

A FIRST BIBLIOGRAPHY OF MODELLING CLIMATE IMPACTS ON MEDITERRANEAN-TYPE ECOSYSTEMS (MTE) AT THE LANDSCAPE LEVEL ^{*1}

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SUMMARY

This bibliography tries to compile the major papers concerning the modelling of (Mediterranean-type ecosystems (MTE) and the modelling of climate impact for MTE. The titles are arranged by region and thematically. Some bibliographic sources on the World-Wide Web are also presented. In his concluding remarks the author criticises that the present dissemination of research results is insufficient with respect to regional and local demands. It is suggested that studies concerning the Maghreb, France or Portugal should also be made accessible in francophone journals. This also applies to Francophone and Lusophone Africa. Under the present system of publications a part of the Mediterranean basin and a large part of Africa are actually excluded from the relevant information. The selection made of the references included in this bibliography is certainly subjective and selective. His criticism is hoped to contribute to improving the situation.

ZUSAMMENFASSUNG

Die Bibliographie versucht die wichtigsten Arbeiten zur Modellierung mediterraner Ökosysteme, sowie die Klimafolgenmodellierung für den mediterranen Raum zu präsentieren. Die Bibliographie ist nach geographischen und thematischen Gesichtspunkten geordnet.

Weiterhin werden einige bibliographische WWW-Quellen vorgestellt. In einer Schlußbemerkung kritisiert der Verfasser, daß die Verbreitung der Ergebnisse von Klimafolgenstudien nicht auf die Bedürfnisse der regionalen und lokalen Anwender abgestimmt ist. Der V. empfiehlt im Hinblick auf eine bessere Verbreitung dieser Ergebnisse, ins besondere im Hinblick auf den Mahgreb, Frankreich und Portugal die verstärkte Publikation in frankophonen Fachzeitschriften. Diese Analyse dehnt der Verfasser auf das gesamte frankophone und lusophone Afrika aus. Der V. kommt zu dem Schluß, dass der aktuelle Weg der Verbreitung von Ergebnissen der Klimafolgenforschung

** This paper is dedicated to my academic mentor and teacher Prof. Dr. Dr. h.c. Peter Frankenberg, who left the university in Summer 2001 in favour of a political career. He is presently Minister for Science & Culture (Minister für Wissenschaft & Kunst) of the state government of Baden-Württemberg in Stuttgart. Peter Frankenberg is one the pioneers of German geographic research (climate & vegetation) in Francophone Africa, especially in Tunisia and Sénégal. He also instituted landscape analysis of MTE, with a focus on vegetation dynamics, fire ecology and agricultural geography, at the Geography Department of the University of Mannheim.*

¹ The author wishes to thank Alexander Scheid for his helpful support in preparing this paper

Teile des Mittelmeers sowie einen großen Teil Afrikas ausschließt. In einer persönlichen Schlußbemerkung weist der V. daraufhin, daß die Auswahl der in der Bibliographie enthaltenen Arbeiten sicherlich subjektiv und selektiv ist. Die Kritik an der aktuellen Art und Weise der Verbreitung der Ergebnisse der Klimafolgenforschung sieht der V. als Einladung für Anstrengungen für eine nachhaltige Verbesserung der aktuellen Situation.

RESUME

Cette bibliographie essaie de présenter les principaux travaux concernant la modélisation d'écosystèmes méditerranéennes et de la modélisation des impacts des changements climatiques au bassin méditerranéen. La bibliographie suit un ordre géographique et thématique. En plus y sont présentés diverses sources bibliographiques sur la toile (le web). Dans une remarque finale l'auteur critique que la dissémination des résultats des études des impacts climatiques ne soit pas à la hauteur des besoins des demandeurs régionaux et locaux. Il préconise que ces résultats en vue d'une dissémination plus large au Maghreb, en France et au Portugal devraient être publiés dans des revues francophones. Cette diagnose est aussi valable pour l'Afrique francophone et lusophone. Il conclut que actuellement la dissémination des ces résultats exclut une partie du bassin méditerranéen ainsi qu'une large partie de l'Afrique. Dans une remarque finale personnelle l'auteur conclut que le choix de référence cité dans la bibliographie est certainement sélective et personnelle. La critique de la dissémination des résultats sont une invitation pour une meilleure dissémination des résultats de recherches sur l'impact climatique pour le domaine méditerranéen.

INTRODUCTION

The modelling of ecosystems at the landscape level, and even at the individual plant level has made considerable progress during the last two decades. Since the pioneer work of BOTKIN² et al. (1972), KESSEL (1979) and SHUGART (1984) a large amount of studies concerning boreal, nemoral and even alpine ecosystems at different scales (individual plant level, plant functional types, landscape level etc.) has been accomplished³. Compared to this, the modelling of Mediterranean-type ecosystems, even though there has been some progress in recent years, is still in its beginnings.

The first part of this bibliography considers papers and university theses dealing directly with the modelling of MTE, having some close relationship to the modelling of Mediterranean ecosystems, or to the modelling of climate impacts. Some of the more or less internal university publications, most of the Ph.D. thesis, are sometimes difficult to obtain, but worth the hunt as they tend to have a comprehensive bibliography, and in some cases also very detailed information on computerized sources, very helpful for finding literature beyond this bibliography. It should be noted that the forest gap approach in modelling, which is most common for northern and even alpine ecosystems in Europe, except for PAUSAS (1999) and, to a certain extent the thesis by MOUILLOT (2000), is not the common modelling approach for Mediterranean ecosystems at the landscape level. Most work has actually been done on the simulation of fire risks and vegetation behaviour after vegetation fires. The studies by MOUILLOT (2000), NEFF (2000), and PAUSAS (1999) include state-of-the-art chapters or paragraphs on these approaches.

