



***Arctostaphylo-Callunetum* in Poland: distribution, variability and active protection**

**15th European Heathlands Network Workshop
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IN TORUŃ

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4030 Dry heaths (*Calluno-Arctostaphyliion*)



Arctostaphylos uva-ursi

DRY HEATHLANDS IN POLAND

(acc. Matuszkiewicz, 2001)

Inland:

Class: ***Nardo-Callunetea*** Prsg 1949

Order: ***Calluno-Ulicetalia*** (Quant, 1935) R.Tx. 1937

I. Alliance: ***Calluno – Genistion*** Duving. 1944

1. association: ***Calluno-Genistetum*** R.Tx. 1937

II Alliance: ***Pohlio – Callunion*** Shimwell 1973 em. Brzeg 1981

1. association: ***Pohlio-Callunetum*** Shimwell 1973 em. Brzeg 1981

2. community: ***Hypnum jutlandicum*** Balcerk. et Brzeg 1978

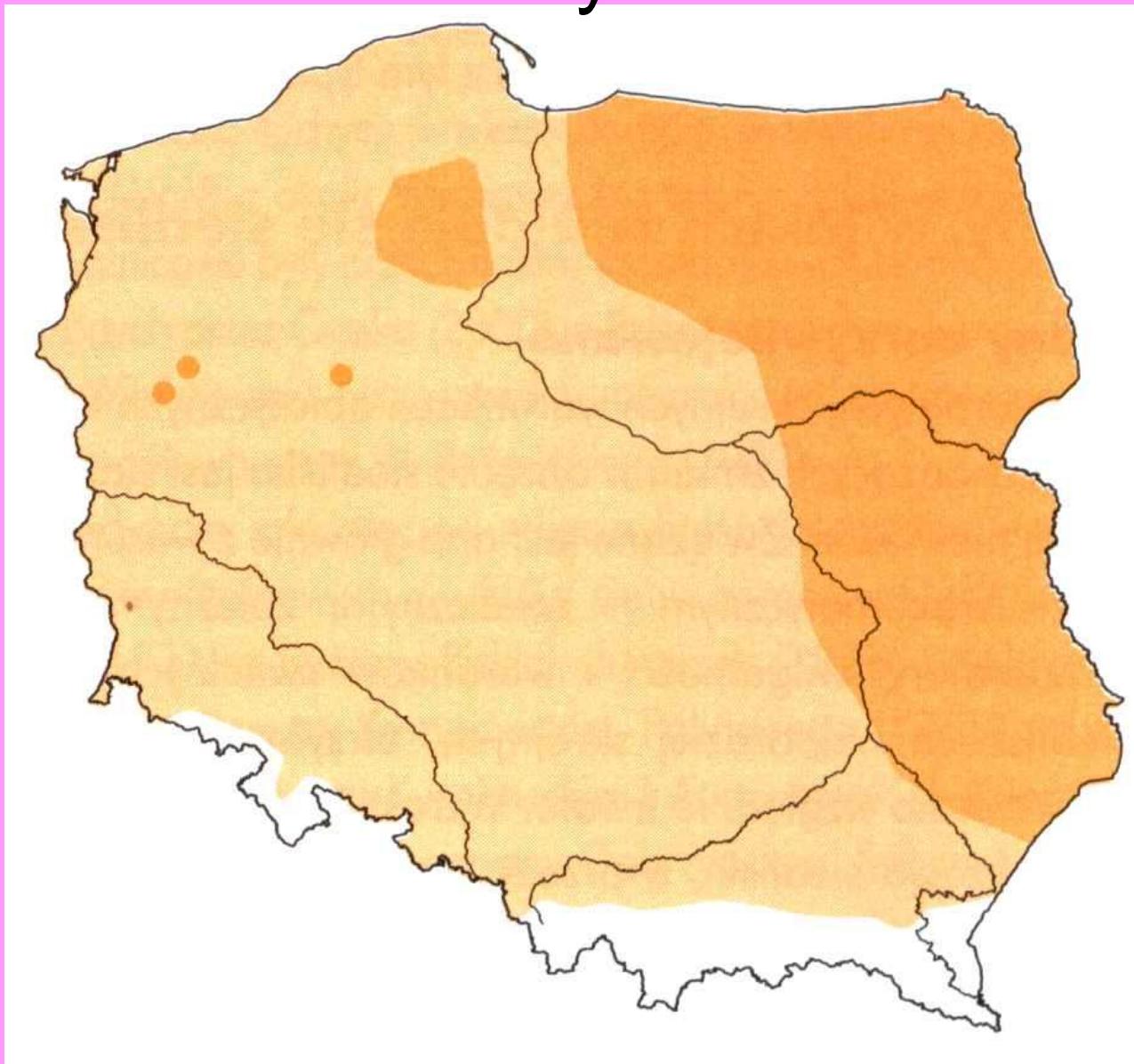
3. association: ***Sieglungio-Agrostietum*** Brzeg 1981

III. Alliance: ***Calluno – Arctostaphylion*** R.Tx. et Prsg 1949

1. association: *Arctostaphylo-Callunetum* R.Tx. et Prsg 1940

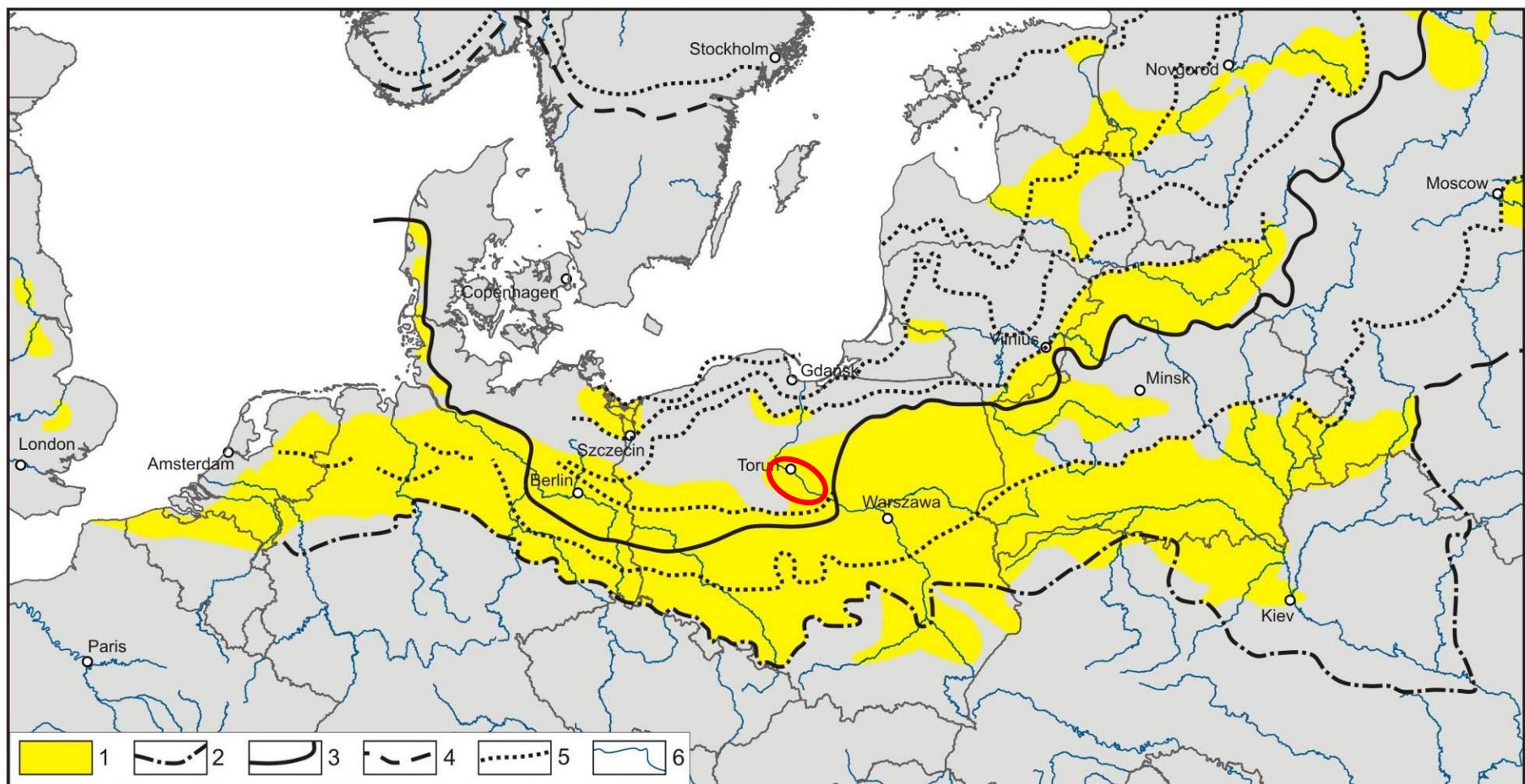
2. association: ***Scabioso canescens-Genistetum*** Balcerk. et Braeg 1993

