



# Climate ≈ water

**Bridging the gap between adaptation strategies of climate change impacts and European water policies**

ClimateWater mid-term Meeting Bratislava May,  
26-28.2010

## *Climate change: Water-related impacts on nature*

University of Vienna,  
Department of Limnology

# Objectives [WP2]

- Identification of impacts on the hydrological cycle and on the water resources in Europe
- Magnitude
- Urgency of Action

# Objectives [WT 2.2]

1. Aquatic Ecosystems (GeoEcoMar) **ecological status according to the WFD**
2. Terrestrial ecosystems (VITUKI) **National parks, Ramsar sites, mountains, lowlands, forestry**
3. Aquatic-terrestrial Ecotones (GeoEcoMar) **Fluvial and lake-side ecotones, wetland ecotones, marine ecotones**

# Methods

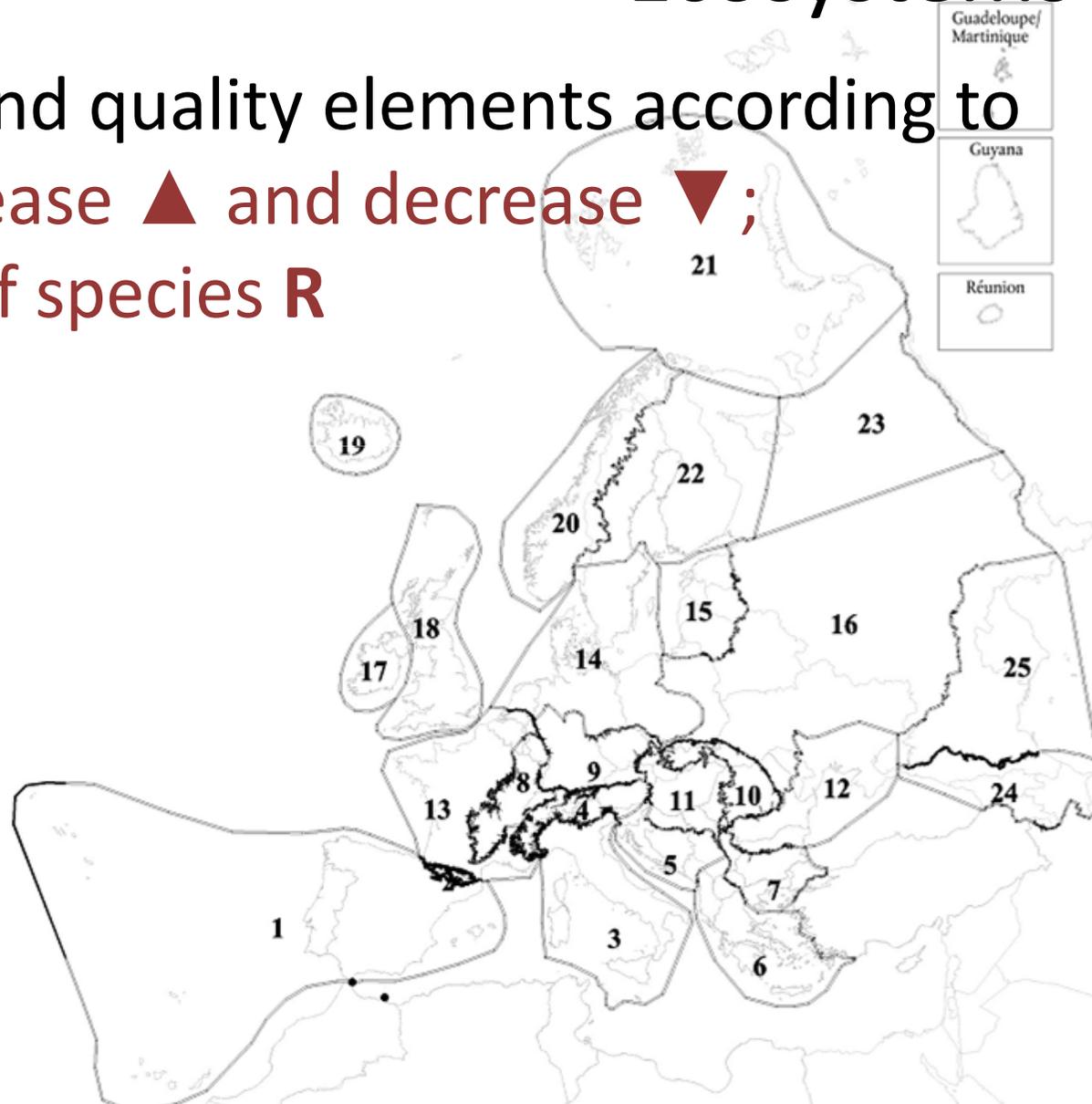
- Meta-analysis of scientific papers and project findings
- Extraction of relevant data
- Summarizing the impacts after topic and region

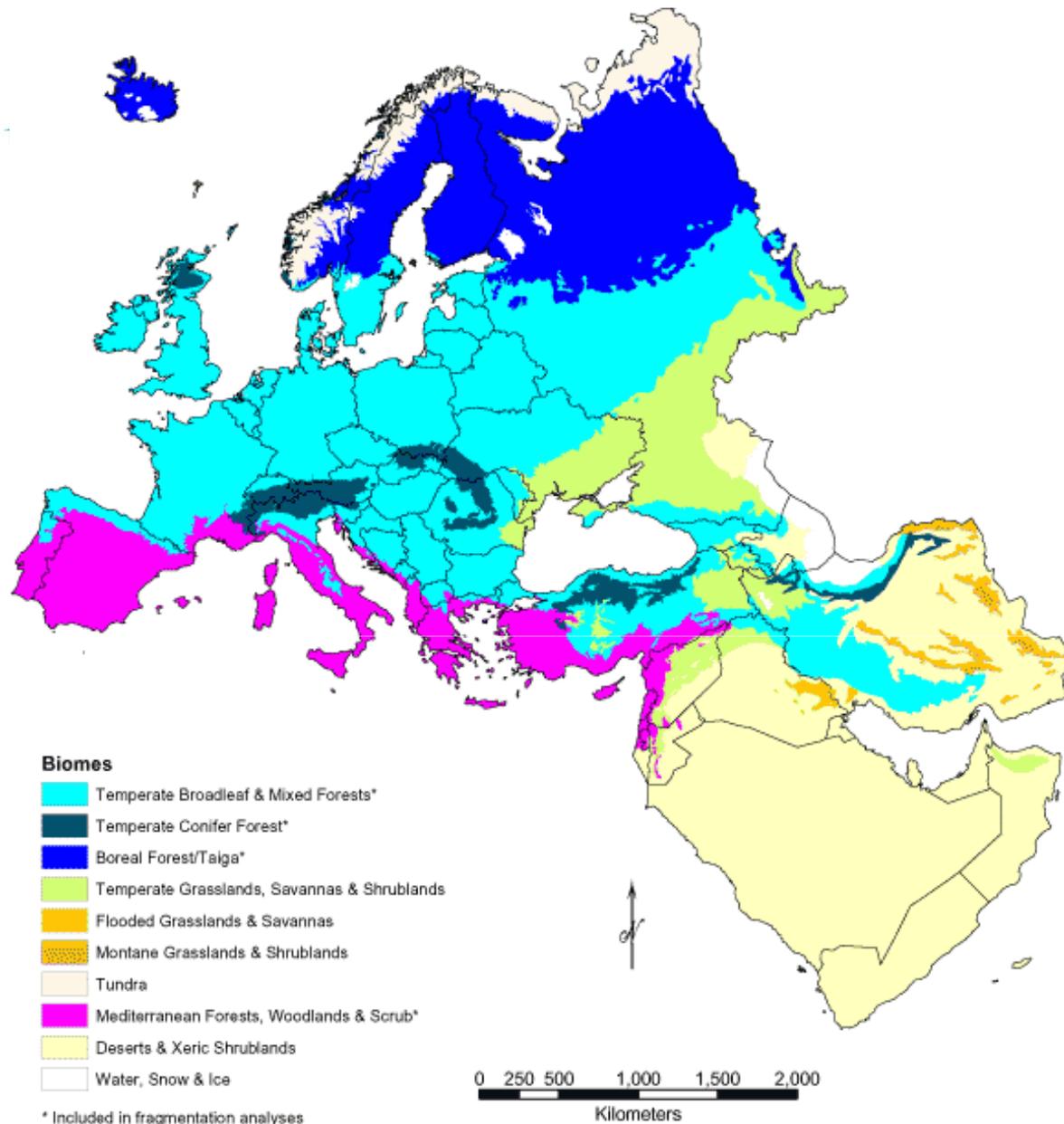
# Results [general]