The modelling of climate impacts for MTE is not very developed yet; at least only a very few papers have been published so far. Therefore I have also included papers which may yield general information by analogy for future impact modelling studies of the MTE. It appears that the Climatic

² For a detailed history of the JABOWA – model family see BOTKIN & SCHENK 1996

³ The history of ecological theory and ecosystem modelling is described in GOLLEY (1993)

Research Unit⁴ of the University of East Anglia (www.cru.uea.ac.uk) is presently the leading group in systematic research directed towards modelling possible impacts of climate change for MTE⁵.

Even though I have tried to conduct a systematic research, this bibliography is certainly not comprehensive. But it may give an initial access to the present status of MTE-modelling as well as climate impact modelling of MTE.

The bibliography is not restricted to papers written in English and published in peer-reviewed journals, which are listed in Current Contents, but also papers in French, German, Portuguese etc. of reviewed journals not listed there. In addition there are also included papers of non-reviewed journals as well as university thesis. There are also short remarks on some selected papers in the footnotes. They were placed there for clearly separating bibliographical information from my personal opinion.

The bibliography begins with the listing of papers of a more general nature, then followed by titles arranged by geographical regions.

1.a. General papers on regional Mediterranean climatology and possible impacts of climate change⁶

BENSEDDIK, B., BENABDELLI, K. (2000): Impacts du risque climatique sur le rendement du blé dur (*Triticum durum* Desf.) en zone semi-aride: approche éco-physiologique. In: Secherresse, Science et changements planétaires, V. 11, 1, 45-51.

BUGMANN, H., LINDNER, M., LASCH, P., FLECHSIG, M., EBERT, B. & CRAMER, W. (2000). Scaling issues in forest succession modelling. In: Climatic Change, 44 (3), 265-289.

CONRAD, K., SCHMIDT, T. F.N. (1999): Ökonomische Auswirkungen einer CO₂ - Minderungs politik in Ländern der EU. In: Geographische Rundschau, 51, 488-493.

COQUILLARD, P., GUEGNOT, J., MICHALET, R., CARNAT, A.P., L'HOMME, G. (2000): Heathlands functioning in a perspective of climate warming - Estimation of parameters, elements for discrete event simulation. In: Plant Ecology, 149 (1), 107-118.

CRACKNELL, A.P. (Ed) (2001): Remote sensing and climate change: the role of earth observation.

CRAMER, W., BONDEAU, A., WOODWARD, F.I., PRENTICE, I.C., BETTS, R.A., BROVKIN, V., COX, P.M., FISHER, V., FOLEY, J., FRIEND, A.D., KUCHARIK, C., LOMAS, M.R., RAMANKUTTY, N., SITCH, S., SMITH, B., WHITE, A. & YOUNGMOLLING, C. (2001). Global response of terrestrial ecosystem structure and function to CO₂ and climate change: results from six dynamic global vegetation models. Global Change Biology 7 (4), 357-373.

CRAMER, W. (1997): Using plant functional types in a global vegetation model. In: Smith, T.M., Shugart, H.H., Woodward, F.I. (Eds.) (1997): Plant functional types - their relevance

⁴ Jean Palutikof and Clare Goodess seem to be the motor of Climate impact research of MTE at the Climate Research Unit at the University of East Anglia.

⁵ Jean Palutikof told me by e-mail (14.08.2001) that in the medalus project (www.medalus.demon.co.uk) and in the RICAMARE (<http://medias.meteo.fr/www/anglais/lettre/11/projets/ricamare.html>) many climate impact studies concerning the Mediterranean region have been done. Unfortunately the publication www.page of the medalus project was down when writing this paper.

⁶ In this paragraph I have also included papers not directly referring to the Mediterranean area - but by their general character having some relevance for the climate impact modelling of MTE.

