Simulations of water balances in different European climates

Potentials and limitations of integrated forest and land-use impact modeling

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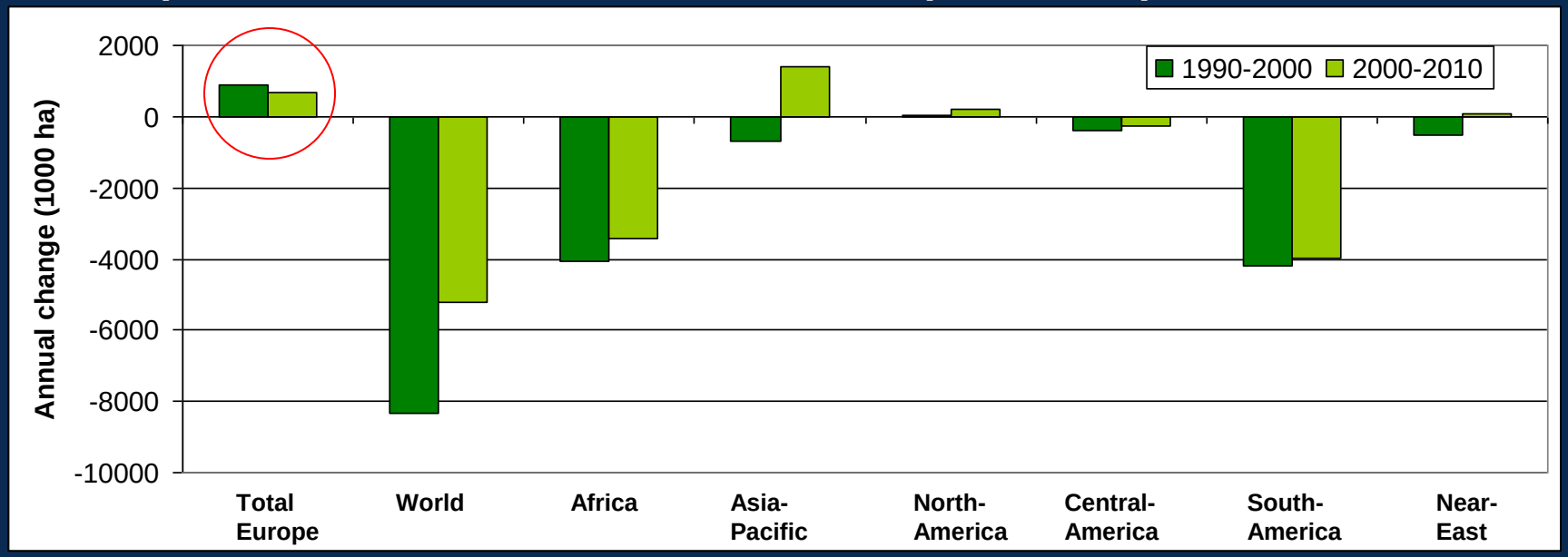
Development of the Forest Area Worldwide (1990-2010)



Source: FAO 2011 State of the world's forests

- increase in Europe mainly due to the cultivation of forest plantations

- short rotation coppice (SRC): plantations of fast growing trees which are coppiced after a few years in a cycle of about four to five times, e.g. *Eucalyptus* in Portugal