1. Aquatic Ecosystems: 70 publications, 2 FP6-projects, 5 web sources 😊
2. Terrestrial Ecosystems: 53 publications, 3 projects, 11 web sources 😊
3. Terrestrial-aquatic Ecotones: 17 publications 😊

# Impacts on Aquatic Ecosystems

For ecoregions and quality elements according to the WFD: increase ▲ and decrease ▼ ; replacement of species R





\* Included in fragmentation analyses

Biomes	Freshwater Ecoregions	Biological elements							
		phytoplankton		aquatic flora		invertebrate fauna		fish fauna	
		species compisition	growth rate						
Mediterranean Forests	<i>1. Iberic-Macaronesian region</i>								
	Rivers		▲		▲	R	▲	R	
	Lakes		▲		▲		▲		
	Transitional waters								
	Coastal waters								
	<i>3. Italy, Corsica and Malta</i>								
	Rivers		▲		▲	R	▲	R	
	Lakes		▲		▲		▲		
	Transitional waters								
	Coastal waters								
	<i>5. Dinaric western Balkan</i>								
	Rivers		▲		▲	R	▲		
	Lakes		▲				▲		
	Transitional waters								
	Coastal waters								
	<i>6. Hellenic western Balkan</i>								
	Rivers		▲		▲	R	▲	R	
	Lakes		▲				▲		
	Transitional waters								
	Coastal waters								
	<i>7. Eastern Balkan</i>								
	Rivers		▲		▲	R	▲		
	Lakes		▲				▲		
	Transitional waters								
	Coastal waters								

# ...biological ctd

Biomes	Freshwater Ecoregions	Biological elements							
		phytoplankton		aquatic flora		invertebrate fauna		fish fauna	
		species compition	growth rate	species compition	growth rate	species compition	growth rate	species compition	growth rate
Temperate Broadleaf & Mixed Forests	<b>2. Pyrenees</b>								
	Rivers					R		R	
	Lakes								
	Transitional waters								
	Coastal waters								
	<b>8. Western highlands</b>								
	Rivers		▲		▲	R		R	▲
	Lakes				▲				
	Transitional waters								
	Coastal waters								
	<b>9. Central highlands</b>								
	Rivers		▲		▲	R		R	▲
	Lakes				▲				
	Transitional waters								
	Coastal waters								
	<b>11. Hungarian lowlands</b>								
	Rivers								
	Lakes								
	Transitional waters								
	Coastal waters								
<b>13. Western plains</b>									
Rivers		▲		▲				▲	
Lakes				▲					
Transitional waters									
Coastal waters									
<b>15. Baltic province</b>									
Rivers				▲					
Lakes				▲					
Transitional waters									
Coastal waters									
<b>16. Eastern plains</b>									
Rivers				▲					
Lakes				▲					
Transitional waters									
Coastal waters									
<b>17. Ireland and Northern Ireland</b>									
Rivers				▲					
Lakes				▲					
Transitional waters									
Coastal waters									
<b>18. Great Britain</b>									
Rivers				▲					
Lakes				▲					
Transitional waters									
Coastal waters									

## Folie 9

---

**H1**

auf allen "biological" sollte das auch stehen, vielleicht in Abkürzung (... b 1, ... b 2, .... b 3) oder " bio ctd" = continued  
Hydrobotanik; 21.05.2010

Biomes	Freshwater Ecoregions	Biological elements								
		phytoplankton		aquatic flora		invertebrate fauna		fish fauna		
		species compition	growth rate	species compition	growth rate	species compition	growth rate	species compition	growth rate	
Temperate Grasslands, Savannas and Shrublands	<i>14. Central plains</i>									
	Rivers		▲		▲				▲	
	Lakes									
	Transitional waters									
	Coastal waters									
	<i>25. Caspic depression</i>									
	Rivers									
	Lakes									
	Transitional waters									
	Coastal waters									
	Temperate Conifer Forest	<i>4. Alps</i>								
		Rivers					R		R	
Lakes										
Transitional waters										
Coastal waters										
<i>10. The Carpathians</i>										
Rivers						R		R		
Lakes										
Transitional waters										
Coastal waters										
<i>24. The Caucasus</i>										
Rivers										
Lakes										
Transitional waters										
Coastal waters										
<i>12. Pontic province</i>										
Rivers										
Lakes										
Transitional waters										
Coastal waters										

Biomes	Freshwater Ecoregions	Biological elements							
		phytoplankton		aquatic flora		invertebrate fauna		fish fauna	
		species compition	growth rate	species compition	growth rate	species compition	growth rate	species compition	growth rate
Boreal Forest/Taiga	<i>19. Iceland</i>								
	Rivers	R	▲			R	▲	R	▼
	Lakes	R	▲			R		R	
	Transitional waters								
	Coastal waters								
	<i>20. Borealic uplands</i>								
	Rivers	R	▲			R	▲	R	▼
	Lakes	R	▲			R		R	
	Transitional waters								
	Coastal waters								
	<i>22. Fenno-Scandian shield</i>								
	Rivers	R	▲			R	▲	R	▼
	Lakes	R	▲			R		R	
	Transitional waters								
	Coastal waters								
	<i>23. Taiga</i>								
Rivers	R	▲			R	▲	R	▼	
Lakes	R	▲			R		R		
Transitional waters									
Coastal waters									
Tundra	<i>21. Tundra</i>								
	Rivers	R	▲			R	▲	R	▼
	Lakes	R	▲			R		R	
	Transitional waters								
	Coastal waters								