- to ecosystem properties and global change. *International Geosphere - Biosphere Programme Book Series 1*. Cambridge, 271 - 288.
- CRAMER, W., PRENTICE, I.C. (1988): Simulation of regional soil moisture deficits on a European scale. In: *Norsk Geografisk Tidsskrift* 42, 149 - 151.
- DEMERITT, D. (2001a): The Construction of Global Warming and the Politics of Science⁷. In: *Annals of the Association of American Geographers*, V. 91, 2, 307-337.
- DUHME, F., PAULEIT, S., PRINTZ, A. (1998): Ecodata as a tool for identifying social and ecological degradation in mediterranean regions. In: *Geoökodynamik* 19, 203-214.
- DAUPHINE, A. (2001): Risques et catastrophes. *Observer-Spatialiser-Comprendre-Gérer*⁸. Paris.
- ERTSEN, A.C.D. (1998): Ecohydrological response modelling. Predicting plant species response to changes in site conditions. *Nederlandse Geografische Studies/Netherlands Geographical Studies* 245, Utrecht.
- EL-KADER, A. (1999): Climate Change and Desertification. In: *Bulletin De La Société De Géographie D'Égypte*, 72, 91-106.
- JEFTIC, L., United Nations Environment Programme (Ed)(1992): Climatic change and the Mediterranean: environmental and societal impacts of climatic change and sea-level rise in the Mediterranean region. London.
- FRANKENBERG, P. (1984): Ähnlichkeitsstrukturen von Ernteertrag und Witterung in der Bundesrepublik Deutschland⁹. *Erdwissenschaftliche Forschungen*, B. 17. Stuttgart.
- FRANKENBERG, P., SIEGMUND, A. (1997): Gedanken zum irdischen Klimawandel – Der anthropogene Treibhauseffekt und seine möglichen Folgen. In: *Geoökodynamik* 18, 17-39.
- GLASER, R. (2001): Klimageschichte Mitteleuropas. 1000 Jahre Wetter, Klima, Katastrophen¹⁰. Darmstadt.
- GOODESS, C.M., (2000): The construction of daily rainfall scenarios for Mediterranean sites using a circulation-type approach to downscaling. Ph.D. Thesis, University of East Anglia.
- HOLZMÜLLER, K., MARSCHNER, B. (2001): Rolle der Böden im Klimasystem der Erde. In: *Geographische Rundschau*, 53, 40- 46.
- LAUER, W., RAFIQPOOR, D., FRANKENBERG, P. (1996): Die Klimate der Erde. Eine Klassifikation auf ökophysiologischer Grundlage der realen Vegetation. In: *Erdkunde, Archiv für wissenschaftliche Geographie*, 50, 4, 275 – 300.
- MEADOWS, E.A. (2001): The Biotic Component of Land Degradation – Action and Reaction. In: *Petermanns Geographische Mitteilungen*, 145, 2001/4, 18- 25.
- MENSCHING, H.G, SEUFFERT, O. (2001): (Landschafts-) Degradation – Desertifikation: Erscheinungsformen, Entwicklung und Bekämpfung eines globalen Umweltsyndroms. In: *Petermanns Geographische Mitteilungen*, 145, 2001/4, 6- 15.
- MOONEY, H.A, HOBBS, R.J. (Eds) (2000): *Invasive Species in a Changing world*¹¹. Washington, D.C.Neff
- NEFF, C. (1998): Neophyten in Mannheim - Beobachtungen zu vegetationsdynamischen Prozessen in einer Stadtlandschaft¹². In: *Anhuf, D., Jentsch, C. (Eds.): Beiträge zur Landeskunde*

⁷ Although this paper has been criticized very harshly by SCHNEIDER (2001), and although I agree with him (2001:340) that Demeritt is partly writing in an incomprehensible jargon, I think this paper is worth reading for all climate modellers and impact scientists dealing with the Mediterranean area.

⁸ This textbook about the geography of hazards and natural catastrophes provides a lot of incentives for further climate modelling of the MTE.

⁹ This study (Published version of the Habilitation thesis of Peter Frankenberg) of the relations between grain harvest and climate in West Germany could serve as a model for a similar study of future grain harvest and climate change in the Mediterranean area.

¹⁰ I have add this book covering 1,000 years of climate history and climatic impacts in central Europe because I think that such kind of book is needed for the Mediterranean area.

¹¹ Although no chapter in this book deals with the Mediterranean region it may provide a lot of incentives for further studies linking invasive species, climate impact and the Mediterranean.

- Südwestdeutschlands und angewandten Geographie. Mannheimer Geographische Arbeiten Heft 46, 65-110, Mannheim 1998. (ISBN 3- 923750-72-2)
- HEMPEL, L. (1999): Stürmische Südwinde im östlichen Mittelmeer innerhalb des Systems der „Großwetterlagen“ Europas. *Geoökodynamik* 20: 323-341.
- HEMPEL, L. (2000): Stürmische Nordwinde im östlichen Mittelmeer innerhalb des Systems der Großwetterlagen Europas. In: *Geo-Öko* 21, 285-303.
- HOFF, C. 1998. Variations spatiales de l'impact des changements climatiques sur le fonctionnement d'un écosystème méditerranéen. Toulouse III: Thèse doc., 269 p. + Annexes.
- HULME, M. 1999: Global warming. In: *Progress in Physical Geography*, V. 23/ 2, 283-291.
- JACOBEIT, J. (2000): Rezente Klimaentwicklung im Mittelmeerraum. In: *Petermanns Geographische Mitteilungen*, 144, 2000/6, 22 – 33.
- JONES, P.D., (1990): Le climat des milles dernières années. In: *La Recherche* 21, 304-312.
- LE HOUEROU, H.N. (1990): Global Change: Vegetation, ecosystems and land use in the southern Mediterranean basin by the mid twenty-first century. In: *Israel Journal of Botany*, Vol. 39, 481- 508.
- LE HOUEROU, H.N. (1992): La Méditerranée en l' an 2050: Impacts respectifs d' une éventuelle évolution climatique et de la démographie sur la végétation, les écosystèmes et l'utilisation des terres¹³. In: *La Météorologie* VII, 36, 4- 37.
- LE ROY LADURIE, E. (1983): Histoire du climat depuis l'an mil¹⁴. (Vol. I + Vol. II). Paris.
- MORENO, J. M., OECHEL, W.C. (Eds.): *Global change and Mediterranean-Type Ecosystems*. Ecological Studies, V. 117, New York.
- PALUTIKOF, J.P., GOODESS, C.M., GUO, X., (1994): Climate change, potential evapotranspiration and moisture availability in the Mediterranean Basin. In: *International Journal of Climatology* 14, 853-869.
- PALUTIKOF, J.P., GOODESS, C.M. (2001): Application of climate change scenarios for impact studies on ecosystems over the Mediterranean area¹⁵. In: *Planton, S., Hanson, C., Viner, D., Hoepffner, M. (Eds): Applying Climate Scenarios for Regional Studies: with particular reference to the Mediterranean*. ECLAT-2 Toulouse Workshop Report No. 4 Toulouse, France, 25-27 October 2000. Climatic Research Unit, UEA, Norwich UK, 46-57.
- PLANTON, S., HANSON, C., VINER, D., HOEPFFNER, M. (EDS) (2001): *Applying Climate Scenarios for Regional Studies: with particular reference to the Mediterranean*. ECLAT-2 Toulouse Workshop Report No. 4 Toulouse, France, 25-27 October 2000. Climatic Research Unit, UEA, Norwich UK.
- PRENTICE, I.C., CRAMER, W., HARRISON, S.P., LEEMANS, R., MONSERUD, R.A., SOLOMON, A.M. (1992): A global biome model based on plant physiology and dominance, soil properties and climate. In: *Journal of Biogeography*, 19, 117-134.
- SCHWARZ, R. (1995): Modellierung der Klimavegetation der Erde auf der Grundlage des Wettbewerbs der Lebensformen. In: *Lafrenz, J. (Eds.): Studien zur Physischen Geographie*. Hamburger Geographische Studien H.47, 1-25.
- SCHÖNWIESE, C.D., RAPP, J. (1997): *Climate Trend Atlas of Europe – Based on Observations 1891–1990*. Dordrecht.