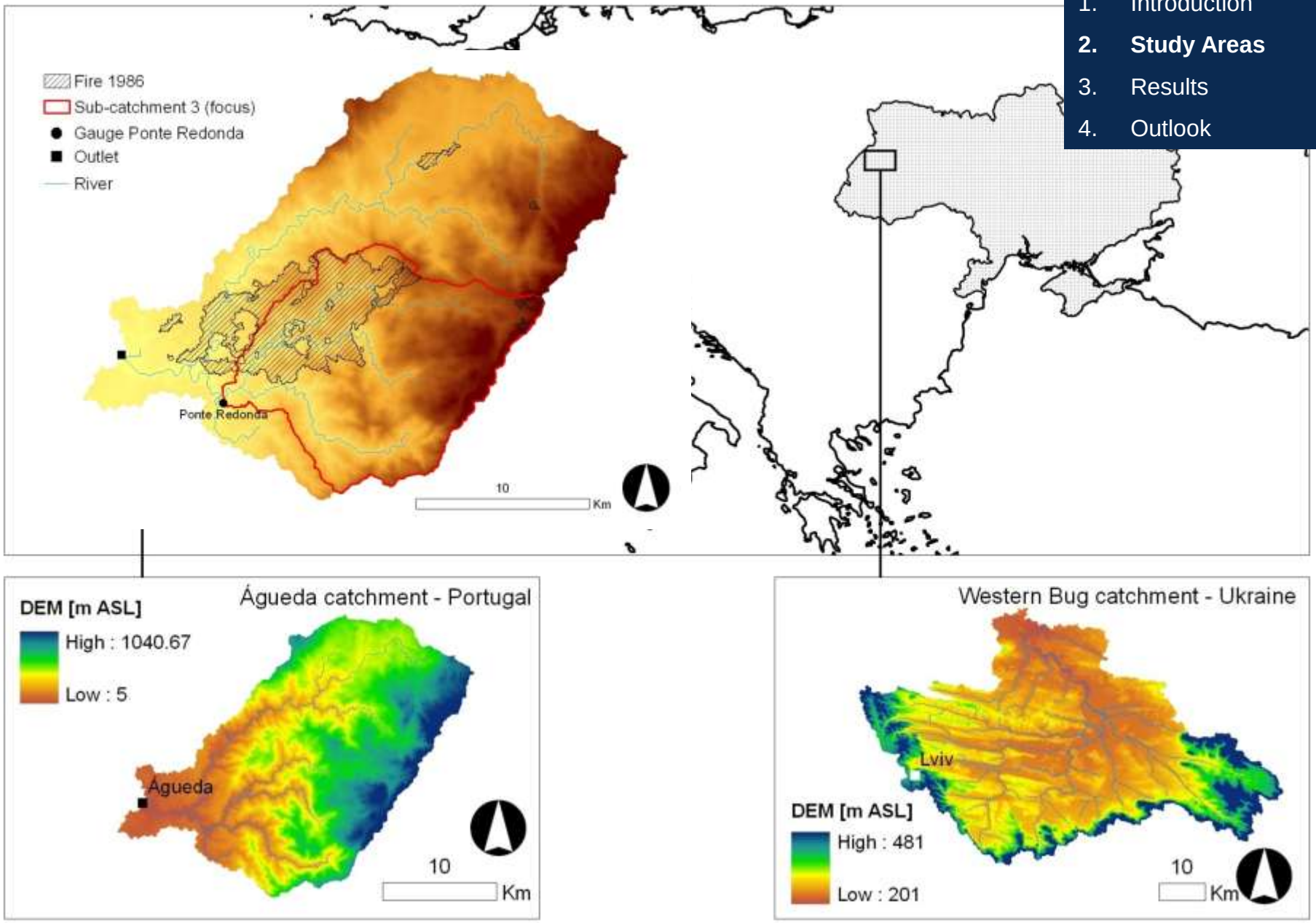
  - SRC makes use of highest tree growth rates and highest LAI

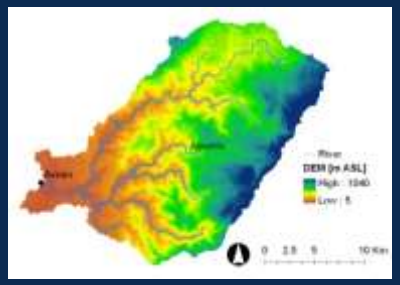
→ **need for the assessment of the potential of forest plantations to influence the water and matter cycle**

Research in Forest Simulation with SWAT

An Overview

Year	Author	Model modification	Main topic
2005	Watson et al.	Forest plant growth model 3PG	Long-term LAI and biomass development
	Mac Donald et al.	Plant growth model ALMANAC	Tree parameters and plant competition, Boreal Plain
	Mc Keown et al.	SWAT 2000-C	Surface litter layer
	Arnold et al.	-	Forest growth as current research and future direction for the development of SWAT
2007	Mac Donald et al.	ALMANAC-BF	Different forest strata and stand age and site productivity
2008	Kiniry et al.	ALMANAC-BF	Diversity of species of forest succession after disturbance (harvest, fire)
2009	Johnson et al.	ALMANAC-BF	Agro forestry systems, Tropical climate

