

Institut für sozial-ökologische
Forschung (ISOE) GmbH
Hamburger Allee 45
60486 Frankfurt am Main



Research on Gender, the Environment and Sustainable Development

Studies on Gender Impact Assessment of the Programmes of the 5th Framework Programme for Research, Technological Development and Demonstration

Authors:

Dr. Irmgard Schultz
Dr. Diana Hummel
Claudia Empacher
Dr. Thomas Kluge
Alexandra Lux
Dr. Engelbert Schramm
Stephanie Schubert
Immanuel Stiess

In Collaboration with:

Dr. Doris Hayn
Johannes Ladwig
Karim Stiebig

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Table of Contents

1	Introduction.....	1
2	The Women and Environment Debate and the Discussion on Sustainable Development in Gender Research.....	3
2.1	The Debate on Women, Environment and Development	3
2.2	Feminist Critique of Natural Sciences and Technology	6
2.3	Everyday Life and the Environment & Health-Issue in Environmental Research	11
2.4	Women, Globalisation and Sustainable Development	16
2.5	Summary	20
3	Gender Impact Assessment in the Field of Environmental Research: Theoretical Framework and Evaluation Concept	21
3.1	General Outlines for a Gender Impact Assessment in Environmental Research	21
3.2	Gender Impact Assessment.....	22
4	Urban Sustainability.....	29
4.1	Research Topics: Sustainability, the City and Gender	29
4.2	Urban Sustainability and Gender: State of the Art	30
4.3	Summary and Priority Issues	47
5	Global Change, Climate and Biodiversity	51
5.1	Global Change	52
5.2	Climate.....	59
5.3	Biodiversity.....	62
5.4	Summary and Priority Issues	70
6	Sustainable Marine Ecosystems	75
6.1	Research Topics	75
6.2	Marine Research with Respect to Gender Dimensions: State of the Art.....	78
6.3	Summary and Priority Issues	82
7	Sustainable Management and Quality of Water.....	85
7.1	Research Topics	85
7.2	Water Research with Respect to Gender Dimensions: State of the Art.....	87
7.3	Summary and Priority Issues	94
8	Natural and Technological Hazards	97
8.1	Gender and Natural Hazards.....	97
8.2	Gender and Technological Hazards	99
8.3	Summary and Priority Issues	104

9	Earth Observation Technologies	107
9.1	Research Topics	107
9.2	Earth Observation Technologies and Gender: State of the Art	107
9.3	Summary and Priority Issues	110
10	Socio-economic Aspects of Environmental Change in the Perspective of Sustainable Development.....	113
10.1	Research Approaches: Socio-economic Ecological Feminism	113
10.2	Socio-economic Aspects of Environmental Change: Selected Gender-specific Research Findings.....	115
10.3	Summary and Priority Issues	133
11	Experts and Networks	137
11.1	Women and Environment/Sustainable Development	137
11.2	Urban Sustainability	137
11.3	Global Change, Climate and Biodiversity	138
11.4	Sustainable Marine Ecosystems.....	139
11.5	Sustainable Management and Quality of Water	140
11.6	Natural and Technological Hazards.....	140
11.7	Earth Observation Technologies.....	140
11.8	Socio-Economic Aspects of Environmental Change in the Perspective of Sustainable Development	141
12	Bibliography	143
12.1	General Remarks.....	143
12.2	The Women and Environment Debate and the Discussion of Sustainable Development in Gender Research	143
12.3	Gender Impact Assessment.....	162
12.4	Urban Sustainability	163
12.5	Global Change, Climate and Biodiversity	173
12.6	Sustainable Marine Ecosystems.....	183
12.7	Sustainable Management and Quality of Water	185
12.8	Natural and Technological Hazards.....	189
12.9	Earth Observation Technologies.....	194
12.10	Socio-Economic Aspects of Environmental Change in the Perspective of Sustainable Development	194

1 Introduction

During the period of June 2000 until April 2001, the European Commission launched Gender Impact Assessment studies in order to introduce a critical dimension in the way gender issues are treated throughout the 5th European Framework Programme for Research, Technology Development and Demonstration (RTD). These Gender Impact Assessments are part of a process started by the European Commission with the objective to take the gender dimension better into account within research policy. The results of these studies shall serve as a basis for the designing of future research policies at the Community level.

Following the structure of the 5th Framework Programme, the studies were carried out according to the specific programmes of the Framework Programme. The Institute for Social-ecological Research (ISOE), Frankfurt/M. Germany, was assigned to assess the Sub-Programme “Environment and Sustainable Development” (ESD)¹. The assessment consisted of four steps:

1. the review of the state of the art in gender and environment/sustainability research and the elaboration of an evaluation concept,
2. the analysis of the gender composition of participating institutions and bodies in the making and implementation of the 5th Framework Programme,
3. the analysis of the contents of the submitted proposals with respect to gender aspects,
4. recommendations for the increase of women's participation in research and for the inclusion of gender aspects in further research programmes.

The present publication is based on the results of the first step of this Gender Impact Assessment: The state of the art in gender and environment/sustainability research as well as the concept of a Gender Impact Assessment in this research field.

Consequently, the presentation of the state of the art in gender and environment/gender and sustainability research given here must be seen against the background of these European Gender Impact Assessment projects. Thus, the specific environmental issues focused and presented in this report, are those that were focused in in the Key Actions and Generic Activities of the ESD-Sub Programme. After an overview of the environment-debate within women studies/gender studies of the last 25 years, the state of the art report focuses mainly on gender and environment research in industrialised countries, neglecting the broader discussion on gender and environment issues in developing countries.

To begin with, *chapter two* gives an overview of four important lines of discussion in gender and environment-research/gender and sustainability-research:
chapter (1) the debate on women, environment and development (WED-debate),

1 The results of the study are published under the title „Gender Impact Assessment of the Environment and Sustainable Development Sub-programme of the 5th European Research, Technology Development and Demonstration Framework Programme“ in the same edition.

chapter (2) the feminist critique of natural sciences and technology,
 chapter (3) the focus on everyday life and the environment & health-issue in environmental research and
 chapter (4) the debate on globalisation and sustainable development from a women's perspective.

Chapter three explains the theoretical background and the proceeding of the Gender Impact Assessment in environmental research. Taking the given overview of the scientific debate on gender and environment as a basis, it identifies three gender-relevant dimensions and gender-relevant priority issues, (general priority issues) in environmental research.

The *chapters 4 – 9* present the state of the art of gender research in specific thematic fields of environment and sustainability research:

- Urban sustainability (*chapter 4*),
- Global change, climate and biodiversity (*chapter 5*),
- Sustainable marine ecosystems (*chapter 6*),
- Sustainable management and quality of water (*chapter 7*),
- Natural and technological hazards (*chapter 8*),
- Earth observation technologies (*chapter 9*) and
- Socio-economic aspects of environmental change (*chapter 10*).

Based on the state of the art in these thematic fields, in each chapter, specific priority issues for gender research are identified. These specific priority issues can serve as indicators for the assessment of gender impacts in these fields.

Apart from literature study (see bibliography *chapter 12*), the state of the art reports were complemented by interviews with gender experts that were carried out either personally, on the phone or by e-mail. Important gender experts and networks in the presented environmental research fields are listed in *chapter 11*.

2 The Women and Environment Debate and the Discussion on Sustainable Development in Gender Research

This chapter covers important issues of gender and environment-research/gender and sustainability-research. In the following, four lines of discussion are focussed:

1. the debate on women, environment and development (WED-debate),
2. the feminist critique of natural sciences and technology,
3. the focus on everyday life and the environment & health-issue in environmental research and
4. the debate on globalisation and sustainable development from a women's perspective.

These discussions actually overlap and therefore cannot be understood in a strict chronological order.

2.1 The Debate on Women, Environment and Development

Until now the debate on women and the environment has been strongly influenced by the debate on development models and development policy strategies within the international women's movement and UN women policies. The World Conferences on Women have played an important role in interconnecting women policies and scientific debates.

At the First World Conference on Women, 1975 in Mexico-City, the "women and environment" issue was brought into public consciousness by the Indian physicist Vandana Shiva. She reported the struggle of the Chipko movement in the Himalaya region, which became a very prominent example in this debate. The Chipko women tried to protect the trees of the woodlands they owned in common against commercialisation and destruction by embracing them. The wood was their reservoir of nutrition, materials for house building and for small goods. Governmental and industrial interests denied the Chipko people their traditional right to the commons, and tried to expropriate them. This kind of government-business joint policy has remained a strong tendency in many regions of third world countries until today.

This example illustrates the fact that land rights are vital to environmental justice. *The question of access to and control of natural resources is an ongoing issue in the women and development debate.* Since the First World Conference on Women 1975 until today there have been strong "women for the environment"-movements in third world countries. They struggle for land ownership by women, and for preserving subsistence economies, in which women mostly have a more powerful position. They fight against the pollution of rural and urban environments, the depletion of resources and against hazardous and "big" technical projects. One example was given by the Indian writer Arundhati Roy, who has drawn attention to the Indian resistance against the Namada dam, a program of 54 huge dams affecting about 50 million mostly indigenous people (Roy 1999).

The environmental issue in international women's movements is often connected with the fight of ethnic groups. Rosi Braidotti explains the strong involvement of third world women in the environmental issue as follows: "Because women are more directly exposed to the negative effects of environmental degradation in developing countries, they have taken up the issue as the main political point" (Braidotti 1999:76). Women of third world countries see themselves in an alliance with the environment which is often called "Alliance for the Future" (Dankelman/Davidson 1988, also Townsend 1995).

In the last decade this kind of environmental activism by women has become more and more connected with questions of women's rights, environmental rights and environmental justice. In addition new issues have been raised, such as in the last World Conference on Women in Beijing 1995:

- the interdependencies between poverty of women and environmental degradations in their living conditions,
- the important role of women in preserving healthy food and nutrition,
- the preservation of women's traditional knowledge against the commercialisation by biotechnological firms,
- the effect of organic pollutants on women's reproductive health,
- the debate on population policies, which were discussed in Beijing in the context of human rights, of reproductive and sexual rights and self-determination for women. The violation of human rights through sterilisation campaigns and induced abortion in population programmes was for the first time officially mentioned and condemned.

The women, environment and development debate (WED-debate) is anchored in a critical view of development policies where the link between modernisation/industrialisation and technology on the one hand and environmental deterioration on the other is focused. The so-called stand point feminists argue for a change in the development model and for a new perspective on development. They state that mainstream development strategies are destroying the environment and the living conditions for more and more people. Discussing this from the perspective of women means arguing from a standpoint of being placed at the periphery of a development model that puts first world countries at the centre and privileges the position of white men. Thus, these feminists connect the women, environment and development issue with an anticolonial perspective. Above all in Asia, women are strongly organised. DAWN ("Development Alternatives with Women for a New Era"-network) works on its own theoretical reflections for developing a global view of the interdependencies of the economic macro level and the everyday life of women. DAWN focuses on a global vision of a society from a women's perspective. Basic to their analysis is the perspective on an "empowerment of women". The empowerment-concept was introduced very successfully into global women conferences. It is the leading perspective (and term) of a gender analysis that respects diversity amongst women.

Within gender research in Europe, the women, environment and development debate has been reflected in the so-called “subsistence approach” (Bennholdt-Thomsen 1980, 1983, 1987; Mies 1982; von Werlhof 1980, 1985; von Werlhof/Mies/Bennholdt-Thomsen 1983, see also chapter 10.1). This approach changed later into a more explicit ecofeminist position. Representatives of this perspective have raised the issue of over-consumption and have argued that consumerism in first world countries is linked to the destruction of subsistence economies in third world countries. From a female perspective, they have argued that one must see the important role of subsistence production in developing countries as well as in first world countries. World-wide, women have been expropriated from their subsistence work by seeing their work in relation to market economy and by placing it lower down in a hierarchy in relation to the market economy. Women, who had been powerful subsistence workers, were transformed into powerless “housewives”, who – in a second step of a developing process – were then integrated into the world work market by performing paid work in addition to unpaid work.

Theoretical Assumptions about the Relationship of Women and Nature/Women and the Environment

Certain theoretical assumptions, closely connected with the names of Vandana Shiva and Maria Mies, figure under the label of “ecofeminism” within gender research. There are different theoretical lines of the ecofeminist approach; the USA and Australia have created their own ecofeminist theoretical traditions (Henderson 1983, King 1989, Biehl 1991, Salleh 1994). However, all forms of ecofeminism stress women’s privileged bond with nature/environment.

This assumption has been widely discussed in gender research. The classic yet still unresolved topic of women’s relationship to nature entails cultural-specific understandings of nature, of gender-division and of women’s relationship with nature. Vandana Shiva stresses the ethical point of “women as care-takers” and sees the linkage between nature and women as being due to a gendered cultural development that led to a deeper spiritual connection of women to nature than men have (Shiva 1988, Mies/Shiva 1993). Maria Mies sees the “nearness” of women to nature as a result of societal historical developments in which women, because of their capacity of giving birth, are bound to nature in a special way. Materialistic ecofeminists see the privileged bond of women with nature as a result of a societal and cultural development that excluded experiences of embodiedness (Mellor 2001). Some have, as well, an anthropological-psychological perspective on human beings as fundamentally containing aspects of femininity and masculinity. They explain ecological destructiveness as caused by the one-sided assertion of masculinity (Henderson 1983).

In opposition to the ecofeminist approach, the Indian ecologist Bina Agarwal argues for a “feminist environmentalism”. This is a more materialistic and pragmatic political approach. She raises broader issues about the management of gender relations in connection with environmental management strategies and stresses the role of customs, laws and social structures in determining women’s relationship to their environment. In this

perspective the different forms of relationship to the environment are seen as caused by different forms of interaction between human beings and their material interests (Agarwal 1991, 1997).

Christa Wichterich, a German feminist, working on women and development issues in development aid, emphasises another important point by criticising the ecofeminist thinking. Through the insinuation of a special nearness to nature, ecofeminists tend to construct “an abstract being woman beyond historical and cultural differences” (Wichterich 1995:112). Wichterich criticises the failure to reflect *diversity* and the different interests and needs of women. By analysing new measures of international development aid in the eighties, she found the “discovery” of women as prominent addressees of developing strategies, even within the policies of the World Bank. Wichterich considers this discovery of the “agency” of women in international governmental policies as ambivalent. Women are addressed and seen as actors, but mostly within small scale and local activities planned to improve environmental conditions without affecting existing power relations. Women’s situation in respect to land ownership and to rights of land use, their access to paid jobs under safe conditions and their overburden of work in subsistence conditions are not affected by these strategies. In contrary, Wichterich shows that women are weighed down with more and more responsibility and other burdens by these political strategies. Without getting real power, women are allocated the function of “nurses for the ill environment” (Wichterich 1995:124).

The theoretical debate about the relationship of women and nature and women and the environment is still going on within feminist theories. Today, the political debate about women, environment and development in a global perspective is focused more often around the key concept of “sustainable development” and globalisation (see chapter 2.4).

2.2 Feminist Critique of Natural Sciences and Technology

A second line of gender debate within environmental research derives from a “women’s view” within natural sciences and technology. A critical reflection on scientific-technological development is constitutive for the environmental movement and research from its beginnings. In fact, there are scientists who say that the environmental movement began with the action of a woman: the US biologist Rachel Carson. In her book, “The Silent Spring” (1962), she was the first to describe the catastrophic consequences for human beings and nature caused by the spraying of pesticides in agriculture. Carson showed how pesticides get from plants sprayed with DDT to other plants, which were not sprayed. From the trees the pollution reaches birds which, in the end, die from it. Before Carson’s book there was no scientific knowledge about these ecological interdependencies, and such connections would not have been accepted if Carson had not demonstrated them by using the language of natural sciences and the methods and measuring techniques of biology and biochemistry. Carson’s call for an end to this environmental pollution formed the nucleus of the beginning environmental movement. In the

end it led to a law that forbid DDT, and to the Environmental Protection Act in USA. A new governmental institution, the Environmental Protection Agency, was founded and new scientific methods within natural sciences and technology research were developed: *environmental impact assessments* and *technological risk assessments*.

The ecologist Patricia Hynes (1989) points out that Rachel Carsons doing was a typical woman's involvement. Many studies on the history of science show that, beside the fact that they have been underrepresented, women in fact have very often developed new paradigms within in the natural sciences in the course of its history (Wylie et al. 1990, Maurer 1993).

Since the seventies, networks of women in natural sciences and technology have been founded in many countries of the Western World. Today, the Women in Technology and Engineering-Network (WITEC) exists in many countries of Europe. Women working in environmental professions are often biologists, biochemists, physicists, geologists, physicians, or they have studied environmental professions in the field of engineering. All these women are working in male dominated professions. But the rate of women within the different disciplines of natural sciences and engineering professions varies considerably among European countries. Nevertheless it can be said in general that women's professional situation is dominated by men in quantitative as well as in qualitative aspects. Even if women are not underrepresented in professional education (as for example in geology and biology), they are seldom to be found at the top level of professional hierarchies.

The majority of the WITEC-studies stresses the organisational dimension of work or focuses on the effects of technologies on the working situation of women. Some studies investigate the gender-specific symbolisation of technologies as more "male" or "female" (e.g. information and communication technologies, computers, tele-working). With respect to the scientific and professional know-how of their professions feminists criticise above all the lack of social and socio-economic knowledge and issues. This exclusion of the "social dimension" from professional profiles is seen as a symptom of male dominance.

Concerning the organisational aspect of the gender gap within technological and engineering professions, WITEC-experts demand three points:

- the analysis of the causes for the exclusion of girls and women from natural sciences and technology in education, in professional work and in decision-making positions,
- the development of new professional profiles which incorporate social questions in general and women's experiences in particular, including women's views on technological development and gender-differentiated views on the quality of life, and
- the further development of existing tools and instruments of technological standardisation, approaches and instruments on product and technological development integrating women's point of view.

There has been agreement within the debate on women in technical and engineering professions that considering questions of education, recruitment and advancement of women is not enough to make women's point of view "visible" within these professions. The tasks and competencies of social sciences must be integrated, and epistemological questions in the different natural sciences must be seen from a gender perspective as well.

In addition to this, there is a strong tradition of critical arguments concerning the unforeseen and, for the environment and human beings, negative effects of technical development, and concerning technological risks within this scientific discourse (Turkle 1984, Rothschild 1989, Wajcman 1991, Wächter 1994, Sundin 1994; see also chapter 8).

Over the last decades the debate on natural sciences and technologies within the international women's movement focused primarily on a critique of gene-related technologies (genetically changed organisms) and biotechnologies. These were criticised, not only because of their potential dangerous effects, but also with respect to their legitimacy in general. Some feminists have general doubts about the future benefits for both different societies and environments, and see negative impacts on the situation of women and their power within gender relations world-wide. The feminist critique of these technologies argues on the one hand, that they contain unforeseen effects on society, environment and health, especially for women (Bradish et al. 1981, Kollek 1985, Satzinger 1994). On the other hand, a more general critique is made, grounded in an epistemological reflection and even a critique of natural sciences and technology in general.

Feminist Epistemological Reflection of Natural Sciences and Technology

Feminist epistemological reflections of science began on a large scale in the seventies. In the beginning, many feminist studies demonstrated that Western sciences had a genuine masculine character. Objectivity and the concept of reason were proven to be no neutral values but deeply connected with Western masculinity and the public sphere (Harding 1986, Hubbard 1990, Schiebinger 1992, Birke/Hubbard 1995).

This critique was very successful in some scientific fields. For example, in the field of primatology, today nobody argues seriously about primates anymore in the way like twenty years ago, when gender stereotypes dominated the scientific discourse. Or in cell biology, the interpretation of eggs and sperms in terms of a "passive" egg that is drifting aimlessly along the fallopian tube until captured by the "heroic, active" sperm, has disappeared from the text books, too.²

² Today, new models of interpretation, shaped by a picture of equal partnership between egg and sperm (similar to a dual-career couple) working towards successful fertilisation, are seen as critical by feminist cell biologists.

Over the last twenty years, this kind of detailed “discrediting” of the principles of objectivity and rationality as inherently gendered has continued to be carried out by feminists in different fields of science. How stereotypes of hierarchical gender relations dominate basic assumptions in medicine and gynaecology has been shown in many case studies (Fischer-Homberger 1979, Elshtain 1981, Farge/Foucault 1982, Fee 1983, Schaps 1982, Bennent 1985, Fausto-Sterling 1985, Bleier 1986, Duden 1987). A critical reflection on the female body forms an epistemological anchor for the definition of women’s needs as bodily needs. This is a basic argument within environmental research from a gender perspective and especially in the field of city planning (see also chapter 4.2.3).

The historian of natural science Londa Schiebinger (1997) sees the important impact of gender studies above all in the feminist critical attitude concerning the institutional dimension of science. *Feminist critique of science and technology focuses on the interdependency of scientific discourses and the forms of “how to do science”.* There are different epistemological schools within feminist research, but more or less they all stress the “process of making” objectivity, rationality and gender-neutrality. In doing this, they apply approaches from the sociology of science or the history of science to natural scientific procedures and models. Thus from a historical perspective Carolyn Merchant (1980) analysed the Bacon-Newton paradigm as a deep societal-cultural shift from an organismic to a mechanistic worldview at the beginning of Enlightenment in Europe. This interpretation influenced a good deal of the epistemological debate on natural sciences. The biologist Helen Longino was more interested in tracing the inner-scientific procedures within natural sciences. She investigated, with methods drawn from the cultural sciences, the values within the community of natural scientists who lead to “objectivity”. Looking at the organisation of natural science with the eyes of an anthropologist, she showed how communities of researchers form “background assumptions” which serve as the bases for mutual understanding and effective research on the one hand and as the basis of a gender-neutrality that is grounded in the community-building of male natural scientists on the other hand (Longino 1990, 1996). *This “double-level” analysis of the sciences constituted by an inherent interdependency between the forms of scientific organisation and the scientific paradigms, approaches and standards, is important for any form of Gender Impact Assessment within the field of sciences.*

An important feminist critique of the natural sciences is the exclusion of alternative development paths within the inner-scientific field. The biologist Evelyn Fox Keller (1983) showed this in an exemplary way in studying the work of Barbara McClintock, who won the Noble Prize in 1954 for her work on genetic transposition in cell genetics. Fox Keller demonstrated how McClintock’s investigating procedures differed from the “male-objective” standards within biological research. McClintock developed other forms of observing “her object” (maize plants), and called this a form of “being within the plants”. Fox Keller analysed how the subject-object relation within this form of observation process differs from mainstream standards, and why this form of “intimate”

observation was critical for her discovery of the co-ordinated “springing” of genetic elements from one place on the chromosome to another. Beside this, McClintock did not respect the scientific standard that demands ignoring the “exceptions” to what can be observed, which in her case were some different pigmentation’s of the maize plants. But the observation and focus on the exceptions instead of “the rules” allowed McClintock to explain more complex interactions and to develop a new model of interpretation. Thus, McClintock’s discovery of the transposition of genes represents an alternative line within the understanding of genetics. Nevertheless, her approach has not been further developed within genetic research. But it shows that there are different possible understandings of genetic biology. In this context one can better understand the inner-scientific reductionist basis of the success of the so-called “zip-fastener-model” of Watson and Crick, which became dominant in genetics because it can be used more easily in applied (and thus economically useful) research (Keller 1983, 1984). Knowing this background, the German biologist Regine Kollek (1991), who has worked in the genetic sciences, has argued for a “diversity of scientific models” and a “keeping open” of different scientific development paths within natural science basic research.

Feminist epistemological reflections with respect to mathematics/information science (Hayles 1992) and physics (Cartwright 1983, Harding 1991, Rübsamen 1993, Scheich 1993) concentrate, – to mention only one basic argument – on the systematic exclusion of what can not be modelled. Such critiques argue that, in the “exact sciences”, only what is seen as the “norm” is theorised and modelled. What cannot be modelled, is an aberration. This critique of the reductionist base of modelling systems is very important with respect to an understanding and critique of global change modelling and the feminist critique of Earth observation (see also chapter 5 and 9).

Besides their importance for a critical view on new technologies, these epistemological arguments are little used within environmental research from a gender perspective. They are important to deconstruct the claim of the natural sciences that the world can be explained exclusively with models that exclude all social dimensions. They show this claim to be a social construction, despite its seeming legitimacy as “naturally given”. But what is still badly needed for basic research is to transform these de-constructive insights into a re-constructive perspective that can be applied to environmental problems from the perspective of the empowerment of women. Londa Schiebinger calls this (re-)constructive perspective “sustainable science”:

“It is not enough to understand how science has been made; we need to develop more practical, constructive ways to employ tools of gender analysis in creating what I will call ‘sustainable science’. Only when gender analysis becomes an integral part of science research programs will the problem of women in science be solved.” (Schiebinger 1997:203).

Some steps in this direction have been made in the approach of the feminist mathematician Donna Haraway. She criticises the postulate of universality and the claim to trans-

ferability of scientific assertions, independent of their specific social gender-situation and independent of their specific environmental situation. In contrast to this kind of “objectivity”, which is to be called into question, she demands a type of “situated knowledge” (Haraway 1988), that reflects its context-conditionality. In feminist environmental research this postulate of “contextualized knowledge” has led to a good deal of critical reflection on the specificity of geopolitical locations, which reflect at the same time different types of gender relations.

Applying this approach to the field of gender & environment-research, Irmgard Schultz calls for a redefinition of the so-called environmental problem as the starting point of a gender-sensitive environmental research, and gives an example of what this would look like in her analysis of waste management (Schultz 1994). The inclusion of gender-specific and local-specific questions in the definition of the so-called waste-problematic leads, on the one hand, to a broader field of research questions, which, at that time, were focused in Germany mainly on the point of separate waste-collection in the household and recycling. On the other hand a re-definition of the waste-problem from a gender-perspective would lead to another focus than the existing one in this research, which Schultz analysed as the “women and waste-syndrome”. Given this new understanding of the problem, different and – as to be expected – more efficient waste management strategies, capable of addressing different “situated” target groups instead of the stereotype “household”, can be developed. As a result, this approach opens up many methodological questions with respect to the diversity of women and target groups and, in general, with respect to the diversity of the involved social agencies. New combinations of empirical methods and participatory methods are required (see also chapter 4.3).

The reflection on diversity and plurality of different gender relations within the specificity of geopolitical locations is symptomatic for post-modern feminist approaches. They criticise the humanist tradition of a universal, self-centred subjectivity called “man”, abstracted from any local boundaries, a view underlying the postulates of the natural sciences. Against this, post-modern feminist approaches argue for an epistemology of fragmented identity (Harding 1986, 1991) and dislocated subjectivity. With respect to science and research this means demanding a procedural-orientated understanding of sciences instead of a postulate-orientated understanding.

2.3 Everyday Life and the Environment & Health-Issue in Environmental Research

The third line of feminist debates focuses on different approaches within the scientific fields of environmental research. These are, for example, urban research from a gender perspective, feminist traffic research, research on gender impacts and environmental effects of energy and water use, women in environmental management strategies such as waste reduction, women in sustainable household strategies and consumer behaviour, women and the agriculture and nutrition question, as well as women and chemistry. *All of these feminist approaches stress in one way or another the importance of everyday*

life for environmental strategies. In this type of gender & environment research social or socio-economic environmental approaches dominate. The methods and instruments of measuring environmental degradation and environmental loads are generally not questioned from a gender perspective. Only a few feminists have begun to consider these methods and their standards as being gendered as well (see Weller 1995).

With respect to the European gender & environment-research that focuses on everyday life and its impact on environmental strategies, two debates must be mentioned. Firstly, since the beginning of women's movement there has been, above all in Italy and in England, a strong debate over paid and unpaid women's work. *Very important for gender & environment research standing in this tradition are studies on the different patterns of time use by women and men, and in general on the gendered implications of time* (Nowotny 1990, Schultz 1994, LeFeuvre 1994, Pasero 1994, Forman/Sowton 1998). As many feminists have pointed out, gendered time use depends on a general openness of women to "others". Their work is very much oriented towards other people, in contrast to men's work, which is more self-oriented (Waring 1988, Merchant 1996, Mies/Shiva 1993, Nelson 1996). The English sociologist Barbara Adam explained this historically. By separating home and work, industrial society has set aside a clearly designed space and time for paid work. Paid work is time-oriented in contrast to women's work in the home. This work is still task-oriented and strongly dependent on "biological time"; for example, babies need to be fed when they are hungry. (Adam 1993, 2001).

In fact, time use differs greatly between men and women with respect to market activities and non-market activities, as the Report on Human Development 2000 shows in selected OECD countries: On an average - observing time use patterns in Australia, Austria, Canada, Denmark, Finland, France, Germany, Israel, Italy, Netherlands, Norway, United Kingdom and United States - women work 430 minutes per day, men 408 minutes. That means that women work 105 % in relation to 100 % of men. From the total work time, 49 % are market activities and 51 % non-market activities. But market activities only constitute 34 % of women's work time (66 % non-market activities), whereas it makes up for 66 % of men's work time (34 % non-market activities) (UNDP 2000:300). Feminist economists and environmentalists above all demand gendered disaggregated longitude surveys on time use. They also argue for a more specific categorisation of different activities of work, which would allow showing the amount of unpaid housework actually done "for the environment".

The theoretical debate about women's work and environment was strongly influenced by the approach of Carol Gilligan. Her psychological approach stresses women's special responsibility for care taking. Gilligan (1982) showed, by analysing some case studies on women's and men's behaviour in special ethical conflicts, that women and girls, with respect to ethical questions, think "in another voice". They follow other ethical rules of behaviour than men. Gilligan called this female ethical rules "ethic of care".

Other feminists broadened Gilligan's "ethic of care" to women's relationship to their natural environment (Plumwood 1986). In doing this, they stressed the untapped human resources that women can still offer to "solve" environmental problems. The claim that there is an "unseen potential in women" for environmental strategies, grounded in a special women's ethic, is typical for this type of theorisation of everyday life and the environment from a women's perspective.

In contrast to this, there are other approaches within the gender & environment-research in Europe, which take a critical attitude toward the assumption of universal women's ethic of care. They ask for more precise analysis of the differences among different women and between other target groups. This is related to the crucial point of the implementation of environmental technologies and policies without participation of women and different target groups. A central criticism is that women's willingness "to do something for the environment" is taken for granted in public and economic environmental management strategies.

This point was the focus of study by Irmgard Schultz and Monika Weiland on "Women and Waste" (1991), as well that of later studies. Schultz/Weiland called this tendency the "feminisation of environmental responsibility". Women are expected by environmental policies to put in more work, engagement and extra strain in order to cope with everyday life. This extra work is planned with no knowledge of the everyday coping strategies of women. But on the other hand, as Schultz/Weiland showed for the introduction of the new waste management system in Germany, women, socially differentiated groups of women or other target groups were not integrated into the technically dominated waste research and waste debates.

This type of feminist environmental research criticises a dominant type of waste studies which exclusively measures the different waste fractions of abstract "households" without reflecting the gendered "waste work" within the households. The most important research questions are hidden by this kind of policy and research. The question, how much waste can really be counted as a household's responsibility is still an unsolved problem of waste measuring methods and its statistical categorization within the dominant type of technical-economically oriented waste research. Or the most important question, which would derive from a technology-critical perspective has never been raised in this context: Are there no better and more eco-efficient, less expensive, more participatory and women-friendlier alternatives to the "big shift" to new waste management systems?

Another approach in gender research, that also has a critical attitude to environmental strategies based on women's potential to save the environment, stresses the "crisis in reproduction work". Marianne Rodenstein has developed this approach within the discipline of feminist urban-planning. It argues that the connection between production work and reproduction work is organized in such a way that reproduction work can hardly be fulfilled in a healthy, sustainable way. It illustrates the critical character of reproductive

work in face of modernised lifestyles and changed expectations of life (Bock/Heeg/Rodenstein 1996). The approach, “crisis in reproduction work”, has also influenced the theoretical discussion in feminist traffic research (Beik/Spitzner 1995).

Environment & Health

The second focus in gender & environment-research that stresses everyday life is the critical discussion of the environment and health-issue. ***“Health” is, as case studies on women’s involvement in environmental actions show, at the top of the list of the most important values embodied in the goals of women’s involvement.*** That has been shown in a study by Josepa Brú-Bistuer (1996) using three case studies of women’s involvement against the opening of mass dumps in different regions in Spain. In general, women integrate environmental issues into their experiences of everyday life and they give more priority to these issues in relation to other societal problems than men do.