¹² This paper studies neophytes and sub-Mediterranean and Mediterranean invaders in the natural vegetation of the City of Mannheim (Germany). It may give suggestions for studying climate impact and biological invasions in the Mediterranean region.

¹³ This climate impact study from Le Houereou is still one of the most detailed papers dealing with possible impacts of climatic change for the whole Mediterranean.

¹⁴ The climate history of Le Roy Ladurie focuses on Western Europe, especially France and the Alps – but this book can certainly give some interesting insights for climate impact research of the Mediterranean region. For the climate history of France and the surrounding regions the books has certainly the same value as Lamb's *Climate history of the modern world* (1995)

¹⁵ I consider this as one the leading papers on the present state of impact studies for the Mediterranean area.

- SEUFFERT, O. (2001): Aussagewert und Vergleichbarkeit statistischer Daten zum Problemkreis Degradation – Desertification. In: Petermanns Geographische Mitteilungen 145, 2001/4, 52-55.
- SUC, J.P. (1984): Origin and evolution of the Mediterranean vegetation and climate in Europe. In: Nature, Vol. 307, 429-432.
- WAHL, N.A. SCHWARZ, R. (1999): Schätzung der Bodenwasserkapazität durch Simulation der genutzten Dornbuschsavanne in Namibia. In: Margraf, O., Lentz, S. (Eds.): Quantitative Methoden und geographische Landschaftsforschung. Ergebnisse zur Modellierung von Landschaftselementen. Mannheimer Geographische Arbeiten 49, 37-61, Mannheim, 1999.
- WATSON, R.T. (Ed) (2000): Land use, land-use change, and forestry: a special report of the IPCC. Cambridge.
- WERNER, P.C., Gerstengarbe, F.-W. (1997): Proposal for the development of climate scenarios. In: Climate Reserach, V.8, 171- 182.

1.b. Western Mediterranean (Portugal, Spain, France and Italy) climatology and climate impact modelling

- ATZBERGER, C. (1998): Estimates of winter wheat production through remote sensing and crop growth modelling. A case study of the Carmargue region. Akademische Abhandlungen zu den Geowissenschaften.
- Claudet, R. (2000): LES CRUES DES 12., 13. ET 14. NOVEMBRE 1999 DANS LES DEPARTEMENTS DE L'AUDE, DE L'HERAULT, DES PYRENEES-ORIENTALES ET DU TARN. ANALYSE HYDROLOGIQUE DE L'EVENEMENT. IN: GEOCARREFOUR, B. 75, N. 3, 205-208.
- COMBY, J. (2000): Elements d'évaluation des consequences socio-economiques des intemperies des 12. et 13. novembre 1999¹⁶. In: Géocarrefour, B. 75, N. 3, 227-244.
- EDOUARD, J.L., TESSIER, L., THOMAS, A. (1991): Limite supérieure de la forêt au cours de l' Holocene dans les Alpes française. In: Dendrochronologia, 9, 125-142.
- ENDLICHER, W. (1989): Une thèse sur le climat de la région de Lisbonne. Finisterra, XXIV, 316-326.
- FERREIRA, A., COHO, C., GONCALVES, R. (1998): Impact of climatic change on slope and catchment hydrology in forest areas, central Portugal. In: Geoökodynamik, 19, 165-178.
- GOODESS, C.M., PALUTIKOF, J.P., (1998): Development of daily rainfall scenarios for south-east Spain using a circulation-type approach to downscaling. International Journal of. Climatology, 18, 1051-1083.
- KELLER, T., GUIOT, J., TESSIER, L. (1997): Climatic effect of atmospheric CO2 doubling on radial tree growth in south eastern France. In: Journal of Biogeography, 24, 857-864.
- MILLÁN, M.M., ESTRELA, M.J., BADENAS, C. (1998): Synoptic analysis of meteorological processes relevant to forest fire dynamics on the Spanish Mediterranean coast. In: Moreno, J. M. (Ed)(1998): Large Forest Fires. Leiden, 1-30.
- MORELLO, P. (1996): Nouvelle répartition de la végétation provençale et évolution récente des températures¹⁷. Approche méthodologique. In: Méditerranée, N. 4, 71-74.