# ...hydromorphological

Biomes	Freshwater Ecoregions	Hydromorphological elements supporting the biological elements					
		quantity and dynamic of water flow	connection to groundwater bodies	river continuity (rivers)/residence time (lakes)	river depth and width variation/lake depth variation	structure of the river/lake bed	structure of the riparian zone/lake shore
Mediterranean Forests	<i>1. Iberic-Macaronesian region</i>						
	Rivers	R			▼		
	Lakes						
	Transitional waters						
	Coastal waters						
	<i>3. Italy, Corsica and Malta</i>						
	Rivers	R			▼		
	Lakes						
	Transitional waters						
	Coastal waters						
	<i>5. Dinaric western Balkan</i>						
	Rivers	R			▼		
	Lakes						
	Transitional waters						
	Coastal waters						
	<i>6. Hellenic western Balkan</i>						
	Rivers	R			▼		
	Lakes						
	Transitional waters						
	Coastal waters						
	<i>7. Eastern Balkan</i>						
	Rivers	R			▼		
	Lakes						
	Transitional waters						
	Coastal waters						

# chemical and physico-chemical.

Biomes	Freshwater Ecoregions	Chemical and physico-chemical elements supporting the biological elements							
		transparency (lakes)	thermal conditions	oxygenation conditions	salinity	acidification status	nutrient conditions	pollution by all priority substances identified as being discharged into the body of water	pollution by other substances identified as being discharged in significant quantities into the body of water
Mediterranean Forests	<i>1. Iberic-Macaronesian region</i>								
	Rivers		▲	▼	▲		▲		
	Lakes		▲	▼	▲		▲		
	Transitional waters								
	Coastal waters		▲		▲				
	<i>3. Italy, Corsica and Malta</i>								
	Rivers		▲	▼	▲		▲		
	Lakes		▲	▼	▲		▲		
	Transitional waters								
	Coastal waters		▲		▲				
	<i>5. Dinaric western Balkan</i>								
	Rivers		▲	▼	▲		▲		
	Lakes		▲	▼	▲		▲		
	Transitional waters								
	Coastal waters		▲		▲				
	<i>6. Hellenic western Balkan</i>								
	Rivers		▲	▼	▲		▲		
	Lakes		▲	▼	▲		▲		
	Transitional waters								
	Coastal waters		▲		▲				
	<i>7. Eastern Balkan</i>								
	Rivers		▲	▼	▲		▲		
	Lakes		▲	▼	▲		▲		
	Transitional waters								
	Coastal waters		▲		▲				

# Impacts on Aquatic Ecosystems

Romania: Black sea and Danube Delta ecosystems:  
detailed information

# Impacts on Terrestrial Ecosystems

- Southern Europe :
- Soil moisture reduced → loss of productivity + fire hazard
- increased drought → reduced **plant growth** and **primary productivity**, reduced nutrient **turnover** and **nutrient availability**, altered **plant recruitment**, changed **phenology**, and changed **species interactions**, increased **torrmentality** of running waters is likely to lead to **increased erosion**

# Impacts on Terrestrial Ecosystems

- Northern Europe:
- Decrease of **snow cover**, increase of soil frost-free periods and winter rainfall → **increased soil water logging + winter floods**.
- Drought-triggered **forest mortality** → rapid ecosystem changes

# Impacts on Terrestrial Ecosystems

- Forests:
- drought-related mortality
- shift of the vegetation zones
- mild winters → aid pest species

# Impacts on Terrestrial Ecosystems

- Steppe and lowlands
- Reduced rainfall and soil moisture threaten **biodiversity**
- Grassland ecosystems in higher elevations are expected to be **restistent** to climate change

# Impacts on terrestrial-aquatic ecotones

## COASTAL ECOTONES

- Increases in sea level and sea-surface temperature
- Decreases in sea-ice cover
- Changes in salinity, alkalinity, wave climate, and ocean circulation
- Increased levels of inundation and storm flooding
- Accelerated coastal erosion
- Seawater intrusion into fresh groundwater
- Encroachment of tidal waters into estuaries and river systems

# Impacts on terrestrial-aquatic ecotones

## FRESHWATER ECOTONES

- Fluvial dynamics → channel migration
- type and magnitude of disturbance
- enhanced terrestrial erosion → decrease in water transparency → loss of aquatic vegetation

Thank you!



# Bibliography

- WT 2.2.1 Impacts on aquatic ecosystems
- Araujo, R. 2006. *Unio crassus* Retzius, 1788. In: Verda & Galante (eds.): Libro Rojo de los Invertebrados de Espana. Direccian General para la Biodiversidad, Ministerio de Medio Ambiente, Madrid.
- Arnell, N.W. and Reynard, N. S. 1996. The effects of climate change due to global warming on river flows in Great Britain. *Journal of Hydrology* 183: 397-424.
- Bondar C., 1989 - Trends in the evolution of the mean Black Sea level. *Meteorology and Hydrology*, 19, 2: 23-28.
- Bondar C., 2007 - Variation of the Black Sea mean level due to river-sea interaction. *Geo-Eco-Marina*, 13: 43-50.
- Bondar C., Filip, I., 1963 - Contribuție la studiul nivelurilor Mării Negre. *Studii de Hidrologie*, 4: 1-70.
- Bondar C., Roventea V., State I., 1973 – Marea Neagra in zona litoralului romanesc. Monografie hidrologica. Bucuresti: 516 pp.
- Brookes, C.J. et al. 2000. Modelling vegetation interactions with channel flow in river valleys of the Mediterranean region. *Catena* 40(1): 93-118.
- Buzby, K.M. and Perry, S. A. 2000. Modeling the potential effects of climate change on leaf pack processing in central Appalachian streams. *Canadian Journal of Fisheries and Aquatic Sciences* 57(9): 1773-1783.
- Cazenave A., Bonnefond P., Mercier F., Dominh K., Toumazou V., 2002 - Sea level variations in the Mediterranean Sea and Black Sea from satellite altimetry and tide gauges. *Global and Planetary Change*, 34: 59–86.
- Ciocârdel R., Esca A., 1966 - Essai de synthese des donnees actuelles concertant les mouvements verticaux recents de l'ecorce terrestre en Roumanie. *Rev. Roum. Geol. Geophys. Geogr., s. Geophysique*, 10, 1: 5-32.
- Corbau C., Simeoni U., 2008 - Impacts of climate changes (sea level rise and increased number of extreme meteorological events) on sandy coasts. example of the Emilia-Romagna Region (Northern Italy) International Seminar on Natural Hazards in the Marine Area 28-29 July 2008, Bucharest, Romania
- Cornea I., Drăgoescu I., Popescu M., Visarion M., 1979 - Harta mișcărilor crustale verticale recente de pe teritoriul R.S. România. *St. Cerc. Geol. Geof. Geogr., Seria Geofizică*, 17: 3-20.
- Dan S., Stive M.J.F., Walstra D.J.R., Panin N., 2009 (in press, available on-line) - Wave climate, coastal sediment budget and shoreline changes for the Danube Delta, *Marine Geology*, doi:10.1016/j.margeo.2009.03.003.