Distribution of dry inland heathlands

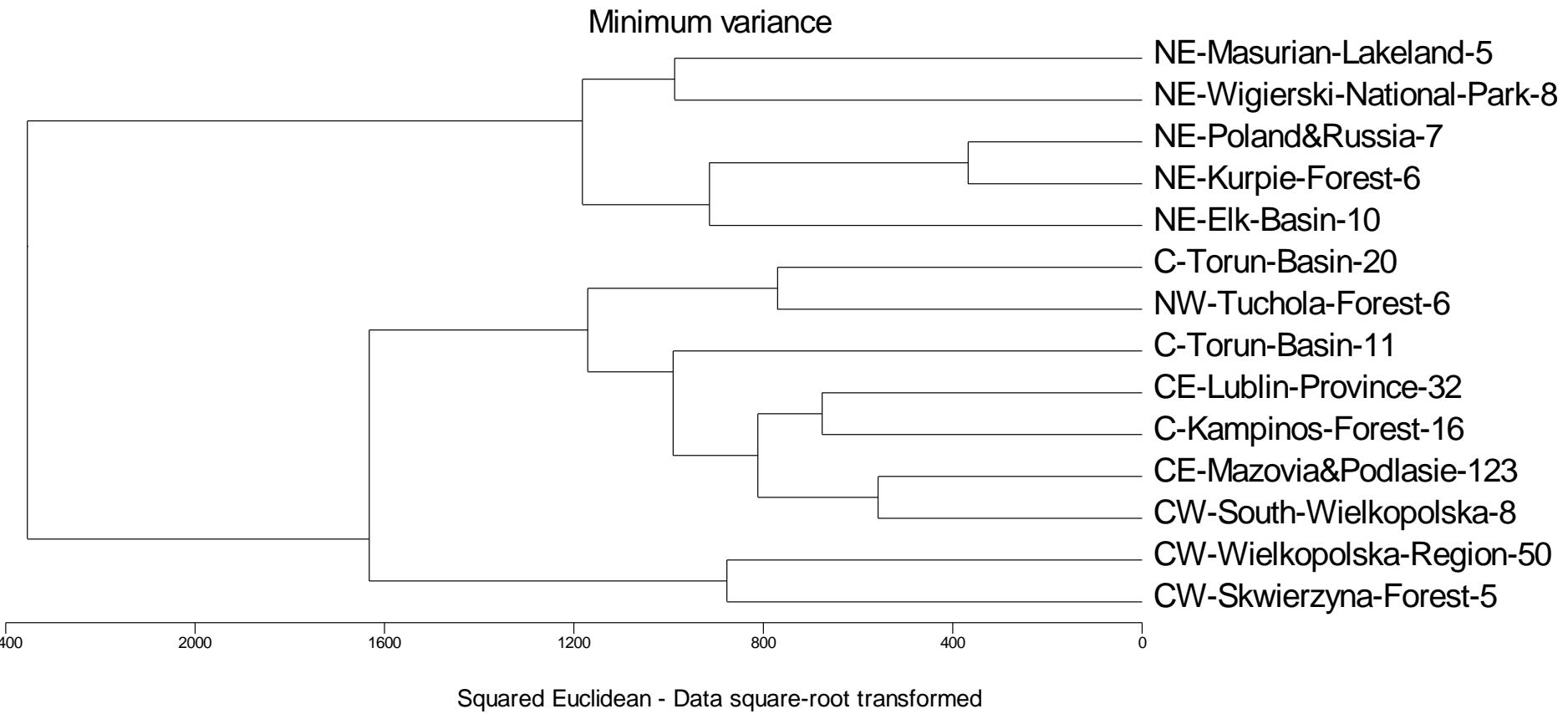


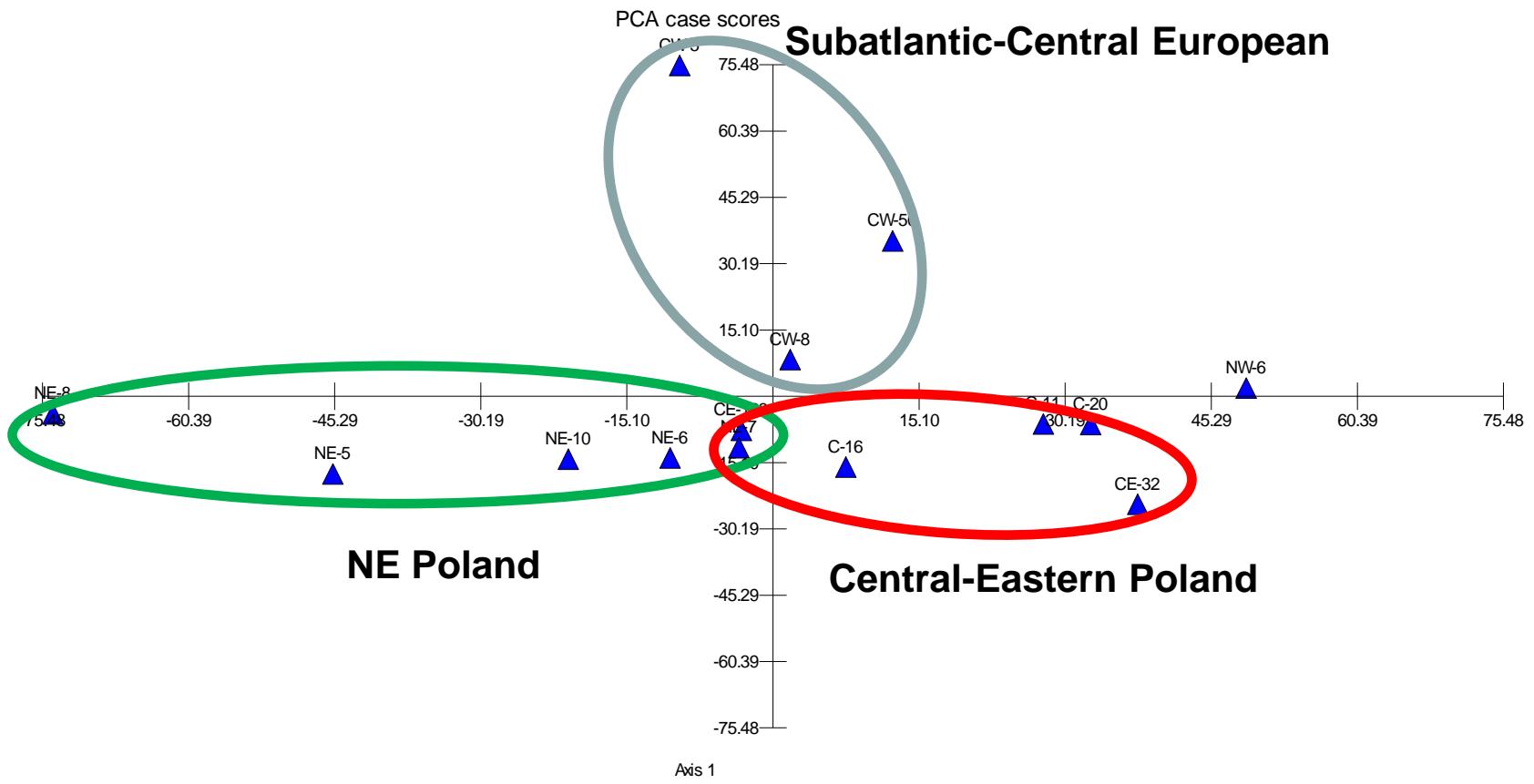
Arctostaphylo – Callunetum (Natura 2000 code – 4030-3)