¹⁶ This study of the economic impact of the November storms of 1999 in the Departement de l' Aude/France may serve as a model for wider study of economic impact by climatic change for other MTE.

¹⁷ First approach of possible vegetation response of global warming in the Mediterranean, especially in the French Provence. I paper on this subject has been submitted (Neff & Frankenberg 2001) in which the expansion of selected Mediterranean thermophilous and subtropical species in the French Corbières is discussed as a possible vegetation response to global warming. In it we come to the conclusion that what appear to be the first signs of climate-change induced vegetation changes are indeed the consequences of changes in land use in the Corbières and of ornamental preferences in the seaside resorts of the Roussillon and Corbières coastline.

- MOTTA, R., PAOLA, N.** (2001): Growth trends dynamics in sub-alpine forests stands in the Varaita Valley (Piedmont, Italy) and their relationships with human activities and global change¹⁸. In: *Journal of Vegetation Science*, 12, 219-230.
- MCGREGOR, G., GELLATLY, A., BÜCHER, A.** (1995): Climate and glacier response in the Pyrénées, 1878-1994. In: *Zeitschrift für Gletscherkunde und Glazialgeologie*, 31, 207-214.
- NOILHAN, J., BOONE, A., ETCHEVERS, P.** (2001): Application of Climate Change Scenarios to the Rhone basin. In: *Planton, S., Hanson, C., Viner, D., Hoepffner, M. (Eds): Applying Climate Scenarios for Regional Studies: with particular reference to the Mediterranean. ECLAT-2 Toulouse Workshop Report No. 4 Toulouse, France, 25-27 October 2000. Climatic Research Unit, UEA, Norwich UK*, 58-74.
- OLLESCH, G., SEUFFERT, O.** (1998): Rainfall variability, runoff and erosion in a pasture ecosystem in Southern Sardinia. A Single-event based study. In: *Geoökodynamik* 19, 269-280.
- RAMBAL, S.** (1987): Evolution de l'occupation des terres et ressources en eau en région méditerranéenne karstique. In: *Journal of Hydrology*, 93, 339-357.
- ROBBEZ-MASSON, J.-M., BARTHES, J.P., BORNAND, M., FALIPOU, P., LEGROS, J.P.** (2000): BELAUAUX, E., DESHAYES, M., IVANES, C. (2000): Bases de données pédologiques et systèmes d'information géographiques. L'exemple de la région Languedoc-Roussillon¹⁹. (Eds.): *Système d'information informatique et forêt méditerranéenne*. In: *Forêt méditerranéenne*, t. XXI, 1, mars 2000, 88-97.
- TRIGO, R.M., PALUTIKOF, J.P.** (1999): Simulation of daily temperatures for climate change scenarios over Portugal: a neural network approach. In: *Climate Research* 13, 45-59.
- VACCA, A., VACCA, S.** (2001): Soil degradation in Sardinia – Historical Causes and Current Processes due to Anthropogenic Pressure. In: *Petermanns Geographische Mitteilungen*, 145, 68-78.
- VINET, F.** (2000): L'épisode pluvieux catastrophique des 12. et 13. novembre 1999 dans l'Aude et les départements voisins: analyse pluviométrique et météorologique. In: *Géocarrefour*, B. 75, N. 3, 189-204.
- VIGNEAU, J.P.** (1986): *Climat et Climats des Pyrénées Orientales*. Toulouse.

1.c. Eastern Mediterranean (former Yugoslavia, Greece, Malta)

To my knowledge there is no paper specifically dealing with MTE-modelling or cClimate modelling of this geographic region.

1.d. North Africa and Middle East (Morocco, Algeria, Tunisia, Egypt, Israel, Palestine, Lebanon and Turkey) climatology and climate impact modelling

- ALI, A.** (1995): Reflections on climate Variability within selected monthly mean time series in Libya and neighbouring countries. In: *Geographia Polonica*, 65, 51-62.
- ANHUF, D.** (1989): Klima und Erntertrag – eine statistische Analyse an ausgewählten Beispielen nord – und südsaharischer Trockenräume – Senegal, Sudan, Tunesien. *Bonner Geographische Arbeiten*, H. 77. Bonn.

¹⁸ Analysis of the growth response of *Pinus cembra* & *Larix decidua* to the changing temperature regime in the Italian part of the southern Alps.

¹⁹ Pedological and hydrological GIS- based data bank of the Languedoc-Roussillon. With this tool the authors tried to make a first climate impact study for durum wheat (*Triticum durum* (Blé dur /French) yield estimates with climatic change for the Languedoc-Roussillon.

