SOUTH EAST EUROPE
Transnational Cooperation Programme

Co-funded by the EUROPEAN REGIONAL DEVELOPMENT FUND

Land use changes in forestry in drinking water protection zones by adaptation to site conditions and to climate change

Roland Koeck & Eduard Hochbichler

University of Natural Resources and Life Sciences, Vienna
Department of Forest- and Soil Sciences
Institute of Silviculture

HydroPredict2012 - Vienna

Jointly for our common future

SOUTH EAST EUROPE
Transnational Cooperation Programme
Co-funded by the EUROPEAN REGIONAL DEVELOPMENT FUND

Introduction - Content

+ Forestry is the predominant land use category within several drinking water protected zones

+ Traditional forestry in Austria focused during the last century on timber yield and on fostering of conifer tree species

+ In current times: Application of forest management concepts with the overall aim of drinking source water protection arises

+ The implementation of those creates land use changes (forestry)

+ Climate change also will provoke changes in land use category forestry

CC-WaterS: Risk reduction for water supply

SOUTH EAST EUROPE
Transnational Cooperation Programme
Co-funded by the EUROPEAN REGIONAL DEVELOPMENT FUND

+ The reduction of the risks for water supply systems by application of adequate management systems was the main goal of the CC-WaterS project

+ Hence the target drinking source water protection under climate change was the focus of research

+ Best practices for the land use category forestry formed one crucial part to accomplish this task

+ Insights from two drinking water protected zones are given as examples in order to outline related aspects

+ Adaptive management concepts in the field of forestry

Orientation to the Purpose

SOUTH EAST EUROPE
Transnational Cooperation Programme
Co-funded by the EUROPEAN REGIONAL DEVELOPMENT FUND

+ The most important basis: A legally decreed drinking water protected zone

+ This defines the purpose for all land use activities, also for forestry:

--- integral drinking source water protection ---

+ The drinking water protected areas of the city of Vienna and the city of Waidhofen/Ybbs were used as examples

+ Water supply for: Vienna 1,800,000 people
Waidhofen/Ybbs 25,000 people

+ Vienna has a legally decreed water protection zone (945 km^2), in Waidhofen it is about being decreed (10 km^2)

SOUTH EAST EUROPE
Transnational Cooperation Programme
Co-funded by the EUROPEAN REGIONAL DEVELOPMENT FUND

Land use category forestry

+ Forestry generally does not involve the use of pesticides or fertilizers

+ Hence it was seen as unproblematic for drinking water protection

+ However: Water quality problems in forested catchments were reported after clear-cuts or large wind-throw events

+ Stability of forest ecosystems in terms of resistance and resilience is important for water protection purposes

+ Only a low disturbance regime in forests can guarantee stable soil and humus layers

+ Those are crucial for the provision of high quality drinking water

Forestry: History and actual situation

SOUTH EAST EUROPE
Transnational Cooperation Programme
Co-funded by the EUROPEAN REGIONAL DEVELOPMENT FUND

+ In the European Karstic Alps: homogeneous Norway spruce plantations on several different and contrasting forest sites

+ These homogeneous forest stands are instable

+ Improvement of forest stability, if forest stands are adapted to the specific forest site conditions

+ This can be achieved by the orientation of tree species distribution to the potential natural vegetation (PNV)

+ The Forest Hydrotope Model (FoHyM) stratifies water protected areas into operational units for forest management, based on the PNV

+ FoHyM includes all relevant information layers like geology, soil type, humus form, elevation above sea level or exposition of a forest site.