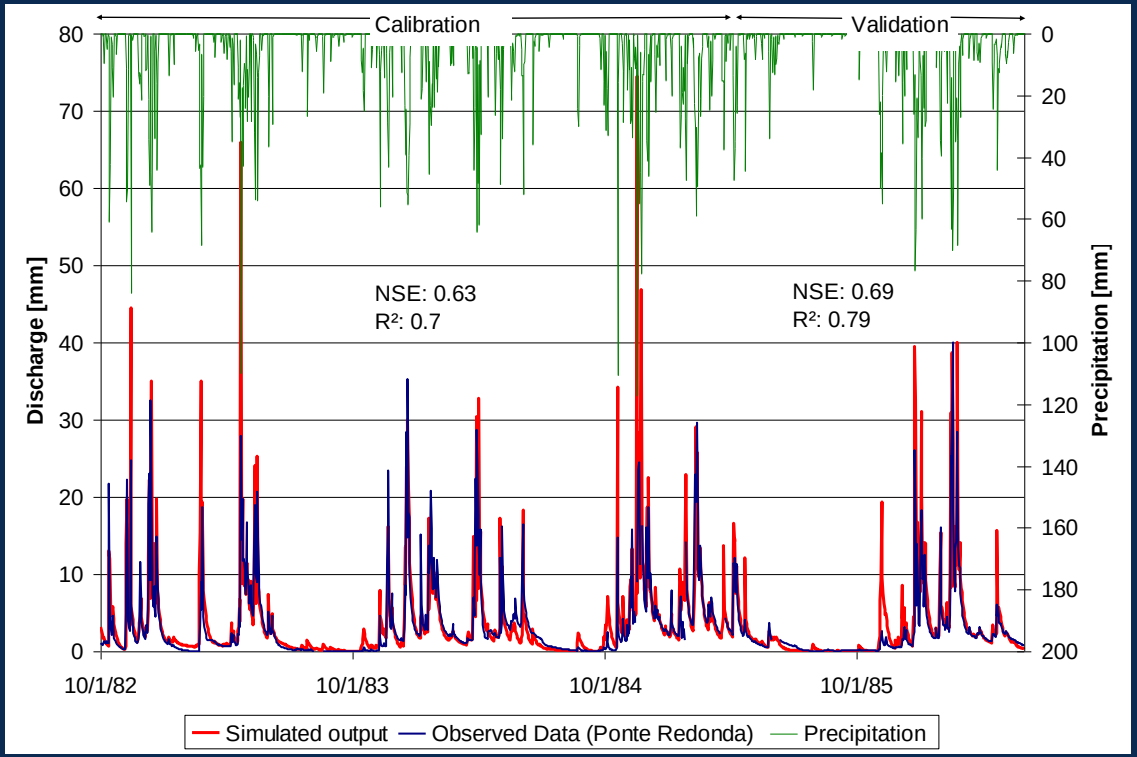




Objective

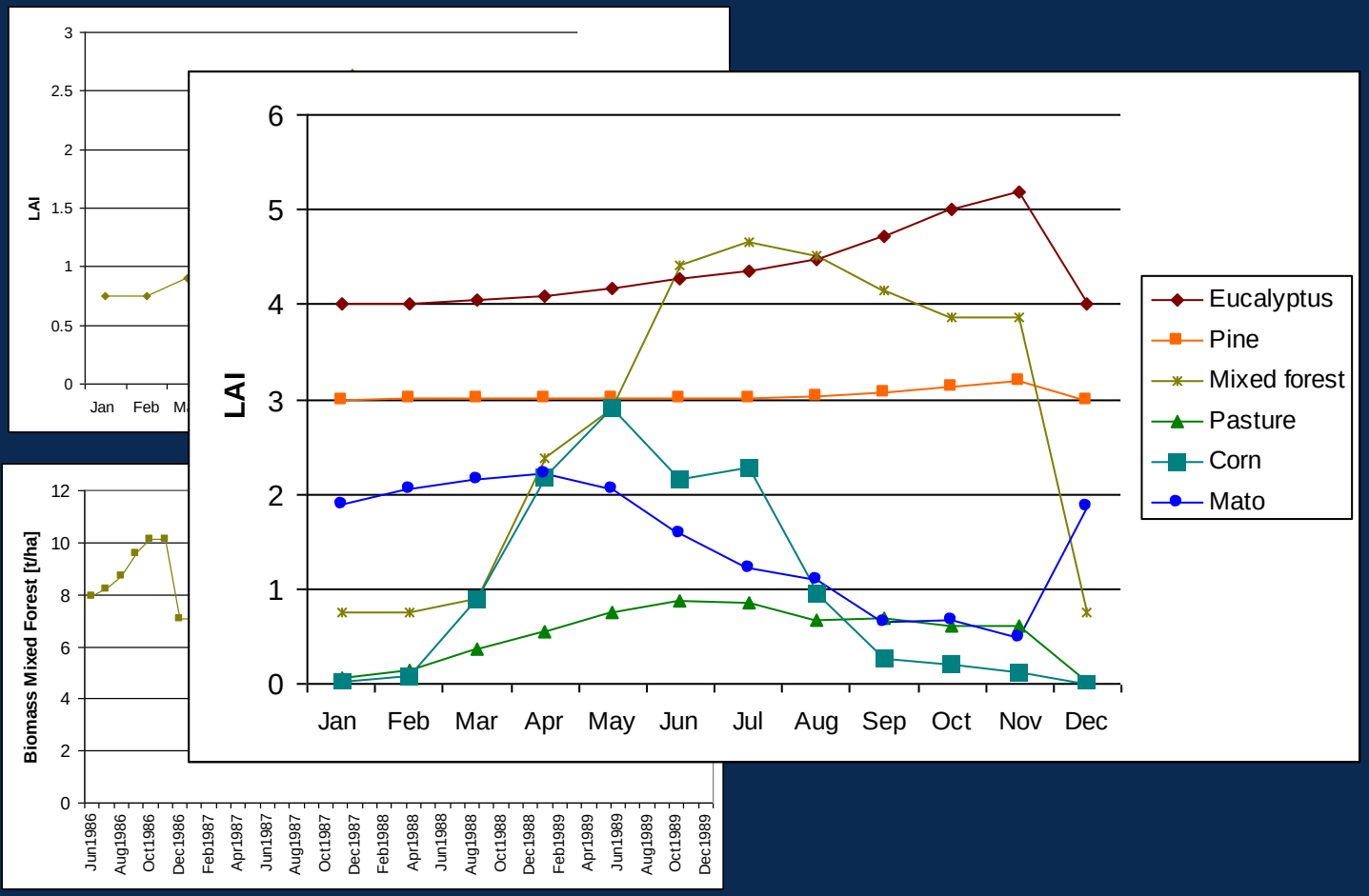
Águeda catchment

- Assessment of forest fire effects on the water balance
- SWAT 2005

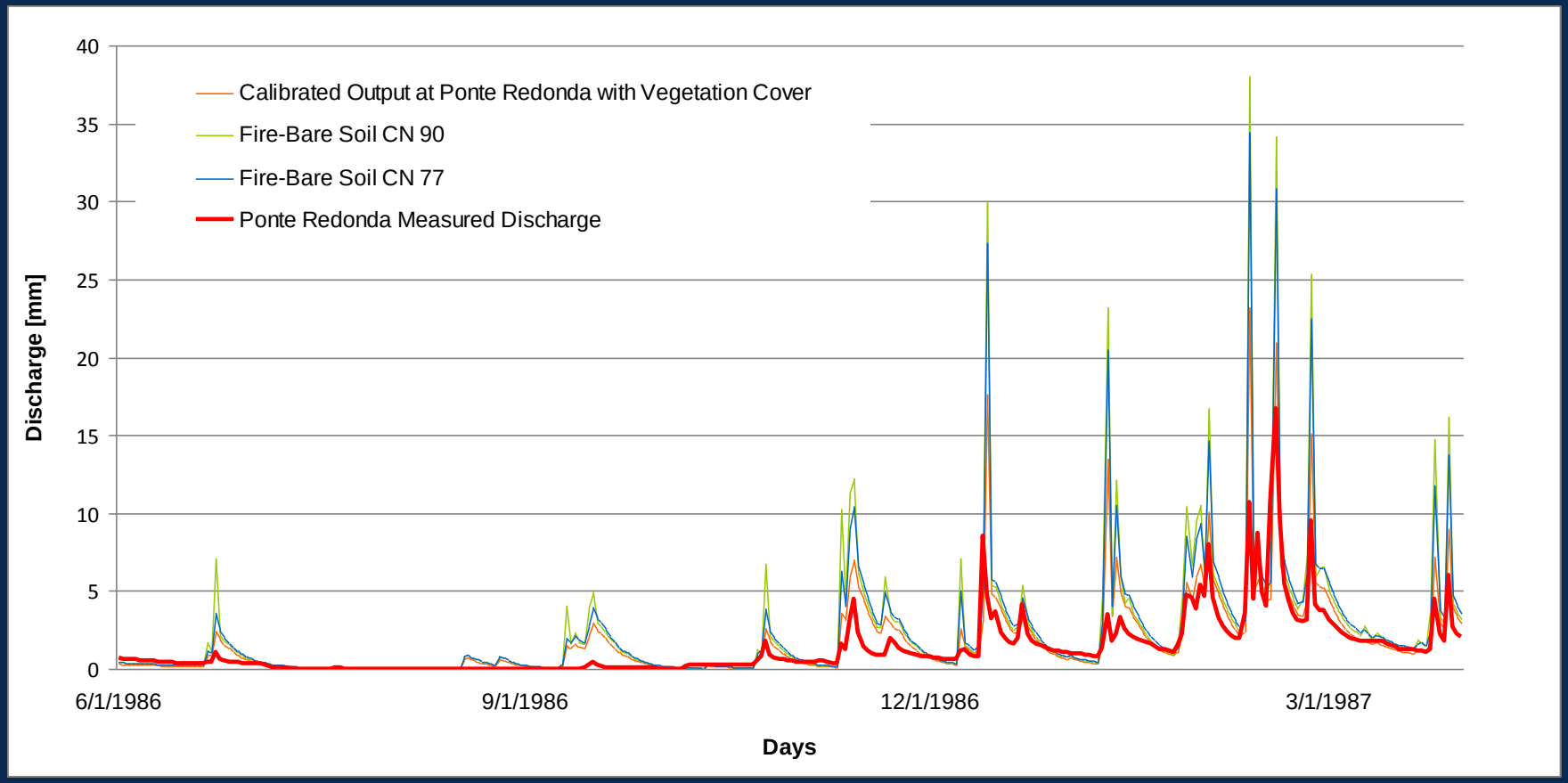


Forest Simulation

1. Introduction
2. Study Areas
3. **Results**
4. Outlook



Simulation of Fire Effects



→ Increment of water yield between 34 % (CN 77) and 40 % (CN 90)

→ Peak discharge is increased up to 190 %

Simulation of Fire Effects

- Results indicate the effects of drastic land-use change from forest to bare soil rather than of fire
- Affected area too small? Fire was not severe?
- Fire application SWAT 2009:
  - SWAT does not account for biomass reduction due to fire
  - is based on CN approach

  → purpose of fire application?