- ANHUF, D., FRANKENBERG, P., LAUER, W. (1999): Die postglaziale Warmphase vor 8000 Jahren. Eine Vegetationsrekonstruktion für Afrika. In: Geographische Rundschau, 51, 454-461.
- BELGHAZI, B., ROMANE, F. (1993): Relations entre caractéristiques morphométriques des arbres et du milieu. Cas du pin maritime (*Pinus pinaster* Sol. var. *maghrebiana*) dans le Maroc septentrional. In: Cahiers Agricultures 1993, 2, 338-342.
- BELGHAZI, B., EZZAHIRI, M., ROMANE, F. (2000): La productivité des peuplements naturels de pin d'Alep dans la forêt de Tamga (Haut Atlas marocain). In: Forêt méditerranéenne, T. XXI, n. 4, décembre 2000, 521-530.
- BENMOHAMMADI, A., BENMOHAMMADI, L., BALLAIS, J.-L., RISER, J. (2000): Analyse des inter-relations anthropiques et naturelles: leur impact sur la recrudescence des phénomènes d'ensablement et de désertification au sud-est du Maroc (vallée de Drâa et vallée de Ziz). In: Sécheresse, Science et changements planétaires, V. 11,4, 297-308.
- BOUSNINA, A. (1986): La Variabilité des pluies en Tunisie. Faculté des Sciences Humaines et Sociales de Tunis. Deuxième Série: Géographie Vol. 22, Publications de L' Université de Tunis. Tunis.
- BOUSNINA, A. (1992): Variations et variabilité de températures en Tunisie. Thèse de Doctorat d' Etat de Climatologie. Université de Tunis I.
- DECHEMI, N., AIT MOUHOUB, D., SOUAG, D. (2000): Contribution à l'analyse du régime pluviométrique sur le littoral algérien²⁰. In: Sécheresse, Science et changements planétaires, V. 11, 1, 5-10.
- DHIFALLAH, S.M. (1998): Agroecological-economic system of Tunisia – an EMERGY analysis approach. In: Usó, J.L., Brebbia, C. A., Power, H. (Eds.): Ecosystems and sustainable development. Advances in Ecological Sciences 1, 25-30.
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²³ Develops fundamentals of GIS-based fire hazard estimates and GIS-based fire fighting help for Mediterranean forests.

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2. BIBLIOGRAPHIC SOURCES FOR ECOLOGICAL IMPACT MODELLING OF MEDITERRANEAN ECOSYSTEMS

In the second part of this bibliography I have compiled keystone papers and textbooks on Mediterranean landscape ecology and vegetation dynamics providing generalized ecological background information on Mediterranean ecosystems for the impact modelling community. There are a lot of textbooks and papers on Mediterranean ecology, and this is certainly my personal choice. An comprehensive list of relevant publications could be made much longer without any problems. Is fire³⁰ is considered to be as one of the major dynamic vectors in MTE, bibliographic sources dealing with this aspect are placed in a separate paragraph (2.b.).

Ecology Mediterranean and *Forêt méditerranéenne*, are journals where modellers dealing with Mediterranean ecosystems will find the most up-to-date information concerning the MTE. Most papers in *Forêt méditerranéenne* are in French, though. A new journal in which impact modellers may find relevant information is the recently launched *Journal of Mediterranean Ecology* edited by *Almo Farina* (University of Pisa). *Geoöko*³¹, edited by *Ottmar Seuffert*, has also a long tradition in publishing papers dealing with Mediterranean physical geography, landscape ecology and climate impact studies³². Concerning Mediterranean fire ecology, interesting information can be found in the *International Journal of Wildland Fire*.

²⁹ This paper and the English version that later appeared in *Nature* can be considered to be at the beginning of ecological modelling.

³⁰ In NEFF (2000) I compared the importance of fire for the dynamics of Mediterranean ecosystems to the importance forest gaps have for the nemoral & boreal ecosystems.

³¹ Formerly *Geoökodynamik*

³² Primarily edited in German and English, also accepts papers in French.

2.a. Selected keystone papers and textbooks for Mediterranean ecology (except fire ecology) and ecological impacts of land-use changes.

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³³ This textbook is certainly one of the most recent and most detailed textbooks concerning MTE, reflecting the actual state of the art of Mediterranean landscape ecology.

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³⁵ In the Colloques phytosociologiques, a series edited by J.M. Gehu (published by Cramer Berlin/Stuttgart), one can find more phytosociological, floristical and geobotanical papers providing additional information on climate impact modelling of the Mediterranean area.

³⁶ This book is certainly one of the most complete studies of *Pinus halepensis*.

³⁷ I have added this paper to the bibliography, because the Macaronesia biogeographical region, belonging to the Mediterranean geobotanical region sensu largo, especially the Azores, are too often overlooked in ecological and biogeographical analysis of the larger Mediterranean region. To my knowledge there is no climate impact study for the whole region.

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³⁸ Thesis of the Doyen of Portuguese geography. For People able to read Portuguese this Masterwork can still provide useful information.

³⁹ Bioclimatologic analysis of the distribution area of the Carob tree (*Ceratonia siliqua*). Could be a base for further climate impact study of this crop tree still important in Portugal and other Mediterranean regions.

⁴⁰ For all people able to read Portuguese I recommend this Geography of Portugal. Especially the description of the physical geography of Portugal is still one of the best existing studies. It includes an annotated bibliography of the geography of Portugal.

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2.b. Selected keystone papers and textbooks on Mediterranean fire ecology

- ALCOFORADO, M.J., DE ALMEIDA, A.F. (1993): Incendios no parque natural da Arrábida. Dados estatísticos. In: Finisterra, 229-241.
- BERGMEIER, E. (1997): Combined effects of fire and grazing on phrygana vegetation - a case study in SW Crete (Greece). In: Ecologia mediterranea 23 (3/4), 1-10.
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⁴¹ Although by now nearly 10 years old this sampler still reflects the state of the art concerning the ecology of *Quercus ilex* Forests.