•

# Bibliography

- Day J.W. Jr. and Templet, P.H., 1989 - Consequences of sea level rise: implications from the Mississippi Delta. *Coastal Management* 17: 241-257.
- Doadrio, I. 2001. Atlas y Libro Rojo de los Peces Continentales de Espana. Direccian General de Conservacion de la Naturaleza. Ministerio de Medio Ambiente. Consejo Superior de Investigaciones Scienta-ficas. Madrid: 129-131.
- Dotsenko S. F., 1998 - Estuary of the Level of Tsunami Hazard of the Black Sea. *Vestn. Mosk. Univ., Ser. 3. Physics, Astronomy* 4: 19–23.
- EuroSION, 2004 - Living with Coastal erosion in Europe: Sand and Sapace dot Sustainability. Guidance document for quick hazard assessment of coastal erosion and associated flooding. Service Contract B4-3301/2001/329175/MAR/B3 “Coastal erosion – Evaluation of the need forAction” Directorate General Environment European Commission: 30 pp.
- Finstad, A.G. et al. (2004): The importance of ice cover for energy turnover in juvenile Atlantic salmon. *Journal of Animal Ecology* 73(5): 959-966.
- FP6 CONSCIENCE STREP Project (Concepts and Science for Coastal Erosion Management) – [www.conscience-eu.net](http://www.conscience-eu.net)
- FP6 IASON Project (International action for Sustainability of the Mediterranean and Black Sea environment), Deliverable D4.2: Assessment of hazards and threats on the coastal zone, arising either from Global Change or from regional variability due to either natural or anthropogenic forcing. [www.iasonnet.gr](http://www.iasonnet.gr)
- Gollwitzer S., 1994 - Structural reliability applications in aerospace engineering, Proc. ICOSAR'93, Innsbruck, A.A. Balkema, Rotterdam: 1265-1272.
- Gomoiu, M.-T. 1992. Marine eutrophication syndrome in the north-western part of the Black Sea. *Science of the Total Environment*. Elsevier Science Publishers B.v., Amsterdam. pp. 683-692.
- Gomoiu, M.-T., Skolka, M. 1996: Changements récents dans la biodiversité de la mer Noire dûs aux immigrants. *Geo-Eco-Marina* 1, 49-66.
- Gomoiu M.-T. 1996. Some remarks concerning the evaluation of ecological diversity the Romanian Black Sea Coast. International NATO Advancev Research Workshop “Conservation of the Biological Diversity as a Prerequisite for the Sustainable Development in the Black Sea Region” Tbilisi & Kobuleti, Georgia, 5-12 October 1996.
- Gomoiu, M.-T., Skolka, M. 1998. Evaluation of marine and coastal biological diversity at the Romanian littoral – a workbook for the Black Sea ecological diversity, “Ovidius” University Annals of Natural Science, Biology-Ecology Series 2. 167 pp.

- Gomoiu, M.-T., Alexandrov, B., Shadrin, N., and Zaitsev, Y. 2002. The Black Sea – a Recipient, Donor and Transit Area for Alien Species. In E. Leppakoski et al. (eds.), *Invasive Aquatic Species of Europe*, Kluwer Academic Publishers, Dordrecht. pp. 341- 350.
- Gornitz V.M., Daniels R.C., White T.W. and Birdwell K.R., 1994 - The development of a coastal risk assessment database: vulnerability to sea-level rise in the U.S. Southeast. In: (C.W. Finkl Ed.) *Coastal hazards: perception, susceptibility and mitigation*. Journal of Coastal Research, 12, Florida: 327-338.
- Graham, L.P. 2004. Climate change effects on river flow to the Baltic Sea. *Ambio* 33 (4-5): 235-241.
- Grigore M., Biter M., Rădulescu F., Nacu V., 1996 - Mișcări crustale recente în Platforma Moesică: Terra, v. 4: 60-69.
- Hoepffner Nicolas (Editor and Coordinating Author), Co-Authors: M. D. Dowell, M. Edwards, S. Fonda-Umani, D.R. Green, B. Greenaway, B. Hansen, C. Heinze, J.-M Leppänen, E. Lipiatou, E. Özsoy, K. Philippart, W. Salomons, A. Sanchez-Arcilla, W. Schrimpf, C. Schrum, A. Theocharis, M. Tsimplis, F. Veloso Gomes, F. Wakenhut, J. M. Zaldivar, 2006 – *Marine and Coastal Dimension of Climate Change in Europe. A report to the European Water Directors*. European Commission, Directorate-General Joint Research Centre Institute for Environment and Sustainability, EUR 22554 EN, ISBN 92-79-03747-1, ISSN 1018-5593, European Communities: 107 pp.
- ICG/NEAMTWS IV, 2008 - Report of the IV Session of the Intergovernmental Coordination Group for the Tsunami Early Warning and Mitigation System in the North-Eastern Atlantic, the Mediterranean and Connected Seas (ICG/NEAMTWS), Lisbon, Portugal, 21-23 November 2007: 44 pp.
- Ion G., Dutu F., Ion E., Radulescu V., Popa A., Stănescu R., Batali L., Ungureanu V.Gh. 2008 - Stability of NW Continental Slope of the Black Sea in the area of gas hydrate accumulations. International Seminar on Natural Hazards in the Marine Area 28-29 July 2008, Bucharest, Romania: 35.
- Ion G., Lericolais G., Nouze H., Panin N., Ion E., 2002 - Seismo-acoustics evidence of gases in sedimentary edifices of the paleo-Danube realm. *CIESM Workshop Series* 17: 91-95.
- IPCC, 2001 – *WGI Third Assessment Report. Summary for Policymakers, Climate Change 2001: The Scientific Basis*. Intergovernmental Panel on Climate Change, Geneva, 13-16 February 2001.
- IPCC, 2007 – *Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of working Group II to the Third Assessment Report on Intergovernmental Panel on Climate Change*, Cambridge University Press, Cambridge, United Kingdom, 1000pp.