SOUTH EAST EUROPE
Transnational Cooperation Programme

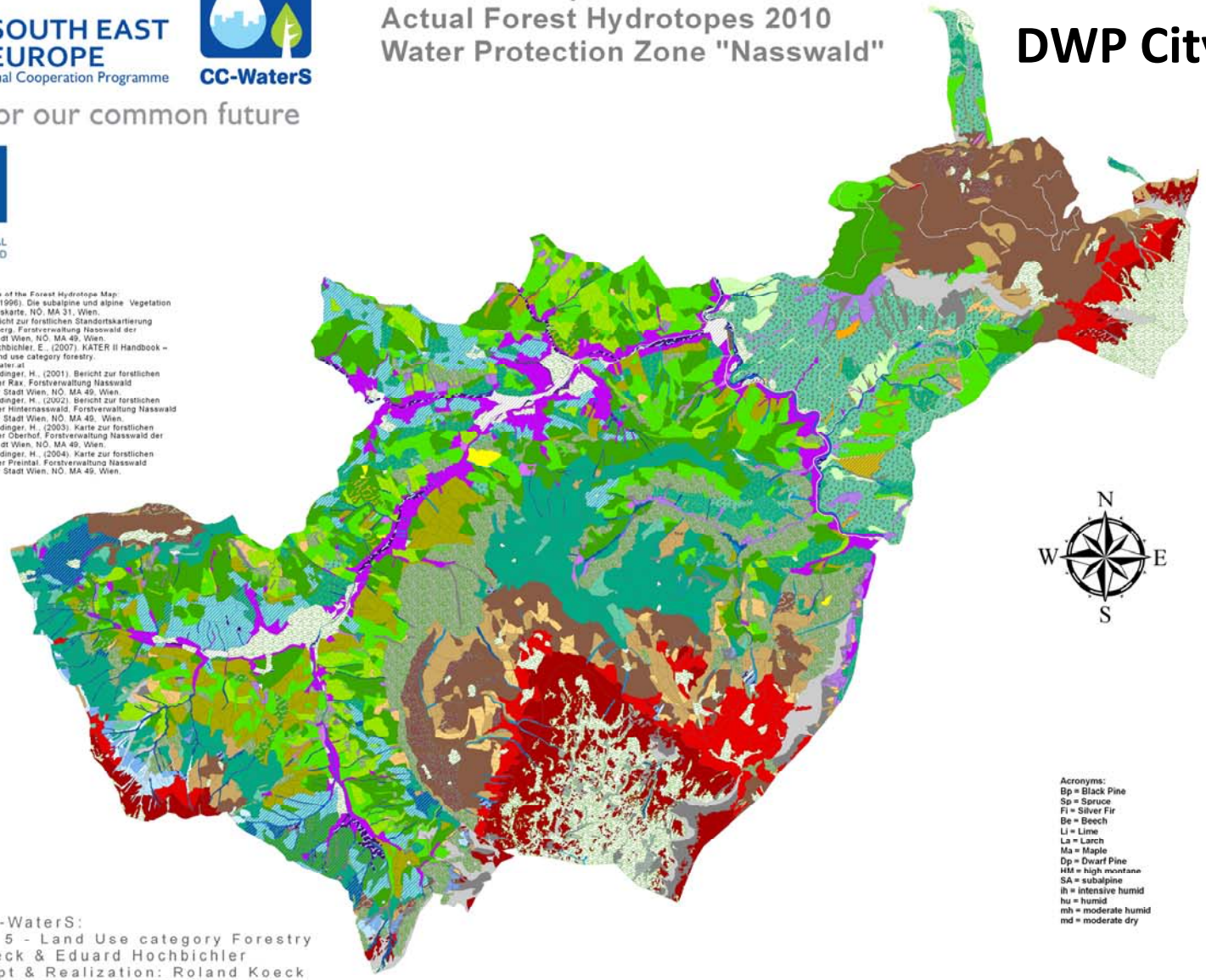
CC-WaterS

Jointly for our common future

Co-funded by the EUROPEAN REGIONAL DEVELOPMENT FUND

Land Use Map:
Actual Forest Hydrotopes 2010
Water Protection Zone "Nasswald"