In Europe the environmental issue was not discussed much within the women’s movement at the beginning. This changed strongly after the accident in Chernobyl 1986. Demonstrations against nuclear technology were organised above all by women in many countries of Europe. In Finland women organised a “birth strike” against nuclear technologies; in Germany, even a year after the accident occurred, there were still more than 1000 (!) so-called “Mother Groups against Nuclear Technology” (Schultz 1987). The accident led to an intensive discussion of the risks of nuclear technologies from a women’s perspective, and until today stands for a wide spectrum of arguments which shape research on technological risks from a gender perspective (see also chapter 8.2). In this discussion of the effects of the nuclear accident a ***strong argument concerning differential vulnerability*** was developed. The “Mother Groups against Nuclear Technology” criticised strategies of minimisation of the radioactivity orientated to so-called limit-values. These limits are premised on the situation of an average healthy male human being instead of taking into account the special vulnerability (vis-à-vis radioactivity) of pregnant women, of ill people and children. This is a main argument with respect to all pollution-minimisation strategies and the gender and health-issue in general.

Medical sciences also received impulse from the Chernobyl accident concerning research on the effects of radioactivity on human health. Before, the data for research on the impact of radioactivity on human health came from studies about the effects of the atomic bombs in Hiroshima and Nagasaki. Now the database is different. Feminist researchers in this field call for gender-disaggregated databases. In the field of environmental health research the implementation of gender aspects in the USA is far ahead of Europe. The US conducted the most expensive health study ever in the field of gendered health, which ran over 14 years as a longitude survey. The data and research approaches are also valid for gendered environmental health research.

The example of US health research shows an important objective that has yet to be reached in Europe. Gender research must be implemented in all health administrations and health research institutions on a programmatic and on an organisational level. The organisational harmonisation and standardisation of different US health in-

stitutions is accomplished, not only by means of specific programs, but also through national workshops, which issue national reports. In 1998 a series of workshops was held issuing in a national report on “Gender differences in susceptibility to environmental factors.” The report was developed by the Institute of Medicine/USA and includes a priority assessment and recommendations (Petit Setlow et al. 1998). We have not found a similar report for Europe.

The report points out at the beginning that there is a growing awareness concerning the fact that environment and environmental factors may play a role in creating health status differences between men and women. “Various factors, such as genetics and hormones, may account for gender differences in susceptibility to environmental factors. In the development of approaches to disease prevention and health promotion, to behavioural and medical interventions, or to the initiation of research strategies, many have come to realise that special consideration must be given to health effects that are either gender specific to or are over represented in women because of environmental factors such as occupation, behaviour, lifestyle, hobbies, reproductive status, or physical activity” (Petit Setlow et al. 1998:3).

Women’s health situation within the context of environmental degradation in industrialised countries is a lot better than in developing-countries but still far from being satisfactory. *Environmental effects that affect women more than men (either because of their living conditions, or because of the higher sensibility of women during pregnancy or while taking care of children) are indoor chemicals, ground level ozone, exposure to dioxin, air pollution from vehicle emissions and endocrine disturbances.* The environmentally caused diseases most often reported are breast-cancer and respiratory ailments. There is also still a considerable high contamination of breast milk.

In Europe, the environmental situation and its health effects on women is particularly disastrous in the Eastern European countries in transition. Women in these countries are often exposed to a considerable degree of chemical pollution and radiation, causing high rates of birth defects, tumours and sterility (WEDO 1999).

The process of harmonisation of the environment and health issues has been intensified since the “European Charta for Environment and Health”, which was issued 1989 in Frankfurt/Main. The report “Concern for Europe’s Tomorrow”, presented at the Second WHO Conference in Helsinki 1994, showed the situation in Europe under totally changed circumstances. Instead of 29 countries, there were now 50 countries in Europe considered in the report.

The “women & health”-debate is central to women’s interests and women’s needs in different environmental research fields. The question of water-caused diseases is central to the “women and water”-debate; the health effects of global change are central to the global change debate from a gender perspective; and the hormonal effects of the

pollution of water and marine ecosystem are central within this research field from a gender perspective as well.

2.4 Women, Globalisation and Sustainable Development

This last theoretical focus within the gender & environment-debate is not really a coherent debate or research field. Globalisation and sustainable development are discussed in very different contexts within feminist debates, on the one hand, and within environmental research, on the other. Nevertheless, it can be argued that the debate on sustainable development puts the older discussion of women, environment and development in a new context.

Since the Rio-process women's and gender issues has been given high priority in the international political debate on sustainable development. *In Rio, women were considered as 'major group' whose involvement is a necessary prerequisite for achieving sustainable development.* The commitment to overcome gender inequality and inequity and the objective of the necessary, full and equal participation of women form essential components of Agenda 21 and other international agreements. Especially, Chapter 24 of Agenda 21 ("Global Action for Women towards Sustainable and Equitable Development") urges changes to "eliminate constitutional, legal, administrative, cultural, behavioural, social and economic obstacles to women's full participation in sustainable development and public life" (ibid. Chapter 24.2c) and outlines strategies to achieve this goal. In addition, gender as a crosscutting issue is addressed throughout Agenda 21. The commitment to gender equity and equality and the participation of women has been reaffirmed at all UN Summit and Conferences in the nineties.

Nevertheless, the understanding of what is sustainable development differs considerably, above all between third world countries and first world countries. In the countries of the South sustainability is seen more in terms of its promise of better economical and social conditions. Whereas, in the countries of the North the normative aspect of preserving the environment for the next generation is stressed (Becker/Jahn 1999). In her overview of existing definitions of sustainability the Canadian feminist Margrit Eichler came to the conclusion that there is little consensus on the meaning of the concept of sustainable development. The three imperatives (ecological, economical and social) are

- to remain within planetary bio-physical carrying capacity,
- to ensure an adequate material standard of living and
- to provide social structures, including systems of governance, which effectively propagate and sustain values that people want to live by (Robinson/Tinkler 1995, cited in Eichler 1999:183).

These are imperatives that go together and interconnect well at a normative level. But it is very difficult to find out how to realise them and to discover the obstacles that would explain why the world as it exists does not interconnect in this way. Eichler mentions the controversy on whether economic growth helps or blocks development in direction

of sustainability. Furthermore, she notes that there is a general agreement that less industrialised countries need “development”, whereas highly industrialised countries do not. The USA, Canada and European countries, however, need development towards a more equitable intranational and international distribution of resources. “Over-consumption” by first world countries, which constitute only about 20 % of the world population, but consume 80 % of the world resources, is a key issue.

Feminist environmental research in Europe agrees with this argument. Beside different forms of feminist involvement in the process of realising “local agenda 21” in accordance with chapter 21 of the Rio declaration, “sustainable consumption and production patterns” have been discussed from a gender perspective (see chapter 10.2.3).

The main argument with respect to sustainable development from a gender perspective calls for the inclusion of gender issues within the social dimension of sustainability. This argument was developed by several feminists who criticised the study “Sustainable Germany”, that was edited by the environmental organisation BUND (Friends of the Earth) and the Catholic development organisation Misereor (BUND/Misereor 1996). The German study succeeded in politicising the sustainability perspective by showing in a quantitative way how the principles of a fair North-South exchange are violated through an ever-growing use of materials and an expansion of goods. But it failed to show gender relations and unequal power relations. Neither the structural significance of reproduction work nor the key issue of societal and human reproduction can be found there, and children and their situation in Germany are not mentioned at all. But the feminist critique considered the methodological problems of this study as an unsolved problem for sustainability research in general. How to combine global ecological perspectives with local socio-economic relations to nature, how to “situate” gender relations and how to combine quantitative and qualitative perspectives is still a great methodological challenge within gender & environment-research (Schultz 1996, Weller et al. 1999).

At the Fourth World Conference on Women in Beijing, the Platform for Action stated that “women have essential roles to play in the development of sustainable and ecologically sound consumption and production patterns and approaches to natural resource management” (Ogunleye/Hemmati 2000:8f.). With respect to the political-institutional level of the Rio process the Platform for Action recommends:

- actions by governments, Local Authorities, international organisations, private sector institutions and NGOs to involve women actively in environmental decision-making at all levels,
- integrate gender concerns and perspectives in policies and programs for sustainable development and
- strengthen or establish mechanisms at the national, regional and international levels to assess the impact of development and environmental policies on women.

Important issues are poverty elimination, information provision and capacity-building for women (ibid.).

In the UN General Assembly Special Session of June 2000, “Women 2000: Gender Equality, Development And Peace for the 21th Century”, the UN Division of the Advancement of Women (DAW) presented a report based on the answers to a questionnaire that was sent to all countries. NGOs produced an “Alternative Report” which shows that important issues still have not been addressed:

- persistent problems of access to and control of natural resources,
- inputs such as land, agricultural inputs, credit etc.,
- problems of environmental health and their gender specific impacts, and especially with reference to the effect of persistent organic pollutants on women’s reproductive health,
- natural disaster mitigation and recovery strategies and
- preserving women’s traditional knowledge.

Since the World Conference on Women in Beijing 1995, the issue of sustainable development has been strongly connected to the debate on globalisation and its understanding from a women’s perspective. In women studies the issue has been treated for years. But with respect to the environment issue there have only been few contributions from a gender perspective. The following tendencies of globalisation should be noted because of their important impact at the same time on gender relations and on the environment.

- Globalisation tendencies are seen in new forms of the world-wide financial system that dominate even national politics and lead to a “weakening of the nation state”, above all in Europe. The new forms of global monetary flows are analysed from a gender perspective with respect to development aid instruments at the international level, which divert financial flows (Elson 1987, 1993; Alternative Women in Development Group 1993; Bakker 1994, 1996). Macroeconomic approaches from a feminist perspective have analysed, for example, the World Bank’s activities and have shown alternative ways of financing projects as having positive gender impacts. Gender Impact Assessment of financial activities and an instrument for gender budgeting have been developed for Canada at the national level and for some Canadian communities at the communal level. A positive impact on the environment is assumed because of the prominent position of women in human and societal reproduction.
- There is agreement within the feminist debate that globalisation is a form of world-wide geopolitical restructuring of economic, societal, cultural and socio-political structures, having strong impacts on the environment. Furthermore, several gender studies agree on the point that globalisation processes are not gender neutral (Klingebiel/Randeria 1998). The world-wide restructuring processes have local corresponding reactions that affect the working and living conditions of women to a large extent.

The macro dimension and the micro level are theorised in different approaches within gender research. Beside the feminist macro economics mentioned above, there are approaches within feminist environmental economics that stress the community economy and the importance of restructuring the world from a local perspective (see also chapter

10.1). The feminist macro economic approaches and the micro economic have not shown the impacts on the environment so far (with methods of ecological standards).

- With respect to Europe, the interdependencies between global and local dimensions have been shown in new forms of work. Feminists argue that the mainstream debate stresses the appearance of new male world market workers who are predominantly working in the financial sector. The feminist analysis stresses new forms of women's work, which have appeared together with new forms of male work. Thus Linda McDowell (1999) has shown this process, using the example of the "world city" of London (see Sassen 1990). The restructuring of the city according to the needs of flexible world market workers in the banks and stock markets (gentrification of the city) is accompanied by a large amount of low paid service work done mostly by immigrant women, often under illegal conditions (King 1996, Sassen 1996). The impacts of this restructuring on the environmental issue are still not understood.
- Since the Conference in Beijing the international feminist debate and women's policies stress the point of poverty of women. Gender research studies have shown that there are new forms of spatial segregation in the big cities due to globalisation tendencies, which lead to an exclusion from social participation for the people affected. These tendencies of reorganisation of urban space according to class/social milieus and ethnicity are characterised by a strong gender-bias. Households headed by women and families with numerous children are over-represented in the "poor" quarters of the cities. US American research on gender & environment stresses the point that these new forms of social restructuring of the cities occur hand in hand with ecological deprivation. The "poor" quarters in the cities are situated near huge highways; they are often placed directly beside a mass dump and built upon contaminated soil. Studies of European cities concerning this point have generally been lacking.

In Europe, globalisation tendencies in the Eastern and the Western countries must be seen differently. In Western Europe, globalisation tendencies have been analysed under the heading crisis of the welfare state. Gender studies show that the social security systems are in transition according to international tendencies of neo-liberal economics. But in every country links between social security systems and nation states are different, and must be analysed carefully. The impacts of this on the environment can not be assumed.

From a gender & environment research perspective tendencies of privatisation of former public supplies (waste, electricity and water) have been analysed as a symptom of an international policy of "structural adjustment". This has had a profound effect on the resource management of private households and the possibilities for so-called private people to participate in decision-making with respect to these "environmental" services. Women are affected in a special way because of their responsibility to secure the affected basic needs (electricity, water and clean living conditions).

Globalisation tendencies in Europe can not be discussed without considering the new political situation in Europe since 1989. In Middle and Eastern Europe the communist regimes have collapsed and given way to the establishment of democracy. The bipolar structure of Europe is fading. The countries of the so-called second world “in transition” display, besides their strong problems in economy, disastrous symptoms of environmental destruction. The effects of economic crisis and ecological deprivation are not gender-neutral. Women doing research on gender & environment-issues in these countries (Bezensek 1994, Nagy 1994, Stastna 1994, Tsepilova 1994, Zdravomyslova 1994, Bellows 1994) have stressed this point.

2.5 Summary

Summarising the debate over gender & environment we want to cite Jovi Seager’s five basic principles of sustainability research, which must also be seen as important dimensions for the evaluation of environmental and sustainability studies:

- *Institutions are gendered.*
- *Individual behaviour is gendered.*
- *Men and women have different relationship to the environment.*
- *Environment degradation has different impacts on men and women.*
- *Environmental action/environmental conflict/environmental discourse is gendered.*

(Seager 1995 cited in Eichler 1999:197).

In the following, starting from this state of the discussion on gender and environment/gender and sustainable development, a Gender Impact Assessment for research, with a special focus on environment/sustainability research, is developed.

3 Gender Impact Assessment in the Field of Environmental Research: Theoretical Framework and Evaluation Concept

3.1 General Outlines for a Gender Impact Assessment in Environmental Research

The assumption of gender-neutrality of policy has unintended, unforeseen but significant and mostly negative effects on the gender relations in a society. Because of this recognition a new instrument, a *Gender Impact Assessment*, was developed. It is designed to analyse potential effects of new governmental policies on gender relations. The Dutch government decided to apply this new instrument for the first time in 1992 (Verloo/Roggeband 1996:3). Meanwhile various policies have been analysed with this instrument. However, in the field of research, and especially in the field of environmental research, no Gender Impact Assessment has taken place so far. Thus, the Dutch Gender Impact Assessment has to be adapted to this specific field.

What is the Meaning of Gender? What are Gender Impacts?

According to international women policies the basic problem in gender relations is the structurally *unequal power relations between women and men*. In this understanding, gender, i. e. the meaning of being a man or a woman, is neither fixed nor biologically or naturally given, but a social construction. Power is directly related to gender because gender is a primary way of distributing and using resources. Furthermore, power is indirectly related to gender in the operation of rules. This means the norms and symbols concerning masculinity and femininity are founded in social interaction as well as in social institutions and organisations (Verloo/Roggeband 1996:7). The problem of unequal power relations becomes apparent in societal symptoms such as unequal participation of men and women in the public and the private sphere, as well as, for example, sexual violence and the non-value of unpaid subsistence work and housework. This understanding is basic for an awareness and understanding of gender problems that can be found internationally. It issues in the political strategy, *empowerment of women*, a strategy that is basic to international women's movements and the United Nations' women policies.

In addition to an empowerment of women the most important effect of gender awareness in the fields of policy and research is its role in drawing attention to the so-called *social dimension in its modes of difference*. When policy and research keep gender differences in mind, they learn to consider different interests and needs of different social groups/different target groups. *Not a construction of the universal man in "his" relation to nature is what is needed, but instead a perspective on gender and diversity*. In the field of environmental research this means studies of, for example, environmental problems and environmental strategies with respect to old or disabled women and young girls, poor migrant boys and rich bourgeois housewives. WISE (Women's International Studies Europe) count gender, "race"/ethnicity, class/income, sexuality, age, ability and geographical location as major axes of social distinction (WISE 1999:10). *Thus, the awareness of gender impacts implies the acceptance of difference, plurality and multiformity. Ignoring these categories has, on the one hand, negative effects on gen-*

der relations in society and on the other, negative effects on political environmental strategies and societal relations with nature.

3.2 Gender Impact Assessment

A Gender Impact Assessment in the field of science and research identifies the gender-relevant factors of a research area and analyses how they influence gender relations. As the feminist critique of science showed (see chapter 2.2), the gender relevance in the field of science must be seen with respect to the interdependency of two levels: the level of scientific discourses and the forms of “how to do science”. This “double-level”-analysis of science and research must be embodied in our gender impact-evaluation concept. On the one hand, such a concept has to cover the organisational level of “doing science” and at the same time cover the level of content. Thus the evaluation concept of a Gender Impact Assessment in research consists of two basic evaluation elements:

- *an analysis of the gender composition at the organisational level* of doing science and research, including an analysis of women participation in the elaboration and implementation of research policies and programmes, as well as the women participation in the projects submitted and funded by research programmes;
- an analysis of the level of contents, including the contents introduced by the objectives of the research policies and programmes, as well as the contents of the submitted and funded projects within these programmes.

Steps of Evaluation

Having defined the two main elements of the impact assessment, four steps of analysis can be distinguished:

First step: The gender composition and the gender hierarchies at institutional level are analysed. This concerns the institutions and bodies involved in the management and implementation of research programmes or policies as well as the gender composition of project groups of funded research in these research programmes.

Second step: The objectives and the research issues of the research policy or programme are analysed with respect to gender aspects.

Third step: At the level of contents, the gender aspects of the submitted and funded proposals within the research programme are analysed.

Fourth step: Recommendations for the increase of women's participation in research and for the inclusion of gender aspects in further research programmes are drawn.

Evaluation Goals

Gender impacts of research are analysed with respect to *two evaluation goals*, which are grounded in basic principles of the international women's policies and women's studies/gender studies.

First evaluation goal: Equity and Equality

The goals equity and equality in the fields of policy and research refer to the structurally unequal power relations between women and men. These unequal power relations become apparent in unequal opportunities and disadvantages for women in the private and in the public sphere, as well as in research. However, in our understanding, equity and equality do not only take into account differences and unequal power distribution between women and men, but also differences amongst women, due to ethnicity, social status, age, geographical location etc. Thus, the goal "equity and equality" rejects the idea of a universal man as well as a universal woman. Instead, it emphasises the perspective of *equity and equality whilst considering diversity*.

The under-representation of women in science, technology and engineering has been a policy concern in at least two ways: first, in terms of principles of social equity and justice, with this rooted both in democratic politics as well as in the ideals that scientific careers 'be open to talent'. Secondly, it can be assumed that lack of women in science leads to the absence of research interest, and consequent lack of information on many problem areas of particular concern to women's lives. In this context, ***the European Commission states that the under-representation of women in scientific research and technological development "must be rectified in the interests of equal opportunities for men and women:*** this is essential to democracy and a political priority for the Union. A greater involvement of women in research would enrich European Science, in terms of its methods, the subjects on which it focuses and on the objectives assigned to scientific research" (European Commission 76/1999). Framed in a policy of equal opportunities, the aim is to promote research *by, for and about* women. These three perspectives aim to:

- a) promote women's participation in research activities;
- b) ensure that women's needs and interests are taken into consideration when setting the research agenda;
- c) promote the understanding and inclusion of gender issues.

Second Evaluation Goal: Sustainable Science

The perspective of an empowerment of women in science, technology and politics requires, in addition to the orientation toward the goals of equity and equality, a second important perspective, one that anticipates a deep change within scientific and technological approaches and instruments. In accordance with the feminist discussion about sustainable development and science we define this second goal as *sustainable science*.

Sustainable science is oriented within the scientific and political discourse towards sustainable development and its ethical principles. Integrated in this way within the

concept of sustainable development, the goal of sustainable science includes gender analysis as an integral part of science and research. This means a deep understanding of the functioning of gender-relevant factors in science (on the level of organisation of science as well as on the level of contents). Thus, sustainable science stresses the anticipation and the shaping of the future. In this sense the shaping power of women, their capability as change agents in “making the future” must be seen and analysed as a key element of sustainable development. In this context, the feminist historian of sciences Londa Schiebinger demands a “sustainable science” (Schiebinger 1997:203, see also chapter 2.2).

Viewing this as a goal of science and research, environmental research will be changed *at the level of standards, methods, instruments and tools as well as on the level of contents*. With respect to methodology questions, a sustainable science demands above all *interdisciplinary and transdisciplinary methods*. A step in this direction would be to see if the scientific methods used reflect a gender perspective. Combining a gender approach with approaches in natural science and technological research will not work by a simple addition of existing approaches. ‘Bridging concepts’ are demanded to bring the perspective of gender together with the perspective of environmental research.

3.2.1 Three Main Analytical Dimensions

Starting from these two evaluation goals, in environmental and sustainability research *three main gender dimensions* must be seen and recognised with respect to the level of contents:

- the gendered division of labour/women's work,
- the organisation of intimacy and
- the shaping power of women in science, technology and politics.

The two first dimensions are directly taken from the Gender Impact Assessment developed in the Netherlands (cf. Verloo/Roggeband 1996), the third dimension is derived from the evaluation goal of sustainable science in which the shaping power of women plays a substantial role.

Gendered environment/sustainability research thus has to integrate and consider all of these three dimensions.

(I) Gendered Division of Labour/Women's Work

“The gendered division of labour is a concept that refers to a complex of values, norms, rules and practices in the field of labour, where an asymmetrical distinction is produced between women and men, between paid and unpaid labour, between work inside and outside the home, and between male and female tasks and professions. An important substructure is the division of tasks between women and men in political organisations” (Verloo/Roggeband 1996:6). Therefore women's work, which has to be seen within the gendered division of labour, is a main dimension of any assessment from a gender perspective. *Work* implies not only market-mediated labour. **“Looking at women's work,**

we can see the variety of social engagements, which are necessary for the survival of a society and its members: domestic work, subsistence work, care work, work in the formal and informal sections of the labour market.” (International Women’s University, Hannover 2000, Internet-announcement).

(II) Organisation of Intimacy

Organisation of intimacy means the organisation of sexuality, procreation and personal relationships in terms of masculinity and femininity. *“As a concept, this refers to norms and institutions around sexuality, extending to the social organisation of personal relationships, procreation, and motherhood: a much broader field than sexuality alone”* (Verloo/Roggeband 1996:6). The organisation of intimacy should be implemented in society in a way that allows all women a life in self-determination and does not violate women’s rights. It concerns all questions of women’s security, women’s health and in a broader sense, the bodily needs of different social groups: women’s needs, children’s needs, the needs of disabled persons etc.

(III) Shaping Power of Women in Science, Technology and Politics

A third dimension addresses the problem of unequal gender-relations and male dominance within science, within technical design and politics. The dominance of natural and technical sciences in environmental research is related to male dominance. It is reflected as a dimension of gendered power as well. This includes the scientific understanding of the societal relations of women and men with nature and with the environment in a broader sense.

Shaping power means the power to create and shape knowledge, new technologies and environmental strategies by reflecting the power of women to create and shape everyday life. This perspective is problem-oriented with respect to both: to the women’s lack of power and to ecological problems. In this way it combines questions arising within feminist debates about the empowerment of women with perspectives which have been developed in technical and natural science-based environmental research (Schultz 1999). How do women, in contrast to men, influence technical design? What influence do women have – in comparison to men – on those decision-making processes within communities and governments leading to new forms of environmental management? Which opportunities for influence are falsely promised to women while accommodating real power structures? The *shaping power of women* raises the perspective of an empowerment of women by increasing their participation within sectors having to do with the generating of knowledge and with environmental planning and management, where women are underrepresented quantitatively and qualitatively in decision-making positions.

List of General Priority Issues of a Gender Impact Assessment

Against the background of the discussion on gender and environment/gender and sustainable development presented in the previous chapter, the three analytical dimensions mentioned above were elaborated and put in more concrete terms in the following *List of General Priority Issues* of a Gender Impact Assessment.

These General Priority Issues constitute a check-list for the analysis of gender impacts of environment/sustainability research, on the one hand at the level of research programmes and at the level of single projects submitted and funded in these research programmes on the other hand.

(I) Gendered Division of Labour/Women's Work

- *women's work (in different professional fields, in environmental professions and in the household);*
- *gendered access to and ownership of resources (money, goods, education, information);*
- *gendered patterns of natural resources (e.g. water use etc.);*
- *reproduction work and daily life experiences of women/men in its relevance for environmental strategies;*
- *gendered (sustainable) consumption and production patterns;*
- *time use patterns of women/men and their relevance for environmental strategies;*
- *compatibility of work and family life;*
- *gendered patterns of the use of space (in private and public places);*
- *gender differences and environmental education/environmental information/environmental communication;*
- *feminisation of poverty, poverty elimination and sustainable development strategies;*
- *women's work, migration (globalisation) and sustainable development;*
- *gender-sensitive macroeconomic instruments to control and to divert financial flows (gender budgeting).*

(II) Organisation of Intimacy

- *women's rights, human rights, reproductive rights and their relevance for environmental issues;*
- *protection of intimacy in environmental strategies (e.g. against data abuse);*
- *women's needs and needs of different target groups (children's needs) in environmental strategies;*
- *women/men and environmental health (e.g. gender differences in susceptibility to environmental health factors, such as: persistent organic pollutants on women's reproductive health);*
- *environmental strategies and the vulnerability of women/men/different social groups;*
- *gendered risk perception of technology and natural damages.*
- *gender, environment and the psychical dimensions*
- *gendered symbolisation of nature and technology;*

(III) Shaping Power of Women in Science, Technology and Politics

- *women's/men's positions in science, technology and politics (in planning-positions, decision-making-positions and controlling-positions);*
- *participation of women, of lay persons, of NGOs in environmental strategies and in participatory decision-making;*
- *women's knowledge/indigenous' knowledge in environmental research and strategies;*
- *standards and instruments of integrated gender and environment impact assessment of gender-sensitive eco-measurements etc.);*
- *models of integrated environmental and social monitoring;*
- *gender-sensitive and social-sensitive technical design;*
- *gender-sensitive indicators of sustainable development;*
- *gender-disaggregated data.*
- *feminist critique of natural sciences and technology and their relevance for environmental strategies;*

3.2.2 Specific Priority Issues of a Gender Impact Assessment

For any Gender Impact Assessment in specific thematic fields of environmental research (as for example in the field of global change) these general priority issues must be specified, i.e. specific priority issues must be identified.

Thus, in the following, we will present the debate about gender research in different thematic environmental fields (following the thematic structure of the Environment and Sustainable Development Programme of the 5th European RTD Framework Programme), and from this derive specific priority issues for gender research in these fields.

4 Urban Sustainability

4.1 Research Topics: Sustainability, the City and Gender

In Agenda 21, issues of gender and sustainable urban development are addressed in the context of

- improving the social, economic and environmental quality of human settlements and the living and working environment of all people (Chapter 7: “Promoting sustainable human settlement development”),
- planning and management of land resources (Chapter 10: “Integrated approach to the planning and management of land resources”) and
- decision-making, planning and implementation processes on a local level (Chapter 28: “Local authorities' initiatives in support of Agenda 21”).

Issues of gender and urban development were specified at the World Summit on Human Settlements, Habitat II, Istanbul 1996. The primary role of women in human settlements is acknowledged throughout the Habitat Agenda. Furthermore, gender equality is addressed in a particular section of the document. The Habitat Agenda provides a comprehensive understanding of sustainable urban development, including the objectives of

- women’s full and equal participation in urban planning and management,
- women’s equal access to resources, services and opportunities to employment, inheritance, ownership, credit, personal development, and decision-making,
- women’s equal access to safe drinking water and sanitation,
- woman’s empowerment and poverty eradication and
- combating social exclusion and discrimination.

The document also outlines strategies, including

- practical methods to integrate gender perspectives in human settlements development,
- gender disaggregated data,
- education and training for women and
- shelter policies benefiting vulnerable groups.

Furthermore, women and good urban governance, as well as women and secure tenure are relevant areas of the Istanbul+5 preparatory process. ‘Women in Urban Governance’ was the global theme for the World Habitat Day in October 2000.

In accordance with the issues of the political agenda outlined above, three crucial tasks can be identified for research activities in the field of sustainable city and gender:

- accounting for gender inequality in living conditions,
- understanding barriers and obstacles that prevent women from full participation in urban life and
- helping design strategies and policies to improve women’s living conditions and to enhance women’s participation in urban life.

4.2 Urban Sustainability and Gender: State of the Art

4.2.1 Gender Approaches in Urban Research

a) The Emergence of Gender Analysis in Urban Research

In the last three decades a considerable body of research has evolved around the issues of gender and (sustainable) city. Feminist and non-feminist scholars, covering almost the entire range of disciplines in urban studies, have examined living conditions of women in the city, often developing innovative cross-, inter- or even trans-disciplinary concepts and methodologies. *Gender related approaches have evolved particularly in the fields of town planning, design and use of urban spaces, housing, mobility and transport, and environmental quality, focusing especially on the issues of the access of women to urban resources, infrastructure and services, the differing use patterns of women and men as well as different needs of women, children, girls and elderly women.*

Gender approaches have been successfully established in academic research in at least some EU-countries (e.g. chair for feminist urban planning at the University of Dortmund, Germany), or independent research organisations, like the Sectie Emanzipatie (SEIROV) of the Nederlandse Instituut voor Ruimtelijke Ordening en Volkshuisvesting (NIROV) (Dutch Institute for Environmental Planning and Housing Affairs) (Gérard 1994). Research networks and professionals' associations have been established in a variety of EU-countries (e.g. FOPA in Germany, the Group Cadre de Vie in France or Women's Design Centre, UK). Publication organs, specialising in gender issues exist in different European countries, such as the PlanerIn or Freiraume in Germany; or the Women and the Built Environment (WEB) Magazine, UK.

On a European level, the City & Shelter network is committed to incorporating gender issues into decision making in the fields of town planning, transport urban safety and habitat. This network co-ordinates research and the exchange of information. In 1994, City & Shelter issued "The European Charter for Women in the City" (Charte Européenne des Femmes dans la Cité 1994). Finally, the network has set up several databases to disseminate the findings of gender relevant research as well as political statements and debates on a European level.

b) Theories, Concepts, Research Topics and Basic Assumptions of Gender Analysis and Urban Research

Gender analysis in the field of urban studies has evolved mainly in the disciplines of architecture, planning sciences, and geography, but has also taken approaches from sociology, psychology, economics and historical studies into account. Among theoretical and conceptual approaches are the analysis of use patterns related to the built environment, gender division of work, cross-cultural analysis, time budget analysis, and assessment and evaluation of use quality of homes, housing environments and public spaces (IJURR 1978).

Looking more closely at women and the differing patterns of women's and men's everyday life, *gender analysis in the seventies and eighties showed that the structuring of urban space and of the built environment does not match the needs of women*. Women have still more responsibility for domestic work and child caring, the daily life of women is much closer tied to their immediate housing environment than that of men. Gender analysis showed a 'lack of fit' (Wekerle et al. 1980) of women's lives, needs, expectations, and activities and the urban environment especially in the areas of housing, mobility, access to local facilities and services and access to public urban space (Coutras 1984, 1996, Dörhöfer et al 1998, Paravicini 1995).

Apartments are designed corresponding to norms oriented to the alleged needs of a nuclear family. They are characterised by a hierarchical ordering of rooms with large living rooms, and provide only small rooms for children and domestic work, as a consequence housework and child-care is difficult to manage. Moreover, housing environments are often monotonously designed and have only little use quality for women and children (Flade 1987, Chapman et al. 1999).

Urban transport systems are car-oriented, while women are more frequently dependent on public transport than men. Transport facilities are geared to male commuting patterns, not being appropriate to women's travel patterns, the latter being more complex than those of men are (Liggett 1992).

Access of women to public spaces, like streets, places or parks, is often restricted due to poor social use quality of these spaces. Women's behaviour related to public spaces is much more defensive than that of men. Research showed that girls, while playing, stay closer to their homes than boys do. *Women associate public spaces more frequently with a lack of safety and a feeling of being threatened. Finally, women are more likely than men to avoid abandoned public spaces or places that have only little social use quality* (Paravicini 1999, Rendell et al. 2000, Spitthöver 1989).

Thus, rather than being gender neutral, the prevailing patterns of urban development after World War II are biased towards the needs of men, discriminating against women and preventing them from active participation in urban life. The close connection of space and citizenship is highlighted in the European Charter claim that "women ... have still to identify themselves with, and appropriate, areas and services in their daily environment before becoming fully-ledged citizens" (Charte Européenne des Femmes dans la Cité 1994).