Location of the Toruń Basin in relation to the European Sand Belt





Differential species of Subatlantic-Central European regional variant of *Arcostaphylo-Callunetum*

Species of Subatlantic range:

Cladonia glauca
Hypnum jutlandicum
Ptilidium ciliare
Cladina ciliata var. tenuis
Cladonia chlorophaea
Cladonia deformis
Pohlia nutans
Deschampsia flexuosa

Species of xerothermic grasslands:

Euphorbia cyparissias
Festuca trachyphylla
Galium verum

Species of psammophilous grasslands:

Agrostis vinealis
Cladonia phyllopora
Cladonia subulata

Differential species of *Arctostaphylo-Callunetum* in NE and Central-Eastern Poland

Ch., D. *Arctostaphylo-Callunetum* et *Calluno-Arctostaphylion*:

Genista tinctoria

Pulsatilla patens

Ch. *Vaccinio-Genistetalia* et *Calluno-Ulicetea*:

Antennaria dioica

Danthonia decumbens

Hieracium umbellatum

Luzula campestris

Nardus stricta

Potentilla erecta

Ch. *Vaccinio-Piceetea*:

Juniperus communis

Melampyrum pratense

Others:

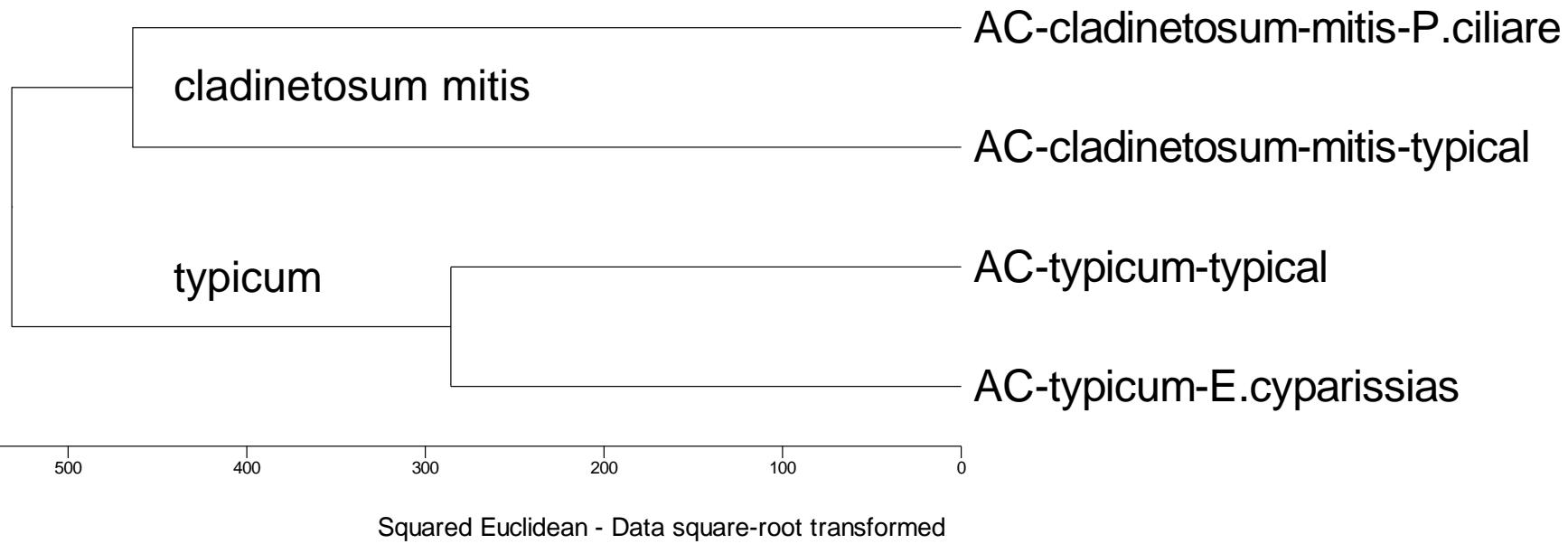
Cetraria islandica

Convallaria majalis

Luzula pilosa

Arctostaphylo-Callunetum in Poland - local habitat variation

Minimum variance





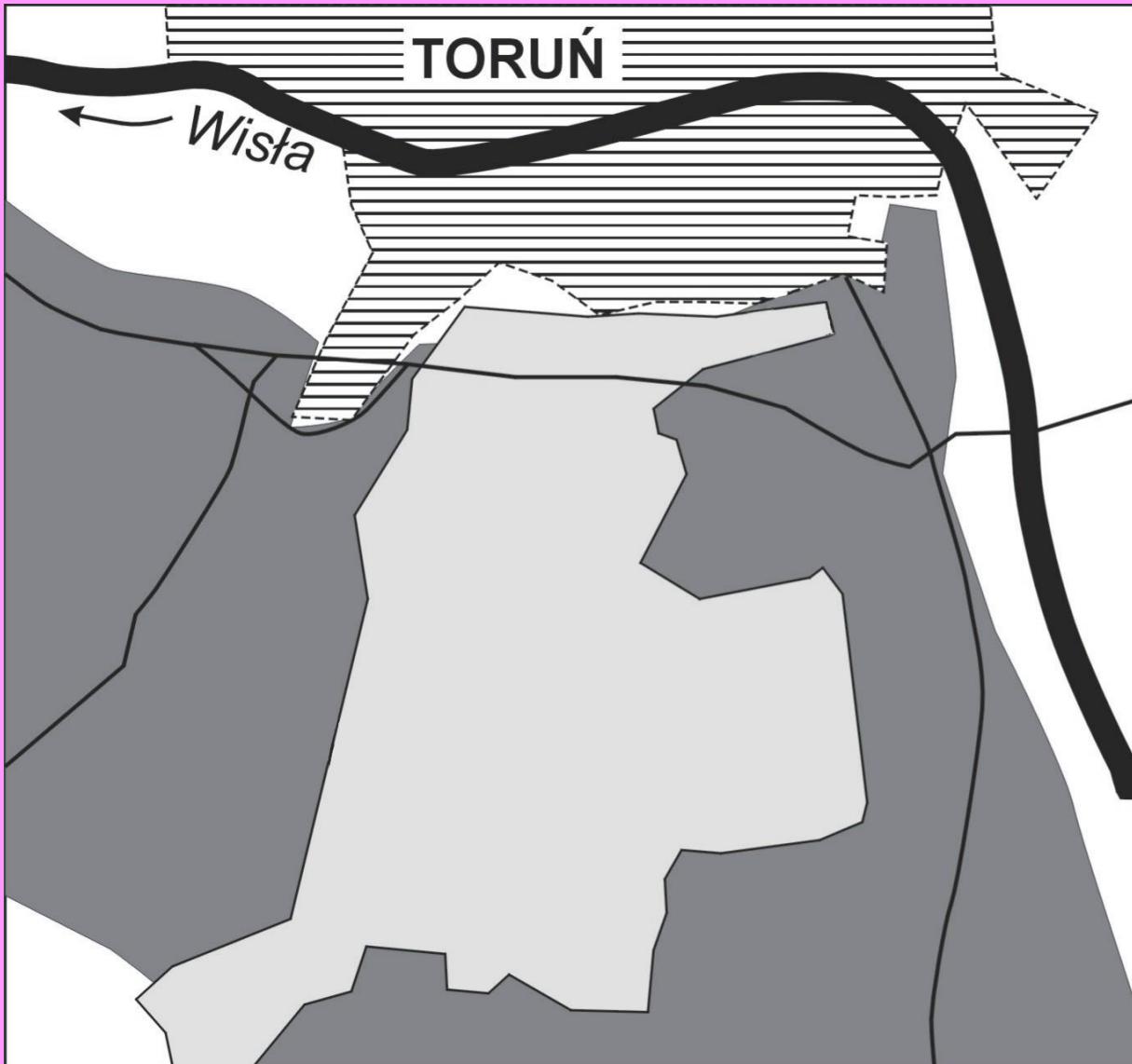
Forest succession



TORUŃ

Wistla

- deforested area of military zone
 - pine forests
 - urban area of Toruń
 - main roads
- 0 2 4 km