DWP City of Vienna



References for the data base of the Forest Hydrotope Map:
Dirnboeck, T., Greimler, J., (1996). Die subalpine und alpine Vegetation des Raxplateaus. Vegetationskarte, NÖ. MA 31, Wien.
Gatterbauer, W., (1998). Bericht zur forstlichen Standortskartierung im Revier Höllental-Schneeberg. Forstverwaltung Nasswald der Quellenschutzwälder der Stadt Wien, NÖ. MA 49, Wien.
Koeck, R., Magagna, B., Hochbichler, E., (2007). KATER II Handbook – Final report regarding the land use category forestry. To be downloaded at: www.kater.at
Koeck, R., Mrkvicka, A., Weidinger, H., (2001). Bericht zur forstlichen Standortskartierung im Revier Rax. Forstverwaltung Nasswald der Quellenschutzwälder der Stadt Wien, NÖ. MA 49, Wien.
Koeck, R., Mrkvicka, A., Weidinger, H., (2002). Bericht zur forstlichen Standortskartierung im Revier Hinternasswald. Forstverwaltung Nasswald der Quellenschutzwälder der Stadt Wien, NÖ. MA 49, Wien.
Koeck, R., Anninger, R., Weidinger, H., (2003). Karte zur forstlichen Standortskartierung im Revier Oberhof. Forstverwaltung Nasswald der Quellenschutzwälder der Stadt Wien, NÖ. MA 49, Wien.
Koeck, R., Anninger, R., Weidinger, H., (2004). Karte zur forstlichen Standortskartierung im Revier Preintal. Forstverwaltung Nasswald der Quellenschutzwälder der Stadt Wien, NÖ. MA 49, Wien.

N
W E
S

Legend
Nasswald:
Forest-Hydrotopes (inc. Nr.)
- Black Pine-Forest on rocks (101)
- Black-Pine Forest on Rendzina
- Bp-Forest + Sp-Fi-Be-Forest (103)
- Bp-Forest + Sp-Forest with rocks (105)
- Red Pine-Forest (untypical variant (201)
- Red Pine-Forest (typical variant) (202)
- dr - md Beech Forest (301)
- mh - hu Beech-Forest (302)
- md - mh Beech-Fir-Forest (401)
- hu Beech-Fir-Forest (402)
- La-Sp-Fi-Be-Forest, sunny slopes & md - mh (501)
- Sp-Fi-Be-Forest, md (502)
- Sp-Fi-Be-forest, humid (503)
- Sp-Fi-Be-Forest, humid + loamy soils (504)
- La-Sp-Fi-Be-Forest on boulder sites (506)
- Pine-Forest + Sp-Fi-Be-Forest [complex] (507)
- Sp-Fi-Be-Forest, hu, on Werfener layers (601)
- Sp-Fi-Be-Forest, ih, on Werfener layers (602)
- Sp-Fi-Be-Forest on Dystric Planosols (603)
- HM Sp-Fi-Be-Forest, humid (701)
- HM Sp-Fi-Sp-Forest, md (702)
- HM Sp-Fi-Be-Forest on Werfener layers (704)
- Typical maple-ash-Forest (801)
- Ma-As-Li-Forest on rubble sites (802)
- Specia Maple-ash-Forest (803)
- Alder Forest on Werfener layers (901)
- Alder Forest on Carbonates (902)
- Alder-Willow-Gallery Forest (905)
- Sp-Forest on boulder + rubble sites (1002)
- SA Spruce-Larch-Forest (1101)
- SA Larch-Spruce-Forest on boulder sites (1102)
- SA Hochstauden Spruce-Forest (1104)
- SA Sp-Fi-Forest on Dystric Planosol (1105)
- SA Hochstauden Sp-La-Forest (1106)
- SA Spruce-Forest + rocks + rubble (1107)
- SA Spruce-Forest + rocks + Sp-Fi-be-Forest (1109)
- Larch-Beech-Fir-Forests (1201)
- Diverse Larch-Forests (1202)
- Larch-Forests on rubble sites (1203)
- Dwarf Pine-Forests on timber sites (1301)
- Original Dwarf Pine-Forest belt (1302)
- Dwarf Pine + rubble + rocks (1304)
- Ma-Be-Fi-Forest on ditch sites (1401)
- Ditches without trees (1402)
- Ditches with rock + rubble (1403)
- Water areas (1404)
- Rock-forests (1501)
- Rock-Sites (1601)
- Rubble-Sites (1602)
- Rubble Sites + Vegetation
- Rubble-Sites on Werfener layers (1604)(
- Avalanche strip (1701)
- Avalanche strip with ditches (1702)
- Meadows (1801)
- Further sites / Settlement areas (1803)
- External area

Acronyms:
Bp = Black Pine
Sp = Spruce
Fi = Silver Fir
Be = Beech
Li = Lime
La = Larch
Ma = Maple
Dp = Dwarf Pine
HM = high montane
SA = subalpine
ih = intensive humid
hu = humid
mh = moderate humid
md = moderate dry