The discriminating character of contemporary cities is deeply rooted in the basic assumptions guiding urban planning in the 20th century. It results from the spatial separation of work, regeneration, reproduction, and mobility which is expressed in the Charter of Athens and which does not take the gender division of work appropriately into account (Charte Européenne des Femmes dans la Cité 1994).

A main reason for this, the absence of women from decision-making and production of knowledge in urban management and planning, has been pointed out by Dina Vaiou (1994) in a comparative study examining the participation of women in urban planning

and decision-making processes in different European countries. The study showed that among both, students and teachers, in the departments of architecture and planning women are in the minority. Similarly, the presence of women in those parts of public administration where decisions about the urban environment are taken is still quite limited (see also Little 1994a).

To overcome the male biased character of cities, feminist researchers and planners developed visions of a 'non-sexist' (Hayden 1980), or 'feminist city' (Andrew 1992). Although the following list is taken from North America it might easily be applied to the European situation. Among the core issues are:

- mixed urban land use and close physical relationship between services, residences, and work-places ('city of short distances'),
- active social housing policy, promoting mixed housing projects for residents of different incomes, household forms, ages etc.,
- access to a well developed network of services (day care, care for elderly and chronically ill etc.),
- access to safe public places, including issues of practical safety, like smooth and well illuminated sidewalks, easy access to pedestrian crossings etc., but also of physical attack-free safety through lively environments promoting a high degree of interaction between residents,
- access to safe and affordable public transport,
- access to meaningful jobs and community based economic development,
- a feminist planning process, enrolling users in the planning process and
- architectural design and public art, strengthening the identification of different groups of users with public space (Eichler 1995:16f).

In the nineties, the growing inclusion of women in the paid labour force, the pluralisation of living and household forms, migration and increasing polarisation of income as a result of economic globalisation have affected the situation of women considerably. The social positions and life styles of women have multiplied. Women with qualified jobs and high income are moving to upgraded inner-city districts, while former inhabitants of these areas find themselves in public housing settlements at the edge of the cities (Alisch 1993, Borst 1990). Socio-spatial analysis has analysed emerging new patterns of social segregation of urban space. Lower income groups, immigrants, long-time unemployed people tended to be concentrated in inner-city areas and/or extensive peripheral estates sometimes in substandard dwellings. These residential areas frequently are characterised by insufficient infrastructure, poor public services, often suffering also from environmental degradation (by traffic noise, air pollution, etc.). *These new patterns of social segregation also include a gender dimension. Among these groups women living in single-parent households, immigrant women, families with more than two children are among the most vulnerable groups* (Rodenstein et al. 1996, Pfau-Effinger 1997).

As a consequence of these changes, the assumption of a homogenous role and corresponding needs of women has crumbled in gender analysis. By contrast, gender re-

search has to tackle a multiplicity of differences - in terms of class, culture, ethnicity, and gender. These differences result in different organisation of everyday time and space, and hence define different needs of women. Thus, besides gender, also social status and the role of values, attitudes and life styles have to be analysed, giving way to an examination of mobility and or housing styles (Öncü et al. 1997).

Finally, the symbolic dimension associated with the construction of urban space has gained increasing attention. ***Besides the physical and social conditions of urban space, also the aesthetic quality of architecture and the semiotic processes that shape the meaning of urban space*** (e.g. by mass-media or public discourse) ***are examined*** (Spain 1995, Paravicini 1998).

c) Implementation

At least some of the results and recommendations of gender sensitive research have been adopted by local administrations and other political bodies and have informed policies and best practices in these fields. ***In various European countries, feminist architects and planners have been involved in the designing of model projects of women- and family-friendly construction and housing*** (for an overview for Germany see Dörhöfer et al 1998). The Dutch Ministry for Housing Affairs has also funded the building of settlements designed according to the needs of women.

The German Federal Ministry for Transport, Construction and Housing has sponsored research within the 'ExWoSt' (Experimental Housing and Urban Planning)-Programme on the specific needs of single-parent households related to housing, housing environment and neighbourhood. The Ministry has also provided funding for the construction of selected model projects (BfLR 1992, 1994, 1996). On a regional level, principles of women-sensitive housing were included in the "Technische Wohnungsbaurichtlinien 93" (Technical Guidelines for Building and Housing) defining standards for public founded housing (HML 1992).

Guidelines for gender-sensitive planning have been adopted by different cities, e.g., the 1984 scheme for urban development of the City of London included a section on 'women plan London' (Taylor 1988), or the city of Hamburg's 'Key Objectives of Urban Development'.

However, despite the success at the level of research and model projects, observers find a remarkable contradiction as far as implementing the results of gender analysis into mainstream policies is concerned. "Even if numerous good practices in gender-sensitive planning exist, the current practice of federal and local planning authorities, housing companies and the private sector has not changed significantly" (SRL 1998:35). Thus, the emergence of gender analysis in the field of urban research might be considered, at least partly, as a success story. However, while there is a growing influence of women networks on urban policies, there is still a lack of implementation of gender relevant

aspects into mainstream urban management strategies and policies, due to poor representation of women in city management and decision-making processes.

4.2.2 Sustainable City and Gender

a) Vision of a Non-sexist Sustainable City

In the wake of the Rio-process women have played an active role in the sustainability process also at the city level. Moreover, the concern with the close connection of citizenship and space has also implied a strong ecological awareness and orientation of feminist and gender sensitive approaches (Karhoff et al. 1993), anticipating some of the main issues of a sustainable city. Regarding the scheme of the town of Seaton (Canada), which was designed as a sustainable city, Margrit Eichler remarks an “extraordinary degree of overlap” (1995:17) between the vision of the Seaton planning team and basic principles of a feminist or non-sexist city.

Overlap exists especially in the areas of physical relation between services, residences, and work places where feminist and environmentalist approaches share the commitment to overcoming the functional segregation of cities adopting the models of decentralised concentration, mix of functions and a ‘city of short distances’. Similar convergence can be stated in the fields of mobility, housing and participation. Both, the non-sexist and the sustainable city – are characterised by relatively high density housing and an approach to mobility that reduces car dependency, promoting public transport and encouraging alternative forms of mobility, like walking or cycling.

Yet, there are also significant differences. Even if mainstream approaches to sustainable urban development share a commitment to equity and stress the need to improve neighbourhoods, they often do not address social and especially gender, concerns appropriately. Whereas feminist approaches depart from a comprehensive understanding of sustainability, many sustainability approaches fail to deal with social issues that are not directly related to physical features of our built and natural environments (ibid.). By contrast, women do not address physical aspects in isolation. They rather adopt the perspective of users, considering environmental issues embedded in everyday life, because they have the everyday experience and know about the needs of different social groups.

b) Gender and the Urban Environment

Only recently, in the context of issues like the eradication of poverty or the fight against social exclusion, social issues have gained more attention in urban sustainability policies. For example, the EU strategy “Sustainable Urban Development in the European Union: a Framework for Action” includes the promotion of equity, social inclusion and regeneration in urban areas as one of the basic pillars (European Commission 1998).

Yet, despite these attempts there is still a lack of integrated approaches, both on the levels of knowledge production and the design and implementation of policies (Slob et al. 1996). *Assessment of environmental quality and design of policies related to the urban environment are dominated by a technical perspective. Little attention has been given to people’s perception of environmental issues as well as to the impacts of envi-*

ronmental changes on different groups of urban residents. Environmental impacts are mainly calculated in average per capita or household ratios. Hence, they fail to take a gender perspective into account. Only a small amount of research has been carried out on issues of gender and environment (Atabay 2000, Fadda et al. 1999, Schultz et al. 1991, and BMBF 2000).

Today some 70 % of the European population (560 Mio.) live in cities (UN/ESA 1997). A great part of the urban population suffers from severe, localised environmental problems, caused by the impacts of noise, pollutants, waste, and restricted availability of fresh water and open space. Particularly, the impacts of transport and consumption patterns, like energy and water consumption and waste production, as well as of urban sprawl are considered to be the main threats on the urban environment (EEA 1999).

Urban air pollution causes a range of problems, including loss of quality of life as well as health risks. Although air quality in the large European urban areas has improved in recent decades, nearly 40 million people residing in the 115 larger European cities still breathe air that exceeds the WHO air-quality guidelines (ibid.). The impacts of urban air pollution clearly have a gender dimension that remains largely unexplored. Environmental impacts on the urban population are usually assessed in terms of health risks. However, conventional measurements do not explore how the quality of life of different groups of urban residents is affected. What does urban air pollution mean to a mother who has to care for children who are more likely to be affected by health risks, such as irritation of the respiratory tract etc.? Air pollution is a problem particularly in summer, when children are forced to stay at home in order to avoid health damages resulting from ozone smog. Even if a mother is not exposed to health risks, it is she who has to explain to her children why they can not go out swimming or playing. It remains to be examined whether existing or projected standards take the needs of those groups of city residents who are particularly vulnerable into account.

Another example applies to urban noise issues. About 65 % of European City residents are exposed to high levels of noise caused by roads, airports, or railways (ibid.). Noise exposure affects people both physiologically and psychologically. It is well known that the perception of the various types of transport noise differ between individuals. Again, there is only little understanding of conditions that influence individual perceptions of noise. And again it remains to be explored, whether existing strategies for mitigating noise problems address the gender dimension appropriately.

A recent study of Ursula Paravicini (1999) on the role of open spaces, including green spaces like parks or public gardens, for the integration of different groups of city inhabitants provides an example of how social and gender concerns can be integrated into research on the urban environment. The study also demonstrates the potential contribution of gender analysis to a more comprehensive understanding of sustainability. Paravicini starts from the assumption that *the quality of urban spaces does not simply depend on physical factors, but is also shaped by social use and perception*. She dem-

onstrates convincingly that public spaces are especially important for the perception of social, cultural and gender differences. Public spaces can also serve as a stage for social communication and interaction where contradictions and conflicts can be acted out. Drawing on these insights, Paravicini examines how public spaces in different European cities are used by different groups of inhabitants in order to evaluate innovative strategies of redesigning public spaces in terms of equal access, safety and support of social interaction and communication (Paravicini et al. 1999).

4.2.3 Sustainable City Planning and Rational Resource Management

a) Urban Governance

At the turn of the century, European cities face rapid economic, social, demographic and environmental transformations. ***A major challenge to sustainable city planning and management in Europe is the lack of integrated urban policies.*** (EEA 1999) Existing policies are insufficient to tackle the growing threats arising from prevailing transport and consumption patterns, as well as from urban sprawl. These shortcomings are mainly due to two reasons. Existing policies are primarily sector-oriented. Hence, there is an urgent need for cross-sectoral integration, particularly with regard to the land use/transport interface and environmental impacts of consumption patterns (Slob et al. 1996). Furthermore, policy making also requires ‘vertical integration’ so that responses can be tailored to unique local circumstances and priorities, including also new links between community activism and urban policy.

b) Good Governance

Good Governance has been promoted as an integral part of implementing sustainability strategies in urban policy and decision making. Good governance implies shifts in urban government towards the integration of public, private and civic sectors and particularly the engagement of groups and communities formerly excluded from decision-making processes. Good governance is based on the rules of subsidiarity, solidarity, partnership between the public and private sectors as well as between the government and civil society. It implies also integrated action between various levels of government; separating policy from delivery of public services and facilities and learning from good practice (Hall/Pfeiffer 2000).

Women play a very active role in community groups and associations, but they have only little influence on decision-making. Hence, the need to improve women’s representation in political structures is still a key issue as far as making urban governance more responsive to the needs of women is concerned (OECD 1995). Moreover, new forms of co-operation and partnership between women and men in urban government should be developed which include women at all stages of policy, planning and management processes. Gender awareness and tools for gender competent practice need to be developed among urban development practitioners within the public, private and non-profit sectors. Finally, participatory urban partnership requires a commitment to

gender sensitive organisational advancement and capacity building. Capacity building is crucial to enhance the enrolment of women not just in processes of implementation, but also in understanding and identification of problems (ibid.).

Good governance certainly provides opportunities for including NGOs and community associations in urban decision making. However, the impact of good governance strategies on existing equal opportunity policies remains largely unexplored. In many European countries, empowerment strategies are based on equal opportunity strategies especially in the public sector. The public sector also plays an important role for the implementation of gender sensitive issues, e.g. by setting of standards for publicly funded housing. The increasing number of public private partnerships and the trend towards privatisation of public services and facilities implies a loss of control of the urban government in these sectors. Privatisation of public services and facilities is supposed to enhance efficiency and user orientation. Yet, until now not much research has been done to examine how different groups of the urban population are affected by these changes. Other issues for research arising in this context are how public participation and especially the participation of women can be ensured, and how the acknowledgement of gender sensitive approaches can be guaranteed as well. There is a need to develop new instruments and tools, such as audits or other forms of regulation that also include a gender perspective.

c) Urban Planning and Gender

In the particular field of urban planning, support for women planners and the enrolment of women's organisation are basic strategies for making planning more responsive to the needs of women. Michel (OECD 1995) makes a number of suggestions that are particularly useful for supporting women planners in planning processes. Michel's suggestions include: openness of the planning process to participation, including at least two or more women in planning committees, enrolling women's groups or associations systematically in municipal hearings in the planning field and creating an atmosphere of discussion that allows women to have their own say (ibid.).

In several EU-countries, women's community groups or organisations are involved in urban planning to ensure that gender issues are included on policy and implementation agendas. In the UK, in some cities, e.g. Sheffield or Harlow, groups like Committees on Women's Issues (ibid.) routinely review planning and other projects. In the Netherlands, the Dutch Women's Advisory Committees for Housing Construction (VAC) have established a network of residential consumer organisations in over 280 municipalities. The main activities are the assessment of plans for dwellings and the residential environment (land use plans, traffic plans etc.). VAC's form part of construction and planning teams, maintaining a regular dialogue with the local authorities, builders and housing associations (VAC n.d.).

In other countries, like Austria or Germany, equal opportunity units or offices were established in municipal administrations. In Vienna, the Office for the Promotion and Coordination of Women's Affairs was installed in 1991 as a municipal department with an own budget. The office is not obliged to participate in decision-making. Yet, it aims to insert a gender perspective into every day community politics, especially in the fields of urban planning and housing for women (OECD 1995).

d) Local Agenda 21 and Gender

Local agenda 21-processes emerged in many European countries. They play an important role in supporting community action, intensifying dialogue between city residents and urban governments, and increasing participation of citizens – urban decision-making. However, a recent study carried out jointly by ICLEI and the German Institute for Urban Affairs (DIFU) has shown that the range of issues as well as the scope of participation varies considerably in different countries, due to differing local conditions and national policies (BMU 1999). The study provides valuable insights, but the gender dimension is not mentioned.

Although women play an important role in local agenda 21 processes, until now only little research on local agenda 21 and women has been done. Among the few exceptions is an empirical study by Schachtner and Seeg on agenda 21 projects and women in Germany (Schachtner 2000). Schachtner and Seeg discovered that the typical woman that takes part in local agenda 21 initiatives is middle-aged, 40-60 years old, and from the middle class. The local agenda 21 process obviously does not appeal to younger women (or else they do not have the time because of family duties). With a few exceptions, agenda groups have not been medium for articulation for immigrant women so far (Schachtner 1998). A remarkable example can be found in the city of Duisburg, where immigrant women have been encouraged to evaluate quality of life of the city in the context of local agenda activities. But despite these examples, it to be seen how the basis of local agenda processes can be further enlarged (Frauenbüro Duisburg 1999). Schachtner concludes that the participation of women has set free a potential within the communities that had not been visible before. Moreover agenda 21 processes show a new understanding of politics: It is not merely acceptance of politics that has been examined by participation of citizens, but it is citizens themselves that are shaping their own future. Innovative approaches refer particularly to topic-based networking to overcome the departmental structure of political and administrative systems by, e.g. initiative that are related to a specific issue, like public open spaces. Other issues refer to structural networking and dialogue orientation, an acknowledgement of variety and difference among women in terms of age, social status, ethnicity etc. and a resource orientation, i.e. starting from existing resources or potentials rather than deficits.

The “future workshop” methodology was suggested to improve public participation and foster women's involvement in designing the city of Heidelberg with a gender perspective (UNED-UK n.d.). This methodology was used to formulate the “City Development

Plan 2010 - Guidelines and Goals”, Heidelberg’s gender-sensitive plan of action and assessment. The City Development Plan was issued in 1997, highlighting sustainability as a central goal of city development. Preparation of the city development plan involved setting up a special committee that, inter alia, managed public discussion and public participation. Women’s groups have been an integral part of these participatory processes. To enhance women’s participation fourteen seminars using the Future Workshop methodology were conducted. The results of these workshops were integrated into the “Women’s Perspectives on City Development” report which was then incorporated into amendments for the city development plan.

Implementation into the city development plan has been a main prerequisite for the success of local agenda 21 process in Heidelberg. But in many cases a lack of commitment at the part of urban government to implement the outcome of local agenda 21 processes in local policies has been stated. This lack of commitment has been identified as a main obstacle to the local agenda 21 processes (BMU 1999). Hence, it remains to explore how it can be ensured that initiatives, proposals and action plans resulting from the local agenda 21 process be implemented in urban decision making. Which enabling conditions and which obstacles and barriers can be identified?

4.2.4 Improving Quality of Life

Measuring and assessing the sustainability of cities requires tools and instruments that integrate the environmental, economic and social dimensions of sustainability. For example, these instruments have to link issues like social exclusion, health, safety, and access to services and essential supplies to city ecosystems. Approaches to integrated assessment of urban environment have mainly been developed within the OECD ‘pressure - state - response’ (OECD 1997) and the EEA ‘driving forces’ - framework (EEA 1995). The “Ecosistema urbano” approach of the Istituto de Ricerche Ambiente Italiano (Istituto de Ricerche Ambiente Italiano 1998) or the “Integrated Sustainable Cities Assessment Method” (ISCAM) which has been applied to the Greater Manchester Metropolitan Region (Ravetz 2000). These instruments are based on a causal framework that assesses societal impacts on and responses to, the quality of the urban environment in terms of driving forces, pressures, states, impacts and responses. Approaches, like ISCAM are designed to also include issues – such as desire for access and mobility or life style patterns. However, these values are usually measured only in a quantitative way. In a second step these values are related to physical indicators, usually in terms of average per capita or household ratios.

Based on a comprehensive understanding of quality of life, G. Fadda and P. Jiron (1999) have proposed an integrated approach to assess the impact of environmental deterioration on the quality of life on urban inhabitants, especially those of lower income and women. In addition to conditions of the physical environment, this approach also takes those conditions into account that emerge from social relationships as well as expectations and perceptions of people, combining quantitative (the use of technical data) and qualitative (observation, questionnaires, discussions) methodologies. Special em-

phasis is given to the issue of how perceptions are shaped by gender necessities, roles and relationships as well as by the degree of access and control of resources and enrolment in decision-making processes.

Fadda's methodology is oriented towards action research and public intervention. The "methodology should be able to measure objective and subjective conditions of urban quality of life and generate indicators, based on the perception and expectations of the community; and as a result, be able to compare different realities and to guide political and local urban strategies to improve quality of life in the urban environment" (Fadda 2000).

4.2.5 Development and Demonstration of Technologies for Safe, Economic, Clean, Effective and Sustainable (Re) Construction of the Built Environment

Revitalisation of city centres and neighbourhoods has become an urgent topic for European cities (Krautzberger 2000). City centres are threatened by social and commercial decline due to the establishment of large retail and leisure facilities at the outskirts of cities. Particularly in large public housing settlements of the sixties and seventies, neighbourhoods are eroding, due to increasing social polarisation and exclusion. To cope with these challenges, reconstruction of building substance and the reuse of urban spaces has become increasingly important in urban planning and development as well as in the building and housing sector (ibid.).

How a gender perspective can be fruitfully included in the design of strategies towards urban revitalisation, can be demonstrated by the example of the Open Sesame Project (UK). Women are more likely to rely on local shopping facilities and town centres that can be easily accessed by public transport or walking. ***Increasing establishment of large warehouses and of hypermarkets at the peripheries of cities implies for women a loss of both shopping and employment opportunity in their immediate living environment.*** Open Sesame is a planning project in the London borough of Haringey that addresses the needs of women in particular, and that seeks active involvement of the community. The Open Sesame Project has been able to successfully highlight access problems of women as carers and to raise awareness of planners and shop-owners on these issues. It also has encouraged the business community to address the problems of access by giving awards to shops that improve access and facilities. Finally, it has succeeded in involving women living in Haringey in all aspects of environmental improvements (Takmaz Nisancioglu 1994).

A second example is related to the sector of housing. The housing sector is subject to reorientation from the construction of new buildings to conservation and modernisation strategies that lead to technical and ecological improvement of the existing housing stock, at the same time fostering social reintegration of eroding neighbourhoods (Deutscher Bundestag 1998). Due to the immense investment needed for modernisation within the next decades the development of appropriate management strategies for sustainable modernisation of the housing stock becomes a key priority. The German Min-

istry for Education and Research (BMBF) is creating a special funding area, focusing on issues of reconstruction. A pilot project within this area is the research project on “Sustainable Modernisation of Existing Buildings – integrated services for sustainable housing styles” (Schmitz et al. 2000). The objective of the project is to develop a comprehensive, economically, socially and ecologically integrated concept for modernisation of medium sized public housing estates, built in the late fifties and early sixties. The particular aims of the research project include:

- improving the co-operation between the housing corporation and the tenants and developing new advisory and service offers, corresponding to the tenants needs and
- enhancing economic efficiency by intensifying the co-operation between the economic actors (architects, firms of consulting engineers, site management, craftsmen etc.) involved in the modernisation process.

An overarching goal is safeguarding the long-term economic viability of the existing housing stock by updating the building substance and the technical equipment of the buildings according to the tenants’ needs, as well as improving the tenants’ housing conditions, strengthening social networks and supporting community building activities among the residents.

The preliminary results of the project underline the importance for rebuilding strategies to adopt a gender perspective. For example, participation of residents is a crucial element for a successful strategy of sustainable modernisation. ***Empirical research has demonstrated that women have a strong interest in improving communication among tenants, hence they are to be addressed as a main target group in the modernisation process.*** Another key issue involves tenants’ living conditions, needs and expectations that have to be respected in the context of the design of leisure facilities, housing environment etc.

Among the research that is funded by the German government, there are also studies related to the particular situation of settlements in Eastern Germany. There, issues of demolition have also been investigated in the context of a general decrease of city population, but also as a strategy towards stabilisation of neighbourhoods and social inclusion (Forum Leipzig Gruenau 2000). Similar research projects on integrated rebuilding strategies are also being carried out in Sweden, which can not, however, be discussed here in greater detail.

4.2.6 Gender Analysis and Traffic Research

Issues of traffic and transportation are among the areas of urban research that have been investigated most intensively from a gender perspective. Among the main issues of gender analysis in traffic research are differing access to and availability of transportation modes, differing travel patterns, travel and transportation needs and use patterns of men and women, as well as differences in traffic behaviour of subgroups, like children, elderly women or single mothers. Furthermore, issues of participation in traffic planning processes and the role of new technologies in this field have been highlighted.

'Gender and transport' has begun to be featured internationally as a recognised issue in transport research. Research networks were created, for example "Frauen in Bewegung" ("Women in Movement") (Germany), "Women and Transportation" (UK) or the international "EuroFEM – Gender and Human Settlement" network. Furthermore, 'gender and transport' has become a main topic on the agendas of conferences, e.g. "Women Travel Issues" in 1978 and 1996, the European congress "Emancipation as related to Physical Planning, Housing and Mobility", 1994, the international conference, "Gender and Human Settlements", 1998 and the World Conference on Transport Research WCTR, 1998.

a) Research Topics and Basic Assumptions on Gender and Transport

Transport is an essential part of men's and women's lives. It determines access to a wide range of resources, including employment, child-care, education and health. Therefore spatial mobility is a precondition for social mobility, social equality and inclusion.

Empirical research on gender and transportation is mainly developed within the conceptual framework of gendered division of labour and an analysis of functional segmentation of urban spaces. Gender differences in transport and travel patterns result from differential accesses to economic, social and time resources (Fouracre/Turner 1995). ***Women's greater domestic responsibilities, coupled with their weaker access to (household) resources also have significant consequences on their transport and travel patterns.***

Gender analysis has shown that there are major differences in travel patterns of men and women. But empirical findings also suggest that there are substantial differences among subgroups of women, which may be greater than aggregate differences between the sexes (Rosenbloom 1996).

Special emphasis has been given to the situation of ***single mothers, whose number is growing in European cities***. Female headed households are especially vulnerable and threatened by social exclusion, due to time poverty and exposure to a high risk of poverty, often living in residential areas with poor quality of public transport services (Grieco 1995).

Studies in various European countries have pointed out that women's travel patterns are in general different from men's. Women (in comparison to men):

- still make the vast majority of the household trips for the purposes of shopping,
- have to escort their children to day-care facilities, schools, doctors or leisure activities,
- often have purchases and children with them,
- are making their travel patterns often in form of 'trip-chaining' (i.e. making travels with more than one purpose),
- are more likely to travel on local and non-radial routes,
- often travel off-peak and
- are less willing to travel after dark.

The key difference is considered to be the propensity of women to combine a set of activities relating to their extensive range of household tasks within the overall structure of one journey (trip-chaining), whereas men are more likely to make a single purpose trip (Grieco/Turner 1998a).

The different travel patterns are also visible in quantitative analysis. Women (in comparison to men), make shorter daily trips, travel fewer kilometres by car, are seldom sole occupant of a vehicle, are less likely to have a car or to be able to drive, and make more trips by walking and public transport.

It has been shown that women use less individual transport than men do (Carlsson-Kanyama et al. 1999, City: mobil 1999). Women are even less mobile; in the case of Sweden, the daily kilometres travelled by men exceeded those travelled by women by 43 %. Consequently, the overall mobility energy consumption for women is lower than that of men. Carlsson-Kanyama, Lindén and Thelander (1999) have been able *to show for Sweden that the gender differences in energy consumption for mobility were as big as energy consumption differences between some industrialised and least-developed countries*. And in Sweden the employment rate for women is almost as high as for men. Hence, the difference in mobility does not result from employment, but has to be attributed mostly to income differences. The group with the least energy consumption for mobility are elderly women with lower income.

However, there is a trend towards increasing mobility and car dependent travel patterns of women. Women's travel continues to grow not only in the total vehicle miles of travel but also in terms of the number, frequency and length of trips (Jeff cited in Rosenbloom 1996). This trend has been fuelled by a variety of factors. In the last decades, employment of women has increased in EU-countries. At the same time the growing number of larger town centre developments or peripheral hypermarkets has emerged (Gavron cited in University of East London/DETR 2000). Land-use patterns have become more and more diffuse so that most women are encouraged to make the majority of their trips using a car (Rosenbloom 1993). Yet, despite increasing car ownership and use among women, there is still an important market for public transport among women (University of East London/DETR 2000).

Women constitute the majority of users of public transport. However, public transportation is usually designed to cater for unencumbered people travelling on their own at peak times on radial tours. *Women's travel needs are in many respects distinct from that of men. Women travelling with children have the most difficulties in using public transportation. Design features of the vehicle, notably step height, are particularly relevant to boarding and alighting*. Lack of space for shopping, luggage, pushchairs, buggies, prams and wheelchairs is a recurrent complaint (ibid.).

Another reason is closely connected to the issues of safety and security, often neglected in conventional traffic research. Gender analysis has pointed out that, due to physical size, strength and mobility, women are more vulnerable to attack and harassment, and

thus have a greater concern for personal security. The fear and threat of violence limits not only women's sense of security and safety, but also has implications for their behaviour (Kelly 1999). The British Crime Survey (1992) confirmed that women restrict their movements far more than men do to avoid danger. Issues of personal safety and security are at the top of many women's concerns, particularly when travelling on public transport (ALA "Safety for women on London's stations" quoted in University of East London/DETR 2000). Moreover, a concern with safety and security is considered to be the major imperative to car use for women (University of East London/DETR 2000).

Thus the prevailing car orientation of urban transport systems and the dominant structuring of urban space have been identified as one of the main barriers to women's equal participation in urban life. The feminist transport researcher Spitzner states that "orientation towards the car in research, planning and policy produces a discrimination of space and time of women, stabilises the structure of domination and violence, worsens the psychological discrimination of women and is counterproductive to very important aims of the policy of equal chances like better conditions for combining work and family, assuring an own (material) existence etc." (Spitzner 1994a:292).

As a result of the prevailing model of car dominated mobility, reproductive work is becoming even more traffic-intensive and the attainability of places for reproduction or social contacts has decreased. The everyday mobility of people without cars is more and more restricted by automobile traffic. Care giving to children becomes more time intensive, because they can't travel or play unescorted in the car dominated unsafe environment. Furthermore, health risks and losses of quality of life resulting from pollution, noise and other negative environmental impacts of traffic-emissions particularly affect women, children and elderly people.

Lack of participation of women in traffic research as well as in the design and implementation of traffic policies is considered to be a main reason for gender blindness in traffic research and planning. Women are only represented amongst transport professionals and transport politics in small numbers. To improve gender responsiveness of urban transport systems, participation of women at all levels of decision-making is crucial.

As a consequence, participation of women should be encouraged in the field of research, particularly in technical traffic research and development. Adequate representation of women within user groups should be ensured. Furthermore gender issues should become part of the professional training process. Finally, research and development of transportation systems should enrol users of urban transportation, and especially those being most discriminated by current transportation policies (Grieco/Turner 1997).

b) Sustainable Transport and Gender

Despite recent trends to increasing the mobility of women, gender analysis has demonstrated that women's mobility is less energy consuming and less harmful to the environment than men's. Thus, it can be concluded that women's travel patterns have a higher actual adaptability to a transportation system that is ecologically sustainable and socially equitable (Polk 1996). The Centre for Sustainable Transportation has outlined basic features of a sustainable transportation system. Using this definition, and the agenda of gender sensitive approaches to urban transport, it can be stated that a sustainable transportation system provides good opportunities to meet many of the travel needs of women more appropriately than current transport systems. The more complex travel patterns of women result in a demand for reducing the distances between the home, workplace, shopping and child day-care facilities in order to make it easier to arrange paid employment with reproductive work: This vision of a 'city of short distances' is voiced by ecologists and planners, too.

Yet, as a caveat it has to be mentioned that women did not join in the 'ecological avant garde' deliberately. Hence, gender analysis is needed to shape sustainability strategies that are designed to match the needs of different groups of people appropriately. The impacts of sustainability strategies on different groups of women are to be monitored to avoid increasing social exclusion. ***A lack of both gender awareness and gender analysis has to be admitted in sustainable transport planning, policy and research. If social impacts are addressed in current research on sustainable transportation, the gender dimension is often neglected.***

c) Towards Integrated Approaches

Another shortcoming of current traffic research results from neglecting so-called soft factors, like motivations, goals, and normative ratings. These factors, which might be addressed as mobility orientations, have an important impact on individual travel behaviour of both women and men. The research project City: mobil (1999), which was carried out by an interdisciplinary research team, demonstrated the influence of mobility orientations on traffic behaviour and consumption patterns. Owning and driving a certain car in a certain way is not primarily dependent on functional or economic factors. It rather "signals membership in a particular milieu, but also detachment from another" (Götz 1997). Linking the examination of mobility orientations and traffic behaviour to a target-group-design is also a fruitful approach to analyse gender aspects in ecologically oriented traffic research and to investigate the complexities of gender in contemporary cities more appropriately. This approach is especially useful to design user-oriented strategies to more sustainable modes of transportation.

A main outcome of the above research approach is the finding that shifts towards more sustainable forms of transportation should be built on strategies that aim at decoupling mobility from car dependent mobility. Mobility needs of the urban population should be maintained or even improved in an ecologically and socially agreeable way, which is economically efficient at the same time.

Another example for comprehensive approaches towards sustainable transportation is an integrated strategy, called '4-pillar-concept', which has been adopted by the German Federal Office for the Environment. The concept includes steps towards the avoidance of traffic, towards traffic-displacement, i.e. affecting changes in modes of transport, - steps in technological development, and steps to influence traffic behaviour.

Recent European and national legislation about the privatisation of public transport systems at national and, in particular, at urban levels have far-reaching implications both for women and the environment (Spitzner 1994b). In this regard, research is needed to explore how these transformations enable or constrain the mobility conditions of women and affect public participation.