⁴² A highly interesting book concerning the interaction between human action, climate history and vegetation dynamics in the Mediterranean region, focused on the western Mediterranean region (France, Portugal & Spain)

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⁴³ J.G. Goldammer is the present head of the Global Fire Monitoring Center (GFMC) – on their homepage, *Global Fire*, (www.ruf.uni-freiburg.de/fireglobe/) one can find interesting links to Mediterranean fire ecology.

⁴⁴ Estimates and mapping of fire risks for the Garrigues de Nîmes (France) using multivariate geostatistics.

⁴⁵ Application of prescribed burning in nature conservation.

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⁴⁶ This book analyses the possibilities of a fire-tolerant Mediterranean forestry.

⁴⁷ Louis Trabaud (CEFE-CNRS Montpellier), has published a multitude of studies concerning Mediterranean fire ecology. He can be considered to be the „Doyen“ of Mediterranean fire ecology. Many of the papers by L. Trabaud dealing with fire ecology can provide interesting starting points for integrating fire ecology in climate impact modelling of MTE.

⁴⁸ The irreplaceable basic textbook on Mediterranean fire ecology.

3. BIBLIOGRAPHIES ON THE WWW

The CNRS-CEFE in Montpellier has a very large bibliography which can be used via internet. (<http://bib.cefe.cnrs-mop.fr/>⁴⁹). In this bibliography, which is the library of the CEFE-CNRS, all relevant papers and texts (incl. Master's theses, Ph.D.-theses, discussion papers, and papers from all kind of scientific journals) concerning MTE can be found. One should have some knowledge of French, because the server and, for example the mask for keyword research, are in French. But with rudimentary knowledge of French (f.e. using the keywords, simulation, modelisation, feux, forêt, etc.) this server is a large bibliographic source of terrestrial Mediterranean ecosystems, representing the present state of the art of Mediterranean ecosystems research. Unfortunately updating of the WWW.Version is rather poorly, - every two years only - so the presently accessible version only comprises papers up to the year 2000. For more recent papers the Geodok www.geodok.uni-erlangen.de at Erlangen University is a good source, but at the moment this server is only in German. Compared to the bibliographic database in Montpellier, one can perhaps find more recent papers, but Erlangen certainly does not a database as large as Montpellier on Méditerrananean ecosystems. As I am informed, the Erlangen Geodok is planned to have English⁵⁰ and French interrogation masks and keywords in the future.

Furthermore <http://biblio.unizh.ch:4505/ALEPH> the IDS-library catalogue of the university library of the University of Zürich could give some help in finding interesting papers. But this resource is unfortunately also only available in German only.

4. ADDITIONAL BIBLIOGRAPHIC SOURCES

It should be noted that many geography departments, in particular in Germany, have begun with GIS-Modelling, and some also do this modelling in relation to MTE. German geography institute staff often do not publish in international journals (those listed in Current Contents etc.), but in their own institute's geographical series. It was impossible for me, as every institute has one or even more geographical series, to conduct a systematic search of all potential papers concerning the modelling of MTE in those series. A good source, where all these bibliographic sources are compiled, is *German Geographical Research 1996 – 1999 Bibliography of Publications in Geographical Series*. (Brogatio & Schulte 2000). Here, one could perhaps find more bibliographic sources for papers dealing with impact modelling of MTE.

5. SOME REMARKS ABOUT DISSEMINATION OF CLIMATE IMPACT STUDIES OF MTE.

Climate modellers and impact modellers as well mostly publish their results in international peer-reviewed journals, such as "Climatic Change" edited by Stephen S. Schneider, to mention just one. Most of these journals are listed in Current Contents. The problem is that these journals are only read by a small scientific community⁵¹. In the SWB, the South German Scientific Library catalogue, which covers 1,160 scientific libraries in the Saarland, Baden-Württemberg and Sachsen, only a few of libraries actually subscribe to "Climatic Change". Focussed on the libraries of the five Geographical Institutes in Baden-Württemberg, "Climate Change" is only subscribed at the li-

⁴⁹ Unfortunately this server is often down.

⁵⁰ The English version of Geodok (<http://www.geodok.uni-erlangen.de/index.htm>) is in operation now. (8.08.2001)

⁵¹ For further discussion about the social organization of global warming and climate change research see the very controversial, but interesting discussion between David Demeritt (2001a,b) and Stephen H. Schneider (2001) in the *Annals of the Association of American Geographers*.

brary of the Geographical Institute of Freiburg⁵². I am afraid that the situation in the various countries of the Mediterranean basin is much worse, especially in the Maghreb. The other question is whether scientists from those regions, for example in Algeria, Morocco, France or even in Portugal⁵³, will read or will be able to read those papers published in English. My personal opinion is that impact studies on the regional level concerning MTE should not only be published in journal listed in Current Contents, but also in journals with a regional impact like *Méditerranée*⁵⁴, *Finisterra*⁵⁵, *Ecologia mediterranea*⁵⁶ and *Forêt méditerranéenne*⁵⁷, *Secheresse*⁵⁸ etc. – and these studies should be published in French⁵⁹, so that the representatives of these fields of research in these region will read them. Another publication platform which could be used for wider dissemination is the annual congress of the Association Internationale de Climatologie (AIC) (<http://www.uhb.fr/aic/welcome.html>) – a worldwide francophone association of climatologists⁶⁰ – the congress contributions are published after reviewing in the annual bulletin of the association⁶¹, which has a fairly good circulation in francophone and lusophone Africa. The next meeting of the AIC will be in Seville, Spain, 14/15 Sept. 2001 (www.uhb.fr/aic/collseville.htm), focussing on climate – environmental process and climate impact studies on MTE.