Heaths near Toruń – military training area





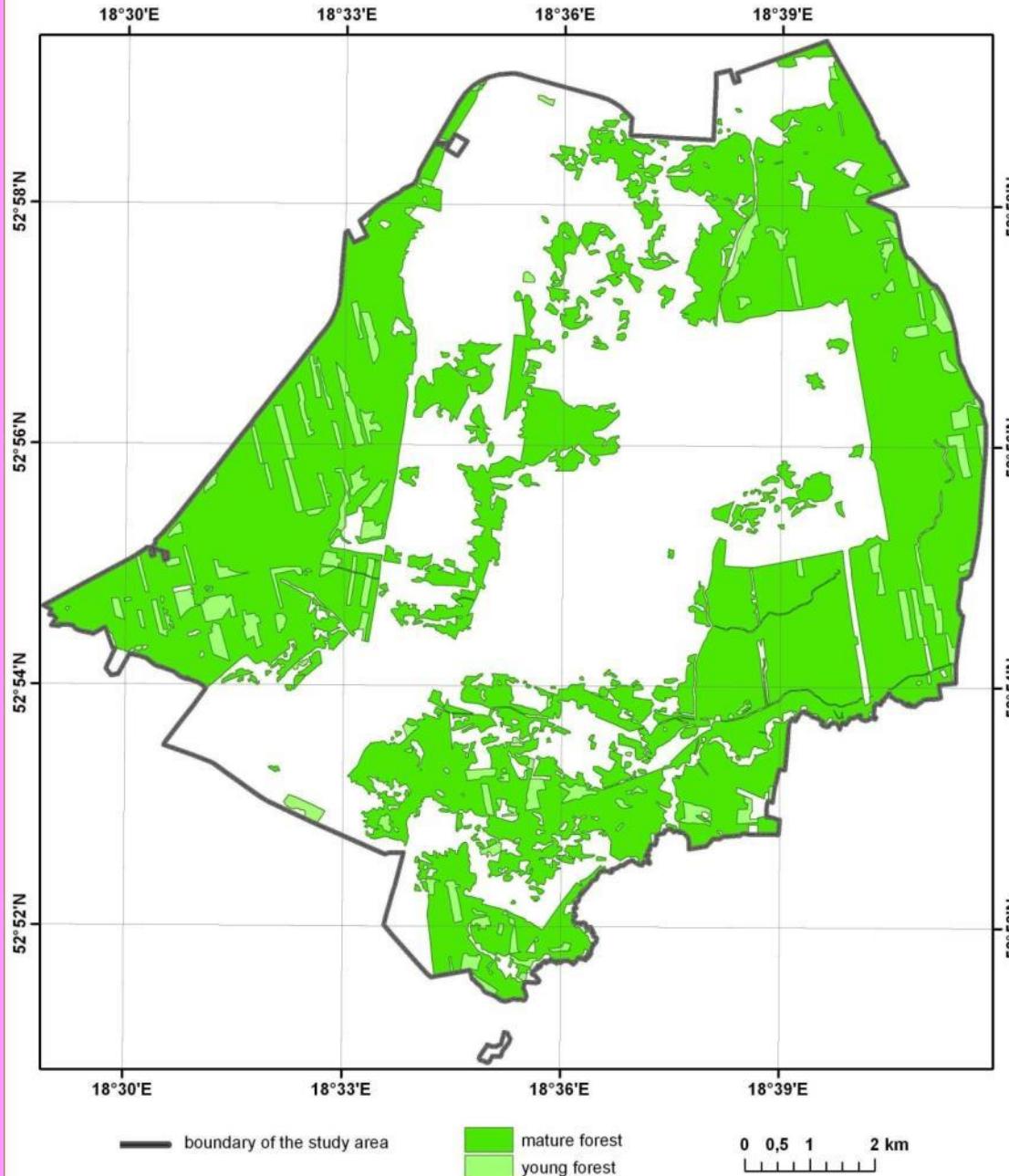
Military activities, photo by Artillery and Armaments Training Center



Military activities, photo by Artillery and Armaments Training Center

Artillery range in Toruń

Land cover in 1986



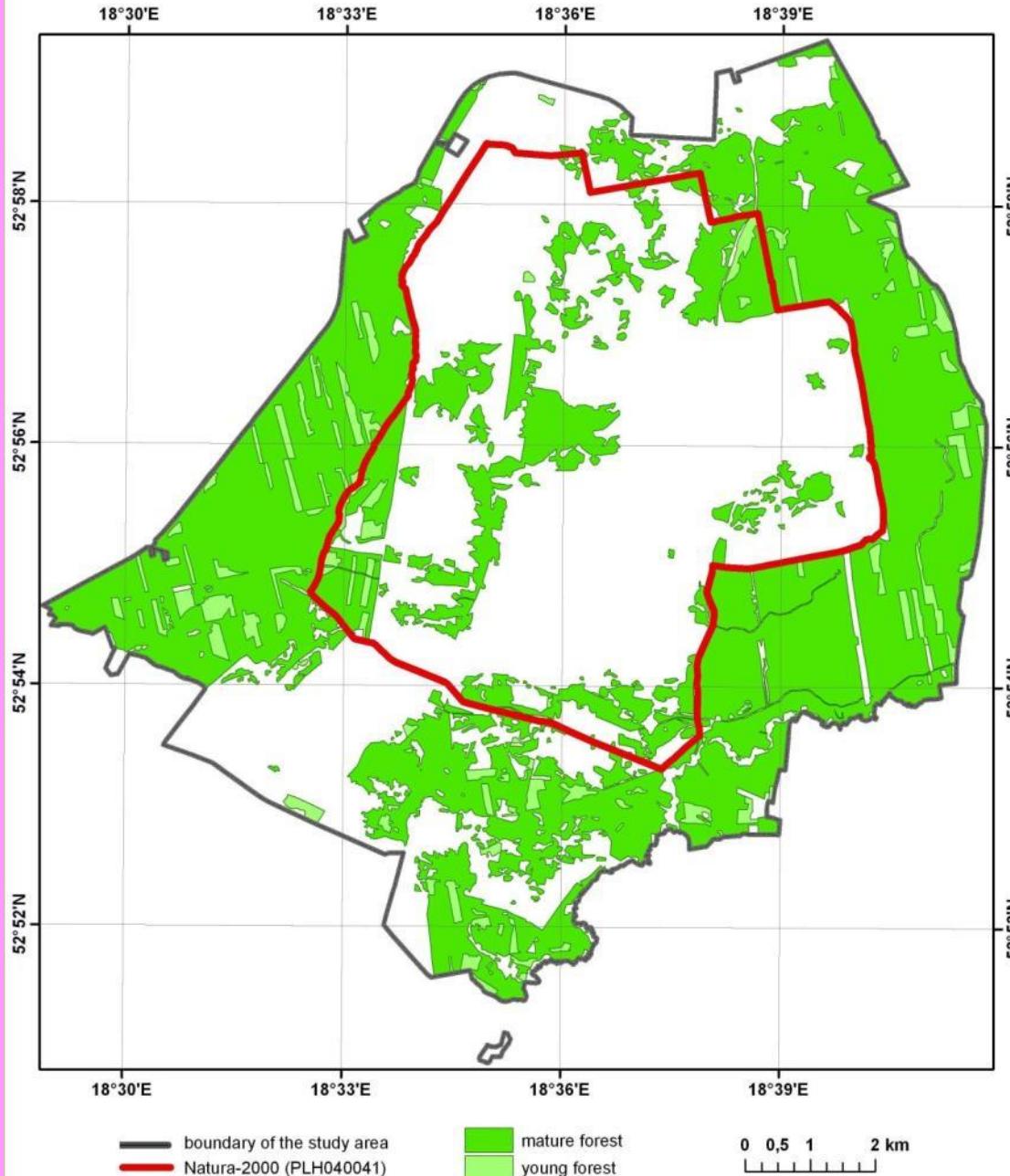
artillery training ground & Natura 2000 PLH040041 area



