	
c_b	0.04	-1.68	0.04	
pfb	-0.21	-2.26	-0.21	
ocr	-0.18	-1.72	-0.18	
frs	-0.14	-2.39	-0.14	
ely	-0.21	-2.73	-0.21	
wtr	-0.18	-2.75	-0.18	
trd	-0.19	-2.91	-0.19	
otp	-0.18	-2.56	-0.18	
wtp	-0.18	-2.78	-0.18	
atp	-0.17	-2.66	-0.17	
Other	-0.21	-2.73	-0.21	

Preliminary results (Case 1)

- As an illustration, -10% precipitation change and -5% temperature change has been studied.
- Given the presented analysis the general conclusions that can be made include:
 - The impact on SRB countries' GDP, consumption and sectoral production seems to be negative over the next 20 years.
 - Slovenia is one of the most severely affected economies.
 - The link between the economy and resource use is quite strong and as the adaptation improves so will the economic welfare.

Way forward

Project/Issue	Energy (Hydropower)	Agriculture	Water - Sava Basin
Focus	Broad energy sector planning	Shift in crops and practices	River basin management
Climate projections	Wide suite of IPCC models	Wide suite of IPCC models	Selective GCM set based on ability to model trends
Water & media modeling	Simple IPCC outputs	Aquacrop; Clirun: WEAP	U.S. Army Corps; HEC-HMS & others
Economics	General outcomes	Selective cost-benefit	Basin-wide economic tradeoffs
Speed/cost	<1 year modest	<2 years modest to high	2-3+ years modest to high
Project-specific?	No	No	Perhaps-yes?