Research on the linkage of new information and communication technologies and sustainable transportation has not yet adopted a gender perspective. However, the implementation of demand responsive and flexible public transport, and the possibilities of telecommuting, teleshopping, etc. could be very helpful, particularly for disadvantaged, immobile groups. These technologies do not only provide keys to the alleviation of women's time poverty, but also to the demands of reducing the volume of motorised journeys in order to meet the problem created by congestion and environmental pollution (Grieco/Jones 1994). As Grieco and Turner (1998c) remark, no European municipality has yet investigated the potential that is provided by creating a demand responsive public transport provision to service the needs of the least mobile sectors of the community.

d) Gender Oriented Policies and Best Practice Examples in the Field of Transportation

In several model-projects in the area of sustainable urban development, mobility is involved. There is an extensive summary about such projects for Germany, which has been collected by Meike Spitzner and Gabriele Zauke (1995).

The international network "EuroFEM" has developed a "Toolkit for Mobilising Women into Local and Regional Development" (2000), in which the integration of feminist and ecological approaches to traffic avoidance is a topic.

In the UK, a "Public Transport Gender Audit (PTGA)" has been developed by the department of transport studies at the University of East London for the Mobility Unit of the Department of the Environment, Transport and the Regions (DETR). The PTGA provides a potential to enhance user participation and gender awareness both within public and private mass transportation. Factors which affect women's experiences and enjoyment (or not) of public transport are explored, identified and translated into a checklist, which assesses utility and acceptability of existing or projected public transport systems which might be interesting from the perspective of women. The PTGA checklist includes 135 statements related to the topics of women's travel, participation of women in the planning process. The checklist also includes internal organisational

issues and a gender audit. It can be used as a management tool, and even as a community tool.

Despite these attempts the gender perspective is far from being incorporated in mainstream transportation research, planning and policies. *There still does not exist a participation protocol in the transport sector, which ensures that each and every (sustainable) transport project considers the gender dimension.*

4.3 Summary and Priority Issues

Gender analysis has been broadly established in urban research. Scholars from a broad range of disciplines have examined living conditions of women in the city, often developing innovative cross-, inter- or even transdisciplinary concepts and methodologies.

Gender analysis has demonstrated that the structuring of urban space and of the built environment does not match the needs of women. A 'lack of fit' has to be stated between women's needs, expectations and activities and the urban environment, particularly relating to housing, mobility, access to local facilities and services and access to public urban space. Thus, the prevailing patterns of urban development are biased towards the needs of men, discriminate women and prevent them from active participation in urban life. Absence of women from decision-making and knowledge production in urban management and planning is considered to be among the main reasons for the lack of gender responsiveness of the contemporary city.

Due to socio-economic transformations during the nineties, social positions and life styles of women have multiplied and new patterns of gendered social segregation have emerged. Thus, city governments, but also urban researchers, have to deal with a multiplicity of differences in terms of class, culture, ethnicity and gender.

Particularly in the fields of housing and urban planning, results and recommendations of gender sensitive research have been adopted by local administrations. There is a growing influence of women networks on urban policies, but there still exists a lack of implementation of gender relevant aspects into mainstream urban management strategies and policies.

Visions of feminist or non-sexist cities are viewed as having a high degree of adaptability to sustainable urban development. *Both feminist and environmentalist approaches to urban planning share a commitment to patterns of urban land use characterised by decentralised concentration, mix of functions and a 'city of short distances'. Similar convergence can be found in the fields of mobility and housing. However, there are also significant differences, due to different perceptions of the environment. Whereas feminist approaches depart from a comprehensive understanding of sustainability, many sustainability approaches fail to deal with social issues that are not directly related to physical features of the built and natural environments. As a result, the gender dimension is often neglected in approaches to urban sustainability.*

A technical perspective dominates current strategies of urban environmental management. Not much attention is given to people's perception of environmental issues, as well as to the impacts of environmental changes on different groups of urban residents. To better understand the interplay of physical factors and conditions that emerge from social relationships as well as from people's expectations and perceptions, a mix of quantitative (use of technical data) and qualitative (observation, questionnaires, discussions) methodologies should be encouraged. Gender related approaches could make substantial contributions in this regard to an understanding of the interplay of the physical, social and symbolic factors that shape the perception of environmental quality.

Thus, research is urgently needed to develop inter- or transdisciplinary approaches, conceptual frameworks and methodologies for comprehensive approaches to the assessment of urban environmental issues, such as air pollution or noise. These approaches should also take a gender perspective into account. Despite some exceptions, environmental research suffers from a lack of linkage between the analysis of impacts of physical factors on the quality of the urban environment and an investigation of how this quality is also shaped by social use and perception. A useful step towards this objective might be disaggregating of environmental data instead of using highly aggregated per capita ratios (to identify areas and groups of city residents that are affected particularly by environmental degradation). Another would be gender-disaggregated collection and analysis of data. Furthermore, using a mix of technical data and qualitative methodologies (observation, questionnaires, and discussions) would allow taking perception and experiences into account.

Lack of integrated urban policies poses a major challenge to sustainable city planning and management in Europe. Existing sectorally oriented policies are insufficient to tackle with the prevailing transport and consumption patterns and with urban sprawl. Good governance has been promoted as a strategy to make urban policy and decision-making more sustainable by integrating public, private and civic sectors into urban government. Hence, good governance has the potential to include NGOs and community associations into urban decision making. However, the impact of good governance strategies on existing equal opportunity policies in the public sector is largely unexplored. This is also true for the implementation of gender sensitive issues, e.g. by the setting of standards for the publicly funded housing.

Not much research has been done to examine how different groups of the urban population are affected by the privatisation of public services and facilities. Other issues for research arising in this context are: How can public participation, and especially the participation of women, be ensured, and how can the acknowledgement of gender sensitive approaches be guaranteed? There is a need to develop new instruments and tools, such as audits or other forms of regulation that also include a gender perspective.

Women play an active role in community groups and associations, but they still have little influence on decision-making. Hence, strategies are to be developed to include

women at all stages of policy, planning and management processes. *Improving women's representation in political structures, developing gender awareness and tools for gender competent practice among urban development practitioners, and capacity building among women are considered to be the key issues.*

In many European countries local agenda 21 processes play an important role in supporting community action, intensifying dialogue between city residents and urban governments, and increasing participation of citizens' urban decision-making. Although women play an important role in these processes little research has been carried out on women's contributions to local agenda processes. A lack of commitment at the part of urban government to implement the outcome of local agenda 21 processes in local policies has often been noted. This lack of commitment has been identified as a main obstacle to the local agenda 21 processes.

How can participation in local agenda 21 processes be broadened? How can groups that are not yet enrolled be included in the process? How can it be ensured that initiatives, proposals and action plans resulting from the local agenda 21 process are implemented in urban decision making? Which are enabling conditions for implementation and which obstacles and barriers can be identified?

Revitalisation of city centres and neighbourhoods has become an urgent topic for many European cities. To cope with these challenges, reconstruction of building substance and the reuse of urban spaces has become increasingly important in urban planning and development as well as in the building and housing sector. The Open Sesame Project in Haringey (UK) addresses the needs of women in particular and promotes broad public participation. Thus, Open Sesame demonstrates how a gender perspective can be fruitfully included in revitalisation strategies for city centres.

The housing sector is subject to reorientation towards technical and ecological improvement of the housing stock. However, a comprehensive approach to sustainable reconstruction also has to address social reintegration of eroding neighbourhoods. Thus, appropriate management strategies for sustainable reconstruction receive high priority in order to safeguard the long-term viability of the existing housing stock.

Only a small amount of research has been carried out on integrated strategies for sustainable reconstruction, for example in Germany or Sweden. There is clearly a need for further examination of these issues.

Women's greater domestic responsibilities, coupled with their weaker access to resources have significant consequences on their transport and travel patterns. The key difference between men and women is the propensity of women to combine a set of activities relating to their extensive range of household tasks within the overall structure of one journey (trip-chaining), whereas men are more likely to make single purposes trips. Women in comparison to men are generally making shorter daily trips and are less

car-dependant. Thus, women's travel patterns have a higher degree of adaptability to a sustainable transportation system. However, due to car-orientation of urban transport systems, increasing diffusion of land-use patterns and the increasing number of women in the work force, women's travel is continuously growing. On the other hand, women are the major users of public transportation. However public transport is usually designed to fit the needs of men. For women, a concern with personal safety and security is absolutely crucial, especially when they have to rely on public transport.

'Gender and transportation' is a well-established area of urban research. Yet, there is still a lack of implementation of gender-sensitive approaches and only limited participation of women into the design and development of urban transportation systems. Soft-factors, like motives, goals, normative ratings, play an important role for individual travel behaviour. Yet, both issues are often ignored in traffic research.

To sum up, promoting research on sustainable transportation strategies that are oriented towards the needs and expectations of different groups of women means:

- investigating 'soft factors' like attitudes and motivations related to travel behaviour, giving special emphasis to issues of safety and security,
- developing integrated strategies which uncouple mobility from car mobility, including traffic avoidance, change of transportation modes, technological improvements and changes in traffic behaviour;
- examining the potential of information and communication technologies for sustainable transportation, especially for demand responsive public transport and service directed towards the least mobile sectors and
- enrolling users of urban transportation in research, particularly those groups being most discriminated against by current transportation policies, such as women, children, elderly and disabled people.

Specific Priority Issues in the Field of Gender and Urban Sustainability

Based on this state of the art on gender and urban research the following priority issues for urban research with high relevance from a gender point of view can be identified:

- 1. Gender and participatory decision making*
- 2. Gender and the impact of privatisation of public services and facilities (housing, transport, water supply etc.)*
- 3. Gender-sensitive regulations and audits*
- 4. Gender-sensitive measurements of quality of life (including health issues)*
- 5. Mix of quantitative and qualitative methodologies*
- 6. Gender-sensitive integrated strategies for sustainable reconstruction*
- 7. Impact of soft factors like attitudes and motivations, e.g. on travel behaviour, environmental valuation, with special emphasis on issues of safety and security*

5 Global Change, Climate and Biodiversity

The term 'global change' refers to a wide range of anthropogenically induced, or at least influenced, changes of key parameters of the 'System Earth', as well as shifts in its large-scale spatial structures and patterns. In the literature about global environmental change, a variety of phenomena and problems have been enumerated (World Commission on Environment and Development 1987, Roberts 1994, Middleton 1994, Schellnhuber/Wenzel 1998). In general terms, global environmental change refers to changes in the global system. It designates "a combination of the transformation of the natural cycles and processes that maintain life of all kinds on earth, and the socio-economic and political causes of this alteration" (O'Riordan/Jäger 1995:17).

Thus, global change is, more or less, gender dependent. Global environmental change applies in particular to climate change and biodiversity losses, but has been extended to a variety of other problems. With respect to research topics relating to global environmental change in particular, the following complex issues may be noted:

- modification of the physico-chemical composition of the atmosphere,
- soil degradation of all types,
- climate change,
- global problems of nutrition,
- amplification of world-wide disparities regarding income, sanitation and education,
- reduction of natural ecosystems by area and quality,
- loss of biodiversity,
- pollution of freshwater resources and coastal zones and
- population growth, implying urbanisation and (transboundary) migration.

In particular, climate is to be considered as an important indicator of the ecological state of the globe. This changed perception of crisis is a product of satellites and computers: the extensive and stimulating model studies by climate researchers which predict the humanly induced greenhouse effect and the gap in the ozone layer, both which were discovered using complicated measurement and observation methods, have produced new benchmarks for discussion of ecology and for developing the debate. Climate change induced by the greenhouse effect seems to be the most menacing global environmental problem. *Obvious social factors, such as population growth, energy consumption and food requirements are inescapably interwoven with the predicted climate changes. Since the Rio conference, other global problems have also attracted attention e.g. the loss of biodiversity; they have, however, not yet been incorporated in the model world.*

In global change research, climate and biodiversity are seen as key parameters, because other factors such as transport systems and land use are strongly interlinked with them. On the side of the human dimensions population development and economic growth are emphasised, because these two factors have particularly strong effects on global environmental changes. Both factors are gender relevant.

5.1 Global Change

5.1.1 Global Change: Research Topics

A clear circumscription of global change, which would be applicable for all the issues listed above, does not exist. This is because all of these problems are highly interrelated and characterised by a high degree of complexity of the whole system, strong interdependencies of system elements, non-linear reactions, irreversibility of processes, and interactions between local and global levels (Reusswig 1997; Petschel-Held et al. 1999).

Reasons for the global environmental changes are seen in general in the dramatic developments within the anthroposphere (population growth, expansion of technical-industrial civilisation, North-South-Conflict), with widespread consequences for the natural sphere. Regarding this, a global network of interrelations between the natural sphere and the anthroposphere is postulated, which is characterised by strong coupling and feedback mechanisms.

In the literature, the natural and social sphere are decomposed in quite different ways and on different levels. Usually, the elements of this network are described as follows: The *natural sphere* consists of atmosphere, hydrosphere, lithosphere, pedosphere, and biosphere.

The *anthroposphere* consists of human population (physical and psychological aspects, in particular values, meanings and behaviour), social organisation (at all levels, including national and international political institutions), knowledge systems (science, technology, religion, education, art), economy (production of food, industry, services) and traffic.

Examples of environmental changes in the *natural sphere* are:

- atmosphere: ozone depletion and greenhouse effect,
- hydrosphere: increase of sea-level, short run of fresh water and contamination of water,
- biosphere: fragmentation of ecosystems, loss of biodiversity and reduction of forests,
- lithosphere/pedosphere: contamination, erosion and over-fertilisation.

Examples of changes in the *anthroposphere* with various impacts on the natural sphere are:

- population: migration, age structure, urbanisation and population growth,
- economy: economic growth, globalisation of markets and shortening of product life,
- traffic: volume of traffic, auto performance and changes in emissions,
- psycho-social sphere: emancipation, individualisation, erosion of values and environmental consciousness,
- social organisation: democratisation, international agreements and institutions, participation and non-governmental organisations,
- science/technique: communication, ecological technologies and increase in efficiency (WBGU 1993:12f.).

These factors are more or less gender-relevant.

The 'System Earth', considered as a functional and structural ensemble of the natural sphere and the anthroposphere on a global level, is the central point of reference in research on global change. One of the major challenges to such research on global change is the different points of view as to how these changes in the global system should be described, modelled and analysed. Such changes can be described in terms of natural science or in those of social science. Another possibility is to take both social scientific and natural scientific points of view into account in an inter- or transdisciplinary manner.

Issues such as global warming, acid deposition, ozone depletion, deforestation and loss of species diversity have, until recently, been primarily matters for natural scientific study without any serious attempt to take gender aspects into account. Therefore, it is highly important to emphasise those environmental aspects that are the objects of social sciences.

As Benton and Redclift (1994) point out, the discussion of global environmental change has been dominated by physical sciences, with consequences that are often problematic for social sciences. The role of the latter has been confined to devising policy responses and to investigating the social impacts of environmental processes, the latter being described by natural sciences. The scientific task consists in linking the results of natural and social sciences in the area of global environmental change research – both still remain for the most part disconnected– and integrating them, both theoretically and methodologically. Only in this way will gender aspects become a focus of research.

5.1.2 Global Change: State of the Art

a) Research on Human Dimensions

Human and social dimensions of global environmental change include the causes and consequences of people's individual and collective actions. These including changes lead to modifications of the earth's physical and biological systems and affect as a result the quality of human life and the fate of sustainable development in different parts of the world.

Only if the social dimensions of global change are taken into account can the entire complexity and dynamic of global change be shown. Societies are intertwined with the structure of the 'System Earth' on both sides of the cause and effect relation. This fact highly complicates the description, analysis and interpretation of global environmental change.

It has become clear that notwithstanding their internal complexity and functional autonomy, societies are not isolated entities, uncoupled from the dynamics of the conditions of the natural environment, but instead are, due to their reproduction requirements, vitally dependant on natural systems. The global change of the latter has significant effects on social systems and individuals. For instance, agricultural modes of production can be disturbed due to changes of temperature, and reductions in freshwater resources raise the danger of local and international conflicts over distribution.

Hence, a multidisciplinary approach to global environmental change with a clear social science component is demanded: As Jacobson and Price (1990) state, research “must consider human activities both as they contribute to and as they are affected by global environmental change. The human activities that interact with the Earth’s natural systems are driven by three fundamental factors: the number of human beings and their distribution around the globe; human needs and desires, as conditioned by psychological, cultural, economic and historical factors, which provide individuals and societies with motivations to act; and the cultural, social, economic, and political structures and institutions and norms and laws that shape and mediate their behaviour” (13).

In this context, the International Human Dimensions Programme on Global Environmental Change (IHDP) has put new issues on the agenda, which have to be taken into account with respect to global environmental change research. They widen the scope of research towards a more comprehensive social science orientation and they open up the possibility of including gender aspects in research on global change.

IHDP was established to complement the earlier natural sciences programmes such as the UNESCO Programme Man and the Biosphere (MAB), the International Geosphere-Biosphere Programme (IGBP), the World Climate Research Programme (WCRP), and the International Programme of Biodiversity Science (DIVERSITAS). As the only programme of its kind operating formally at a global level, the IHDP provides an institutional setting for research on global environmental change focussing on human dimensions.

IHDP lists the following central questions, which have to be addressed in Human Dimensions of global environmental change research:

- How do human actions contribute to global environmental change?
- Why are these actions taken?
- How does global environmental change feed back into people’s lives?
- What actions whom to respond to, reduce and mitigate the effects of global environmental change can be taken?

Over the last few years, IHDP has selected four major themes for internationally co-ordinated science projects:

- Land-use and land-cover change,
- global environmental change and human security,
- institutional dimensions of global environmental change and
- industrial transformation.

In each of these themes gender-relevant issues should be articulated. However, gender aspects have until now played only an insignificant role in research practice.

b) Syndromes of Global Change

One example of a theoretical approach, which attempts to be transdisciplinary and tries to overcome the separation of natural and social scientific questions, is the concept of ‘syndromes of global change’. This approach rests on the decomposition of the intriguing dynamics of global change into patterns of civilisation-nature interactions (‘syn-

dromes') by an iterative scientific process of observations, data and system theoretical analyses, together with attempts at modelling. A 'syndrome' is defined as a typical pattern of the human-environment-interaction that contributes to the entire dynamic of global change, in other words: a pattern of non-sustainable development. A 'syndrome' is specified by the interaction of social, economic or political – that is societal – dynamics, together with the (natural scientific) regularities governing climate, soil functions, vegetation or water household. Hence, a 'syndrome' is an object constituted across scientific disciplines. Case studies and detailed investigations of the interactions of human-environment relation are the basis of 'syndrome'-analysis. This analysis attempts to generalise and type the cause-effect-relations described in the case studies.

For example, the 'Sahel-syndrome' describes the processes that led to a poverty-caused overuse of agriculturally marginal land. This leads to the rise of a network of interrelations: Due to the lack of alternative means of livelihood and high poverty, which prevent the satisfaction of human basic needs, peasant families are dependant on the continuing use of natural resources. The overuse induced by the marginality of the site conditions means in turn the impossibility of an increase in yields and a reduction of poverty. Besides this central mechanism other factors (natural as well as socio-economic, demographic and cultural in character) are important: Besides factors like regional climate change, the position of women is explicitly mentioned (Petschel-Held/Reusswig 2000). In this context, the necessity of qualitative data is stressed with respect to gender issues. Petschel-Held et al. (1999) give one example: ***"Emancipation of women includes such a variety of aspects that indicating it purely by data like 'participating of women with higher education' and/or 'number of children per women' is far from sufficient. Other factors are equally important: for example, the role of woman within the respective culture and/or religion including, e.g., decision-making on the number of children"*** (298).

c) Modelling Global Environmental Change

Characteristic for global environmental changes are multidimensional problems, which are interlinked and form new synergies like population development, ecological limitations of supporting systems and globalisation of resource economy. Natural and social processes are thus interwoven and lead to new processes, so that it makes no sense to isolate social and physical factors and analyse them separately.

Modelling global environmental change is seen as an essential tool for improving the understanding of these system dynamics and for forecasting future developments. The first epoch-making piece of modelling the dynamic interlocking of global ecology and global society occurred in the Meadows study of the Club of Rome (1972).

As Jacobson (1998) points out, there is broad agreement among scientists that this modelling should encompass, in addition to the biological, chemical, and physical processes involved in global change, the anthropogenic factors that contribute to global environmental change and should yield forecasts of the consequences of global change for humankind. Another agreement is that the models should be sufficiently comprehensive and reliable so that they can be used to clarify the likely consequences of various policy

interventions. Jacobson mentions that such integrated, comprehensive and reliable models of global change, which include human dimensions do not exist. “Even though the international natural science research programmes acknowledge the importance of human interactions in global change, neither goes very far in incorporating human dimensions in their models. Human dimensions are either put in a black box or incorporated by making relatively simple assumptions about human behaviour” (Jacobson 1998:304). ***Thus, until now, the most critical question remains how to introduce the human and social dimensions to models.***

Starting from similar concerns, Rockwell (1998) formulates the question as follows: “Is there anything equivalent to ‘the total Earth system’ for the social scientists who are seeking to understand the human contributions to global changes and the effects of these changes on humans? Is there a solid foundation upon which to build a quantitative model that pertains to all of the Earth’s peoples and societies? Are there economic, social, cultural, or political processes that operate at the level of the entire globe or invariably around the globe, and that can be usefully modelled at that level?” (464). At present, the majority of scientists is of the opinion that these questions have to be answered negatively.

Recently, the International Human Dimensions of Global Environmental Change Programme (IHDP) has developed an incorporation of human dimensions in the modelling of global change. One of the foci of the IHDP, the social dimensions of resource use, is defined primarily in terms of modelling demographic, economic and technological change and resource use. Further, the Intergovernmental Panel on Climate Change (IPCC) has used models that incorporate human dimensions to generate scenarios of climate change and its consequences for such factors as temperature, precipitation, soil moisture, snow and sea ice, and sea level. Jacobson (1998) points out ***that these models cannot provide a strong base for prescriptions about actions that should be taken to deal with global environmental change, for they have no adequate regional resolution, and the variance among the models concerning regional effects is much greater than that concerning global effects.*** “These are primarily natural science issues, and considerable natural science research is in process to address them. On the social science side, the human dimensions are so primitive that they provide only a very flimsy basis for forecasting and an even weaker basis for policy intervention” (Jacobson 1998:305).

Helpful are models that couple natural and societal systems. The “Wissenschaftlicher Beirat der Bundesregierung: Globale Umweltveränderungen (WBGU) (Science Council of the Federal Government: Global Environmental Changes) has outlined at least a general framework. At the highest aggregated level, a distinction is made between the natural sphere and the anthroposphere, which together comprise the ‘System Earth’. Both spheres are intertwined through their metabolisms. The natural sphere is further divided into atmosphere, hydrosphere, lithosphere, pedosphere, and biosphere, which are characterised through interchanging processes. The central question about the possible destabilisation of the natural sphere due to the dynamic of the anthroposphere can be an-

swered seriously only if we have comprehensive quantitative knowledge about the coupling of the natural sphere and the anthroposphere (WBGU 1993:14). The social supporting systems such as transportation, energy, water and food supply are of high relevance for this coupling. The data is aggregated data from the past and the present now being used in global models. These models are the basis for forecasts, leading to global data on the future.

One of the major unsolved problems is how to disaggregate these predicted global data at a regional level. Very important in this field would be new concepts of trans-disciplinary research, ones that combine cultural, social, economic and ecological factors. This is a necessary precondition for the integration of gender analysis in the research on global environmental change.

d) Gender Research in Global Environmental Change Research

It can be assumed that gender dimensions are essential to every aspect of investigating the anthroposphere and human dimensions of global environmental change. Nevertheless, gender differences have until now only been addressed and reflected upon in a sketchy way within global environmental change research. At the same time, gender-oriented research seldom refers to global environmental change research, but mostly concentrates on specific thematic areas such as gender aspects related to socio-economic factors, biodiversity, agriculture, water management and, more generally, gender issues related to sustainable development or environmentalism in general (see chapter 2 and 10).

For example, Cecile Jackson (1994) tackles the question of gender analysis and the discourses surrounding 'environmentalism'. She criticises the way in which women in the South have been conceptualised, arguing that Northern environmentalism is largely gender-blind and, in so far as gender identities are recognised, works with reductionist stereotypes as a substitute for gender analysis. As she points out, one consequence of the absence of gender analysis in environmentalist discourse is the failure to recognise that the environmental relations of women reflect prevailing gender ideologies and struggles.

One of the main reasons for the lack in gender research can be seen in the prevailing concentration on natural scientific factors. Besides gender research in the named thematic areas, there exists a broad discussion about gender aspects regarding one critical human dimension, namely population development.

e) Population, Environment and Gender Issues

In the context of global change, the argument that rapid population growth is one of the main causes of the global environmental crisis, and that activities to reduce the birth rates, especially in the South must become a major strategy in order to achieve sustainable development, has gained increased momentum. The feminist debate concerning population, environment and gender issues is quite developed. There are no homoge-

nous points of view, with differences in perceptions regarding the linkages among population, gender and environment. Both feminist researchers and activists within women's health movements have been attempting to change the terms of the debate and to expand its scope.

An important part of this challenge is the critique of the dominant view of 'over-population' as the central root of poverty, under-development and ecological degradation. In general terms, on the critical view, rapid population growth in Southern countries is interpreted not as the cause of poverty or environmental destruction, but rather as a symptom of the world-wide failure of a flawed model of development leading to increasing inequalities, hunger, poverty and ecological crisis. According to this argument environmental degradation and parallel impoverishment of the majority of the world's people must be seen in relation to the high levels of consumption in the North: excessive spending on military, debt, structural adjustment, and trade policies responsible for perpetuating the inequity of the existing world order (e.g. Bandarage 1997, Corea 1994).

With regard to demographic development and environmental degradation, in particular the 1960s and 1970s witnessed the emergence of neo-Malthusian concerns that too many people reproducing too rapidly retards economic growth, destroys the environment and exacerbates poverty. Some of the most influential early documents were "The Limits to Growth" of the Club of Rome (Meadows 1972) and "The Population Bomb" of Ehrlich (1969). The interest in global and local carrying capacity, vis-à-vis growing human population sizes and densities, stimulated the production of a considerable scientific and popular literature. Feminist economists and historians have argued that this literature has tended to ignore some of the important anthropological debates about carrying capacities, as well as to disregard the inconclusiveness of empirical evidence linking environmental change to population growth. In this context feminists question or reject mathematical models like the I-PAT-formula, which links environmental impact (I) with population growth (P), growth in affluence/consumption per capita (A) and technological efficiency (T). The critique of these mathematical models argues that population is not just an issue of numbers but of complex social relationships governing the demographic variables birth, death and migration. The simplistic linear view of cause and effect and the subsumption of complex interrelations under mathematically reductionist models are questioned. ***The aggregation of absolute figures of people and resources without quantifying their levels of consumption has been considered problematic*** (e.g. Duden 1993, Sen 1994, Hummel 2000).

With respect to the contribution of population growth to environmental degradation like desertification, deforestation or degradation of soils, many authors emphasise the interactions of factors on different levels (global, national, local, community, household). In the global context these include, for example, international market and economic relations, development policies and structural adjustment and in the national context class relations, property conditions and ownership, modes of production and market systems.

On the local and household level these include factors such as the division of labour, relations between men and women and between generations, education, knowledge-systems and access to resources (Arizpe et al. 1994, Blaikie/Brookfield 1987, Schminck 1994). Feminists such as Betsy Hartmann (1995) and Patricia Hynes (1993) argue that to blame environmental destruction on overpopulation obscures the causes of the crisis: corporate irresponsibility, militarism, and elite control over land and other resources.

Another important point is the critique of population policy and of family-planning programmes as being biased (with respect to gender, class, and ethnicity) in their basic objectives and in the methods that they predominantly use. This form of criticism questions the objectives (population control rather than, and often at the expense of women's health and dignity), the strategies (family planning gaining dominance over primary and preventive health care in the budgets of ministries) and the methods (use of individual incentives and disincentives for both 'target' populations and programme personnel). More broad-ranging evaluations of population policy objectives and strategies have found them to be 'top-down' in their orientation, largely ignorant with respect to power structures and basic human rights, in fact, often violating the latter. Instead of the fertility-reduction on replacement level as an end in it, feminists stress women's empowerment, right to self-determination and full control over their bodies as central issues. In general terms, the feminist critique agrees with many other critiques that population control cannot be made a surrogate for comprehensive development strategies. Reducing population growth is not a sufficient condition for raising livelihoods or meeting basic needs. Regarding the impacts of population policies on women in the context of the discussion of human rights, the critical role of reproductive and sexual rights and self-determination, and their pre-conditions of their realisation, were stressed (e.g. Correa/Petchesky 1994, Dixon-Mueller 1993, Randeria 1996, Wichterich 1995, Hartmann 1995). With these aspects new dimensions are pointed out which go far beyond the narrow concept of population stabilisation.

But the results of these debates, and the findings of socio-demographic research on local and regional levels, have until now not been introduced into research on global change. There is a selectivity of conceptual schemes and modelling which creates a scientific insensibility towards gender aspects.

5.2 Climate

5.2.1 Climate: Research Topics

Research on climate change deals in particular with natural-scientific issues such as changes in the atmospheric composition, stratospheric ozone depletion, climate variability and climate change prediction. It is very difficult here to identify existing gender research. Research on gender and climate is currently just at the beginning. This is connected with the fact that 'climate' and 'climate change' are themselves no fields of action.

Gender aspects with respect to climate are mostly treated in gender and feminist research within fields such as energy, traffic, agriculture and technology as well as climate protection. With respect to the latter, most feminist research concerns eco-efficiency strategies for consumption and production (see chapter 10). However, some issues are discussed with respect to gender and climate change. Specific research topics are:

- knowledge about reasons and factors of climate change,
- the link between impacts and adaptation, and between perception and action with respect to climate change
- climate change and health consequences and
- participation of women in climate policy processes.

5.2.2 Climate: State of the Art

a) Impacts on Climate Change and Climate Policy for Women

For industrialised countries, the impacts of climate change and climate policy have been discussed mainly with respect to the expected effects for the reproductive work and time use of women. In general terms it has been argued that much of the effort needed to reduce the world's carbon dioxide emissions (one major goal of the agreements of the conference in Kyoto) is inevitably exerted in the everyday lives of women in their homes. Examples are economy in water use, minimisation of waste, sorting for recycling, conservation of land and resources, and caring for people sick from pollution. ***Women as producers of food are mainly affected if climate changes lead to desertification or the salinisation of water resources. In industrialised countries women have to devote more care to their children whenever the latter's possibilities for expressing their potential for self-development is restricted by, for example, being confined indoors due to summer fog.*** As a result, women have to spend a lot of time with the children inside their homes. Women also have to spend more time accompanying children on their way to school and during leisure activities in order to protect them from the dangers of increasing traffic. With respect to nutrition, women are responsible for the supply of unpolluted food for their families. Furthermore, women have to spend more time on the medical treatment of their children, who are the most vulnerable group with respect to pollution of the air and resulting diseases such as allergies and asthma (Frauen für Frieden und Ökologie 1995:8).

b) Planning and Implementation of Strategies for Climate Protection

In the context of planning and implementation of measures for climate protection in the areas of energy, traffic, agriculture, financing, education and transfer of technology it has been stressed that it is necessary to take gender and women aspects better into account. ***Assessment of environmental and climate impact has to be enlarged to include an assessment of 'women's impact'. This can be understood as a vetting of social acceptance, including women-related demands and valuation criteria coming from women*** (Frauen für Frieden und Ökologie 1995:15).

c) Gender Aspects with Respect to Perception of Climate Change

Within the WISE (Weather Impacts on Natural, Social and Economic Systems) project, the Institute for Climate Impact Research (PIK) in Potsdam, Germany, conducted research to assess the influence of weather on various socio-economic sectors and the general public in Germany as part of a trans-national comparison. In addition, the willingness and ability to adapt to weather extremes and climate change were investigated. The population survey aimed at investigating public perception of and behavioural response to unusually hot and dry summers and mild winters.