0 1 2 4 Kilometers

1 : 17.000

Project CC-WaterS:
Group: WP 5 - Land Use category Forestry
Roland Koeck & Eduard Hochbichler
GIS-Concept & Realization: Roland Koeck
Department of Forest- and Soil Sciences
Institute of Silviculture
University of Natural Resources and Applied Life Sciences, Vienna
February 2010

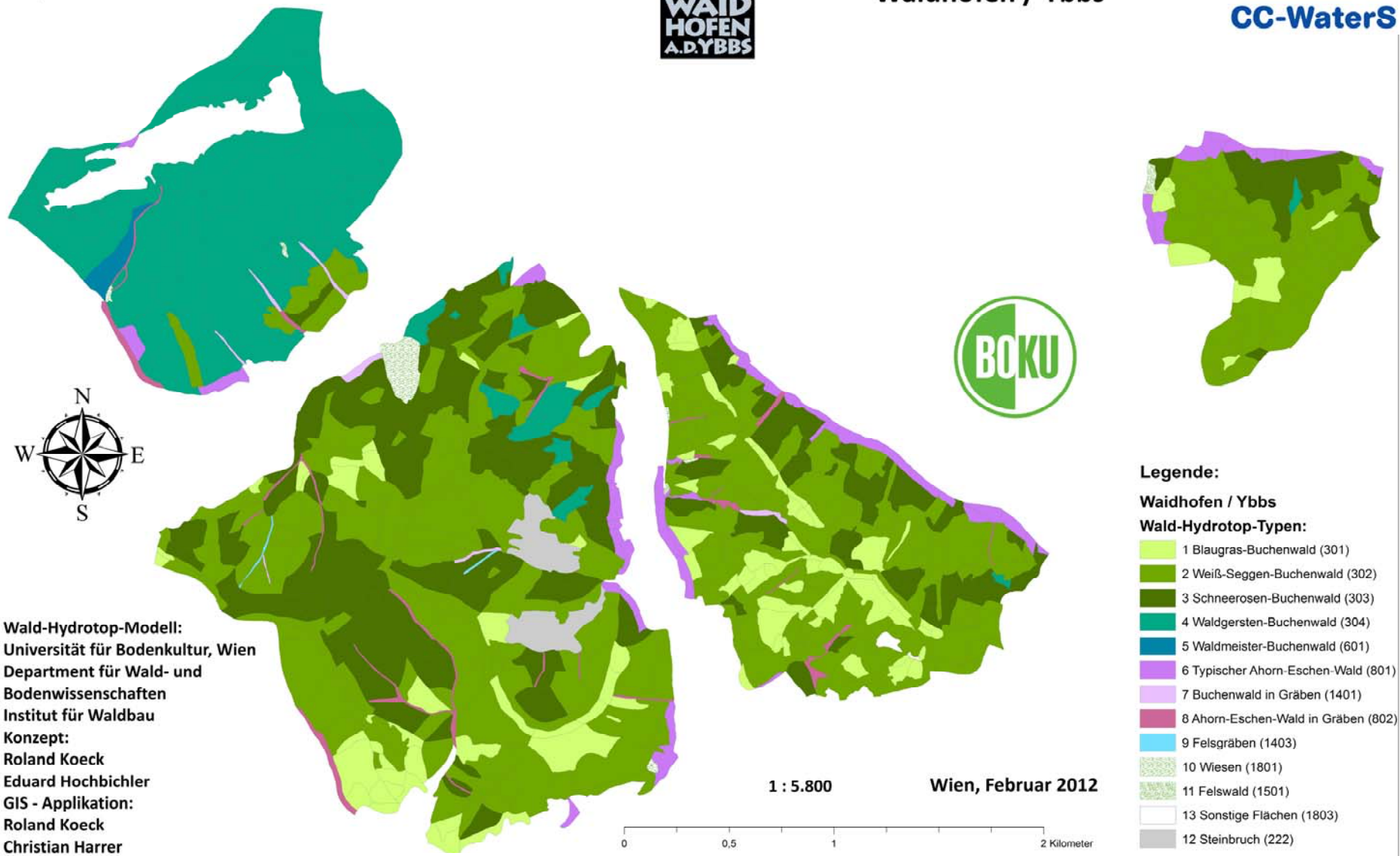
Adaptive towards site conditions

SOUTH EAST EUROPE
Transnational Cooperation Programme
Jointly for our common future