timber forest

Artillery range in Toruń

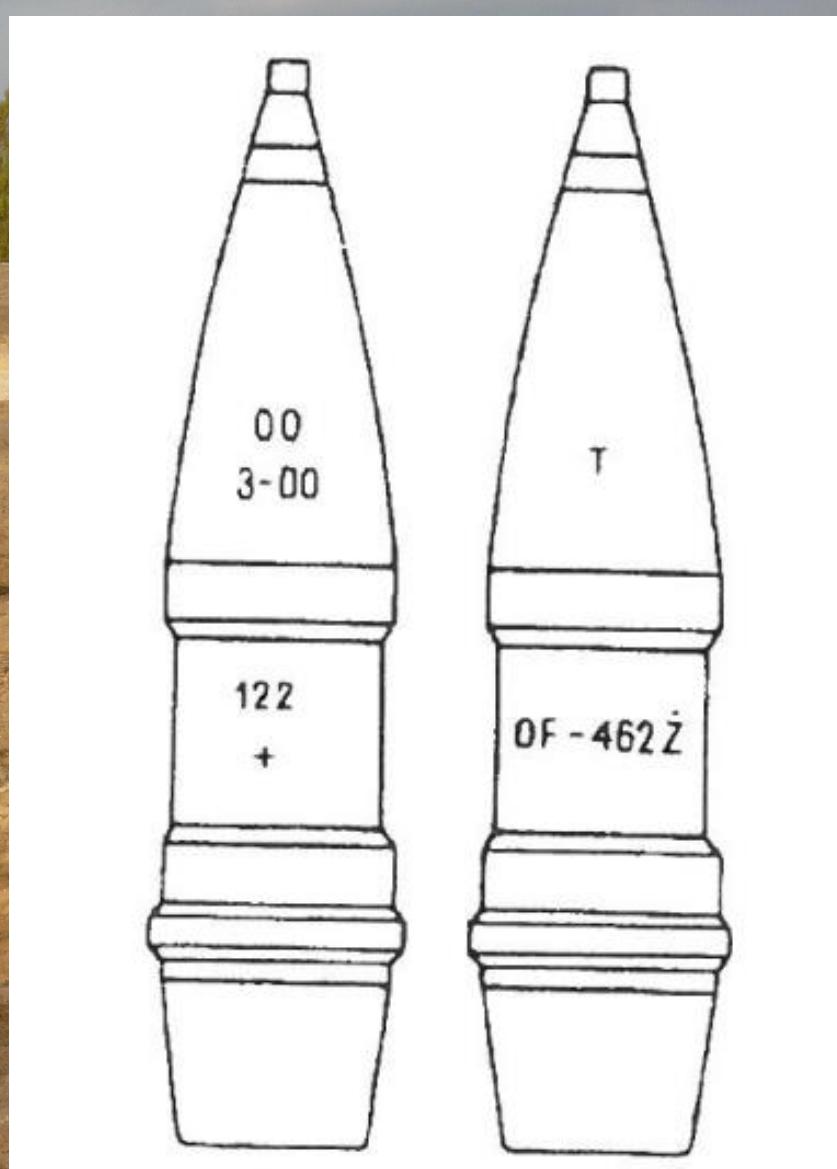
Land cover in 1986



artillery training
ground
&
Natura 2000
PLH040041 area



timber forest



Area for detonation of explosives





Pulsatilla pratensis
(Sasanka otwarta)
- Natura 2000

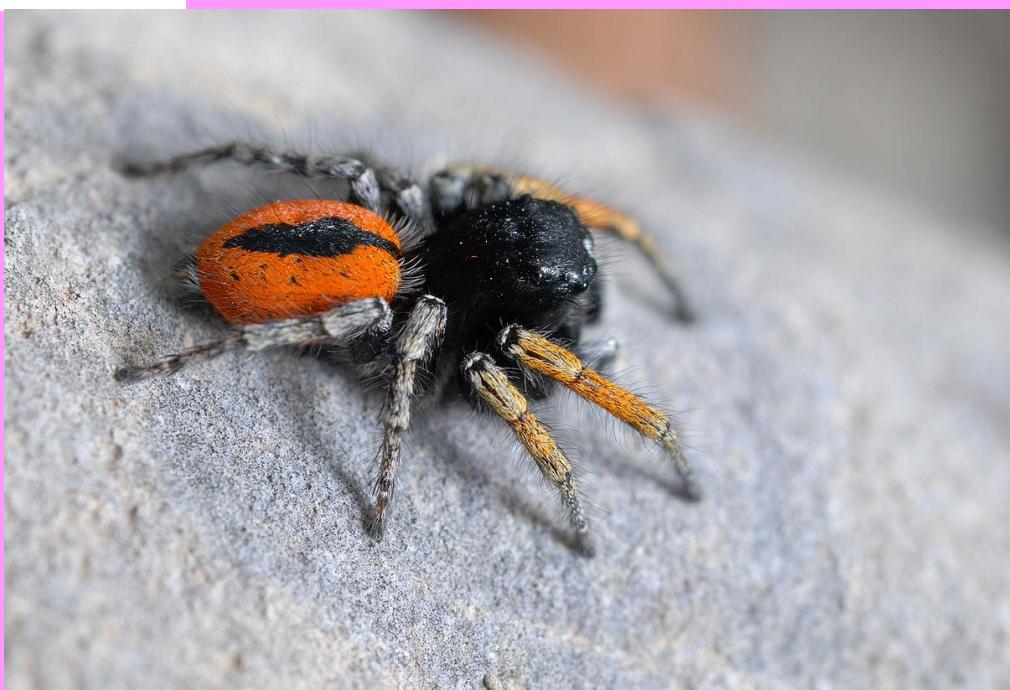
Sasanka otwarta
27.4.12 L.Rutkowski



Epigeic lichens



Eresus kollari Rossi, 1846 (*Eresus cinnaberinus* Olivier)



Philaeus chrysops Poda, 1761



Polyommatus coridon Poda, 1761



Papilio machaon Linnaeus, 1758



Lacerta viridis



Vipera berus



Lullula arborea



Lanius collurio



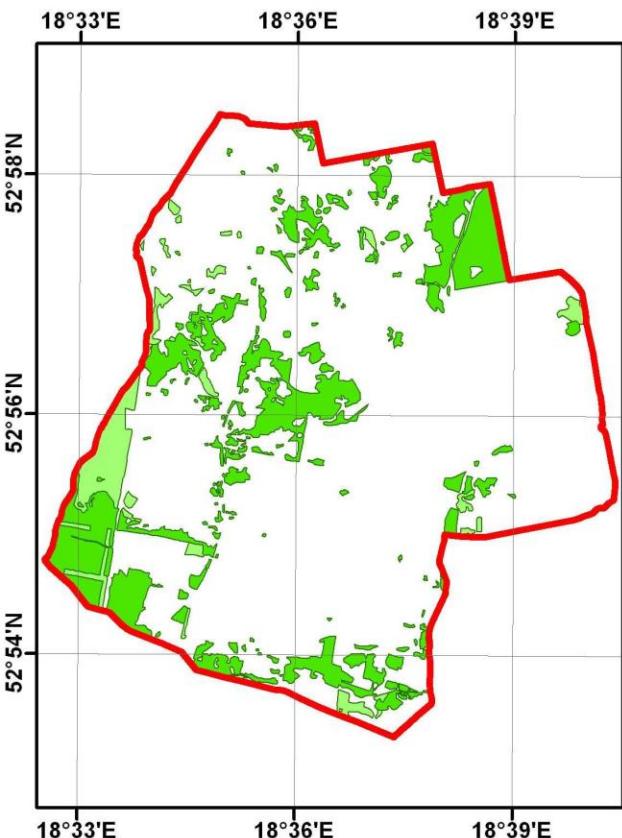
Provisional ecosystem services - hunting products



Wolves – *Canis lupus* L.