Some noticeable differences were found between female and male respondents in perception of and reaction to extreme weather events. Women adapt more to extreme weather than men do. The study revealed that women are more sensitive to unusual hot and dry summer weather than men. Women also change their means of transport more than men do during hot and dry summers, more women than men use their car less and their bicycle more. But although women perceived more effects and adapted themselves more than men, gender differences in the willingness to change their attitudes towards mitigation of climate change were less obvious. Even though a slight tendency was found that women would accept changes in habits to counteract climate changes somewhat more easily than men (for example less energy consumption at home, less car-driving) (PIK 2000).

d) Pollution, Health and Gender

In the area of environmental medicines a recent US-study, scheduled to run to the end of 2003, observed long-term exposure to pollution, and found different effects of air pollutants on girls and boys. ***A study of researchers at the University of Southern California found that, while boys and girls suffer both from common air pollutants, they suffer differently.*** The study tracks respiratory symptoms, breathing capacity and school absenteeism among children aged 9-18 in a dozen California cities. The investigators found distinct gender differences in the way that boys and girls react to high levels of nitrogen oxides, ozone and particle pollution. The report found that boys were more likely to be affected by high levels of ozone gas while girls were more affected by high levels of particle pollutants like dust and nitrogen oxides, a smog forming contaminant that comes mainly from vehicle exhaust. The investigators did not offer any explanation for the difference in health effects between boys and girls, saying that more testing and analysis was needed. Probably it is due to the fact that boys when they are outside, exercise harder, or are more active. The study also showed that the bad effects of pollution, distributed across both sexes, were considerable (Reuters Ltd. 1998).

e) Women's Participation with Respect to Climate Policy in International Conferences

In a recent paper, the Australian Sociologist Margaret Sargent (1997) analysed the attendance, and investigated the reasons for ***the lack of participation, of women's NGOs at the Kyoto-Conference in 1997. Almost no women's organisations were present.*** Whereas NGO members numbered about 4.000, and included many women, generally

they were pursuing the efforts of environmental bodies led predominantly by men. No women's perspective seemed to be present. Sargent stresses the importance of the absence of women's organisations because, had they been present, they would have expressed values related to quality of life, future generations, health and well-being, and human rights, especially those of disenfranchised groups such as women, children and elderly people.

The reasons Sargent found for non-attendance were cost of attending, finding the time to attend, lack of meaningful information, not an area of expertise, and no accreditation by the United Nations. Another reason Sargent sees is that issues of greenhouse effects on flora and fauna and human health were almost entirely absent. Decisions were made with little consideration being given even to human survival. *According to her, the arguments used were almost entirely economic, which she sees as a very masculinist perspective. Furthermore, the conditions of women's lives may prevent conference participation overseas; for example poverty, care of children, work requirements, and insufficient educational opportunities.*

Sargent sees 'malestream' thinking as a generally important factor for the non-attendance of women. In this thinking a split has been presumed between the public (political and economic sphere) and the private (domestic) spheres of life. "These spheres were viewed as associated with the location of men's and women's activities respectively. So domestic environmental issues such as local waste recycling and community organised environmental protection have been largely left to women and civil society (NGOs) while environmental matters directly relevant to corporate profits and national budgets are taken to be the province of men, business and government. Thus environmental philosophies, values and location of operations have been oversimplified and attached to stereotyped gender roles" (Sargent 1997).

Concerning future strategies for a better women's representation at conferences the following points are suggested in her survey:

- securing funds for attendance,
- early widespread diffusion of information about the conference,
- environmental education for women,
- ensuring that women constitute at least half the membership of NGO delegations and
- prompting governments to include women in official delegations.

5.3 Biodiversity

5.3.1 Biodiversity: Research Topics

Besides climate, biodiversity is another critical variable in global environmental change. Biodiversity (biological diversity) embraces the totality of different forms of life (plants, animals, and micro-organisms, including the genetic variability within individual species) and of ecosystems. In the Convention on Biological Diversity, biodiversity is defined as "the variability among living organisms from all sources, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they

are part; this includes diversity within species, between species and of ecosystems” (UNCED 1992:3).

One dimension which has been largely overlooked is the vital role women play in understanding and managing the living diversity of their surroundings, and the importance of that diversity to sustaining women and the families they support. Although research on the issue is still in a rather initial phase, there is abundant evidence that there is a mutual relationship between gender and biodiversity management.

Research issues include:

- gender-specific use of biodiversity,
- gender-specific knowledge about biodiversity,
- indigenous knowledge and gender aspects therein,
- gender relations and the management of plant genetic resources (on and off-farm) and dynamics of changes therein, i.e. with the introduction of new bio-technologies, improved seed conservation efforts, cultural and economic change,
- gender and intellectual property rights as well as farmers rights and
- international politics of biodiversity conservation, participation of women in decision-making on biodiversity issues.

There is very little literature concerning research on gender and biodiversity in Europe. An international, comprehensive literatures review on “Gender and the management of biodiversity” world-wide is being compiled by a project at the chair of Gender Studies in Agriculture at the University of Wageningen, Netherlands. According to this survey, the existing literature is highly dispersed, and can generally be categorised as relating to: nutrition, food security and famine, ethno-botany, gender and agriculture/environment, anthropological studies of hunters and gatherers, agroforestry and forestry (especially non-timber-forest use), participatory plant breeding, and green revolution technologies.

In general terms research on gender and biodiversity is more applied than theoretical, often based on case studies. The majority of research concentrates on developing countries. Therefore, in the following we report on findings mostly from these countries. Similar studies for the highly industrialised societies of the North are not available.

5.3.2 Biodiversity: State of the Art

a) Biodiversity and Gender Impacts in the International Context

The Convention on Biological Diversity, which was signed at the Earth Summit 1992 in Rio de Janeiro, explicitly recognises in its preambles “the vital role that women play in the conservation and sustainable use of biological diversity”. It affirms “the need for the full participation of women at all levels of policy-making and implementation for biological diversity conservation” (UNCED 1992:2).

Sustainable use of biological diversity is defined in the Convention on Biodiversity as “the use of components of biological diversity in a way and at a rate that does not lead to the long-term decline of biological diversity, thereby maintaining its potential to meet the needs and aspirations of present and future generations” (UNCED 1992:4).

Because of social differentiation according to gender, women in most societies play a significant role in managing the diversity of the ecosystem, since they are responsible for the reproductive labour, food production, child-rearing and sustaining the livelihood of the family. Women have developed multiple strategies for their farming systems, almost all of that are based on a sophisticated management of genetic diversity.

It has been acknowledged that, in particular in the South, women play a central role in agriculture and forestry and in dealing with the variety of ecosystems (Douma et al. 1994, Abramovitz/Nichols 1992, Abramovitz 1994, Rocheleau 1996, IDRC 1998). Within the social division of labour their knowledge and roles are different than men's.

In many developing countries, and at the international level, the interlink of biodiversity conservation, economic development and gender is articulated and implemented in programmes, projects and studies on conservation and sustainable use of biodiversity. Some of these take gender differences into account, for example projects of FAO (Food and Agriculture Organisation of the United Nations), IGPRI (International Plant Genetic Resources Institute), IUCN (World Conservation Union), UNEP (United Nations Environment Programme), and World Bank.

It may be noted that, in developing countries, activities aimed at biodiversity conservation and/or women/gender-political activities are often combined with feminist theoretical approaches (Rocheleau 1995, Shiva 1993, Douma et al. 1994).

Especially prominent is the ecofeminist approach, which posits a close connection between women and nature, based on a shared history of oppression by patriarchal institutions and dominant western culture, as well as a positive identification of women with ‘nature’. In the ecofeminist perspective, environmental conservation is viewed through a lens of gender identity which privileges women as a group of nurturers, environmental caregivers, and allies of ‘nature’ whose interests and values are at stake in the struggle to preserve biodiversity (Shiva 1988, 1993; see also chapter 2). In contrast, the approach of political ecology stresses the importance of defining biodiversity in a broad context, based on the diverse experiences and the distinct sciences of distinct groups. According to Rochelau (1996), this approach, as applied to biodiversity, “recognises complexity in both social and ecological spheres and acknowledges the uneven relations of power embedded in the use, perception and control of ‘resources’” (10). This approach starts by identifying the multiple uses and values at stake, the multiple actors, relations between them and the diverse organisations that mediate peoples relations with the surrounding ecosystem, the physical and spatial relation of both to landscape, and the distinct sciences of life that guide various groups in their daily land use practices.

b) Gender-Specific Issues of Biodiversity Management and Knowledge

Biodiversity management is understood as encompassing both conservation and sustainable use. ***In general it can be stated that the roles of men and women with regard to biodiversity management differ in all societies.*** How and at what level men and women are involved with biodiversity management differs across communities and countries, due to both cultural and socio-economic factors. They differ with respect to labour, responsibilities, interests and control in agricultural production, forestry and resource management. Levels of involvement with biodiversity management also depend on household consumption needs and male outmigration, access to individual and household economic resources such as land, labour and income, and the importance and dependency of agriculture and wild biodiversity resources (GTZ 1999, Shiva 1993, Abramovitz/Nichols 1992).

Related to the management of biological diversity is the context-determined distribution of knowledge between men and women. This is not only the case for agricultural production and food supply, but also for other use of biodiversity, such as the collection of plants for medical and religious purposes or construction material (Quiroz 1996, Sachs 1992). Women perform both traditional roles and those they have to take over from men as men out-migrate temporarily in search for jobs. The use of traditional medicinal plants is also gender-differentiated. Men and women have in general different knowledge of the healing potential of biological diversity, its application and use. This distinct knowledge can be invaluable for identifying species or management practices for agricultural, forestry and pharmaceutical use. In this context the relationship between the conservation of natural resources, indigenous knowledge systems (cultural diversity), gender and intellectual property rights has been explored (Rocheleau 1995, Ferguson 1994, Jiggins 1988, Shiva 1988, Quiroz 1994).

Gender-specific knowledge is in the meantime widely acknowledged as a critical factor in the conservation and sustainable use of biodiversity. So far it has not been observed whether this context is also valid in industrialised countries.

c) Forest Biodiversity in Developing Countries

In several studies, the relationship between women and forest biodiversity and their decreased access to forests is highlighted: Women are the main collectors of wild fruits, nuts, fuel and construction material for both their own consumption and for trade on local markets. Women's control over components (animals, crops, trees, shrubs, pasture) and the products (food, fodder, fuel, timber, cash, medicine) of agroforestry systems is often subject to rules distinct from those governing men's action. They are generally directed toward supporting the household. Women also use forest products for their own purposes, such as basket making and dyeing; therefore, they may have a more detailed knowledge of trees and their uses (GTZ 1999, Domoto 1994).

d) Land Use and Sustainable Land Management in Developing Countries

90 % of women in the developing world, where most of the planet's biological wealth is found, depend on their land for survival. Women head 30 % of the households in developing countries, 80 % of food production in sub-Saharan Africa is done by women, 60 % in Asia and 50 % in Latin America (Domoto 1994:220). ***Here, the 'feminisation of agriculture' is a particular phenomenon of developing countries.*** In this context it has been stated that the specific contributions of women and men to agricultural production are divided along gender lines, with important implications for sustainable agricultural practices and biodiversity conservation. Men are generally responsible for land preparation, such as clearing and tilling the soil. Women are responsible for sowing, hoeing, crop maintenance and harvesting, food processing and storage, and seed selection for future planting.

Land use practices and, consequently, the degradation, conservation or improvement of the soil, are influenced by a wide range of factors. Any policies or planning processes to promote gender-sensitive and environmentally aware land management programmes and processes should start with local land users – both women and men – their experience, and their interpretation of reality. It is also necessary to take account of the factors which have a combined impact on the options available to land users, and which thus play a role in fostering or preventing sustainable land management.

According to Helen Zweifel (1998), these factors can be formulated as six key issues concerned with relations between gender, land management and the environment, which are interrelated and re-inforce each other: Division of labour and responsibility, access to and control over land, conflicts of interest over land use, knowledge and skills, local stakeholders and decision-making processes as well as external influences and support.

e) Biodiversity and Gender Impacts in the European Context

In contrast to the size of the literature on gender issues and biodiversity in developing countries, the state of research in Europe is scarcely explored. ***The research in industrial countries has until now not paid very much attention to the relationship between biodiversity, gender and economic questions.*** Mostly, the issues are treated separately (economy and gender, resources and gender) - and furthermore do not include empirical research. Therefore it can be stated that there is an enormous deficit on the issue of biodiversity and gender issues in Europe.

This should not be taken to imply that there are no gender aspects on biodiversity in the European context. Many research topics regarding gender and biodiversity in the international context and in developing countries are significant as well for industrialised countries. Topics concerning the assessment and conservation of biodiversity with the goal of establishing criteria, methods, indicators and strategy that will help to conserve biodiversity, are highly relevant regarding gender impacts.

For example, ***in the current crisis of agriculture in Eastern Russia, women's indigenous knowledge of wild plants becomes a critical resource for providing food. Indige-***

nous people in Northern Europe, the Saami people, rely considerably on wild resources. In European peasant societies, women are generally more concerned with plant biodiversity, because of the gender division of labour (Anderson 1983).

Some ethnobotanical studies exist about the knowledge of women of medical plants that analyse human indicators and quantify diversity that humans use, in the context of knowledge about plants and the dependence on wild plants. This research has discovered a rich store of local knowledge and practice concerning the use and management of food and medicinal plants, with gender-specific use and knowledge of particular plants (Steir 1996, Stine 1996, Brown 1999, Campbell 1996, Humphries 1990).

As all interviewed experts argued, research should emphasise the specific situation of women in agriculture, knowledge about biodiversity and gender aspects. Furthermore, issues on biodiversity and gender in home gardening and horticulture have been especially stressed for industrialised countries. Another critical issue concerns biotechnologies and genetic engineering in agriculture.

f) Agriculture, Biodiversity and Gender Aspects

When treating biodiversity & gender-issues in a European context, the areas of agricultural production in particular have to be taken into account. In Europe, due to industrialisation, agricultural production is organised differently than in developing countries. Here, the transformations of gendered divisions of labour are of great importance. Most of European studies on agriculture and biodiversity ignore the critical role of women in these issues. A few, explicitly feminist, studies refer to the knowledge, use, and management of agro-biodiversity with respect to genetic plant resources and the breeding of domestic and work animals (e.g. Bücking 1994, Matthes 1995). In agriculture, in particular, experiential knowledge plays an important role. For example, in the past peasant women were the only ones competent in rearing young livestock and caring for dairy cows. It has been argued that transformations in agriculture (industrialisation, agro-chemistry and technology) have increasingly marginalised this competence, condemning it more and more to insignificance.

One example for the complex relationship between biodiversity, agriculture and gender issues in the European context can be seen in the following:

A possibility to find indicators of changes in biodiversity are so-called '*red species lists*', which represent the niches of entire species. The 'Bird of the Year 2000', the red kite stands, for example, for the tended fields and meadows of low mountain regions. If changes occur in socio-cultural background conditions, and, as a result, in land use patterns determined by these, then certain co-evolving conditions of life for the red kite will be lost. For example, the open and easily surveyed landscape of these areas, consisting of meadows and feed-fruit fields, guarantees the presence of particular populations of rodents and birds that serve as food resources. If fields were no longer cut twice a year for hay harvests, if the meadows were allowed to be lay fallow and become overgrown with bushes, then these hunting fields would be irretrievably lost. But such

changes are framed by a background of socio-economic changes; for example, the giving up of dairy farming in low mountain areas and the laying fallow of meadows tended for hundreds of years. In such areas new links between economic forms and the maintenance of potentials for natural development must be worked out.

On hand of this example one can show empirically the importance of gender aspects. For it is the connection between environmental changes and socio-economic transformations in agriculture that make dairy farming as a family business so difficult to maintain. Such research could also investigate how those forms of animal husbandry, which are a burden for women, could be improved.

These issues are of importance to large areas across Europe, on the peripheries of large urban agglomerations in Central Europe and in low mountain areas as well. These areas are, for example, the home of commuters, and here farming is in decline and fields are lying fallow.

Another aspect of this process of transformation is the loss of nationally endogenous domestic animal species and stocks. Many of these animals were used multi-functionally; for example, cows did not only produced milk but also pulled plows and functioned as pack animals. Breeding goals for such animals included agility, stamina and pulling power. Chickens and turkeys resistant to disease were a part of the household. Maintaining biodiversity here would mean retaining specific stocks of knowledge – for example, that concerning the non-industrial breeding of domestic fowl – that could assure the quality of today's domestic animals. With respect to gender oriented research into biodiversity it would be of interest to better identify the links between old stocks of knowledge and forms of production, and to understand how these change in response to processes of social transformation. In short, the point would be to see how social and natural production are linked, and how this linkage determines whether natural potentials are either maintained, developed further or lost.

g) Horticulture

Home gardens, as one important part of subsistence livelihood, generally lay in the realm of women – both in developing and industrialised countries. In developing countries, a considerable diversity was found in home gardens (e.g. Quiroz 1996, Howard-Borjas 1998). Home gardens often provide a variety of vegetables, relishes and condiments. They are often experimental plots where women try out and adapt diverse wild plant and indigenous species.

Regarding the latter in industrialised countries, it has been pointed out, that home gardening is mostly a domain of the women too; here the knowledge of women about seeds and wild plants and cultivation of old sorts is stressed. The intergenerational transfer of knowledge about old species (for example the cultivation of old fruit sorts like apple trees) is emphasised. In this context, the study of Inhetveen (1994) analyses the role of

horticulture as a possible model for approaches aiming at a 'preventive economy' (see Busch-Lüty et al. 1994 and chapter 8).

h) Biodiversity and Biotechnology

With the development and introduction of biotechnologies and genetic-technologies in agriculture the technologically conditioned risks with respect to nutrition and the 'state' of nature have been pointed out. Regarding the areas of biotechnologies and genetic-technological research, which deals with the risks of development and analysis of agricultural, nutrition and the protection of nature in the wider sense, relevant themes (which encompass gender dimensions and the central deficits in research arising from gendered points of view) include:

- epistemological approaches for the theorisation of the societal relationships with nature and the understanding of nature in agriculture,
- comparison of ecological and conventional agriculture (which allows the use of biotechnology and genetic engineering) in the dimension of farming and cultivating under gender aspects,
- changes in the agricultural practices due to the use of biotechnology and genetic engineering and their implications for women (in particular for their working situation) and
- gender-specific points of view, perceptions and valuations of the risks due to these technologies in agriculture and nutrition (perception of risks, risk definition and analysis; technology assessment and technology analysis; dealing with risk control (Mies 1997, Weizsäcker 1994, Blum 1998, Klaffenböck 1996, Hammer 1992, Bücking 1994, Bradish 1987).

i) Value of Biodiversity

Besides profound ethical implications, loss of biodiversity has severe social and economic costs. In the context of the environmentalist discussion about biodiversity a lively interest in the monetary and economic value of biodiversity has emerged. These calculations relate as a rule to the value of individual species, protecting areas or functions of ecosystems. The results of such calculations point to large amounts of economic value, which, in turn, strengthens demands for the conservation of biodiversity (e.g. Constanza et al. 1997, Blöchlinger et al. 1996, Gowdy 1997, Pearce/Moran 1994). The contribution of women to the preservation of the value of biodiversity however, so far has not become a topic within environmental economics.

j) Biodiversity of Marine Ecosystems

Questions of biodiversity and microbiology are one important topic of biological research into marine ecosystems (see also chapter 4). In particular, the discussion concerning the significance of the loss of species as indicators for the stability of ecosystems shows the importance of the stability of ecosystems found in shelf oceans. The loss

of species in coastal zones is very significant, because nearly 95 % of the fishing proceeds originates from these zones. Here, gender-specific aspects with respect to the division of labour have to be taken into account. For developing countries, Erie S. Tamale (1999) has shown in a case study of the Cogtong Mangrove Bay, Philippines, the critical role of women in coastal biodiversity.

5.4 Summary and Priority Issues

5.4.1 Global Environmental Change

As has been shown, one of the comprehensive scientific tasks in global environmental change research consists in linking the natural sphere with the anthroposphere on a model level in a consistent manner. As it turns out, the main task lies in integrating, both theoretically and methodologically, the results of the natural and social sciences, which, for the most part, still remain disconnected. Only in this way will gender aspects become a focus of research.

Therefore, *the empirical basis for a gender-oriented global environmental change research has to be developed*. In a first step, gender aspects on different levels must be identified, evaluated and also quantified to create a new empirical knowledge base.

In a second step, the challenge of combining natural- and social scientific approaches to global environmental change research must be tackled, and the modelling of human dimensions improved. Gender Studies in the field of global environmental change research could be seen, therefore, as the basis of a bridging concept, one making the way free for interdisciplinary access in a manner which takes both natural and social science approaches into account.

In a third step, the 'problem of scale' must be tackled: Research should deal with the question, how the models and statements on a global scale can be reformulated on a regional level. Only in this manner can social-science aspects, and therefore gender dimensions, be treated, and conditions and feasibility of action and intervention can be determined.

With regard to the complexity of the interrelationships between demographic development and environmental problems a shift of scientific awareness is necessary. "Instead of asking whether population is the principal cause of environmental degradation, a more insightful question would be: How are the factors that negatively affect the quality of life of people and the sustainability of the natural environment dynamically interrelated?" (Arizpe et al. 1994). In this context, gender issues should be investigated under their specific socio-economical, cultural, geographical, political and environmental conditions.

Demographic development and gender aspects with relation to environmental problems so far have only been discussed in terms of population growth in Southern countries.

Given the demographic developments in industrialised countries (e.g. migration, decline in birth rates and ageing of population), and the enormous differences in lifestyles and consumption patterns, studies on the impacts of these factors on the environment are almost totally lacking. ***Preference should be given to the question, what impacts demographic trends do have on environmental degradation in industrialised countries and what importance does gender have within these trends*** (see also chapter 10).

5.4.2 Climate

Gender impacts with respect to climate change and climate policy have only partially been analysed so far. They arise mostly in research on the social causes of the anthropogenic greenhouse effect and on the social impacts of climate change. The natural science oriented climate research turns out to be more or less gender-neutral.

It is one main prerequisite of the analysis of gender issues with respect to the impacts of climate change to draw a clear cut distinction between the macro (global), meso (regional) and micro (local, individual) level. If research only focuses on the global level and natural scientific factors, human social aspects – which always include gender relations - and therefore social scientific perspectives cannot be taken into account.

Research needs relate in particular to different gender aspects regarding the impacts of climate change, on the one hand, and strategies of climate protection, on the other hand. In particular, regarding the development of scenarios of risks to human health associated with climate change, the different gender impacts have to be taken into consideration. Further, starting from labour division and different daily life conditions of men and women (for example, reproductive work and time use), research on strategies for climate protection has to deal with their impacts on women-related valuation of criteria and demands.

Research on policy processes and decision-making regarding strategies for climate protection (e.g. reduction of greenhouse gas emissions and concentration) should take into consideration the conditions for the participation of women with respect to the question: How are gender issues and different interests recognised?

5.4.3 Biodiversity

In contrast to the amount of studies on gender issues and biodiversity in developing countries, the research on gender impacts in biodiversity in European countries is only in an initial state. ***The major obstacle is to identify issues and areas, where women, gender and biodiversity are intermediately related.*** In general terms, the interest in women's knowledge and biodiversity should be seen in the wider context of international economic and agricultural policies as well as their transformations and gender-related implications therein.

Key questions for empirical research are especially: Who will benefit from information and studies on women's indigenous knowledge? What would this information mean for consumers – women in contrast to men in first world countries? Will research on women's indigenous knowledge contribute to the autonomy of women and give them better access to, and control over, such vital resources as seeds, information, assets, and decision-making power? One further question, with respect to the growing interest of ecological products and agriculture, is: How are sustainable trade relations between indigenous women and users of their knowledge in first world countries possible?

A few studies refer to the knowledge, use, and management in agrobiodiversity and wild plants and wild food resources. This needs to be linked to conservation and should be based upon stimulating demands for the users. Hence, **women need to be a major focus, as consumers and as the ones who have a predominant role in food production in the household.**

Research with a specific perspective on gender differences is lacking in the area of crosscutting issues such as sustainable use of biodiversity, protected areas, and incentive measures. **There is, for example, neither international research on the impact of gender on protected areas management nor studies of gender-differentiation in protected area institutions (National Park management, co-management practices and protected area services).** This lack includes marine protecting zones and the political and social mechanisms of developing of criteria for the selection of such protected areas. Furthermore, there has been little research on urban biodiversity, let alone gender-differentiated management of biodiversity.

Regarding plant genetic resource (PGR) management, Howard-Borjas (1998) presents a further list of research needs and priorities:

- Analysis of the relevance of gender, socio-economic and cultural factors in plant genetic resource management, conservation and exchange systems.
- Analysis of changes in gender relations, other cultural practices and socio-economic conditions affecting men and women's knowledge access and use of genetic resources.
- Analysis of factors affecting adoption, preservation and use of local versus introduced genetic varieties, including perceptions of risks and benefits, as well as trade-offs (e.g. regarding multiple use).
- Analysis of direct and indirect costs and benefits of introduced genetic varieties to farms, farm household and individual farm household members.
- Analysis of relations between induced change in PGR management and existing local systems of management and use of biodiversity, and the significance of gender in these relations (including analysis of participation, and of socio-economic and genetic consequences of new strategies, by gender, given different policy orientations, objectives, institutional frameworks, and intervention methodologies).

- Analysis of engendered politics around intellectual property rights and genetic resources at local, national and international levels.

With respect to agriculture and agrobiodiversity research on the effects and impacts of new biotechnologies and genetic engineering, this research has to take gender aspects into consideration. Here, in particular, the changes in agricultural practices due to the use of biotechnology and genetic engineering have to be investigated with respect to their implications for women and their particular affectedness by these technologies, especially regarding their working situation and their access to resources.

Regarding the improvement of institutional and policy arrangements concerning biodiversity conservation, case studies should investigate the possibilities of women's control over their resources, decisions, and their knowledge.

Specific Priority Issues in the field of Global Change and Gender

With respect to the presented state of the art we identified the following specific priority issues in the field of Global Change, Climate and Biodiversity research and gender issues:

1. ***Combination of natural-scientific and social-scientific approaches in global change, climate and biodiversity research:***
This constitutes a fundamental pre-condition for the inclusion of gender aspects. Important dimensions here are:
 - ***Human dimensions of global change***
 - ***Modelling: Linking the natural sphere with the anthropogenic sphere on model level; integration of results of the natural and social sciences***
2. ***Participation of women and social target groups in decision-making structures, policy, planning and management processes concerning global environmental problems***
3. ***Gender impacts of climate change***
 - ***Gender and Health: risks to human health associated with climate change***
 - ***Impacts of climate change and climate policy on women's living conditions: concerning the gendered division of labour and the different everyday-life conditions***
4. ***Social and gender aspects of biodiversity***
 - ***Gender-specific knowledge, access and use of biodiversity***
 - ***Gender-specific aspects of biodiversity conservation and management***
5. ***Gender aspects of sustainable land use***
 - ***Female access to and control over land and resources***
 - ***Gender-specific division of labour and responsibilities***
 - ***Changes in cultural practices (e.g. due to the use of biotechnology)***

6 Sustainable Marine Ecosystems

6.1 Research Topics

The earth is covered with 360 million square kilometres of ocean, of which only a small proportion (in comparison to land areas) count as having been researched. At the moment, the transition areas between land and ocean, estuaries and coastlines, are in a state of dynamic development. Three-quarters of all cities are situated, and over 50 percent of all human beings live, in narrow corridors along coasts, areas deeply influenced by industrialisation, construction of harbours and cities, and by measures taken to erect tourist infrastructures.

Marine research has always concentrated on the exploitation of marine resources along the shelf regions. At present, one can notice an expansion of research interest beyond this, with a movement from the continental shelf to the continental slope and beyond to the deep sea. This wide ranging – in spatial breadth and as well as depth – marine research raises new challenges affecting many areas, from applied basic research to the development of modern technology. Marine research, including marine environmental research, is taking place at present along three dimensions: the ocean as a climate factor, the marine ecosystem and the ocean as a resource reservoir.

a) The Ocean as a Climate Factor

The distribution of temperature and precipitation, and changes in the circulation of the atmosphere, are linked to changes in the ocean system. The oceans can store and release great masses of heat (the storage and release of gases affecting the climate, such as CO₂, the different layers of water, and currents moving the water mass, the oscillating ice cover of the polar caps and the different exchange behaviour of gases such as CO₂ linked to this). It is transported across the global ocean circulation system to the highest latitudes (the Gulf Stream is one such phenomenon). It is only with great difficulty that one can predict the effects of changes in this circulation system. So, for example, not much is known about the exchange among the various factors. Better knowledge of these mechanisms could improve predictions of CO₂ concentration in the atmosphere and thereby those concerning possible climate changes.

Polar research plays a large role in this ocean and climate research. One special branch of polar research includes research into climate variability using borings from the Antarctic interior and shelf ice, as well as Greenland's ice shield. Climate oriented marine research is a worldwide endeavour; here there are international research programmes with corresponding collaborative research teams. At the same time, research efforts dealing with regional effects have been established within the European Union.

Marine research encompasses an array of natural scientific disciplines, including geology, biology, chemistry and physics. Particularly with respect to climate research, physical oceanography, with its descriptive, modelling approach, works closely together with other natural sciences to understand the complex current mechanisms and their influence on the transport of physical, chemical and biological entities in the ocean.

This research is only possible with the aid of lavish computer simulations. Fundamental here are in particular numerically complex models (coupling-ocean-atmosphere). These simulation models require use of computers with the highest possible computing power.

b) The Marine Ecosystem (Marine Environmental Research)

Marine environmental research in the narrow sense is concerned with anthropogenic impacts at the regional and local levels. Anthropogenic impacts can be caused by direct introductions but also by air traffic or rivers (estuaries) which impact on the coastal zones (in particular the coast waters) and the ocean as a whole. Research topics here include:

- degree of spread and transformation of pollutants,
- effect of nutrients on marine ecosystems,
- effect of fishing on fish stocks, on the biotic and a-biotic factors and thus on the food chain and
- further themes for marine environmental research include: effects of deep sea mining and the disposal of waste in the deep sea.

Biological marine research is concerned with questions related to biodiversity (see also chapter 5) and the interrelated issue of metabolic processes, as well as those of microbiology. In particular, the discussion of endangered species as an indicator of the stability of ecosystems directs attention to coastal waters. Loss of species here are of importance because these areas account for 95 % of all fish catches, while also being the centre of present marine extraction of oil and gas as well as serving as reservoirs for extraction of construction material (sand and pebbles). Another important field of research at present for marine biology are cold and hot vent systems. Here highly developed, microbiologically interesting communities of organisms are being investigated. These micro-organisms have adapted themselves to extreme physical-chemical conditions such as high temperatures, strongly reductive chemical reactions, high levels of heavy metals and saturated saline solutions, and are potentially useful for biotechnology, for example, for processing polluted waste or as raw material for pharmacological products.

In addition to such microbiological research, applied basic research is also being carried out in such fields as chemistry, biology and geology. Here the interaction between water columns and sediment (and its effect on biodiversity – see chapter 5) is being studied. For example, the transfer of carbon from the sunlit zone to the ocean floor by means of water columns is influenced by the interaction between phytoplankton and zooplankton, while particle exchanges between sediment and water layers near the seafloor play an important role with respect to individual processes of basic circulation. Such exchanges also play a role within circulation models used to gain a better understanding of the distribution of nutrients and oxygen in the water columns.

c) The Ocean as Resource Reservoir

Another key area of research for marine biology is the study of metals in the shelf seas, the continental shelf and slope and, increasingly, the deep sea as well (magnesium, cobalt and precious metals have been found along the craters of undersea volcanoes). Large deposits of fossil energy in the form of gas hydrates (a fossil fuel source four to five times larger than oil) in solidified form as well as, at lower levels, as liquid gas have also been studied. There are serious problems with the extraction of these materials (Japan and the USA are very much engaged in applied basic research), especially since a possible uncontrolled release of methane would have incalculable ecological risks.

d) Research Topics in Europe

A study initiated by the EU and the European Science Foundation at the beginning of the nineties and produced by the Committee on Ocean and Polar Science (ECOPS) identified ***several critical fields that are still influential for European marine research:***

- development of a scientific basis for an operational ocean observation network analogous to the global weather network,
- study of north polar zones (with climatological aspects),
- study of deep sea as a biotope that is variable and possible sensitive to human intrusions and
- questions concerning integrated management of coastal zones.

The continuation of this growing European research endeavour requires that particular attention be given to management concepts for Europe's oceans. These should be clarified and made more useful in three ways:

- by improving the understanding of modelling and its use for predicting (with respect to Europe's oceans, both at high sea and in coastal zones) the functioning of marine systems and their changes through anthropogenic activities,
- by developing environmentally friendly technologies for monitoring, evaluating and using the marine environment and
- by improving the ability to predict using environmental parameters that have effects on offshore activities.