I am afraid that for francophone and lusophone Africa – which comprises more than 50% of the surface of Africa, the situation is even worse. The standard paths of dissemination of studies on global climatic change and climatic impact de facto excludes large parts of the Mediterranean basin and a major part of the African continent.

A first step in the right direction certainly was the mixed-language edition (English/French) of the ECLAT workshop in Toulouse (Planton et al. 2001) dealing with regional Mediterranean climate scenarios and impact studies. But more has to be done, if climate change and climate impact research concerning MTE is to be more than insider discussion in a closed-shop scientific community.

FINAL PERSONAL REMARK

The idea to this paper was born during the ECLAT-Workshop “Applying Climate Scenarios for Regional Studies: with particular reference to the Mediterranean“, October 2000, in Toulouse, where I realised that climate modellers and climate impact modellers on the one hand, and the landscape ecologist or planner or stakeholder on the other hand, sometimes appear to be living on two separate planets. Several of the discussions we had seemed to me what is called „dialogue de sourd“ (dialogue of the deaf) in French. The landscape ecologist, the geographer or the regional planner doing impact studies for often regional or local demand is interested in reliable data and

⁵² One of the causes of this situation is the high price of the these international Journals, edited by international publishers like Kluwer, Elsevier, Springer or Backhuys. My attempt to subscribe *Ecosystem* edited by Monica Turner and published by Springer for the library of the Geographical Institute of the University of Mannheim were unsuccessful because of the price of this Journal, and also the insufficient storage place in our department library. The *Journal of Mediterranean Ecology* edited by Almo Farina is presently (August 2001) not available in any German university library. For the present study I mainly relied on the Library of the CEFE-CNRS in Montpellier (France) and the Library of the Botanical Garden of Geneva (Switzerland).

⁵³ In Portugal and lusophone Africa French is still a very important scientific language. For more informations see NEFF & BASSING & FRANKENBERG (2001).

⁵⁴ Edited in French.

⁵⁵ Edited in Portuguese, French and English.

⁵⁶ Edited in French, Spanish and English.

⁵⁷ Edited in French, Spanish, Italian and Portuguese.

⁵⁸ *Secheresse, Science et Changements Planétaires* edited in French.

⁵⁹ Or any other important Mediterranean scientific language with a large geographical impact, such as Spanish, Italian, Portuguese or even Arab.

⁶⁰ The current President of AIC is Prof. Wilfried Endlicher of Humboldt University in Berlin

⁶¹ Of course published in French.

scenarios, and not in endless academic discussion about the advantages of various GCMs⁶² or methodological problems of downscaling⁶³. Another important point is that I personally mistrust techniques which I do not fully understand⁶⁴. Nevertheless I appreciated the discussions during the ECLAT workshop and I think that they were a scientific enrichment. I hope that in the near future there will be other workshops concerning climate impacts on the Mediterranean region.

I came to the conclusion that what was actually missing was a broad overview of the present state of climate impact research in the Mediterranean –so I tried to compile the present bibliography from the different sources I had access to, in journals, books and on the web. The choice of references included in this bibliography is certainly subjective and selective. I am a geographer and landscape ecologist working on Mediterranean vegetation dynamics and landscape changes, but I am not a climate or impact modeller. Perhaps the climate change community may take this paper as an invitation for doing a systematic analysis, from their perspective, of their own of the present status of research on the impact of climate change on the Mediterranean region.

In chapter 5 I have made some critical and certainly subjective remarks about the dissemination of knowledge of the results of research on climatic change in the Mediterranean. The Mediterranean is a highly diversified cultural-landscape ecosystem⁶⁵ and a very vulnerable one at that, with respect to climate impact due to global warming. Perhaps at the moment in some regions of the Mediterranean people have different problems to cope with: the ongoing struggle in former Yugoslavia, the ongoing tensions in Palestine, or the ongoing civil war in Algeria, to name only three of those problems. But in the long run the Mediterranean countries and societies need more knowledge about the climatic impact due to global warming in order to have the possibilities to face this impact in a better-prepared way. My criticism of current knowledge dissemination policies is intended to be taken as an invitation for the community of climate modellers and impact modellers working on the regional Mediterranean level to think about a better regional and appropriate dissemination of their results.

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⁶² GCM = Global Circulation Model

⁶³ Patrice Miran (*Plan bleu Sophia Antipolis*) and me had several deep discussions and even disagreements on some points with several „Climatic change modellers or Impact modellers“ during the workshop.

⁶⁴ My impression is, that the statement by Demeritt (2001:309) „Thus, most scientist stand in a similar downstream relation to climate models as those of policy makers and the lay public: they are forced to put their faith in technical expertise they do not fully understand“ is a good description of what many landscape ecologists, biologists, geographers and scientists of related disciplines are likely to think in silence.

⁶⁵ Myers et al (2000) regard the whole Mediterranean region as one of the world-wide 25 biodiversity hotspots for conservation priorities.

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