STADT WAIDHOFEN A.D.YBBS

Wald-Hydrotop-Modell
Wald-Hydrotop-Typen
Waidhofen / Ybbs

CC-WaterS



Adaptive towards site conditions

Adaptive towards site conditions

SOUTH EAST EUROPE
Transnational Cooperation Programme
Co-funded by the EUROPEAN REGIONAL DEVELOPMENT FUND

+ Adaptation towards site conditions involves a higher degree of biodiversity:

Instead of only:	High diversity:
Norway spruce	European beech, Silver fir, Norway spruce, Sycamore maple, European larch, Oak species, rowan berry, elm species, yew, etc.

+ This is crucial, hence the FoHyM stratification is a basic requirement

+ The higher diversity of tree species supports forest stand stability

+ Together with best practices (e.g. prevention of clear-cuts, focus on continuous cover forest systems) -

>>> source water protection can be achieved <<<

Adaptive towards climate change

SOUTH EAST EUROPE
Transnational Cooperation Programme
Co-funded by the EUROPEAN REGIONAL DEVELOPMENT FUND

+ The awareness about the actual potential natural vegetation (PNV) is an excellent basis for any adaptation to climate change conditions

  - The actual PNV is the most stable type of vegetation

  - It defines a whole tree species set (actual)

  - With a given climate change signal (CC-WaterS), the expected tree species composition can de determined (future)

  - For the whole set of forest hydrotopes, by application of the ecological behaviour of tree species

  - Each forest hydrotope (PNV) will react in a specific way to the climate change signal

SOUTH EAST EUROPE
Transnational Cooperation Programme
Co-funded by the EUROPEAN REGIONAL DEVELOPMENT FUND

Risk reduction by land use changes

+ Adaptation to site conditions improves the forest stand stability

+ It can be fulfilled immediately & it relies on e.g. successful forest regeneration dynamics

+ Based on the stratification of the water protection zone with FoHyM, adaptive forest management plans can be elaborated

+ These also form a crucial data base for adaptation to climate change

+ All necessary changes, which are triggered by climate change conditions, can be defined in a spatial explicit way

+ The risk reduction for drinking water supply is given, if the actual stability of forest ecosystems can be improved and if they can be adapted to changed climatic conditions

SOUTH EAST EUROPE
Transnational Cooperation Programme
Co-funded by the EUROPEAN REGIONAL DEVELOPMENT FUND

Necessary land use changes (Summary)

+ The actual given dominance of Norway spruce will disappear (valid for the two mentioned test areas)

+ Adaptation to site conditions will enhance the proportion of deciduous tree species, above all of European beech

+ This will form an excellent basis for the adaptation of the forest stands to climate change scenario conditions

+ In future, the adaptation to climate change conditions in some cases will have to involve artificial recruitment techniques

+ The overall purpose of adaptive forest management is

>> The improvement of the water protection functionality of forests <<

in order to reduce the risks for water supply

Acknowledgements

We want to express our acknowledgements to the European Union for the support of the CC-WaterS project.

Our special gratitude is communicated to the Lead Partner of the project, the City of Vienna,
and within this context to Vienna Water, represented by Dr. Wolfgang Zerobin and Dr. Gerhard Kuschnig,
for their unbending support of CC-WaterS.

We also want to express our gratitude to the Austrian Federal Ministry of Agriculture, Forestry, Environment and Water Management, especially to DI Gerhard Mannsberger and DI Hubert Siegel, and to the city of Waidhofen / Ybbs,
especially to Mag. Wolfgang Mair and Ing. Markus Hochleitner.

SOUTH EAST EUROPE
Transnational Cooperation Programme
Co-funded by the EUROPEAN REGIONAL DEVELOPMENT FUND

Thank you for your attention

Roland Koeck
Eduard Hochbichler

University of Natural Resources and Life Sciences Vienna

Department of Forest- and Soil Sciences

Institute of Silviculture

roland.koeck@boku.ac.at
eduard.hochbichler@boku.ac.at
www.boku.ac.at