- IRDOSER, 1983 – Piano progettuale per la difesa della costa adriatica Emilia-Romagnola – Vol. IV Il trasporto fluviale nei bacini tributari dell'Adriatico: 429 pp.
- Janauer, G. A., Jolankai, G. G. 2008. Lotic processes: Vegetation. In: Harper, D., Zalewski, M., Pacini, N. (Eds.) Ecohydrology: Processes, Models and Case Studies. An approach to the sustainable management of water resources. CABI, Wallingford p. 46-61.
- Jacobsen, D., Schultz, R. and Encalada, A. 1997. Structure and diversity of stream invertebrate assemblages: the influence of temperature with altitude and latitude. *Freshwater Biology* 38: 247-261.
- Janauer, G.A., Jolankai, G.G., Exler, N. 2006. River restoration in the Tisza River Basin: conflicting interests and the future of the aquatic macrophyte vegetation. *Archive of Hydrobiology* 158, 525-540.
- Malciu V., 2000 - Implications of Accelerated Sea-Level Rise (ASLR) for Romania. Proceeding of SURVAS Expert Workshop on European Vulnerability and Adaptation to impacts of Accelerated Sea-Level Rise (ASLR)- Hamburg, Germany, 19th-21st June 2000
- Mee, L.D., Friedrich, J., Gomoiu M.T. 2005. Restoring the Black Sea in times of uncertainty. *Oceanography* Vol. 18, No. 2: 100 – 111.
- Monserrat S., Vilibic I., Rabinovich, A.B., 2006 - Meteotsunamis: atmospherically induced destructive ocean waves in the tsunami frequency band. *Natural Hazards and Earth System Sciences* 6: 1035–1051.
- Monserrat S., Vilibic I., Rabinovich, A.B., 2006 - Meteotsunamis: atmospherically induced destructive ocean waves in the tsunami frequency band. *Natural Hazards and Earth System Sciences* 6: 1035–1051.
- Murgoci G.M., 1912 - Studii de geografie fizică în Dobrogea. *Bull. Soc. Rom. Geogr.*, V, XXXIII: 1-2.
- OAIE G., SEGHEDI Antoneta, DIACONESCU M., 2008 - Marine hazard assessment in the Black Sea Basin. case study - the tsunami phenomenon. *International Seminar on Natural Hazards in the Marine Area, 28-29 July 2008, Bucharest, Romania*: 33.
- Oaie Gh., Bondar C., Secrieru D., Seghedi A., Diaconescu M., Ioane D., Ruzsa Gy., 2007 - Black Sea Basin: Assessment of Tsunami Marine Hazard. In “Excellence Research – A Way to ERA” (Eds. Lanyi S., Vasiliu N.), Ed. Tehnica (ISSN 1843-5904), AMCSIT Conference, CD –ROM – C. 161 pdf , , Brasov (Romania): 6 pp.
- Oaie Gh., Bondar C., Secrieru D., Seghedi Antoneta, Diaconescu M., Ioane D., Ruzsa Gyöngyi, 2009 - Black Sea Basin: Assessment of Tsunami Marine Hazard. *Geophysical Research Abstracts*, Vol. 11, EGU2009-132, 2009, EGU General Assembly 2009

- Oaie Gh., Bondar C., Seghedi A., Diaconescu M. 2007 - Marine hazard assessment in the Black Sea basin. Case study – tsunami phenomenon. National Symposium of Geology and Geophysics GEO 2007, Bucharest, Abstract volume: 21 – 22.
- Oaie Gh., Secieru D., Seghedi A., Ioane D., Diaconescu M. 2006 - Preliminary assessment of the tsunami hazard for the Romanian Black Sea area: historical and paleotsunami data. GEOSCIENCES 2006 Conference, Sofia, Bulgaria: 300 – 302.
- Friedrich, J., Dinkel, C., Friedl, G., Pimneov, N., Wijsman, J., Gomoiu, M.-T., Cociasu, A., Popa, L. and Wehrl, B. 2002. Benthic Nutrient Cycling and Diagenetic Pathways in the North-western Black Sea. *Estuarine, Coastal and Shelf Science* 54, 369-383.
- Panin N., 1996 - Danube Delta. Genesis, evolution and sedimentology. *Geo-Eco-Marina*, 1: 7-23.
- Panin N., 1996 - Impact of global changes on geo-environmental and coastal zone state of the Black Sea, GEO – ECO – MARINA 1, Bucharest, Romania: 1–6.
- Panin N., 1999 - Global changes, sea level rise and the Danube Delta: risks and responses, *Geo-Eco-Marina* 4, Bucharest, Romania: 19–29.
- Panin N., 2008 - The Black Sea: geology, environment and natural hazards. International Seminar on Natural Hazards in the Marine Area 28-29 July 2008, Bucharest, Romania
- Pirazzoli P.A., 1996 - Sea-level changes. The last 20000 years. John Wiley & Sons, New York: 211 pp.
- Polonic G., Zugrăvescu D., Horomnea M., Dragomir V., 1999 - Crustal vertical recent movements and the geodynamic compartments of Romanian territory: Istanbul, Turkey, 2nd Balkan Geophysical Congress, Book of Abstracts: 300-301.
- Popescu M.N., Drăgoescu I., 1986 - The new map of recent vertical crustal movements in Romania - scale 1:1 000 000. *Rev. Roum. Geol. Geophys. Geogr., s. Geophysique*, 30: 3-10.
- Rangelov B., Mardirossian G., Gospodinov D., Spassov E., 2008 - The EU SCHEMA Project – Bulgarian participation. SENS 2008 - Fourth Scientific Conference with International Participation SPACE, ECOLOGY, NANOTECHNOLOGY, SAFETY - 4–7 June 2008, Varna, Bulgaria: 161 – 165.
- Rangelov B. and Gospodinov D., 2000 - Tsunami vulnerability modelling for the Bulgarian Black Sea Coast. Geophysical Institute, Bulgarian Academy of Sciences, Acad. G. Boncev Street, bid. 3, Sofia 1113, Bulgaria
- Rangelov B. K. 2003 - Possible tsunami deposits discovered on the Bulgarian Black Sea coast and some applications. In Yalciner A. C., Pelinovski E., Synolakis C. E., Okal E. (eds). *Submarine Landslide and Tsunamis*: 237 – 242.