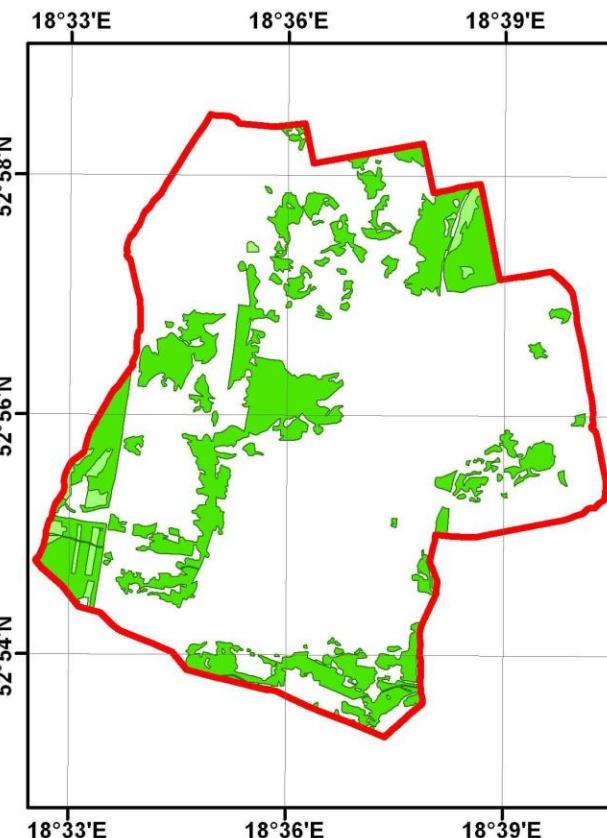
Beekeeping on heathlands



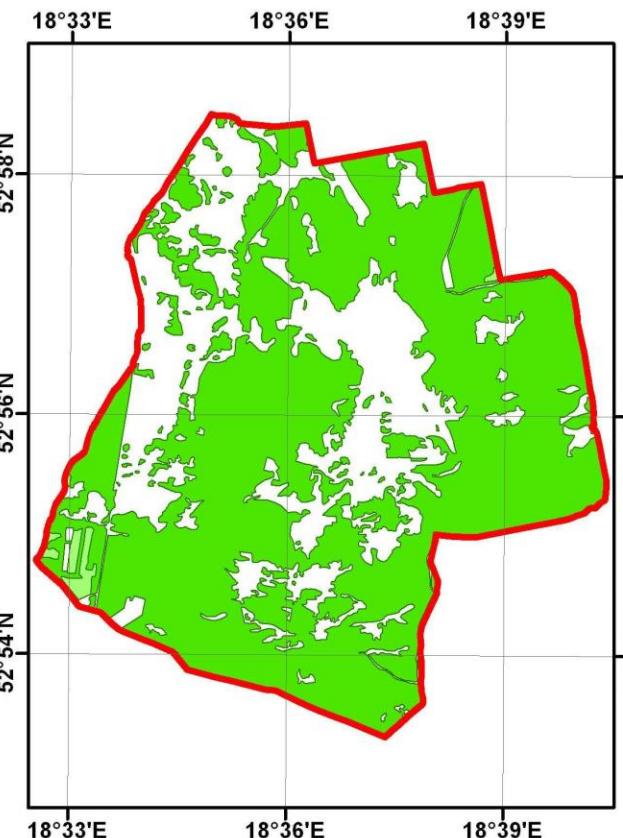
Land cover in 1973

Forest - 19%

boundary of Natura 2000

Land cover in 1986

Forest - 22%

 mature forest
 young forest**Land cover in 2016**

Forest - 69%

0 1,25 2,5 5 km





Mondi Packing Paper Świecie S.A.

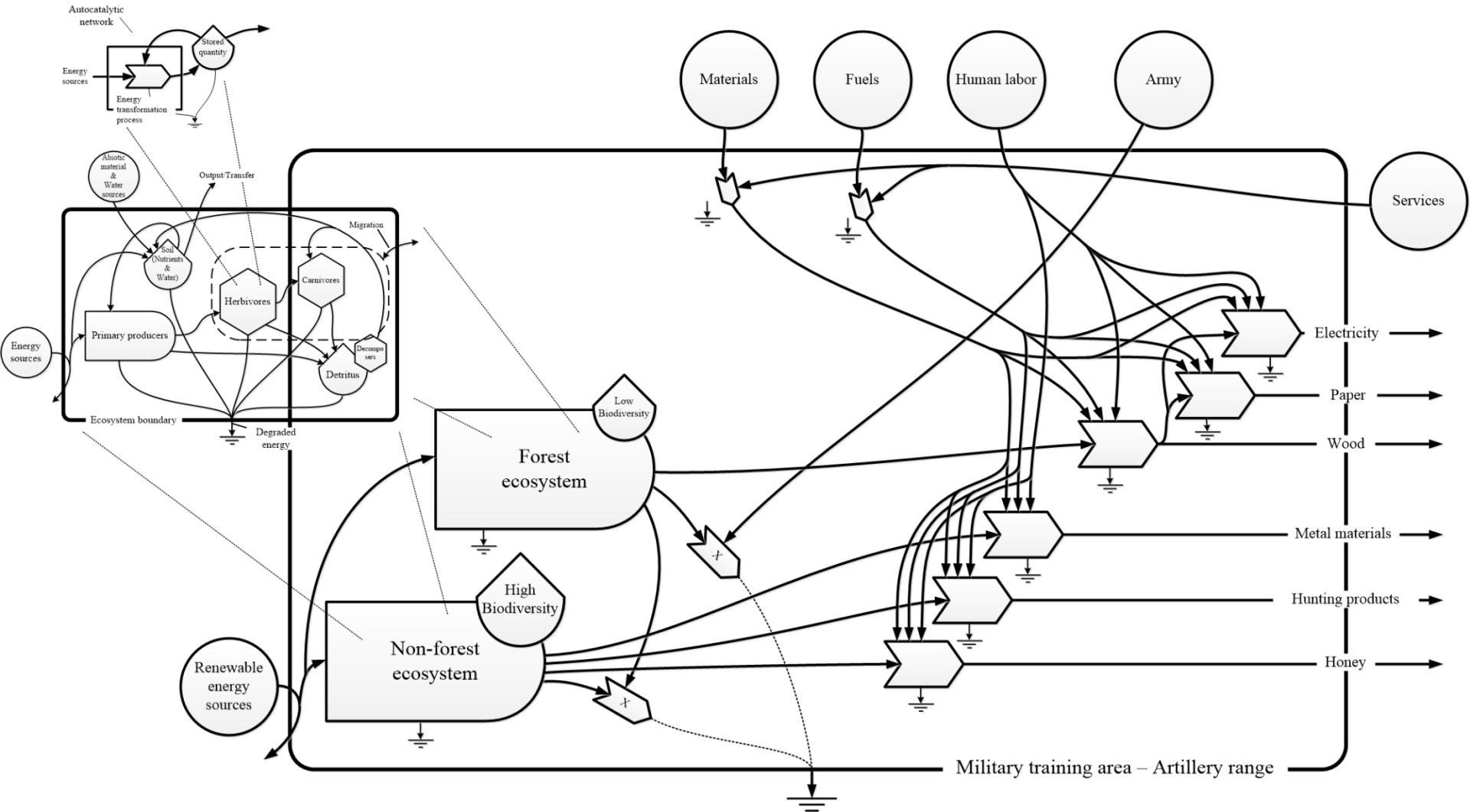
ENERGY SYNTHESIS

MAIN OBJECTIVE

THE IMPLEMENTATION OF A BIOPHYSICAL ACCOUNTING SYSTEM ABLE TO EXPLORE BOTH NATURAL AND ECONOMIC RESOURCES WITHIN AN INTEGRATED FRAMEWORK.