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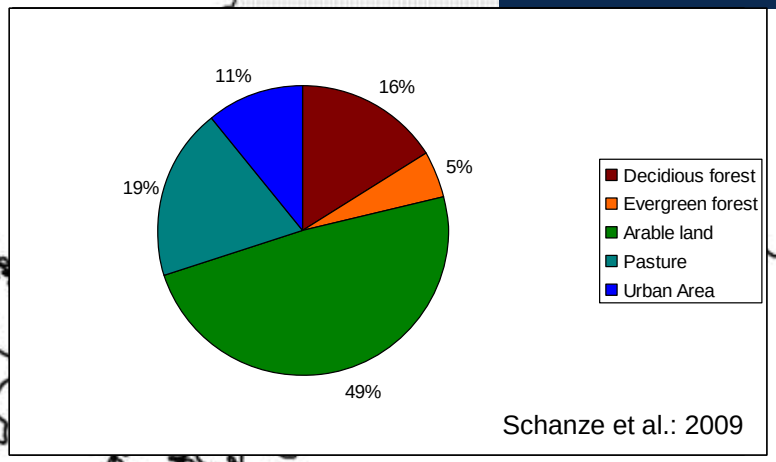
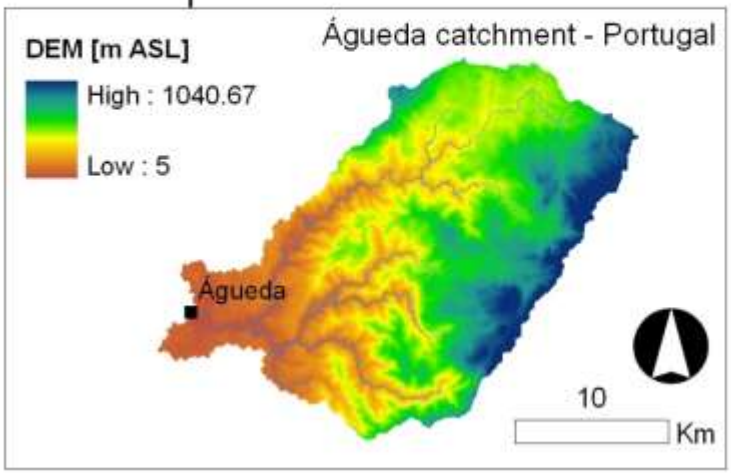
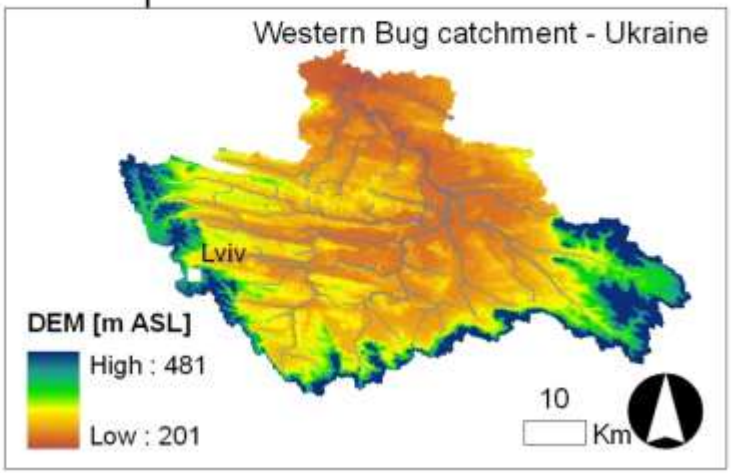
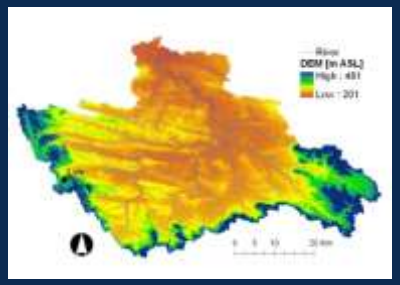


Schanze et al.: 2009







Outlook - Objectives

Western Bug catchment

- IWAS project: International Water Research Alliance Saxony
- Enhancement of surface water quality
- SWAT 2009

- Simulation of different courses of actions with SWAT:

  → effective land-management; adapted, optimal fertilization ✓

  → short **r**otation **c**oppice (SRC) ✗

Thank you for your attention !

Newly planted *Eucalyptus* …

April 2010

… one year later

April 2011

Funding:

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