- Ranguelov B. K. 2008 - Tsunamis in the Black Sea and some recent investigations. International Seminar on Natural Hazards in the Marine Area, 28-29 July 2008, Bucharest, Romania: 21 - 22.
- Ranguelov B., 2005 - Tsunami hazard in the Black Sea., Proc. Intl. Symp., Natural Hazards-New Challenges for Eng. Geology and Civil Protection., Sofia, 5-8th Sept.: 5pp. (on CD)
- Reist, J.D., et al. 2006. An overview of effects of climate change on selected arctic freshwater and anadromous fishes. *Ambio* 35(7): 381-387
- Ries, R.D. and Perry, S. A. 1995. Potential effects of global climate warming on brook trout growth and prey consumption in central Appalachian streams, USA. *Climate Research* 5(3): 197-206.
- Serra-Tosio, B. 1972. Ecologie et biogeographie des Diamesini d'Europe (Diptera, Chironomidae). *Travaux du Laboratoire d'Hydrobiologie et de Pisciculture de Grenoble* 63: 5-175.
- Spataru A., 1984 – A Method to Determine the Design Waves. In: International Symposium on Maritime Structures In the Mediterranean Sea. Athens. Bondar Constantin 1973.
- Stănică A., Panin N., 2009 - Present evolution and future predictions for the deltaic coastal zone between the Sulina and Sf. Gheorghe Danube river mouths (Romania). *Geomorphology*, 107: 41-46.
- Tinti S., Armigliato A., Pagnoni G., Tonini R., Zaniboni F., 2008 - Tsunami hazard and risk in the Mediterranean and in the Black Sea. International Seminar on Natural Hazards in the Marine Area 28-29 July 2008, Bucharest, Romania: 1–2.
- Tinti S., Maramai A., Graziani L., 2001 - A new version of the European tsunami catalogue: updating and revision, *Natural Hazards and Earth System Sciences*, 1, 255-262
- Van der Hoeven A.G.A., Mocanu V., Spakman W., Nutto M., Nuckelt A., Matenco L., Munteanu L., Marcu C., Ambrosius B.A.C., 2005 - Observation of present-day tectonic motions in the Southeastern Carpathians: Results of the ISES/CRC-461 GPS measurements: *Earth and Planetary Science Letters*, v. 239, n. 3-4: 177-184.
- Wijsman, J.W.M., Herman, P.M.J., Gomoiu, M.-T. 1999. Spatial trends in sediment structure and benthic activity in relation to the Danube plume on the Black Sea continental shelf – *Marine Ecology Progress Series* 181, 25-39.
- Wright, R. F. 1998. Effect of increased carbon dioxide and temperature on runoff chemistry at a forested catchment in southern Norway (CLIMEX Project). *Ecosystems* 1: 216-225.
- Yalciner A. C., 2008 - Data processing, modeling and assessment of tsunamis between source and target regions; Mediterranean and Black Sea examples. International Seminar on Natural Hazards in the Marine Area, 28-29 July 2008, Bucharest, Romania: 7 - 9.

Yalciner A., Pelinovsky E., Talipova T., Kurkin A., Kozelkov A., Zaitsev A., 2004 – Tsunami in the Black Sea: Comparison of the historical, instrumental and numerical data. Jour. of Geph. Research, vol. 109, C 12023: 1 – 13. doi:10.1029/2003JC002113.

Yalciner A.C., Karakus H., Ozer C., Ozyurt G., 2005 - Short Courses on Understanding the Generation, Propagation, Near and Far-Field Impacts of TSUNAMIS and Planning Strategies to Prepare for Future Events. Course Notes prepared by METU Civil Eng. Dept. Ocean Eng. Res. Center, for the Short Courses in University of Teknologi Malaysia held in Kuala Lumpur on July 11-12, 2005, and in Astronautic Technology Malaysia held in Kuala Lumpur on April 24-May 06, 2006, and in UNESCO Training on Tsunami Numerical Modeling held in Kuala Lumpur on May 08-19 2006 and in Belgium Oostende on June 06-16, 2006.

Web sources:

BioPlatform, 2001. European Platform for Biodiversity Recommendations of the participants of the European Platform for Biodiversity Research Strategy meeting held under the Swedish residency of the EU in Sigtuna, Sweden, 11 - 12 June 2001 concerning "Biodiversity of Freshwater and Forest Science in support of the Ecosystem Approach". <http://www.bioplatform.info/objectives.htm>.

20100331 16:34

Gibbs Ph., Climate Change and the Fisheries of NSW - a Background Paper for NSW Department of Primary Industries  
[http://www.dpi.nsw.gov.au/\\_\\_data/assets/pdf\\_file/0020/191522/Climate-change-and-fisheries---a-background-paper.pdf](http://www.dpi.nsw.gov.au/__data/assets/pdf_file/0020/191522/Climate-change-and-fisheries---a-background-paper.pdf)

20100331 16:36

<http://www.eea.europa.eu/>

20100331 16:34

<http://www.ipcc.ch/>

20100331 16:38

<http://www.roadmap2010.eu/>

20100331. 16:41

- WT 2.2.2 Impacts on terrestrial ecosystems

Allen, C.D. 2009. Climate-induced forest dieback: an escalating global phenomenon? *Unasylva* 60 (231/232) . 43-49.

DEFRA. 2003. Agricultural practice and bats: a review of current research literature and management recommendations. Project no: BD2005. Report to Defra, UK. 73pp.

Baillie, S. Peach, W. 1992. Population limitation in Palaearctic-African migrant passerines. *Ibis* 134, 120-132.

Bartha, S., Campetella, G., Ruprecht, E., Kun, A., Hazi, J., Horvath, A. Viragh, K. Molnar, Zs. 2008. Will interannual variability in sand grassland communities increase with climate change? *Community Ecology* 9, 13-21.

Batáry, P., Báldi, A., Erdos, S. 2007. Grassland versus non-grassland bird abundance and diversity in managed grasslands: local, landscape and regional scale effects. *Biodiversity and Conservation* 16, 871-881.

Bat Conservation Trust. 2004. The National Bat Monitoring Programme Annual Report 2004. Joint Nature Conservation Committee/The Bat Conservation Trust, UK.

Botnariuc N., Vadineanu, A. 1982. Tendinte in evolutia Deltei Dunarii si posibilitati de protectie. In: Stugren B. (Coordinator) - Probleme Actuale ale Ocrotirii Naturii. Edit. Dacia, Cluj, Romania.

Botnariuc N., Toniuc N., & Filipascu A. 1975. Necesitatea infiintarii parcurilor nationale in Delta Dunarii. *Ocrotirera Naturii* 19/2. Bucuresti.

Brotons, L., MaNosa, S., Estrada, J. 2004. Modelling the effects of irrigation schemes on the distribution of steppe birds in Mediterranean farmland. *Biodiversity and Conservation* 13, 1039-1058.

Cook, C., Harrison, P.A. (Eds.). 2001. Climate Change and Nature Conservation in Britain and Ireland. MONARCH – Modelling Natural Resource Responses to Climate Change. UK Climate Impacts Programme, Oxford, UK.

Curriero F.C., Patz J.A., Rose J.B., Lele S. 2001. . . *Am J Public Health* 91.1194-99.

Deelstra, J., Eggestad, H.O., Iital, A., Jansons, V. 2008. Hydrological processes in small agricultural catchments. In: Proceedings of the 10th International drainage Worskhop of ICID Working Group on Drainage. Helsinki/Tallinn 6-11 July 2008. Pp. 314-333.

Dickson D., Brett E., Bruce W. 2006. The Role of Ecotones in Emerging Infectious Diseases. *EcoHealth* 3, 281-289.

Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy

- Field, R.H. & Anderson, G.Q.A. 2004. Habitat use by breeding Tree Sparrows *Passer montanus*. *Ibis* 146, 60-68.
- Grime, J.P., Brown, V.K., Thompson, K., Masters, G.J., Hillier, S.H., Clarke, I.P., Askew, A.P., Corker, D., KIELTY, J.P. 2000. The response of two contrasting limestone grasslands to simulated climate change. *Science* 289, 762-765.
- Grime, J.P., Fridley, J.D., Askew, A.P., Thompson, K., Hodgson, J.G., Bennett, C.R. 2008. Long-term resistance to simulated climate change in an infertile grassland. *Proceedings of the National Academy of Sciences of the United States of America* 105, 10028-10032
- Herzon I., Helenius, J. 2008. Agricultural drainage ditches, their biology and functioning: Literature review. *Biological Conservation* 141,1171-1183.
- Hopkins, J. 2008. British wildlife and climate change 3. The future. *British Wildlife* 20, 99-106.
- IPCC. 2007. *Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of working Group II to the Third Assessment Report on Intergovernmental Panel on Climate Change*, Cambridge University Press, Cambridge, United Kingdom, 1000pp.
- IPCC. 2001. *Third Assessment Report "Climate Change 2001" Working Group II: Impacts, Adaptation and Vulnerability*.
- Janauer, G.A. 2005. Aquatic habitats in Vienna (Austria) – integrating ecology and urban water management. *Ecohydrology and Hydroecology* 5, 281-286.
- Janauer, G. A., Jolankai, G. G. 2008. Lotic processes: Vegetation. In: Harper, D., Zalewski, M., Pacini, N. (Eds.) *Ecohydrology: Processes, Models and Case Studies. An approach to the sustainable management of water resources*. CABI, Wallingford p. 46-61.
- Janauer, G.A., Jolankai, G.G., Exler, N. 2006. River restoration in the Tisza River Basin: conflicting interests and the future of the aquatic macrophyte vegetation. *Archive of Hydrobiology* 158, 525-540.
- Johnson L., Hayhoe K., Kling G., Magnuson J. and Shuter B. 2003. *Wetland Ecosystems - Technical Appendix. Report on Confronting Climate Change in the Great Lakes Region* <http://www.ucsusa.org/greatlakes/>
- Jolankai, G. , Biro, I. 2002. How much do we know about planning ecohydrological management actions? *Ecohydrology and Hydrobiology* 2, 321- 327.
- Jump, A.S., Hunt, J.M. & Penuelas, J.P. 2006. Rapid climate change-related growth decline at southern range edge of *Fagus sylvatica*. *Global Change Biology* 12, 2163-2174.
- Láng I. and Jolánkai G. (2009): *The VAHAVA Report, Global Climate Changes, Impacts and Responses in Hungary* (English language condensed summaries of selected chapters of the VAHAVA report, a special version of the English booklet in edition, made for the ClimateWater Project; Original reference: Láng I., Csete L., Jolánkai M. (editors, 2007): *Globális Klímaváltozás. Hazai hatások és Válaszok: A VAHAVA Jelentés*. Szaktudás Kiadó Ház, Budapest, p.220)

- Lellei-Kovacs, E., Kovacs-Lang, E., Kalapos, T. & Botta-Dukat, Z. 2008. Soil respiration and its limiting factors in a semi-arid sand forest-steppe ecosystem – results of a climate simulation experiment. Alps-Adria Scientific Workshop, Stara Lesna, Slovakia. pp.1223-1226.
- Kovács-Lang, E., Molnár, E., Kröel-Dulay, G., Barabás, S. (Eds.). 2008. The KISKUN LTER: Long-term ecological research in the Kiskunság, Hungary. Hungarian Academy of Sciences, Institute of Ecology and Botany HAS 2008.
- Maclean, M.D., Rehfisch, M.M., Robinson, R.A. & Delany, S. 2008. Migratory Waterbirds and Climate Change: Effects within the African-Eurasian Flyways. BTO, Thetford, UK.
- Maroschek, M., Seidl, R., Netherer, S. and Lexer, M.J. 2009. Climate change impacts on goods and services of European mountain forests. *Unasylva* 60 (231/232). 9pp.
- McCarthy, J.J., Canziani, F.O., Leary, A.N., Dokken, J.D., White, S.K. (Eds.). 2003. Climate Change 2001: Impacts, Adaptation, and Vulnerability. Contribution of Working Group II to the Third Assessment Report of the Intergovernmental Panel on Climate Change. GRID-Arendal
- Melman, Th.C.P., Schotman, A.G.M., Hunink S. & de Snoo, G.R. 2008. Evaluation of meadow bird management, especially Black-tailed Godwit (*Limosa limosa* L.), in the Netherlands. *Journal of Nature Conservation* 16, 88-95.
- Naiman R.J., Décamps H., Fournier F., (Eds). 1989. The role of land / inland water ecotones in landscape management and restoration: a proposal for collaborative research. *M A B Digest* 4. Unesco, Paris: 93 pp.
- Neilson, R.P. 1993. Transient ecotone response to climatic change: some conceptual and modelling approaches. *Ecological Applications* 3 (3), pp. 385-395
- Newton, I. 2004. The recent declines of farmland bird populations in Britain: an appraisal of causal factors and conservation actions. *Ibis* 146, 579-600.
- Nunes, J.M., López-Piñero, A., Albarrán, A., Muñoz, A. & Coelho, J. 2007. Changes in selected soil properties caused by 30 years of continuous irrigation under Mediterranean conditions. *Geoderma* 139, 321-328.
- Olson, D.M., Dinerstein, E., Wikramanayake, E.D., Burgess, N.D. Powell, G.V.N., Underwood, E.C., D'Amico, J.A., Itoua, I., Strand, H.E., Morrison, J.C., Loucks, C.J., Allnutt, T.F., Ricketts, T.H., Kura, Y., Lamoreux, J.F., Wettengel, W.W., Hedao, P., Kassem, K.R. 2001. Terrestrial Ecoregions of the World: A New Map of Life on Earth. *BioScience* 51(11), 933-938.