Further key research topics involving basic questions concerning marine ecosystems include: sedimentation issues, issues concerning transport of pollutants by anthropogenic causes, effects on biological diversity, and the issue of avoiding anthropogenic effects on biodiversity and the encouragement of the development of sustainable and economic technologies for use of the oceans. Furthermore, with respect to coastal management, the avoidance of problems linked to erosion and protection of the coasts is of particular importance. Finally, issues involved in oil extraction in offshore areas are being more closely studied.

6.2 Marine Research with Respect to Gender Dimensions: State of the Art

Marine research takes place mainly within a framework of 'pure' natural sciences. At present at both the international and the European level marine research is concerned with the organisation of purely natural scientific interdisciplinary efforts, i.e. coupling physical, biological, geo-chemical and ecological models and corresponding measuring platforms.

Since access to data in the marine environment is difficult and expensive, very different forms of high technology are being used, such as, for example, integrated automatic operating measurement platforms. 'Autonomous underwater vehicles', mobile systems steered from a ship that can collect and examine objects on the ocean floor, are also being used, along with remote-controlled exploration systems, robots and sensor technology.

With the exception of approaches to coastal management, so far, there has been a lack of concepts for linking social science and natural science approaches to finding solutions to marine environmental problems, at the regional level and beyond. Interdisciplinary efforts within research programmes themselves also lack a conceptual basis. From such an interdisciplinary perspective, gender oriented research within European marine research is practically non-existent. Only in limited individual areas, such as the European fishing industry (concentrating on the issues of fish catches and processing), isolated steps have been taken in the direction of gender studies, but these have mostly been confined to studies of non-European oceans from a social-anthropological point of view.

It is therefore necessary to establish the basis for a gender oriented marine research. This task is linked to the challenge of combining social science and natural science approaches to marine research.

a) Women in Marine Research

The proportion of women with university degrees working in marine research is generally rising, more so in the fields of marine biology and geology than in physical oceanography. In general, the proportion of women researchers is something between 20 % and 25 %. Moreover, there are no more restrictions on women participating in research aboard research ships. However, as in all University-based research, despite the growing efforts to insure equal opportunity in science and research, getting the credentials needed to participate in research and teaching is still linked to doctoral and post-doctoral work. The financial resources needed for acquiring such qualifications are tied to project positions limited to a specific time frame (3-5 years). Women who have completed university studies are often at an age where the decision between career and family becomes problematic. Given a 3 or 5 year position, a women has at most two years, and possibly only a few months, left to work after completing her maternity and parental leave. In the field of marine research, many women who start in the field of physical

oceanography, or in geology and biology, end up going into the computer industry (in particular the areas of IT and EC) after having a child because there the key skills of data organisation and processing with a computer they learned in their original field are highly valued. In this way *the organisation of research helps to solidify the limited presence of women in leading positions in research and teaching.*

b) Integration of Women and Gender Research within Marine Environmental Research

A more flexible marine research (in the form of an openness to new ways of asking questions found in France, England, Germany, the Netherlands and the Scandinavian countries, primarily within non-university research centres) *must be promoted in ways that permit the combining of motherhood and career in marine research.* As in other research areas, in marine research as well, it is the specificity of women's lives (combining employment with family work), in connection with the temporal demands of research projects, that cause women to abandon a research career when starting a family. It is not an inherent lack of qualifications as is often assumed (e.g. "Council of the Sciences Recommendations for Equal Opportunity for Women in Science and Research" 1998).

In our interviews with experts, women working in petrochemistry, marine biology and geology, physics and marine environmental research have expressed the wish for a gender oriented 'platform' they could use to discuss among themselves which gender oriented topics are of interest to them. They have stressed a need to learn more about social science oriented gender studies and to understand these, in order to formulate their own independent, interdisciplinary, gender specific research interests.

c) Gender Research as a Bridging Concept within Marine Environmental Research

Gender studies in the marine environmental research could represent an independent basis for building a bridging concept linking social science and natural science approaches to finding solutions to marine environmental problems. This linkage is a basic precondition for awareness and integration of gender aspects. Such a bridging concept is of increased importance because marine research is at present moving, with the aid of a great deal of technical know-how, engineering skill and instruments of all kinds, away from the shallow sea areas and onto the continental slope and further out, to the exploitation of the deep sea. The potential use to society of possible stocks of fossil energy alone seems immense, the social and ecological risks equally so. *Here future problems are being addressed which go beyond the evaluation capabilities of the natural sciences.* A gender oriented bridging concept could help furnish an independent capability for self-reflexivity that could be applied, above all, to questions concerning the foundations and consequences of such research.

d) Gender Oriented Marine Research as a Concept of Prevention

As a start, gender oriented marine research could concentrate on developing a gender oriented concept of ocean prevention and especially risk prevention. Doing this, ***the experiences of gendered risk assessment and gender specific methods of valuing technology could be used in this research field***, too (see state of the art in chapter 6). Such a concept of prevention could be applied in gender oriented interdisciplinary research into directions of development within marine research such as the exploitation of the deep sea and marine mining (manganese, cobalt, precious metals as gold, diamonds and gas hydrates). The problematic consequences of these developments should be investigated with respect to the oceans on the one hand. Alternative development paths on land should be considered on the other. For example, what consequences are to be expected from use of oil platforms in ever-deeper waters (such as the platform of Trinidad with a depth of over 2000 meters)?

First of all, the question of modelling must be considered: which models of cause-effects patterns assume which material parameters and which intrinsic material properties? Many of these kinds of questions have been raised only within research dealing with fresh water areas. As far as the biotic and a-biotic conditions of the oceans are concerned researchers are just beginning to work on the problems. The debate over models and the correct construction and interpretation of possible cause-effect relations are of particular importance. It is important because, for example, in the area of persistent polar organic pollutants the use of test organisms and laboratory tests is often not feasible because effect thresholds are subtle and can only be observed after a long period, one beyond the observation frame of laboratory tests. ***A gender specific principle of prevention must deal with the different interpretations, and different possible modes of evaluating the properties of persistent pollutants.*** Another task for a gender specific approach in this area would be determining which products are the sources of such pollutants and to what extent others could replace them.

Further tasks for a gender specific and prevention-oriented research could be how the consequences of large-scale wind energy parks should be evaluated. Which different evaluation criteria and safety factors (puffers) are being used (noise emission, consequences marine mammals, definition of protection for birds)? Wind power facilities are a European development that, as far as their effects on the Shelf Ocean, has only begun to be investigated.

Gender oriented preventive measures for deep-sea research and exploitation must include looking at organisms such as a-biotic elements in the deep sea. Here one must be particularly careful to include very sensitive processes, for these processes are very long term as far as both regeneration and the irreversible destruction of forms of life are concerned. Such systems are principally more sensitive than those of the shelf ocean, the latter being more capable of interacting with their environment. ***Preventive research with respect to the deep sea requires its own evaluation criteria, ones established by means of an interdisciplinary, gender specific process.*** It would be also relevant here

to find out how different preventive criteria with respect to deep sea research are justified and what effect these differences have on such research.

e) Gender Oriented Deep Sea Technology Research

Gender oriented marine research would also look at the male fascination with technology, investigating the objects of this fascination and placing them in a new context. Underwater vehicles, fast ferries and underwater mining missions all could be objects of study here. Which social purposes are served by these systems, and are there any other options?

f) Offshore Activities

Oil drilling platforms are working in ever-deeper waters, with a corresponding increase in **work place risks** such as fire, crashes during helicopter transfers and large waves. The International Labour Office counts offshore work as one of the most dangerous. Drilling platforms also raise questions concerning the gender specific division of labour, the health and environmental issues. ***In Norway on the huge platform “Fiskoil” about 20 % of the offshore workers are women. They are working mainly in service areas such as catering or cleaning.*** Working on the platform, the workers stay two weeks offshore. Then they can stay at home for two or three weeks. For women, as well as for men and their families, consequences for family life and their particular life situation are of equal importance for studies of workplace and ocean ecology as questions concerning risk estimation and assessment.

g) Gender Composition within Decision-Making Bodies

An important point where gender research within marine research could be applied would be in analysing the political and social mechanisms affecting ***the setting of criteria within decision-making bodies***. Especially a critical evaluation of existing international law, ***in particular with respect to the establishment of marine protected zones and the selection criteria for these (e.g. cold water reefs, special ecological niches) is lacking***. A leading question would be why issues concerning what levels of sustainable regeneration rates and related sustainability of nutrient foundations and marine ecology are scientifically defensible and why they are evaluated differently within decision-making bodies in comparison to the sciences. This reflection should include issues concerning ecological food chains, evaluation of so-called ‘side-catches’ in the fishing industry, general changes in marine flora and fauna, the conflict over the scientific evaluation of model assumptions in the fishing industry and the political negotiation of catch quotas from a gender specific perspective (decision-making bodies, lobbying, etc.).

6.3 Summary and Priority Issues

Marine Research provides knowledge that helps us understand the complex interactions among atmosphere, biosphere and ocean systems, including shallow waters and coastal zones. This knowledge is the basis for actions dealing with marine raw materials and food resources. Using on an array of modern equipment – satellites, underwater craft, research ships (floating laboratories) and powerful computers among others – this knowledge is produced by several different disciplines – geology, chemistry, biology, physics, etc.

A structural problem in the European field of Marine Research as in other research areas arises from gender differences in career chances. The cause of this situation does not result from qualification-deficits of woman. It is rather due to organisational structures of research.

In the wide-ranging field of Marine Research one can find a close link between basic research and technological innovation, and an increasingly interdisciplinary form of co-operation among biology, chemistry and physics. However, apart from two limited exceptions, this development towards a new form of interdisciplinarity has taken place almost exclusively among natural science disciplines.

- In the area of coastal management there has been a link to social science disciplines such as landscape and regional planning, urban renewal and architecture.
- In the area of the fishing industry (catch, search and processing methods) there have been social science directed studies, including those that cover gender topics such as women in hierarchical structures and the gender specific division of labour in methods used.

Aside from these marginal exceptions one can argue that marine research is almost exclusively a matter of the natural sciences and that the social sciences play almost no role within it. This stands in stark contrast to the social significance of marine research itself, for these are on the threshold of providing the technical and scientific means for a more thorough exploitation of marine resources (e.g. oil, gas hydrates, special micro-organisms useful for biotechnology).

But in order to study the societal potential and risks of exploiting marine resources one must look at the ocean as a system coupling humankind and nature, a humankind-nature system, rather than a 'natural' system (which is affected exogenously by anthropogenic disturbances). The coupling of natural scientific and social scientific approaches to analysing and providing solutions for marine environmental problems requires new concepts and new research organisational structures with a regional base. The linking of natural scientific and social scientific modes of access to problems and their solutions is a fundamental condition for the inclusion of and reflection on gender aspects of marine research.

It would be sensible to introduce socio-economic aspects (e.g. cost-benefit analyses) in marine research (as has also been formulated in the 5th Framework Programme of the

EU). But socio-economics is only one discipline within the social sciences and cannot replace the whole. A socio-economic approach is not sufficient (from the perspective of the social sciences as a whole) to deal, both theoretically and practically, with the coupled system of humankind and nature.

Gender research constitutes a strategic starting point for linking natural and social scientific approaches, and is, at the same time, a stanchion supporting this linkage. A graded procedure would be possible:

- Gender research as a first ‘platform’ of agreement considering which potentials for integrating social scientific research into the area of marine environmental research could be achieved by gender research,
- development of a gender risk assessment and in a broader sense a gender oriented concept of prevention with respect to the detecting and evaluating of polar, persistent materials, in particular in the evaluation of inherent material characteristics such as risk evaluation of persistence and polarity properties,
- gender research as part of follow-up research on deep sea exploitation and on biodiversity,
- environmental problems connected with offshore activities, oil-drilling platforms and also wind energy parks,
- gender aspects of decision-making structures and mechanisms in decision-making bodies (international as well as national) responsible for catch quotas for fishing, for establishing marine protected zones and for the exploitation claims on marine resources inside and outside the 200 mile limit, and finally
- evaluation of the specific, quite elaborate equipment of technology (‘a male fascination with technology’) in marine research, in a fashion similar to space research, and the possibility of substituting alternatives (technology assessment).

Specific Priority Issues in the Field of Marine Research and Gender

With respect to the presented state of the art we identified the following specific priority issues in the field of marine research and gender issues:

1. ***Integration of natural scientific and social scientific approaches***
The linking of natural scientific and social scientific modes of access to problems and their solutions is a fundamental precondition for the inclusion of, and reflection on, gender aspects of marine research.
2. ***Societal importance of oceans & marine research***
Marine Research must be studied in terms of its importance for society; that is, positive effects as well as negative side effects for human society deriving from the exploitation of marine ecosystems due to marine research should be investigated.
3. ***Participation in decision-making/policy***
Only the participation of different social actors (including women) in decision-making bodies (responsible e.g. for catch quotas for fishery, for establishing marine protected zones and for the exploitation and claims on marine resources in-

side and outside the 200 mile limit etc.) can ensure that gender aspects are sufficiently taken into account.

4. Technological development

Modern technologies for the exploitation of marine ecosystems can have significant social-ecological side effects. Consequently, in marine research, there is an urgent need for methods of technological development that includes gender-specific aspects.

5. Gender aspects of fishery and coastal management

In the area of coastal management there exists a link (in a broader sense) to social sciences (socio-economic issues) and, possibly, to gender research. In the research area of fishery (fishing industry) gender-oriented research concerning, for example, the gender specific division of labour is an important subject.

6. Working conditions and safety connected with off-shore activities

Working conditions and work place safety with respect to risks, environmental problems and health are an important aspect both for men and women.

7 Sustainable Management and Quality of Water

7.1 Research Topics

Water is a basal resource for the reproduction and development of society and nature. Furthermore water balance is one of the most sensitive parts of the eco-system. Much research has been done in the field of water engineering and management aimed at maintaining this balance. It extends from water supply to water use to waste water treatment, dealing with quantity as well as quality – even if in the past, aspects of critical thresholds and loads of pollutants were more in the focus than an integrating view of quality and quantity. But the new EU-Water Framework Directive seems to offer possibilities for changing this praxis.

Water infrastructure (freshwater and sewage) in Western Europe can be very expensive, but these countries are able to invest in the needed technologies and guarantee a constant water quantity and quality in accordance with law and standards. Although existing differences between countries should be considered; for example in countries like Spain, Portugal, Italy and Greece freshwater resources are very scarce.

Despite the introduction of water quality targets in the European Union, there has been no overall improvement of river quality since 1990. Approximately 20 % of all surface water in the EU are seriously threatened with pollution. Furthermore, the eutrophication of surface water with nitrates from agriculture is increasing. Excessive algal blooms are the consequence. Even if phosphorus emissions have been reduced due to initiatives in agriculture and industry (waste water treatment and product as well as production innovations), groundwater quality and consequently human health is still threatened by pollution by nitrate, pesticides, heavy metals, hydrocarbons and chlorinated hydrocarbons. But the overall water use has fallen in the last 20 years – above all because of the shift from (heavy) industry to services using less water (European Environmental Agency 1998).

Although wastewater treatment is well organised in most Western European countries, some regions and cities, such as Milan and the Po river basin in Italy, have difficulties with reprocessing of sewage. One possible way to solve these problems is to give up a purely technical view of water affairs and develop more integrated solutions, especially since the potentials of the often-introduced end-of-pipe solutions in water treatment have almost been exhausted. Innovative technologies must not only purify but also avoid sewage, which includes reducing water use, substitution of freshwater through other water qualities like rain- and dew-water, as well as reusing water and increasing the utilisation of water cycles. Industry has made some efforts here, but on the household-level many solutions are conceivable, e.g. sewage-free housing.

Another way of avoiding expensive purification of wastewater is to avoid the pollution from the beginning. One of the main polluters is industry and agriculture. Even if the input of chemicals into water by industry is decreasing, (intensive) agriculture uses ever more chemicals. Possibly, new thinking about ecological farming could lead to new

solutions. Due to the careful selection of cultivated crops according to the quality of land and adequate irrigation methods, a double effect can be reached: pollution and emissions of waste water, as well as freshwater demand, could be reduced.

In Eastern Europe the situation is more drastic. Techniques for water supply and reprocessing of sewage are more obsolete. Additionally, water quality of ground and surface water is in poor condition. For example, in Bulgaria two-thirds of the rivers were polluted in 1991, and the Yantra River was classified as the dirtiest in Europe. Furthermore, all groundwater is contaminated with nitrates, while the highest concentration can be found in agricultural areas. In the whole country microbiological contamination is on the increase, and the percentage of poor (drinking) water quality samples is several times higher than WHO and European Union guidelines (WEDO 1999). Hence water-born diseases increase, *of which women and vulnerable groups like children and elderly persons suffer most*. Similar situations can be found for Russia, the Ukraine etc. Additionally environmental safety in production facilities is not always guaranteed. The recent accident in Rumania, where cyanide-contaminated water of a gold mine got into the river Tisza, showed that environmental damage can be caused through insecure production methods. In some sections of the river, 80 % of fish have died, and thousands of other animals like birds were endangered (The Guardian, 11th Feb. 2000). The consequences for human health and social effects e.g. for fishery, also have to be taken into account.

Even if the situation is not as dramatic in all Eastern European countries, the problem of water quality is wide spread. Prevention of water pollution and safeguard of quality would be one of the main challenges in Eastern Europe.

But nevertheless water shortages and water crises occur in Eastern and Western European urban agglomerations, as well as in semiarid regions (European Environmental Bureau 1997, European Environmental Agency 1997, Nunes Correia 1999). The ability of 'conventional' water management systems to find solutions to unresolved problems seems to be exhausted. New problems are arising:

- depletion of scarce water resources,
- decreasing quality of drinking water in some parts of Europe,
- destruction of water-dependant ecosystems and interregional conflicts over water resource use,
- problems of acceptance of wastewater sludge in the agricultural sector,
- groundwater pollution by agriculture,
- problematic forms of wastewater management,
- unintended effects of privatisation in the water-sector,
- increasing prices for water supply and water disposal (because in many European countries the principle of cost-effectiveness will be introduced) and
- expensive maintenance and renewal of water infrastructure.

These problems are a challenge to water research and policy (European Commission 1997, Nunes Correia/Krämer 1997). The EU Water Framework Directive already provides a good framework for generating regulations in response to the problems. This framework now must be fleshed out nationally, and, above all, at the level of river basin/catchment areas.

According to the male dominance in the field of technical professions there are mainly men working in the field of water infrastructure and management (see in detail chapter 2.2). Above all, top positions are mostly held by men. The water supply and wastewater treatment is predominated by male civil engineers and male hydrogeologists, although in quality securing (analytical chemistry, hydrological biology) women are engaged, even if not to the same extent as men. In research on wastewater treatment women are not found in technical or mechanical treatment (civil engineers, technical chemistry) as often as in biological analyses (microbiology).

Against this background one can say, that men dominate water research. Perhaps this is caused by the fact that women have different scientific interests than men – and those more female interests (e.g. avoiding of pollution before measure it) are not fully compatible with the technical orientation and often short-term scoring of successes in water engineering.

7.2 Water Research with Respect to Gender Dimensions: State of the Art

At the Fourth World Conference on Women held in Beijing in 1995, the participating governments undertook to carry out a comprehensive platform for action intended to ensure that the gender perspective is reflected in all policies and programmes (OECD/DAC 1998). They recognised gender mainstreaming as the principal means to achieve these objectives. As a part of binding international law, this declaration should also have an effect on water policy and programmes of all signing countries. *The study “Risks, Rights and Reform” (WEDO 1999) carried out by Women’s Environment and Development Organisation showed that 90 % of countries in the survey report water pollution as a serious threat to women and health.* Inadequate sewage systems continue to lead to untreated runoff in many developing countries – but Northern European countries are also affected by water pollution.

An investigation of gender-sensitive research in water resource management shows that gender-projects are often confined to developing countries. The main focus there is on integrating a gender-oriented perspective into water management and planning processes by enabling women and men to formulate and express their views and to participate in the whole process of planning and implementation.

The need of female participation in water management strategies in the South has two main reasons: First, women are responsible for the domestic water supply; principally it is women who fetch water from the source to the house. Second, as mothers and care-

takers they provide for hygiene and health care. They have got a clearly identifiable water use for domestic purposes.

Based on these two facts one can see a sort of competition in the use of water between women and men, with men needing water for agriculture and production primarily. Further there is a debate about competition in water use for irrigation, a so-called intra-household conflict: Gender disparities are evident in the value men and women place on irrigated agriculture, and men's and women's different crop preferences. While men prefer seasonal cash-crops like rice cultivation with high irrigation needs, women farmers often combine agriculture tasks with domestic duties, including a continuous (non-cash) crop farming (e.g. weed), cattle, etc., which require a continuous water supply. It can be shown that gender division of labour and gender specific crop choices may partly govern men's and women's preferences for quantity, timing and timeliness of water deliveries (Zwarteveen 1997).

So the central point of many projects is, on the one hand, the participation of women in planning and implementation processes and, on the other, the intersection of water and hygiene or sanitation.

Two current initiatives can be identified as best practice projects:

- Mainstreaming Gender in Water Resource Management – co-ordinated by the World Water Vision Unit/UNESCO (Part of World Water Vision process): Professionals and stakeholders developed an integrated, regional vision for Water Resource Management in 15 regions of developing countries. The goal is to share burdens, decisions and benefits more equally between men and women (World Water Vision Unit 2000).
- Vision 21: A Shared Vision for Hygiene, Sanitation and Water Supply – co-ordinated by the Water Supply and Sanitation Collaborative Council: Vision 21 is directed to achieving a world by 2025 in which each person knows the importance of hygiene, and enjoys safe and adequate water and sanitation. The action plan which was developed aims to inspire women and men to overcome obstacles and achieve fundamental changes (Water Supply and Sanitation Collaborative Council 2000).

The need of research and action in the field of women, water and development can be seen through many declarations and recommendations that were formulated on conferences and meetings. For example the International Information Centre and Archives for the Women's Movement started the international network project Gender 21. One outcome was a 21-point recommendations list, that is presented to the second Ministerial Conference on water (IIAV, 2000). It is based on a comprehensive vision of how sustainable, efficient, and effective water management and conservation systems can be achieved. Recently in July 2000 the *Gender and Water Alliance* was founded. Partners that have been involved in gender mainstreaming have formed an alliance that will continue to assist implementation of the vision on the ground.

These research and development projects are also interesting for European water research:

- Firstly, Northern countries export their technology to the South, and until now it has been rarely reflected whether the use of those technologies and techniques is practical in developing countries. In wide areas there are other preconditions for water quantity and quality (e.g.: in arid and semiarid regions water is too valuable for toilet water), cultural and religious relationship to water, water use patterns and social and economic situation etc., which are not fully considered in development projects.
- Secondly, problems equivalent to those in the South arise in (Eastern) Europe. As was shown above, the water infrastructure there is obsolete or non-existing – renewals and upgrading is urgent. Experiences of women's participation in water management strategies and examples of gender-sensitive water planning models proofed in third world countries could be useful for the rethinking of European strategies.
- Thirdly, the system of water supply and wastewater treatment in Europe is often non-efficient: Too much water is used, means for purification are too expensive, energy-intensive and ecologically questionable (e.g. CO₂-emissions due to burning of sewage sludge). For a sustainable change in water management that leads to better water quality, rational water use and consequently to a better quality of food, needs and women's experiences, often grounded in their responsibility for housework and children's care in industrialised countries, can not be ignored (see in detail chapter 2.3).

7.2.1 Current Water Resource Management and Water Policy

Except for some problems, water policy in most countries of the European Union is mainly judged as successful. Successes in prevention of pollution were made; water infrastructure on the whole is in a good condition. But the organisation of the current water management system focuses on one dimensional way on technical infrastructure: supply-side oriented water management focusses mainly on the availability of sufficient water resources for an expected, fixed demand³; demand-side oriented approaches appear in the last decades, but are not implemented sufficiently. One reason may be the gender composition of decision-making committees: As in research, decision-makers are mainly men. For example in the Dutch Water Boards only 3 % of the Chairpersons, 1,5 % of the Executive Secretaries and 6,2 % of the members of the Executive Committees are female (van der Molen 2000).

One main cause of water shortages and crises in Europe is the non-participatory and non-integrative approach and organisation of current water management system. Especially forms of (women) participation in decision-making are missing.

3 Additionally, solutions seem to follow the motto 'Purification before reduction', which cannot be accepted as part of a sustainable water resource management.

Thus, important aspects and integrating perspectives of water management are ignored:

- the combination of water supply and reprocessing of sewage/waste water treatment,
- rational water use/demand-side management; participation and involvement of stakeholders,
- the change of people's perceptions, values, attitudes and habits concerning water use ('water culture') and
- technical and organisational transformation of water infrastructure (water quality, use patterns).

The present water management systems are the result of a current non-sustainable water culture: There is only little public interest in shaping water infrastructure or in changing evolved patterns of water use; both aspects need the integration of stakeholder involvement and participatory elements. Water problems are delegated to technical and administrative experts. These experts tend to solve water problems without raising public attention or initiating interactive dialogues. The result is a vicious circle reproducing the current water culture and thus requiring, again and again, exclusively technical and supply-side oriented solutions to the problems. But ignoring the demand-side problems and needs means above all to ignore women's needs, the needs of vulnerable and other target groups and to ignore everyday life practices.

In contrast to this reductionist perspective, the term 'water culture' stands for a society's value and perception system in relation to water and water dependent eco-systems. Water culture also comprises the socio-economic embedding of water management, the (institutional) shaping of water management and water use, and thus the material production of corresponding meanings (Ipsen et al. 1998:15).

To break out of the vicious circle, and to promote a sustainable development of different sustainable water cultures, one has to gain a new understanding of water management, integrating dialogic-participatory elements and all water use and stakeholder aspects, including women's and lay person's issues. This would also include regional specificities in water deposits and landscape. Beyond this, the different sectors, industry, agriculture, and public water supply (including private consumption, tourism and municipal facilities) of water management should be taken into consideration. Their water demand differs greatly between European countries. Agriculture is the most important user of water in Mediterranean countries, mainly for irrigation. Public water supply and the industry sector is the greatest user in most Northern European countries. The water consumption by industry sector decreased during the last twenty years, in the end due to the switch of (heavy) industry to services (EEA 1998).

7.2.2 Gender-Specific Water Use

The domestic water demand is mainly determined by cultural habits. Here personal hygiene is as important as laundering, cleaning, common standards of hygiene and do-

mestic sanitation facilities.⁴ The influence of e.g. washing clothes on the environment can be seen in eco-balances as they were done by the Öko-Institut for Germany (Grieshammer et. al 1997). But ecobalances do not show how and under which conditions this washing work is done. In contrast to this, the “social history of washing” shows clearly, that washing historically was the most important women’s work (Orland 1997). And even today washing is still one of the housework tasks that shows the highest gender gap: According to the time use study in Germany, women on average spend 39 minutes per day for washing and ironing clothes, whereas men only spend 3 minutes per day with washing (Statistisches Bundesamt 1998, 110).

As water use in the household mostly is in the competence area of women (one exception may be car-washing), patterns of water use are gender-specific. The same is true for body care and the frequency of personal hygiene; how often someone takes a shower or a bath and which kind of products are used depends on cultural conditions and backgrounds. Thus, apart from gender differences, regional and cultural differences seem to be important as well (e.g. between Southern and Northern Europe).

Apart from the question who does the family and household work, the question arises whether women also feel more responsible for environmental protection. For waste separation and disposal in Germany, it could be shown that it was indeed the women who felt more responsible for this than men (Schultz/Weiland 1991). ***But up to now there is no study available about gender differences in water savings and prevention of water pollution.***

A further part of family work, one that is not directly attached to domestic water use, is nutrition. ***Looking at agricultural products and their production reveals a link between households and farming.*** As presented above, the agricultural sector (especially in the Southern European countries) has a significant demand for water. This is especially true for conventional irrigation methods, which normally do not reflect the quality and characteristics of land, e.g. whether it is suitable for extensive land use or too much irrigation is needed for good field yield. If such factors were considered, large savings in water could be achieved by alternative irrigation methods. Furthermore, those alternatives could prevent salinisation, e.g. due to ‘underground irrigation’ in a closed system. Thus, good conservation of soil also means good prevention of water pollution.

Ecological agriculture recognises such problems and develops new techniques – coming partly from traditional farming techniques, which were replaced through the expansion of (water) intensive agriculture (e.g. terrace growing), and partly from innovative methods – combined with careful selection of crops in tune with land quality. Furthermore, ecological agriculture uses less nitrates and pesticides; consequently, water resources (especially groundwater) are additionally preserved (double saving effect).

Joan Davis, expert in water-research, sees two reasons for gender-sensitive research in ecological farming.

4 If irrigation of the garden is done with freshwater, gardening could also be part of the focus.

- First, it seems that women are more interested in implementing ecological farming. To prove this assumption and the reasons for it, more gender-research in this field should be done. By own experience, made in Switzerland, Davis assumes that female farmers prefer gentle ways of agriculture, which means preserving land and water by moderately using water and chemicals like nitrates, pesticides etc. But this does not necessarily mean that field yield is less intensive than in conventional agriculture; in the long term often the harmony of land characteristics, plant selection, irrigation methods, use of fertiliser and so on can increase harvests. Those issues must be investigated carefully in further research.
- Second, on the household level, women are often responsible for nutrition. If they could be convinced of the advantages of ecological agriculture (especially health care through less chemical additives, environmental protection), this kind of farming could be encouraged and the advantages could be utilised for public health. But before this can become widespread, possible changes in consumer behaviour are required, including more information for consumers (principally women). As mentioned above, current orientations, behaviour and habits depend on various cultural factors. Those must be evaluated, before successful initiatives can be started.

In urban areas water supply often has lasting effects on wetlands around the cities, because water is taken from the surroundings and the natural water cycle is disturbed – the diversity of landscape is endangered. Beyond environmental damages (loss of biodiversity, drain of land etc.), social-ecological changes can be expected, because important recreation areas in the municipal area and the outskirts of a town decrease (see also chapter 5).

A huge amount of water flows through cities – incoming freshwater and outgoing sewage. One reason can be found in the male dominated water resource management that concentrates on industry with its great water demand, the centralised water supply for cities and the aim of a good hygiene standard in towns and cities. All these goals were reached – but there was also a high price paid, e.g. dehydration of cities and surroundings as well as the endangering of landscapes and biodiversity in the periphery, loss of recreation areas near cities. In the past, the technically oriented engineers who primarily did and still do planning and research rarely considered those factors. ***A gender-sensitive view of this subject would lead to a more functional intermixture: A more sustainable vision for regions that combines technical requirements and benefits with a regional, decelerated hydrologic cycle and an increase in quality of living and, finally, attractiveness for industry, services, trade and (foreign) investment.*** Furthermore, a vision of sustainable regions should include compensation between those regions that provide water and those who consume it, so that the dehydration and its negative consequences for the environment could be prevented. In the end, women and men would use these (new) recreation areas. And even here different requirements with respect to quality, utilisation, structuring and appearance could arise. But at the moment no studies on these issues can be found.

With regard to such gender-aspects, water research and policy can not be further seen as a task for engineers: Beyond questions of quantity and quality in water resource management (ground and surface water, sewage), a sustainable regional development includes also aspects of agriculture and commercial exploitation of (ecological) farming products. Landscape, town planning, and management must also be considered.

The previous considerations were concerned mainly with the use of water and with use patterns. But the quality of water also has an influence on human health. Even if industry tries to reduce the discharge of chemicals into water, as a result of technological development more and more hard degradable substances remain. Hormones and hormone-like substances can be found in all synthetic organic substances such as pesticides, detergents, colours and cosmetics. *The interdependence of health and environment with respect to hormone-like substances has not been adequately investigated, especially with respect to the persistence of those substances.* For animals such as some kinds of trout, a change of sex can be observed, if they live in water contaminated with hormone-like substances. Even if the linkage between women's health and environment is currently an established research field, *knowledge of men's health and environmental pollution is not sufficient. For example, the influence of persistent hormone-like substances on fertility has yet to be scientifically confirmed or rejected.*

7.2.3 Demand-side-oriented Management and Participation

If gender differences in water consumption and use are assumed, water management and policy can no longer be supply-oriented. Policy should aim at introducing changes in habits and behaviour. Possible starting points could be information about new technologies that reduce water consumption (possibly linked with energy and material savings). For this, well known technologies can be modified for more economical use (process innovation). But through innovative applications (product innovation) even more saving effects could be reached. For example, the promotion of water-related services can be one type of innovation. Then, the quality of the delivered water is related to the kind of usage; for example irrigation (especially for gardening) or water toilets do not require pure freshwater, the reuse of water is conceivable. But those concepts must be adopted in light of regional peculiarities. One role model for everywhere would not be possible.