- TO STUDY THE ENERGY METABOLISM OF ARTILLERY RANGE, WITH PARTICULAR REFERENCE TO THE EVALUATION OF NATURAL CAPITAL AND ECOSYSTEM SERVICES.
- TO CALCULATE INDICATORS OF ENVIRONMENTAL PERFORMANCE AND SUSTAINABILITY FOR THE MAIN ACTIVITIES, PRODUCTS AND SERVICES GENERATED BY THE INVESTIGATED SYSTEM.
- TO ASSESS THE USE OF A NATURA 2000 AREA AND SURROUNDING FORESTS RESOURCES, IN ORDER TO UNDERSTAND THEIR POTENTIAL IN SUPPORT OF A SUSTAINABLE ECONOMY (FORESTRY AND HONEY PRODUCTION, EDUCATION, ETC.).

Energy & Emergy Flow Diagram



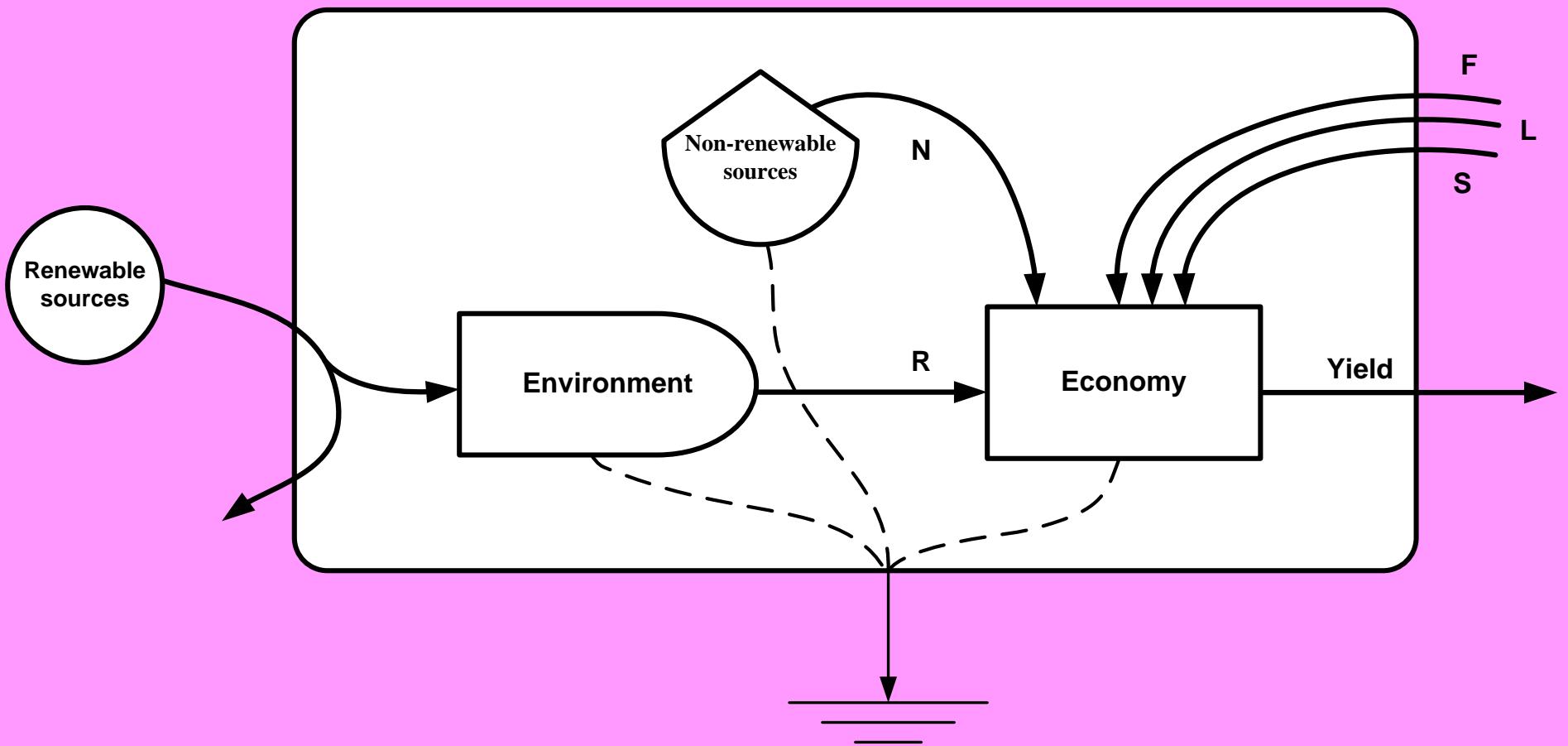


Diagram presenting energy inputs (after Ulgiati & Brown, 1998)

Total Energy input

$$U = (R + N + F + L + S)$$

Energy Yield Ratio

$$EYR = U/(F + L + S)$$

Environmental Loading Ratio

$$ELR = (N + F + L + S)/(R)$$

Energy Sustainability Index

$$ESI = EYR/ELR$$

Research focused on the assessment of Regulating Ecosystem Services

- Biodiversity in the main taxonomic groups of organisms
- Detailed map of Land Use / Land Cover
- Plant biomass and NPP
- Evapotranspiration
- C_{org} in live and dead plant biomass
- TOC under main categories of LU/LC
- Matter cycling and energy flow in the ecosystem under study

Stock and Economic Costs of Ecosystem Services

Provisioning Ecosystem services:

- timber wood and firewood
- mushrooms and herbs
- hunting products
- bee products
- fish products
- Scrap metals

Cultural Ecosystem Services:

- military trainings
- education
- research
- sport events
- historical events

Energy calculation

$$\text{Flow} * \text{Transformity} = \text{Energy}$$

Table 1: Energy account main line items

#	Line item	flow	flow units	trf	trf units	Year: 2000	energy, sei
RENEWABLE FLOWS:							
1	Sunlight	3.1E+21 3.1E+21	J J	1.0E+00 1.0E+00	sei/J sei/J		3.1E+21 3.1E+21
2	Rainfall						