- Ostendorp, W., Schmieder, K., Jöhnk, K. 2003. Assessment of human pressures and their hydromorphological impacts on lakeshores in Europe. *Ecohydrology and Hydroecology* 4, 379-395.
- Peach, W.J., Robinson, R.A. & Murray, K.A. 2004. Demographic and environmental causes of the decline of rural Song Thrush *Turdus philomelos* in lowland Britain. *Ibis* 146, 50-59.
- Parnesan, C. 2006. Ecological and evolutionary responses to recent climate change. *Annual Review of Ecology, Evolution, and Systematics* 37: 637-669.
- Patz J. 2008. - Global Warming & Health: Great Risks AND Opportunities. Presentation to the Pan American Health Organization (PAHO) April 9, 2008 [http://www.opas.org.br/ambiente/uploadArq/ev\\_127\\_apre\\_13.pdf](http://www.opas.org.br/ambiente/uploadArq/ev_127_apre_13.pdf)
- Patz J., Campbell-Lendrum, D., Gibbs, H., Woodruff R. 2008. Health Impact Assessment of Global Climate Change: Expanding on Comparative Risk Assessment Approaches for Policy Making. *Annual Review of Public Health*, April 2008, Vol. 29: 27-39. (doi: 10.1146/annurev.publhealth.29.020907.090750)
- Risser, P.G. 1995. The status of the science examining ecotones. *BioScience* 45, 318-325.
- Santos, M.J., Pedroso, N.M., Ferreira, J.P., Matos, H.M., Sales-Luis, T., Prereira, I., Baltazar, C., Grilo, C., Candido, A.T., Sousa, I. & Santos-Reis, M. 2008. Assessing dam implementation impact on threatened carnivores: the case of Alqueva in SE Portugal. *Environmental Monitoring Assessment* 142, 47-64.
- Scheffer, M., Carpenter, S., Foley, J.A., Folke, C., Walker, B. 2009. Catastrophic shifts in ecosystems. *Nature* 413 (6856), 591-596.
- Stoate, C., Morris, R.M. & Wilson, J.D. 2001. Cultural ecology of Whitethroat (*Sylvia communis*) habitat management by farmers: trees and shrubs in Senegambia in winter. *Journal of Environmental Management* 62, 343-356.
- Szep, T. 1995. Relationship between West African rainfall and the survival of central European Sand Martins (*Riparia riparia*). *Ibis* 137, 162-168.
- Tews, J., Brose, U., Grimm, V., Tielbörger, K., Wichmann, M.C., Shwager, M., Jeltsch, F. 2004. Animal species diversity driven by habitat heterogeneity/diversity: The importance of keystone structures. *Journal of Biogeography* 31, 79-92.
- Ursua, E., Serrano, D. & Tella, J. 2005. Does land irrigation actually reduce foraging habitat for breeding lesser kestrels? The role of crop types. *Biological Conservation* 122, 643-648.

Voigt, W., Perner, J. & Jones, T.H. 2007. Using functional groups to investigate community response to environmental changes: two grassland case studies. *Global Change Biology* 13, 1710-1721.

Wesche, S., Kirby, K. & Ghazoul, J. 2006. Plant assemblages in British beech woodlands within and beyond native range: implications of future climate change for their conservation. *Forest Ecology and Management* 236, 385-392.

WHO, 1990. Potential health effects of climate change. Geneva: World Health Organization.

Web sources:

BioPlatform, 2001. European Platform for Biodiversity Recommendations of the participants of the European Platform for Biodiversity Research Strategy meeting held under the Swedish residency of the EU in Sigtuna, Sweden, 11 - 12 June 2001 concerning "Biodiversity of Freshwater and Forest Science in support of the Ecosystem Approach". <http://www.bioplatform.info/objectives.htm>.

20100331. 16:34

<http://www.eea.europa.eu/>

20100331 16:34

<http://www.ipcc.ch/>

20100331. 16:38

<http://www.roadmap2010.eu/>

20100331. 16:41

<ftp://ftp.fao.org/docrep/fao/011/i0670e/i0670e12.pdf>

20100413 13:45

<http://www.forestry.gov.uk/website/publications.nsf/>

20100413 13:45

Climate  
≈ water



<http://biol.lancs.ac.uk/psi/research/forestry.html>

20100413 13:49

[http://www.weichholzaue.de/pdfs/ea\\_ser\\_0159.pdf](http://www.weichholzaue.de/pdfs/ea_ser_0159.pdf)

20100413 13:51

<http://cses.washington.edu/db/pdf/kc05whitepaper459.pdf>

20100413 13:51

[http://www.safnet.org/publications/jof/jof\\_cctf.pdf](http://www.safnet.org/publications/jof/jof_cctf.pdf)

20100413 13:51

[http://ec.europa.eu/environment/nature/biodiversity/economics/pdf/teeb\\_report.pdf](http://ec.europa.eu/environment/nature/biodiversity/economics/pdf/teeb_report.pdf)

20100413 13:52

### WT 2.2.3 Impacts on aquatic-terrestrial ecotones

- BioPlatform, 2001 - European Platform for Biodiversity Recommendations of the participants of the European Platform for Biodiversity Research Strategy meeting held under the Swedish residency of the EU in Sigtuna, Sweden, 11 - 12 June 2001 concerning "Biodiversity of Freshwater and Forest Science in support of the Ecosystem Approach". <http://www.bioplatform.info/objectives.htm>
- Botnariuc N., & Vadineanu A. , 1982 - Tendinte in evolutia Deltei Dunarii si posibilitati de protectie. In: Stugren B. (Coordinator) - Probleme Actuale ale Ocrotirii Naturii. Edit. Dacia, Cluj, Romania.
- Botnariuc N., Toniuc N., & Filipascu A., 1975 - Necesitatea infiintarii parcurilor nationale in Delta Dunarii. Ocrotirera Naturii. Tom 19: 2, Bucuresti.
- Corbau Corinne, Simeoni Umberto, 2008 - Impacts of climate changes (sea level rise and increased number of extreme meteorological events) on sandy coasts. example of the Emilia-Romagna Region (Northern Italy). International Seminar on Natural Hazards in the Marine Area 28-29 July 2008, Bucharest, Romania).
- Curriero F.C., Patz J.A., Rose J.B., Lele S., 2001 - Analysis of the association between extreme precipitation and waterborne disease outbreaks in the United States, 1948-1994. Am J Public Health 2001 (Aug) 91:1194-99
- Dickson D., Brett E., Bruce W., 2006 - The Role of Ecotones in Emerging Infectious Diseases. EcoHealth, Vol. 3, No. 4: 281-289.
- Gibbs Ph., Climate Change and the Fisheries of NSW - a Background Paper for NSW Department of Primary Industries [http://www.dpi.nsw.gov.au/\\_\\_data/assets/pdf\\_file/0020/191522/Climate-hange-and-fisheries---a-background-paper.pdf](http://www.dpi.nsw.gov.au/__data/assets/pdf_file/0020/191522/Climate-hange-and-fisheries---a-background-paper.pdf)
- IPCC, 2007 – Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of working Group II to the Third Assessment Report on Intergovernmental Panel on Climate Change, Cambridge University Press, Cambridge, United Kingdom, 1000pp.
- Johnson L., Hayhoe K., Kling G., Magnuson J. and Shuter B., 2003 - Wetland Ecosystems - Technical Appendix. Report on Confronting Climate Change in the Great Lakes Region <http://www.ucsusa.org/greatlakes/>
- Malciu V., 2000 - Implications of Accelerated Sea-Level Rise (ASLR) for Romania. Proceeding of SURVAS Expert Workshop on European Vulnerability and Adaptation to impacts of Accelerated Sea-Level Rise (ASLR)- Hamburg, Germany, 19th-21st June 2000.