Beyond a pure technology orientation there is a great challenge in the field of consumption and use patterns because it has not been verified that information on technology use alone has any influence on water demand and rational use. *Successful initiatives and campaigns for rational water use must be oriented to different female/male target groups. This means the differences between men and women, and, further, different use patterns among women or among men (which are determined by regional factors, affiliation to social groups or other socio-economic and social factors) have to be considered.* Without this, some measures would not be effective, and acceptance would not be achieved, e.g. for water savings or the use of detergents (Schramm 1998).

In connection with behavioural changes, questions concerning participation arise. It is doubtful that top-down campaigns, though widespread, are as effective as initiatives from the bottom. Participation and integration could be useful for the success of steering. Citizens, farmers, and other water users all have roles to play with respect to water quality and quantity, both passively and actively. Participation can be implemented by enabling and encouraging citizens to engage in water monitoring programmes, to practice water conservation, and to serve as advisors to decision makers. Farmers also can modify their behaviours to safeguard water resources. But in many European countries participatory structures are often defectively developed, so that individuals have no direct influence on water issues – even if they are interested. And within participatory approaches often the integration of female farmers and their organisations, as for example in Germany “Der Landfrauenverbund”, are forgotten. Questions of participation and its structures arise more and more, if privatisation of the water sector occurs.

As stated above women do play a particular role on the household level. It is doubtful, whether male dominated water resource management can adequately anticipate their requirements. Thus, in participatory processes women have to be integrated.

7.3 Summary and Priority Issues

Water quality and quantity seem to be relevant for many parts of everyday life which is very different for women and men. This results in gender-specific water use patterns, particularly because women are often responsible for family work, which includes washing, cleaning, health care, care for children, nutrition, etc. But these differences can also be due to different lifestyles or social status (e.g. the integration in the labour market).

Apart from gender aspects as a whole, it is also necessary to consider the views of different social (target) groups. The goal of an integrated water management should be the harmonisation and co-ordination of different planning and realisation processes for different resources (land use, soil protection, urban/rural planning, air protection etc.). For the organisation of the current water management system this means moving away from a view that concentrates on technical infrastructure and the availability of sufficient water resources for the expected demand. Instead, environmental, social and economic factors should be integrated into the management and the effects of decisions from and for other planning/realisation processes should be considered.

A predominantly technical view regarding freshwater and sewage has led to the dehydration of the areas surrounding urban agglomerations. Because of this, landscapes and biodiversity are endangered. Future planning of water affairs should consider a functional intermixture where technical aspects of water quality and quantity are combined with a sustainable view of regional water management and spatial development.

Research needs in this field also include ways of increasing the participation of women and the number of women in planning and management processes. Their different needs as well as the specific needs of vulnerable groups (as children, elderly people, pregnant women, disabled persons) have to be considered in an integrative, demand-oriented water management process, which leads to the rational use of water. Furthermore, the share of women in decision-making institutions should be increased. One model for such a participatory and integrative arrangement of processes could be the experiences in (gender mainstreaming) projects of developing countries.

In addition to rational water use on the household-level, water demand and water pollution by agriculture and industry should be reduced. One way to achieve both is to strengthen ecological farming: with alternative irrigation methods, water can be used more economical, the salinisation of land can be reduced and less nutrients and fertiliser are needed. Finally, the end-products are less loaded with pollutants and human health could be improved. But a support of ecological farming should also consider the distribution channels for products from ecological agriculture. Here women, often responsible for nutrition, are a main target group.

Clean water is fundamental for human existence and hence water and health are closely linked. Clean water, therefore, should be assured by the prevention of water pollution and water protection measures. On the other hand, there is still sufficient knowledge concerning the impacts of water pollution. Different social groups might be affected differently and consequently, methods should be developed to identify gender- and target group-specific susceptibility to water pollution. In the case of hormone-like substances this is particularly relevant.

Specific Priority Issues in the Field of Water Research and Gender

With respect to the presented state of the art, the following specific priority issues were identified in the field of gender and water research:

1. Every-Daily Life: Gender-specific patterns of water use

- ***Consumption of water at household level;***
- ***Gender-specific division of responsibility for water, water use, reduction and saving;***
- ***Gender-specific water culture concerning people's perceptions, values, attitudes and habits concerning water;***
- ***Gender-specific needs, and needs of vulnerable groups, connected with water use.***

2. Focus on social target groups in water management

- ***Integration of environmental, social and economic factors in the water management process by broadening the technical-oriented, engineer-dominated processes towards a 'social view' and 'gendered view';***
- ***Participation of stakeholders (including women and vulnerable groups) in the planning and management processes;***

- *Knowledge transfer from successful water projects in the South that integrated gender aspects;*
- *Rational use of water (here a linkage to water use patterns exists);*
- *Integrating water use, land use, urban/rural development and planning, management of other resources and other relevant parts of the ecosystem as well as the social and the economic sphere;*

3. Water and health: Gender-specific implications

- *Promotion of water protection through emphasising the linkage between water quality, water supply and protection of other media of the ecosystem (e.g. soil);*
- *Development and promotion of water protecting, (alternative) production methods (e.g. ecological farming);*
- *Development of gender health assessment methods to monitor and detect possible gender differences in susceptibility to environmental impacts of water pollution, 'water-born diseases', and in connection with persistent hormones and hormone-like substances.*

8 The Fight against Major Natural and Technological Hazards

8.1 Gender and Natural Hazards

8.1.1 Research Topics

Gender research on natural hazards is based on a concept of disaster as a social process. It encompasses research on the social impacts and effects of natural hazards, including the pre-disaster phase as well: planning for natural hazards, warning and reaching the population, evacuation etc.

In Europe, the Disaster and Social Crisis Network (Part of the European Sociological Association, see www.anglia.ac.uk/geography/d&scrn) is a network of researchers engaged in research on social aspects of disasters. Gender issues are not its main field of study, but are included by some researchers (Fordham 1998, 1999). *Particularly in the last 10 years world-wide, research on natural hazards concerning gender questions in the field of natural hazards has been developed. A gender and disaster network was founded to exchange research results and to foster the gender issue in disaster research and policy* (see www.anglia.ac.uk/geographygdn). Nevertheless, gender has been, and continues to be, a neglected issue in disaster research, reduced mostly to a demographic variable.

Existing research is more applied than theoretical, often based on case studies. It does not emphasise different kind of disasters (floods or earthquakes), but concentrates on the political, economic, social and cultural roots making some people more vulnerable to disasters than others. *The central theoretical concept of gender research with respect to disasters is that of disaster vulnerability*. It indicates the degree to which social groups can be affected by disasters, that is the socio-economic conditions that determine the degree of damage, the capacity to confront with and to recover from the damage.

In general, more research has been done on disasters in so-called third world countries, because their disaster vulnerability is much higher. But industrialised countries show special patterns that should be integrated into research as well, such as the trend towards the ageing of the population, since more women than men figure among elderly and their disaster vulnerability is very high as well.

Moreover, research issues within this field are: Different impacts of disasters on men and women, including women and housing, violence against women in and after disasters, how to reach women and children in disasters, women's quilts, women's perception, women's work in disasters and women's capacities, needs and vulnerabilities in disasters.

8.1.2 Gender and Natural Hazards: State of the Art

The key-work in the field "The gendered terrain of disaster", edited by Elaine Enarson and Betty Hearn Morrow (1998), collects a great number of key research findings. The current state of the art has been summarised in a paper submitted to the ILO for an ILO

workshop in Geneva on gender issues and natural disasters (Enarson 2000). Enarson criticises the predominant technocratic emergency approach, and suggests an alternative approach that derives from vulnerability and feminist theory and which links “social justice and gender equality to disaster mitigation through sustainable development” (2000).

On the one hand, women are especially hard-hit by the social impacts of environmental disasters, because post-disaster mortality, injury and illness rates are often higher for women and girls, and, as they are poorer, economic losses impact them more. Moreover, their workload changes, and their responsibilities increase, so that they show a higher rate of post-disaster stress symptoms. It has also been observed that there are increased rates of sexual violence and domestic violence against women and girls in disaster contexts.

Gender differences also exist regarding emergency communication, household disaster decisions, voluntary relief and recovery work, access to evacuation shelter and relief goods, employment in disaster planning, relief and recovery programmes. Moreover, male dominance in disaster decision-making may misdirect disaster relief from family needs to personal interest. Consequently, “gender inequality is a root cause of women’s disaster vulnerability” (Enarson 2000).

But men’s disaster vulnerability may also increase through risky but ‘heroic’ rescue activities and self-destructive coping strategies. Additionally, masculine norms may limit the ability to ask for help.

As gender is not a universal category, differences between women, especially highly vulnerable groups and their specific needs have to be taken into account. These groups tend to be less visible, but have urgent needs in disaster situations.

On the other hand, women also have a special capacity to cope with disaster situations. “Women are active and resourceful disaster responders but often regarded as helpless victims” (Enarson 2000). During and after disasters women do reproductive, productive and community disaster work, and their local community knowledge, their key roles in families and strong social networks make them resourceful social actors in crisis.

Since ***women and children have been identified as ‘Keys to prevention’ during the International Decade for Natural Disaster Reduction,*** Enarson argues that ***they should also be considered as equal partners in disaster mitigation and community-based planning.*** “Gender issues must be effectively integrated into disaster research, planning, and organisational practice” (Enarson 2000).

With respect to sustainability the discussion concerning women and children as ‘indicators’ of prevention strategies could be broadened. Anja Possekel (1999) has stressed the argument that natural hazards could also be understood in a different perspective, as an opportunity for introducing more sustainability. She studied the volcanic crisis on the Caribbean island Montserrat, and developed an applicable combination of hazard management and development planning in which the reconstruction process following a

disaster is understood as an opportunity for structural changes and self-organisation processes that can foster sustainable development.

8.2 Gender and Technological Hazards

8.2.1 Research Topics

The main focus in gender research on technological hazards is found also in the social sciences. As shown above, there exists a profound debate about technology in general, and about certain technologies in gender research. But approaches to technological risk research are mostly done - except for some studies about biotechnology - from a social scientific perspective. The technical standards of a certain technology and methods of standard-definition - have so far not been treated within gender research as such.

Gender research concerning technological hazards in a broader sense has investigated, above all, the perception of technology. Thus empirical studies show that *there is a remarkable gender-bias in the perception of technology. Women show more fear with respect to risks. They expect catastrophic situations, whereas men tend to think in terms of probabilities of risks* (percentages of risk levels). A study in the USA on environmental risk perception suggests that white men play down environmental risks (Flynn et al. 1994). US-American studies on risk assessment and risk perception which have been done from a gender perspective focus mostly on questions of human health and questions of reproductive health. Another focus of gender research in the US concerns questions of technology assessment with respect to computer technologies and tele-work.

In Europe, research on gendered risk perception is less frequent. Within mainstream research on technological risks (above all within the discipline of sociology of technology) gender is treated mostly as a variable within the social structure. The following questions have in general not been investigated systematically:

- the definition of risk,
- gender disaggregated data in all dimensions of risk research,
- the integration of women/target groups in risk assessments (above all in the process of valuing risks),
- the integration of women/target groups in strategies of risk minimisation after an accident has happened and
- the integration of women in risk communication strategies.

There are exceptions, however. One is to be found in Sweden. Gender research within the field of risk perception, technology assessment and perception of technology is explicitly integrated into the research programmes of the Department of Technology and Social Change/University Linköping, in Sweden. The programme focuses on questions of risk and security that are connected with questions of a gendered technology.

The programme distinguishes four research fields:

- Information technology,

- processes of research, knowledge and learning within techno-science,
- women's work, health and poor health and
- technology transfer from a global perspective.

Beside the university of Linköping, the universities of Lulea and Umea in Sweden also integrated qualitative research with a gender perspective into the research on technology and risk perception (e.g. Maria Udén, Luleå tekniska universitet, "The qualitative role of technology to women engineers" 1993, Liselotte Jakobsen, Karlstad universitet, sociologi, "Every day understanding of risk and safety in different life modes" 1995-1999).

8.2.2 Gender and Technological Hazards: State of the Art

*A broader spectrum of research questions concerning the focus of technological hazards from a women's perspective has been raised by the very prominent example of the accident in the nuclear power plant in Chernobyl in 1986, and the effects of this accident on women's everyday life.*⁵

In Germany, the accident in Chernobyl provoked strong reactions within the public. Women clearly reacted stronger than men did. They founded so-called 'Mother groups against nuclear technology' all over Western Germany, which organised mass demonstrations and many political actions. Even one year after the accident more than 1000 of these so called 'Mother Groups' still existed. The arguments, which arose during these times of strong resistance and organised reaction of women's groups against the nuclear technology, are exemplary of feminist argumentation with respect to technological hazards and risks. Therefore, this example will be dealt with in some detail.

An often-repeated first argument was: Women were not asked when the technology was constructed, but when an accident happens, they are strongly called upon to 'solve' the existential crisis. But even if women want to do this, even if they would bring to bear their never-ending care work and housework (cleaning away the dangerous substances, for example), women can't 'solve' the crisis (see in detail Schultz 1987). This argument can be found after technological hazards in other cases; for example, it also appeared after a hazardous accident at the chemical producer HOECHST in 1993 (Hien 1993). This is why women groups - as well as scientists - ask for participation of women in the process of technological construction and risk assessment.

In Germany, another argument that embedded the Chernobyl accident within a traumatic German memory has followed this argument. 'This accident is the same as war', women argued; 'Men use war technologies, and afterwards, when the land is laid in ruins, women have to rebuild the destroyed landscape and daily life'. The slogan "We do not want to be rubble women (Trümmerfrauen)" arose at the same time at different demonstrations, without knowing about the other ones.

5 The following arguments build on a study on "The effects of the accident in Chernobyl" which was done by Irmgard Schultz (1987).

Risk perception and the forms of valuing the nuclear accident differed widely in Europe. In comparison to the strong reaction of the public in Western Germany, in France no public reactions on the accident could be registered. Reactions depended very much on national information politics about the accident (see below) and on socio-cultural meanings concerning risks, which differ very much in Europe. In Germany, as well as in Russia, the traumatic experiences of World War Two provided the pattern for a metaphoric risk interpretation. In contrast to Eastern Germany, the issue of destructive technology development was strongly politicised just some years ago by a strong anti-missiles-movement in the beginning of the eighties, in which many feminists were involved (with their own peace camps).

Beside this cultural framing of the accident's perception and interpretation one could also see a specific form of interaction between official politics, public interpretation of what had happened and the actions and reactions of women. This may be summarised in three points (this summary is based on interviews done in 'mother groups against nuclear technologies'):

- Directly after the accident official politicians seemed helpless. They gave advice on the organisation of the everyday life, which was experienced by women as provocative. The politician's recommendations exhausted in advice aimed at the avoidance of radioactive substances: not to let little children go out into the radioactive puddles in the street (because the fall out came by rain), not to eat fresh fruit and vegetables, not to drink milk etc. This advice strongly influenced the organisation of everyday life of women. Above all women with small children learnt within two days to change nutrition completely. Women learned above all, on the basis of this advice, that they had to change nutrition patterns.
- Scientific interpretations gave new orientation to the organisation of nutrition. An indicator for critical amounts of caesium 137 was declared most important, and measured in vegetables, fruit and milk. This radioactive substance was found in high quantities in the milk coming from the South of Germany. Another radioactive substance, strontium, on the contrary, was found in strong quantities in milk from the North of Germany (because these substances react differently to rain and wind). Women preferred the milk from the North in order to avoid caesium 137. Half a year later, strontium was shown to be more dangerous, especially for small children's health. A debate began over why caesium instead of strontium had become the leading indicator. The debate showed a new level of dependency of everyday life on scientific interpretation.
- After some weeks, politically decided risk minimisation strategies were put into place. In Sweden the government decided to destroy the harvest of hay and to treat it as hazardous waste. The strong effects on reindeers and on the culture of Sami people were known. In Germany, it was at the level of the federal states where decisions on risk minimisation strategies were taken. The limit levels with respect of caesium 137 in milk differed considerably from state to state. Thus, it became obvious, that the so-called objective limit levels were drawn arbitrarily. Politically decided risk minimisation strategies also differed very much among the states. Hessen decided to

mix radioactive-free hay from the year before together with the 1986 hay to a level that was declared a 'limit value' and was measured with respect to caesium 137.

Feminist biologists and physicians, and the 'anti nuclear mother groups', criticised the limit threshold strategies on three points. Their arguments can still be considered as exemplary for a scientific critique of accident management from a gender perspective:

- To base risk management strategies on threshold limits of leading indicator substances is, in the case of radioactivity, not very successful, because it is known that the effects of radioactivity are present even in very low levels. Risk management based on only one strategy, namely to lower critical loads below 'threshold values', was doubted in general. Instead of a one-point-strategy women demanded a 'risk minimisation-strategy-mix'. In addition to this they argued that several effects of different substances within the fall-out (see the controversy about caesium 137 and strontium) have to be considered.
- The scientific transfer of levels of radioactive substances into degrees of human health effects is oriented to an average human being, one who is not pregnant, who is male, about 35 years old and healthy. Instead of orienting to this 'average person', women's groups demanded orienting possible effects on human health to vulnerable groups: pregnant women, babies, sick persons, and elderly people. In fact it was known that many pregnant women in Germany aborted their foetuses, fearing a deformed baby during this period.
- Activists within anti-nuclear groups demanded, on the one hand, a whole series of measurements with respect to different fields of everyday life where radioactivity had penetrated (soil, plants, nutrition, food etc.). On the other hand, they demanded measurements of the radioactivity within the body of children and women. This demand provoked a strong reaction from scientists within the activist groups. They criticised all measuring activities on living people because they saw problems of data-protection. Beside this they argued that measuring activities do not help to minimise the radioactivity within the body (for further details see Schultz 1987).

The study on women's reactions on the accident in Chernobyl stresses the specific vulnerability of women that has to be taken into account in political risk management strategies. According to this, the most important demand from women's perspective in risk management strategies is the participation of women in the procedures of defining those strategies. This means, on the one hand, participation of women as 'daily life-experts', but it also means on the other hand - this is stressed in the study as a whole - the participation of feminist scientific experts in the procedures of defining crisis management strategies. Furthermore the study shows women's everyday life competencies, their capacity to organise 'survival' in difficult circumstances. And finally the study shows in an exemplary way that a lot of women feel more anxious or worried about technological risks, and that they often react in different behavioural patterns than men do.

The last fact is used ambivalently in the public debate about women, the environment and risks. In the case of the Chernobyl accident the stereotypical argument about 'women's hysteria on health risks' was to be heard not for the last time. In Germany the shift within the public debate from a strong involvement in the environmental issue to a stereotypical 'environment is out' argumentation was strengthened by the argument of 'the overly hysterical nature of the environmental debate'.

With respect to gender and environment research that stresses the importance of everyday life and women's experiences, the influence of the *media* as a filter of interpretation of environmental and health risks has been seen very clearly by feminists. As shown by the example of the communication of the Chernobyl accident in the media, the public debate about environmental health effects is above all a debate about natural scientifically defined 'facts'. These 'facts' are interpreted by media/communication within a cultural, social and socio-historical framing that strengthens or mitigates the perception of a risk (Brand et. al 1997).

The Environmental Health Action Plan for Europe (EHAPE), which must be realised in every European country in the form of National Environmental Health Action Plans (NEHAP), considers the point of information and participation of the public in environmental risk issues as very important. The German NEHAP-process stresses the point of risk communication as one of the most important tools within environment and health strategies. A German study of the Robert-Koch-Institute recently defined five key elements for a risk communication according to the ALARA- principle, that means 'As Low As Reasonably Achievable':

- reduction of risks,
- fair distribution of risks,
- mitigation of societal conflicts about risks,
- transformation of the discourse from emotional arguments to rational reasons and
- legitimacy of risk burdens (Bundesministerium für Gesundheit 1999:210).

Feminists see this communication approach ambivalently. On the one hand, this strategy could open new forms of women's participation that would bring together the question of empowerment of women and environmental justice (stressing the second point). On the other hand, feminists have a fundamental critique of this strategy, above all in the public debate about cloning and genetically changed organisms. They fear that risk communication in this field is a strategy to weaken resistance against a certain technology by counting on the time. Instead of clear ethical frames and limits (which would in respect to genetically changed organisms argue from the non-knowledge of their effects) risk communication is put into place. Meanwhile, while the public is involved in risk communication, the big food companies are realising their strategy of 'faits accomplis'.

8.3 Summary and Priority Issues

Research on gender and natural disaster is based on the understanding of disasters as social processes and the concept of disaster vulnerability. It could be shown repeatedly that women are more vulnerable to the effects of natural disasters because of their specific socio-economic situation that is mainly caused by discrimination. But on the other hand women also possess specific knowledge and skills to cope with disaster situations and therefore are recognised as ‘keys to prevention’.

The findings about technological hazards and gender are similar in many aspects to that of natural disasters, although the nature of technological hazards is quite different, because they are caused by human activity.

A gender gap within technology risk perception can be identified, women are more sceptical towards technology in general and they have a different understanding of technological risks. This seems to reflect their real-life experiences in a certain way, because technological disasters showed that women's everyday life was deeply changed by technological hazards. As was shown here by the example of the Chernobyl accident, the ones that developed coping strategies for the effects of the accident and those who set the limit values for different materials were the experts, mostly men. Whereas it was women that had to cope with the situation above all with respect of the change in nutrition, the politicians seemed to be helpless. They were not able to offer any help to manage the daily life situation under conditions of crisis. Beside this the accident showed a new level of dependency of everyday life from scientific interpretation. Limit values represented the starting point for avoidance (of radioactivity) strategies. It was criticised by feminist scientific experts within the women's groups, which were founded after the accident, that the setting of limit values proceeded from the situation of a healthy man, instead of taking into account special vulnerable groups. Official activities were mostly reduced to pure measurement of substances, which did not help to decrease nuclear substances in the environment, in the nutrition and within the bodies of people. The example shows the importance of feminist scientific expertise within avoidance and mitigating strategies.

Specific Priority Issues in the Field of Gender and Natural and Technological Hazards

Deriving from the state of the art, several important specific priority issues arise when considering gender questions in natural and technological hazards:

1. *Participation of women as ‘daily life experts’ in technology development*

Women and their different points of view have to be integrated in the development of new technologies and in the technology assessment process.

2. *Participation of women in risk assessments*

Women and their different points of view have to be integrated in the development of risk assessments as well as risk communication strategies.

Female scientific experts should participate in defining the scientific goals of hazardous effects-mitigating strategies and in defining political avoidance and mitigating strategies.

3. *Participation of women in disaster (survival) planning:*

Women should participate in the planning in every stage of disasters. This includes the systematic integration of their specific knowledge about every-day life and coping strategies.

4. Gender issues in emergency response:

Gender issues have to be implemented in emergency response, relief strategies and reconstruction policies, again focussing on women's specific situation and needs.

5. Development of indicators:

Social indicators should be developed that predict relative impact of natural and technological disasters on women and men and show their disaster vulnerability.

9 Earth Observation Technologies

9.1 Research Topics

Continuous environmental monitoring is an important tool in environmental research within the natural sciences. It serves to forecast developments, to verify models and to evaluate the effects of environment-related interventions. Here, standardised indicators and reliable measurement procedures are crucial for being able to draw comparisons across different spatial regions or periods of time. Hence, the observation of ecological states and changes within the framework of environmental monitoring plays a substantial role in the context of sustainable development.

Earth observation technologies play an important role in the monitoring, modelling, analysis and forecasting of environmental changes. For example, satellites provide data about land use, deforestation, desertification, some kinds of environmental contamination, and natural hazards. With these data, changes and variations can be observed. These data form the basis for the development of models, which serve to describe the different developments and to forecast future developments.

9.2 Earth Observation Technologies and Gender: State of the Art

With respect to remote sensing systems, earth observation technologies and satellites only a small number of studies deal with gender aspects. Some studies and data relate to the professional aspects with regard to proportion of female scientists in earth sciences. Other studies deal with the basis of theoretical approaches and with the societal impacts of these technologies regarding the perception of the planet and environmental problems, the societal relationship with nature and, starting from feminist perspectives, gender-related impacts therein.

a) Women in Earth Sciences and Organisational Aspects of Research

According to the “Network for Women in Earth Sciences” (GAIA) in the Netherlands, the percentage of female graduates in Earth sciences over the last decade has been considerable (ca. 30 %) in this country. However, only few female scientists gain access to permanent positions in science and industry, as only 5 to 10 % of the earth scientists are women in these organisations. Further data about other European countries are not available.

Research on gender aspects of the technologies in earth observation has not been conducted so far. Until recently, mineralogy and palynology were considered the (only) appropriate fields for young, mobile and unattached female earth scientists. Fieldwork and work abroad were considered as major obstacles for married female scientists and scientists with children. This situation gradually started to change in the eighties. There is some research on the position of women in earth sciences and on the success of women applying for research funds. The success rate of women candidates in earth science appeared to be not, or slightly negative related to their scientific record, while for

male candidates this relation was – as expected – positive. In US research, a study has been done on the position of female faculty in earth sciences, showing a very slow increase to 10 to 15 %, and on barriers they experience. ***In the Netherlands women constitute only 2 % of faculties at universities, while around 30 % of the graduates are women*** (information from Hanneke Gieseke, president of GAIA).

b) Societal Impacts of Earth Observation Technologies

Authors like Sens (1990) and Sachs (1992, 1993) have analysed earth observation technologies in the context of a transformation of the world's image and the societal perception of the globe as the 'blue planet'. A new generation of instruments and equipment created the possibility of collecting and processing data on a global scale. ***Satellites, sensors and computers made a new world image possible. The debate on global environmental change depends on them.*** With the construction of increasingly high-powered computers it was possible to process a profusion of data and to gather this information in the world models of the system analysts. Thus a dynamic picture of the globe emerged which revealed, and made people aware of, the finite nature of available resources, the limits to growth and the stress capacity of the planet. ***It was the image of the earth seen from outer space and transmitted all over the world through television screens, which opened a 'planetary perspective' to humans.***

Sachs stresses the danger of a technocratic view and the construction of new realities, which collect mountains of data, but abstract totally from people and their different living conditions. According to him, these kind of global data, collected by planetary sciences "provide a knowledge which is faceless and placeless" (Sachs 1993:19). The abstraction of the 'satellite perspective' offers data, but no context. "The global vantage point requires ironing out all the differences and disregarding all circumstances; rarely has the gulf between observers and the observed been greater than between satellite-based forestry and the seringueiro in the Brazilian jungle" (ibid.). Along with this tendency toward abstraction, Sachs stresses the danger of 'ecocracy', if the claims of global management are in conflict with the aspirations of cultural rights, democracy and self-determination.

c) Feminist critique

From a feminist perspective, Donna Haraway's approach stands for another argument within the feminist critique of scientific rationality, one that is relevant for environmental research, too. Taking post-modern approaches as a starting point, feminists appropriate in their own way cybernetics and information technologies. Following the arguments of the French philosopher Michel Foucault, whose expositions about 'bio-power' influenced a great deal many feminist epistemological approaches, ***Haraway (1988) sees the dominance of the visual dimension in contemporary technology as a symptom of gendered power. Haraway and other feminist critics of science (e.g. Lykke/Braidotti 1996, Duden 1991) interpret the disembodied gaze that constitutes virtual spaces as a tendency towards abstraction that goes together with an increasing***

degree of control of intimacy. Starting with the perspective of ‘situated knowledge’, Haraway stresses the effect of new instruments of visualisation like sonography systems, artificial intelligence-linked graphic manipulation systems or satellite surveillance systems as compounding these meanings of disembodiment by creating new forms of scientific ‘objectivity’. These new forms of scientific ‘objectivity’ increase the distance between the knowing subject and the object of knowledge (see general outlines in chapter 2).

The debate about ‘cyberspace’ and the reflection about the disembodied view to the globe, the ‘planetary gaze’ from Sputnik perspective to earth, go together with a reflection about basic changes in the understanding of the world in respect to the end of the space-time continuum of Modern European thinking. In environmental research feminists appropriate critically the ‘ecological’ message, which is expressed in the picture of “The blue planet is dying”, that is grounded on the extra-terrestrial ‘planetary gaze’ of satellite technology. ***The inscribing of pictures of Earth observation in the understanding of the world leads to a special form of abstraction of everyday life. It excludes above all women’s bodily experiences.*** The ‘whole world’ and ‘everyday life’ are more and more bound together by observation technologies, those of Earth observation on the one hand and those of medicine and body control (‘intrauterine gaze’ into the body of pregnant women, for example) on the other hand.

Environmental research from a gender perspective makes this point by criticising the extra terrestrial Sputnik-point of view. The ‘blue planet’ is a picture in which the world is understood in terms of scientific definitions of pollutants. On this view the ecological crisis of the globe is defined by ‘too many’ material flows and energy conversions, which are seen as destructive for the ecological balance of the globe. This is the frame picture of thinking ‘ecology’ today. ***Against this reduction on pure natural scientific interpretation of the world, gender research argues for new images and scientific models that combine the natural sciences perspective with everyday life experiences of women and different social groups.*** Consequently, ecology in a gender-perspective must be social ecology. The so-called ecological crisis is a global societal crisis, in which political, economical, social, ecological and gender-political crisis factors are inseparably bound together (Schultz 1997). The thinking of ecology as a societal-free space is criticised by feminist ecologists.

d) Feminist Perspective on Political Impacts of Earth Observation Satellites

In her study, Karen T. Litfin (1997) explores a feminist perspective on earth observation satellites. Her research relates to the social and political dimensions of earth observation by satellite. She discusses questions regarding who has access to satellite data and the social and political purposes to which the data are used. In particular, she considers ***questions about new uses of satellite imagery by non-state actors (international organisations monitoring environmental treaties, indigenous groups making land rights claims).***

e) Impacts for Indigenous People

The paper of Madsen (n. d.) investigates the problems associated with remote sensing from space-based platforms as they relate to the protection of the rights of indigenous people around the world, and especially in the USA and Canada. ***Besides the right of individual privacy, the right to a collective or “communal right of privacy” is stressed, especially as it relates to the rights of indigenous people to be free of wanton exploitation from data on their lands and waters that are collected from orbiting surveillance and sensing platforms.*** Hence, conflicts on the use, the access to and the benefit of data, for example of satellite-based geographic information systems, can occur. The data of these technologies can be used for identifying the damage done to rain forests, but they also can be used for further exploitation. Besides the spiritual and religious significance of the land, indigenous people stress the danger of the abuse of these data, which can be used to deny them their rights. The author demands that international treaties and other regimes that seek to protect the rights of indigenous people to their lands and resources must be strengthened to address privacy protections against wanton snooping from overhead surveillance satellites.

9.3 Summary and Priority Issues

As part of environmental monitoring, earth observation technologies are crucial for the monitoring of global and regional environmental changes. As supporting instruments earth surveying satellites are important for the fight against global environmental degradation, for example regarding deforestation and climate change. As early warning systems they are of great significance in the area of the prevention of catastrophes; for example, regarding earthquakes, floods, dam breaks and volcanic eruptions on the global level. On the other hand, the development of new sensors and sensor technologies can help to cope with regional and local problems.

Regarding gender-specific aspects, the situation of female scientists in the earth sciences has to be taken into account. Therefore, further studies have to be done in European countries about the impediments and enabling conditions for the access of female scientists to qualified professional positions.

Moreover, European studies of the political, societal and social impacts of earth observation technologies should be done, in particular regarding the access to satellite data of different groups with different interests, the political purposes to which the data are used and gender impacts therein. Therefore, in particular, ***questions concerning the standards of interpretation of the data have to be taken into consideration. In the sense of “situated knowledge” the research question has to refer to the geo-political peculiarities of environmental factors, on the one hand, and the consideration of social conditions and gender relations, on the other.***

One impact of these desiderata is the call for a kind of an environmental oriented ‘social monitoring’ (see Kruse-Graumann et al. 1998).

Specific Priority Issues in the Field of Earth Observation Technology and Gender

With respect to the state of the art the following specific priority issues concerning Earth observation technologies and gender have been identified:

- 1. Societal significance of Earth observation***
- 2. Social and political impacts of Earth observation technologies***
- 3. Access to data of remote sensing systems and enabling factors for the use, application and shaping of these data by different social groups***
- 4. Standards of interpretation of data***
- 5. Situation of women in Earth sciences and differences in career chances.***

10 Socio-economic Aspects of Environmental Change in the Perspective of Sustainable Development

In the EU RTD-programmes socio-economic aspects are understood in a broad sense: the term summarises aspects that are not being studied by natural sciences. Hence, socio-economy in this understanding embraces all social and economic sciences as well as human sciences. Gender is thus an integral part in socio-economy. However, it has to be emphasised that gender can not be simply reduced to socio-economic aspects, but is a concept that, within socio-economy and beyond, determines perceptions and shapes sciences as a whole (as has been shown in chapter 2).