National Environmental Accounting Database



Center for Environmental Policy, University of Florida

About NEAD

NEAD Data by Country

NEAD Data by Indices

Documentation

Publications

Global Data Links

Acknowledgements

Center for Environmental Policy
University of Florida

ENERGY SYSTEMS

About NEAD

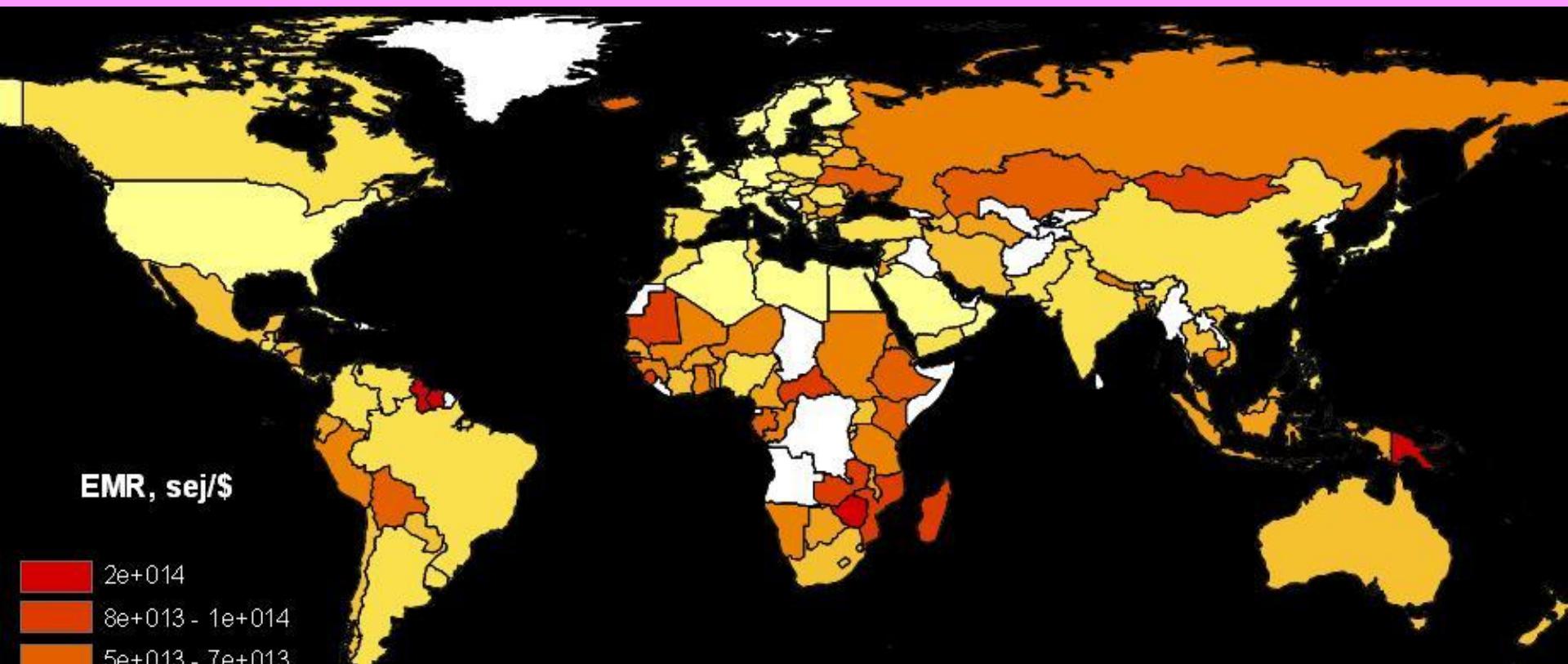
Please note... we are currently performing error-checking. Please let us know if you find something you suspect is an error by emailing sharlynn@ufl.edu.

The National Environmental Accounting Database (NEAD), compiles detailed information for 169 countries about the full array of resources that underlie economies, including environmental flows (sunlight, rainfall), natural capital stocks (soil, water, forests, fish), mined materials (metals, fuels) and economically transformed goods and services (agricultural commodities, manufactured goods, services). Data for production, extraction, and trade flows are from 2000, 2004 and 2008, while long-term average data are used for climate and hydrology flows.

Selecting a country in the menu below will return an interface with tabs for three tables and the national synthesis diagram.

Total Energy Use, sej/year

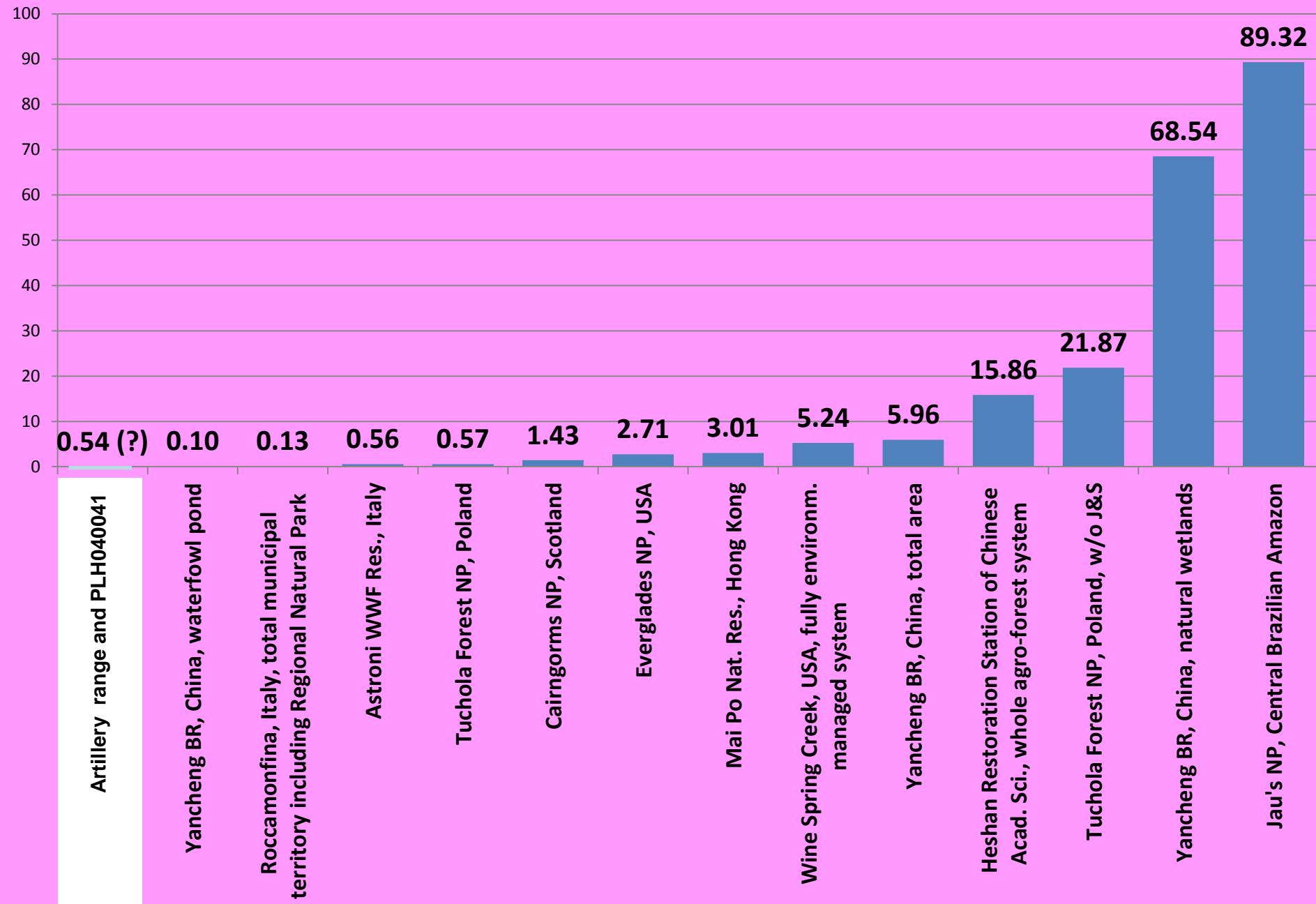
Energy Money Ratio ($\text{sej}/\$$)



$\text{EMR} = \text{Total Use}/\text{GDP converted to US\$}$

acc. Sweeney et al., 2012.

Comparison of Energy Sustainability Indices



SUMMA – Sustainability Multi-criteria Multi-scale Assessment

(Sergio Ulgiati, Vilgia S., Franzese P.P.,
Parthenope Univ., Naples, Italy)

- **Material & energy flow assessment,**
- **Fossil energy, abiotic material and water resources depletion,**
- **Assessment of emissions (CML2 Method),**
- **Life Cycle Assessment; LCA,**
- **Energy Synthesis method,**
- **Economic valuation.**

Thank you for your attention