Bringing together socio-economic aspects with both environmental sciences and a gender point of view is an important perspective with regard to sustainability, since this means opening the perspective towards a transdisciplinary approach of sustainability research.

Keeping this in mind, this chapter will present socio-economic concepts that have been developed to explain and reduce environmental impacts from a gender point of view. But apart from merely analysing existing concepts, feminist theory has always gone beyond this and brought forward its own theoretical approaches and thus opened the way for new modes of thinking. Hence, the chapter starts with socio-economic ecological theories that have been developed by feminist researchers.

10.1 Research Approaches: Socio-economic Ecological Feminism

Two major streams within economic thinking may be identified. On the one hand there is what we can call the 'hard' economy: It is based on 'hard' economic objectives such as profit or the maximisation of shareholder value. This economic thinking is based on purely mathematical models and it would like to be understood as a part of the natural, the 'hard' sciences.

On the other hand there is the so-called 'soft' economy. Within the 'soft' economy other aspects are being considered as well: the effects of economic action, the social conditionality of economic behaviour and the involvement of different actors.

The 'hard' economy has been subjected to considerable criticism. From a feminist point of view, economic theory is based on a view of the 'economic man' (Mellor 1996). *Feminist critique of economic theory is in many points similar to the critique of economic theory made by ecological economics, since both women's work and the environment are being treated as external factors.* Women's unpaid household work is not entering into the GNP and their needs are not been taken into account in public budgeting (Warren 1987). In the same way, businesses externalise environmental costs and have few incentives to stop degrading the environment.

Therefore, feminist ecological economists address the connections between ecology and women in their work and, consequently, take into account both gender and nature points of view. They emphasise the primacy of work taking place in the household. This sort

of work is named 'provisioning' (Nelson 1996), 'sustenance' (Shiva 1996) or 'caring activities' (Jochimsen/Knobloch 1997).

Moving beyond these common points different models of an alternative economy have been developed.

- The approach of 'Vorsorgendes Wirtschaften' (preventive economy) has been set forth by German and Swiss economists Christiane Busch-Lüty, Maren Jochimsen, Ulrike Knobloch, Irmi Seidl and Adelheid Biesecker. They argue that an economy that is to be sustainable must be extended by the principles of social prevention. The preventive economy is based on three principles that can be observed in the female sphere of the private household: Prevention, co-operation and an orientation towards basic needs (Jochimsen et al. 1994). Jochimsen and Knobloch speak of a model of economic activity that consists of three parts. First, there is a 'maintenance economy' made up of ecological processes on the one hand and the social and physical relations indispensable for human existence on the other hand. Finally, there is the 'industrial economy', which is closely related to the maintenance economy. They argue that women are responsible for caring activities and therefore depend on the ecological processes. But the industrial economy has negative impacts on ecological processes and consequently, any violation of ecological processes affects caring activities. The 'Vorsorgendes Wirtschaften' (preventive economy) approach remains within the theoretical boundaries of a market economy and has hence been criticised for its lack of changing existing power relations and the structural discrimination of women's work and needs (Möller 1997).
- Mary Mellor (1996), however, argues that the problem of externalities can not be solved within existing economic theory, by paying women wages for housework and by pricing the use of environmental resources. In her view wages for housework and the pricing of the environment only sustains the existing structures of exclusion. Moreover, paid housework would only raise consumption demands and thereby increase the material throughput of the economy. She also criticises the idea of an eco-tax. It would increase prices with grave social effects: the consumer (mainly women) and poor people (mainly women) would have to pay the price for decisions mainly made by men.
- Starting from similar concerns, Hilka Pietila (1996) emphasises the dominance of household activities and nature over the market economy. She develops a model of 'human economy', borrowing models from Hazel Henderson: Her starting point is the idea that taking care of basic human needs is central to the functioning of the economy. Hence, human economy covers all work etc. that is necessary for the existence and survival of society. Pietila's economic model is made up of three concentric circles. She places the 'free economy' (economic activities that have no price) at the centre in the inner circle. The free economy is surrounded by the 'protected sector' made up of production and work for the domestic market, whereas the outer circle, the 'fettered economy', consists of production activities for export. Pietila argues that a revival of the free economy would make economic growth unnecessary, since the protected sector would not have to be increased. If economics

would centre on household or community provision of basic needs, women's work would be more valued and the environment less subject to destruction without having to monetise all externalities (Pietila 1996).

- The German 'Bielefelder approach' of 'subsistence', developed by Maria Mies, Veronika Bennholdt-Thomsen and Claudia von Werlhoff has been presented in chapter 2. They depart from the eco-feminist theory and depict an 'eco-feminist economy' whose central aim is the subsistence production or, as they call it, 'the production of life' (see chapter 2). They enumerate several basic attitudes necessary for this sort of economy: work must be regarded not as a burden, but as a unity of burden and fun, the understanding of time must be oriented towards the cycles of nature, and economic activity in general should follow feminine principles (Mies 1988, Mies/Shiva 1995). Although they have been criticised for their eco-feminist position, the approach made an important contribution to the discussion of the future of work in societies where paid employment is constantly decreasing by introducing the subsistence perspective (see chapter 2).
- In the context of the sustainability discourse the issue of self-sufficiency of economic activities of communities and entities smaller than nation states has been emphasised repeatedly (Peters 1997). These community-based approaches are also widely influenced by feminist theory since it is argued that 'feminine principles' such as co-operation, subjectivity and intuition support the building of sustainable communities (Nozick 1992). Furthermore they argued that skills are needed that have mainly been preserved by women in order to move towards self-sufficiency (Adair/Howell 1993)⁶.

Summarising these feminist theoretical approaches and their emphasis of household activities and women's needs, three complexes have to be reflected within socio-economic ecological concepts from a gender point of view:

- the economy of households (economy of care),
- the use phase within the life cycle of products and
- participation in policy and product development.

10.2 Socio-economic Aspects of Environmental Change: Selected Gender-specific Research Findings

As socio-economy and gender issues in the context of sustainable development is a very broad issue, this part will focus on three important issues:

- critical relationships between socio-economic development and environmental change
 - tools and methodologies for integrating sustainability into policies
 - key transition paths towards sustainability
- and the respective gender-specific issues therein.

6 For further discussion of gender aspects in sustainable regional development see chapter 10.3.

By doing this, we follow the structure of the objectives given in the Sub-Programme for Environment and Sustainable Development (ESD) of the 5th EU-RTD-Framework Programme.

10.2.1 Critical Relationships between Socio-economic Development and Environmental Change

a) Environmental Implications of Socio-economic Drivers

Some of the most important socio-economic drivers for environmental change, such as attitudes, technology development and demographic changes will be analysed here with regard to the interlink of environmental impacts and gender aspects to emphasise the importance of gender differences within this scheme.

Attitudes

Surveys about attitudes as socio-economic drivers for environmental change are important with regard to two aspects. First, surveys about attitudes towards the environment within the population can serve to prioritise political policy tasks, second, they are an important source of information for environmental education and communication (see below).

As to gender aspects, in industrialised countries, surveys about environmental consciousness and environmental behaviour show clear differences between men and women.

- Women tend to have a higher environmental awareness than men do (e.g. for Germany: Kuckartz 2000, Preisendörfer 1998, for Japan: Sumito-Life Research Institute 1996, for Finland: Niva et al. 1997).
- Women also show a higher personal concern about environmental problems than men, their values seem to be more linked to the preservation of the environment, as they more often emphasise the importance of health and the well-being of their families (Waldmann 1992).
- Consequently, women are more sensitive towards environmental risks and more sceptical as to technological solutions to environmental problems (Kuckartz 2000).
- Women in general show a higher engagement and more willingness to act for preserving the environment (Preisendörfer 1998, Niva et al. 1997, Devries 1997).
- As to actual behaviour, women act more environmentally friendly when it comes to buying environmentally sound products or avoiding or collecting waste (Franz-Balsen 1998, Preisendörfer 1998). The most important gender differences can be observed in mobility behaviour (see chapter 4).

For Germany, Preisendörfer found that the differences in environmental awareness and behaviour within the category gender were more distinct than within any other socio-demographic variable, although gender differences were clearer in West than in East Germany (Preisendörfer 1998:140).

However, women's knowledge about environmental problems seems to be lower than men's knowledge (e.g. de Haan/Kuckartz 1996, Niva et al. 1997). But it has been argued that the understanding of knowledge in these empirical studies is defined as scientific knowledge, not knowledge that arises from experience and is closely linked to every-day life. If asked about what one can do to preserve the environment, women would probably know more than men would.

Concerning environmental communication strategies, the usefulness of research about attitudes was put into question, as empirical research stated a 'gap' between the environmental awareness and the real environmental behaviour⁷. This gap has been an often discussed issue with respect to the reasons why people, though environmentally aware, do not behave in a corresponding way.

The critique of this discussion developed by the Institute for Social-Ecological research (ISOE) argued that research about attitudes and behaviour simply presumed that people were universally the same. Social differences in life-styles and social milieus were not taken into account (Schultz/Weller 1997). This critique led to the development of the so-called style-approach. Within this approach, empirically identified social groups with different life-style patterns are studied in terms of their orientations and their actual behaviour. In a project on mobility behaviour and orientations carried out by ISOE, it was shown that by differentiating between groups with different mobility orientations one could observe that within the group with a strong identification with car mobility there was a considerable consistency of orientation and behaviour (CITY:mobil 1999:55ff). Moreover, the study showed that with regard to behaviour and attitudes gender is a determining category, although differences were noted among different social groups.

In Germany, it has been largely recognised in the meantime that it is important to consider both attitudes and behaviour while taking into account different social backgrounds and life-styles.

Technological Development

Current important drivers in technological development affecting women to a large degree are biotechnology and information technology (e.g. tele-working). Gender research on technological development was presented in chapter 1 and in chapter 6, which showed, among other aspects, that there exists a considerable gender gap in the perception of technology risks.

Moreover, it has been argued repeatedly that technological development would have less impact on the environment if women would participate in the processes, because their social contexts obliges them to care for their social and ecological environment

7 Moreover, it was found that the gap between attitudes and behaviour differed between different fields of environmental action. This led to the "low-cost hypothesis", meaning that behaviour that could be implemented with low personal costs in terms of money and time use, like the separation of waste, were more probable to be put into action than behaviour with high personal costs, like e.g. mobility behaviour.

more than men do (section above). But so far, women have not been integrated widely in technological development. Additionally, *there are failing approaches that integrate both, gender and environmental aspects.*

There has been, for example, a large debate about how to integrate the user's view in technological development processes, without addressing women as a specific user group.

One example of user involvement has been worked out and implemented in the Netherlands: the concept of Constructive Technology Assessment has been widened to a "consumer-oriented Constructive Technology Assessment" which systematically includes consumers' views and values in the process of shaping technologies (Fonk 1994, Hoogma/Schot 1996). However, similar approaches to the inclusion of user groups in environmental product development do not exist (Empacher/Schramm 1998). This concept could be a key to integrating gender-specific perspectives in technology development as well. But it has been argued that the integration of gender-specific views in these development processes will again demand time from women who already, due to their double burden, do not dispose of much time resources. This should be taken into account when working out this process, either by paid participation or by providing child care services (Empacher/Schramm 1998).

Demographic Development

Demographic development and gender aspects with relation to environmental problems have almost only been discussed so far in terms of population growth. This is mainly seen as a problem of so-called third world countries, whereas the so-called first world is facing different demographic problems.

Gender aspects of demographic developments in industrialised countries have been widely neglected issues so far. Nevertheless, demographic changes may have important impacts on the environment. For example, a study in Germany has shown that demographic changes have important impacts on consumption (Stiller 1998). Moreover, the diversification of life-styles and the pluralisation of family structures that can be observed throughout industrialised countries leads to a diversification of consumption patterns and hence material flows.

For industrialised countries, demographic trends that are important for both gender and environmental aspects are (Empacher et al. 1999):

- *The Ageing of the Population*

In terms of gender aspects the ageing of the population is an important demographic trend for study as most of the elderly population is female (UN 2000).

The environmental impacts of this trend are not evident. There are even studies that show that the ageing of the population will lead to a decrease in consumption, because the purchasing power of a huge part of the older population will decrease (Stiller 1998). On the other hand, there will be an increase in health

care, in services for the elderly and specific household equipment for elderly people.

- ***The Increasing Amount of Smaller and Single Households***

The ageing of the population together with the trends towards later marriages, more divorces and more single-parent households that all have gender-specific impacts (UN 2000) lead to an increasing amount of small and single households. More and smaller households imply higher material flows since every household needs a basic equipment stock. Together with the trend towards more technical and furnishing equipment within households this has an important effect on resource consumption.

- ***Migration***

Migration is already an important demographic trend in industrialised countries and will become even more important within the next few decades. Women represent a large portion of international migrants (UN 2000). Meanwhile, a lot of research on the theme of women and migration in Europe exists. Thus, the last European Feminist Research Conference was held about “Shifting Bonds, Shifting Bounds. Women, Mobility and Citizenship in Europe” (Ferreira et al. 1998). But feminist research on women and migration ignores the impacts of migration on the environment so far. With respect to material throughput and traffic it can be supposed that migrant groups bring their consumption habits and hence their goods to the new country which can lead to transport needs, to a differentiation of consumption patterns and increasing material flows.

- ***The Increasing Employment Rate of Women***

The overall employment rate of women in industrialised country tends to rise and more women with small children under the age of 3 are employed (UN 2000). In a European study it has been shown that this trend goes together with the increase of the use of convenience products, which are generally more resource- and energy-intensive (Litzenroth 1995). This will continue if the double burden of women is not balanced by more social supplies or by men taking their share of household work and care for children.

Gender as Socio-economic Driver

Regarding the state of the art of the analysis of gender within socio-economic drivers for environmental change, it becomes evident that gender can be regarded as one of the most important drivers itself, since it plays a role within every other driver. As such it should be regarded as a horizontal category that is structuring the impact of all other socio-economic drivers on the environment:

- gender aspects in attitudes,
- gender aspects in technological development and
- gender aspects in demographic change.

b) Influence of Environmental Change on Society and Economy

Influences of environmental change on gender-relations, society and economy are mainly being discussed with regard to women in so-called third world countries. These women are most susceptible to being affected by changes of the environment because their survival directly depends on the state of the environment and the access to resources for basic needs.

For industrialised countries, the impacts of environmental change on women have been discussed mainly with regard to three issues:

- the interlink of health effects and environmental degradation,
- the interlink of poverty and social exclusion with the exposure to environmental hazards and degradation, and
- the impact of environmental change on the quality of life.

Environmental Change and Health

The most important discussion about the effects of environmental change is about health impacts. It is argued that on the one hand women fall ill more often than men due to their specific physical and social conditions (e.g. breast-cancer). On the other hand, environmental diseases of their relatives affect women more often than men, because they hold the caring responsibility for the whole family.⁸

Environmental Change, Poverty and Social Exclusion

The interlink of poverty and environmental impacts have been discussed repeatedly. The UNED Human Development-Reports shows that above all in so-called third world countries the poorest population is always affected most by environmental degradation. But even in industrialised countries it can be shown that people with less income suffer the most from environmental degradation, e.g. from noise and air pollution caused by traffic or from contaminated soil in their living environment. People with little income do not have the means to avoid their exposure to these environmental factors, for instance by moving away or by buying safe products, because in industrialised countries clean and healthy living-conditions are a costly factor. Hynes showed this effect for lead contamination in housing in the USA (Hynes 1991) and calls for 'environmental justice' by politicising the injustice that is done to people caused by the pollution of their environment (Hynes 1994).

As the gendered nature of poverty and the need for gendered responses have been pointed out repeatedly (May 1997, Bronstein 1999, Brundtland 2000), the interlink of poverty and the effects of environmental degradation is an important factor for the situation of women in industrialised countries as well (see chapter 1). But it has to be taken in mind that the situation of women and the meaning of poverty in different in-

⁸ For a detailed discussion about environmental health impacts on women confer chapter 2.3 and 8.

dustrialised countries, e.g. in the USA and in Europe or in Western and Eastern Europe can still differ to a large extent.

Poverty is often accompanied by other social phenomena such as unemployment, illness or homelessness. The coming together of several of these factors may lead to social exclusion and hence to an even higher exposure to environmental degradation. ***Lone-parent families that still consist mostly of women are susceptible to be hit by the phenomenon of social exclusion because of small incomes and the lack of social networks due to time problems.*** Reeves argues that the framing of social exclusion in terms of poverty and unemployment can make the underlying differences between women and men visible (2000b).

The impact of environmental change on socially excluded groups has been shown in some cases (e.g. for black people in the USA, Chavis/Lee 1987), but women have not been explicitly addressed so far⁹.

Environmental Change and the Quality of Life

The concept of quality of life has emerged as a counterweight to the measuring of social welfare by purely economic indicators (e.g. GNP). The quality of life is a multi-dimensional construct that reflects the population's living condition in important dimensions of life (Empacher/Wehling 1998). There has been a broad discussion about how to operationalise this concept for measuring the quality of life in social surveys. In the meantime, consensus has been reached that the quality of life concept must contain objective factors (objectively observable phenomena) as well as subjective factors (perceptions and opinions expressed by the population) (Harthmut 1998). In the past two decades the state of the environment as a factor of quality of life has been widely acknowledged, since it has found entrance in social surveys in many industrialised countries (Habich/Noll 1994).

The difference in the perception of the importance of environmental factors on the quality of life between sexes is not made explicit in most cases. But surveys about environmental concerns, as has been shown in the section above about attitudes, do prove that women's quality of life is affected more by environmental problems.

c) Barriers and Enabling Factors

Barriers and enabling factors for the transition towards sustainability are manifold. Beyond institutional, legal, political and supply-side factors that have often been dis-

9 The environmental awareness of social excluded groups and their capacity to adopt environmentally friendly behaviour was the issue of a project funded within the 4th EU-framework programme (Grant/Cames 1999). Five socially excluded groups were studied: long-term unemployed, elderly, working-poor, single-parents and ethnic minorities. The study showed that single-parent families showed a considerable higher degree of environmental concern than other socially excluded groups, but were often not capable to engage in environmental activities accordingly.

cussed, there also exist a lot of factors at the individual level. Some examples of barriers and enabling factors concerning individuals include the following

- resources:
 - time,
 - money,
 - education and knowledge, and
 - social resources (such as social networks).
- motivational factors:
 - environmental orientation,
 - health orientation,
 - orientation towards economising money, and
 - quality orientation etc. (Empacher et al. 2000).

Though some studies deal with the importance of these factors, there are few that discuss strategies to overcome barriers and promote enabling factors. Littig brought forward the concept of 'motivational alliances' ('Motivallianzen'). She argued that connecting environmental motivations with other motivational aspects such as health (Littig 1995) might induce environmental behaviour.

For motivational factors that clearly enable environmental behaviour, such as health orientation, the concern for children or empathy with animals, there seems to be empirical evidence that these motivational factors tend to be stronger in women than in men. Above all the concern for health and the health of the family is very important for women. The existence of a small child in the family induces environmental behaviour to a large degree (Empacher et al. 2000).

Moreover, the factors named above can not all be regarded as being clearly either enabling or hindering environmental behaviour. There are factors that are ambivalent, according to the specific context they turn out to be barriers or promoters. Hence, it is important to create contexts in which these factors can act as promoters, always taking into account women's specific working and living conditions (Empacher et al. 2000)¹⁰.

10.2.2 Tools and Methodologies for Integrating Sustainability into Policies

The discussion of specific policy tools and methodologies for the transition towards sustainability in a gender perspective implies taking a look at the gender impact of tools and methodologies and, secondly, at specific tools that integrate men and women's needs into policies.

The following section presents methodologies used in the Agenda 21 process and instruments for environmental policy.

10 The German Federal Environmental Agency is currently carrying out a project that is to work out where the emancipation of women, which is an inherent goal in the concept of sustainability, can be a promoting factor towards a sustainable change of consumption patterns.

a) The 'After-Rio-Process': Implementation of Agenda 21

The result of the Rio Conference 1992, the so-called Agenda 21, emphasised the importance of women for the implementation of sustainable development. In the consultation process following Rio and particularly at present, in the preparation for the Rio+10 Conference, women as a major group have always taken part. ***To integrate women's issues in the process and to implement the goal of chapter 24 (Global action for women towards sustainable and equitable development), two ways have been discussed and set partially into action: the promoting of women's networks and the setting up of gender-specific indicators.***

Networking

The 'Women and Sustainable Development'-initiative (formerly 'Gender 21'), under the administrative direction of UNED-UK, tries to identify, link and network women's groups that are engaged in promoting sustainable development. But there is still research needed on how to effectively network women of different cultural background and interests.

Gender-specific Indicators

The indicator Gross National Product (GNP) has dominated the perspective of development for decades. In the meantime, the critique of the single-perspective of GNP has led to the development of different indexes that reflect more aspects of human development, such as the Human Development Index (HDI) or the Indicator of Sustainable Economic Welfare (ISEW) (Daly/Cobb 1989). However, these existing indicator systems on quality of life and sustainability have often been criticised from a feminist point of view because they do not take into account women's needs and the work women do to sustain the social and environmental context of human life (e.g. O'Hara 1999).

UNDP was the first organisation to develop gender-specific indexes for the national level and compare them between countries (UNDP 1995). The annual Human Development Report presents the Gender-related Development Index (GDI) and the Gender Empowerment Measure (GEM) for 130 countries. The GDI, which is more apt to show the situation in third world countries, combines the gender-specific life expectancy, literacy, and school education with the income ratio of women and men. The GEM is made up of the percentage of women represented in Parliament, administration and management and technical professions, combined with the male/female income ratio. But these indexes are not directly related to environmental aspects.

The Commission of Sustainable Development has initiated a process to develop indicators that can measure the implementation of sustainable development within countries. Although the proposal for indicators is oriented according to the different chapters of agenda 21, there is no paragraph with gender-specific indicators. Neither is the gender-category systematically integrated in the other dimensions of sustainable development.

The first proposal of 134 indicators only named five indicators about women's situation. But proposals for amendments have been made by several national states, and, in the case of Germany, contain one indicator about time budgets for paid work and unpaid provisioning work.

The gender category in other proposed sustainability indicators is also undervalued (e.g. indicators for sustainable consumption of the OECD). Consequently, the Women and Sustainable Development Initiative has started a process to develop gender-sensitive indicators for sustainable development on a national level. They presented a first proposal of indicators for 6 categories: education, health, marginalised groups, transport and housing, local agenda 21 and indicators, consumption and waste (UNED-UK 2000). The proposed indicators do reflect women's situation in industrialised countries as well, but so far they still lack a systematic approach.

Some sustainable indicators for local communities have been developed within the process of local agenda 21 (e.g. for the city of Seattle, USA, for The Hague, Netherlands, The Hague City Council 1998), but only very few communities tried to develop gender-specific indicators (Local Agenda 21 Bayreuth, Germany). One example in Germany has been worked out for the city of Duisburg. The indicator set consists of five thematic areas: political participation of women, participation of women in the field of environment, women, work and income, gender-specific perception of environmental protection and resource use, perception of quality of life. Each area covers three indicators that are weighed and aggregated to one indicator value for each area. The areas that are covered, the fact that a combination of objective and subjective indicators are used and the aggregation of indicators make this indicator set a useful tool for political decision making (MURL 1999) and may be regarded as best-practice example in this field.

The most important hindrance to implementing gender-specific indicators is that databases with gender-specific data are largely missing, because national surveys and statistics very rarely differentiate between sexes.

b) Environmental Policy Instruments

The United Nations Division for Sustainable Development (UN-DSD), together with the International Institute for Sustainable Development (IISD), have initiated a compendium of policy instruments for changing production and consumption patterns (see also the following section) actually containing about a hundred instruments. But women or gender aspects do not play any specific role in any of these instruments, apart from one in Egypt that addresses women as a specific target group (UN-DSD/IISD 1997).

Existing gender-specific reflections will be presented here in the area of economic and voluntary/public information instruments.

Economic Instruments

Among economic instruments, the discussion about an ecological tax reform has gained most attention. The feminist critique of an ecological tax reform was already mentioned above (Mellor 1996). The same critique applies to other economic instruments such as product charges or tradable emissions.

Concepts for gender-sensitive budgeting have been developed on the one hand (see chapter 2) and green budgets on the other. But so far, no attempts have been made to integrate both.

Voluntary/public Information Instruments

A considerable amount of voluntary instruments for environmental policy has been developed in the last two decades.

One example is that of new actors co-operations, such as:

- public-private partnerships,
- integrated product policy and
- co-operation between key actors in regional planning and development.

From a gendered point of view there are two problems within actors co-operations. First, the integration of users into these processes: Unlike other economic actors, users do not have advocates that can represent their interests like industry or retail. So their integration has been widely neglected so far. Secondly, the actors represented in the co-operations are being treated as gender-neutral and act in a gender-neutral way.

Voluntary information instruments such as environmental reports or eco-labeling have been criticised because they increase women's workload by implying that women or consumers have time to inform themselves thoroughly before making their buying decisions (Eie 1995).

Moreover, environmental reports certainly contributed a lot to a rise of awareness within the company. But as a communication instrument they were often badly designed, as they rarely took the needs of their readers into account and were difficult to read and understand. Moreover, ***social aspects of sustainability have only recently entered the reporting initiatives of businesses*** (cf. ISEA 1999, GRI/CERES 1999, future e.V. 2000, imug/IÖW 2000). ***Most of these initiatives build on a stakeholder consultation process where consumers as important stakeholders are always included. Women are not addressed explicitly as stakeholders, but the gender question in these reporting initiatives is almost always addressed by reporting about women's situation in the companies. Women's share of positions and measures undertaken for the equity of women are an issue. Although this recognition of the gender equity issue is quite remarkable, women's capacity to foster the change towards sustainability is not being realised.***

For the level of private business an audit process for equality processes has been developed. This so-called Total Equality Management (TEQM) reviews the measures under-

taken to implement equality policy within the firm. But TEQM has no interlinks to environmental or other social issues. By contrast, the concept of a Sustainability Audit developed by ISOE (Empacher et al. 2001) combines the taking into account of different aspects of sustainability in the audit process and is the first concept to have an integrated gender audit. This Gender Audit developed by Jung (Jung 2000) is integrated into a broader process towards the implementation of a sustainable business policy. It departs from the philosophy of mainstreaming that gender aspects have to be integrated into all fields of business action.

Environmental and consumer education is another important voluntary information instrument regarding sustainability. Although the importance of environmental education for women has repeatedly been emphasised, environmental education has also been criticised as to its gender blindness. For instance, consumer and environmental movements mostly do not deal with gender-related issues (for the UK Grover et al. 1999, for Germany Franz-Balsen 2001).

Franz-Balsen argues that *gender-oriented environmental education, apart from very rare special projects, does not exist so far*. This would imply the development of gender-sensitive didactics that consider male and female strengths and weaknesses. Franz-Balsen argues that it is important to recognise that education for sustainable development does not mean the simple imparting of knowledge, but activation of potentials. Women have to be put in the position to actively discuss their needs and projects with men, for instance within local agenda 21 processes. However, Franz-Balsen also emphasises that what really is needed is educating men on the behalf of environmental and social issues (Franz-Balsen 1998).

10.2.3. Key Transition Paths towards Sustainability

a) Eco-efficiency Strategies for Consumption and Production

Chapter 4 of Agenda 21 deals explicitly with the necessary change of consumption and production patterns. The objective of 'Sustainable production and consumption patterns' is to minimise environmental burdens and to satisfy basic needs. The Commission for Sustainable Development took over 'changing consumption and production patterns' as a main focus in their work programme.

Considering the existing debates about 'eco-efficiency' and about 'sustainable consumption and production' two feminist critiques have arisen:

Firstly, strategies for sustainability are often being divided in two categories: efficiency strategies, that is strategies that improve the material and energy efficiency of products and services, and sufficiency strategies, that is strategies that aim at the putting into question and the change of existing need structures. From a gender perspective this separation is being criticised, because there is a danger of attributing sufficiency to female and efficiency to male strategies and consequently even broaden the gender gap (BUND 1997, see critique of the study sustainable Germany in chapter 2.2.). However,

it is necessary to see both strategies interlinked, since neither efficiency nor sufficiency alone will be able to make a real change towards sustainability.

Secondly, the separation of the spheres of production and consumption that is common to mainstream economics is being criticised. The household is merely seen as an area where consumption takes place, ignoring the fact that there is a huge amount of productive and reproductive activities being done in the household. Furthermore, by the separation of these spheres, the interlink of production and consumption are being neglected. Finally, feminists criticise the silent assumption of economists, that production is a male and consumption a female sphere.

The general critique is that there is a tendency to attribute sufficiency strategies to the consumption sphere and eco-efficiency to the production sphere.

However, the political debate about 'sustainable production and consumption patterns' has brought about some improvements since chapter 4 of Agenda 21 recognises the linkage between the two. But the perception of this field of political action within groups of actors and the research that is done in this field still separates largely between production and consumption.¹¹ Either research is done from a supply-side or from a demand-side focus. Bridging concepts that consider production and consumption as a whole interlinked sphere are still scarce.

Sustainable Consumption and Production Patterns and Gender Issues

The discussion about supply-side approaches, later called sustainable production patterns, has undergone several qualitative changes in the last two decades. In the beginning, ecological production was to come about by environmental regulation. Environmental policy consisted of prohibitions and limit values and industrial activities consequently concentrated on technological solutions for industrial processes that were mostly end-of-pipe. Then there was a shift to process-oriented environmental production, accompanied by the rising of voluntary instruments such as eco-balances and eco-audits. Finally, the produced products and their environmental impacts got into focus. All these evolutions however stayed within the limits of ecological changes within the producing company.

Life-cycle assessments of products (see chapter above on instruments) however, brought the use phase of products into view and therefore broadened the perspective towards the consumption phase. ***The discussion about eco-efficient services and the prolongation of a products' life-cycle (Stahel 1986), that stressed the service a product fulfills (the so-called functional orientation), opened the view towards an extension of the producer's product responsibility on the use phase of products.*** Finally, Schneidewind's approach of 'need orientation' (the so-called COSY-concept) even went beyond this by integrating the user himself with his specific needs in the reflection of the producer (Schneidewind et al. 1997, Belz/Schneidewind 1995). The functional orientation

11 For instance, the World Business Council for Sustainable Development (WBCSD) is still mainly discussing "sustainable production patterns".

and above all the COSY-concept present an important bridging concept towards sustainable consumption where gender aspects play an important role.

The issue of consumption within the environmental debate had been neglected for quite a long time. After the Rio-Conference it came more into view and it was argued that an important part of resource consumption could be attributed to the consumption sphere. Figures differed, according to their theoretical approach, from 30 to 70 % of all resources used.

The so-called OSLO Symposium presented a working definition of sustainable consumption as:

“the use of services and related products which respond to basic needs and bring a better quality of life while minimising the use of natural resources and toxic material as well as the emissions of waste and pollutants over the life cycle of the service or product so as not to jeopardize the needs of future generations” (OECD 1997).

Both Agenda 21 and the OECD point out that to attain this objective consumption behaviour and sustainable consumption have to be understood more thoroughly and the OECD emphasises the importance of actors that are likely to be the most effective agents of change (OECD 1997).

But so far, consumption patterns have predominantly been examined as to energy and material requirements of different need areas. Above all mobility has been analysed (Linden et al. 1999, see chapter 2.4), or food and textiles (Moll 1999, Groot-Marcus et al. 1996, Groot-Marcus/van Moll 1996, Groot-Marcus 1996, Groot-Marcus et al. 1995). Ecological footprints and material intensity for specific consumption goods and services have been determined (Schmidt-Bleek 1994, Wackernagel/Rees 1997, cf. for Germany as well the study ‘Sustainable Germany’). Proceeding from results of these studies, priority areas for action and indicators for sustainable consumption have been developed (e.g. Lorek/Spangenberg forthcoming). It was argued that consumption areas with most material and energy use are construction and housing, food/nutrition and transport/tourism (Lorek et al. 1999).

These approaches have been criticised because they ignore the qualitative environmental impacts of resource and material flows (such as toxicity of materials) and often set the system boundaries of their reflections rather arbitrarily. Moreover, these analyses mostly do not take into account who is using resources and how they are being used (Grover et al. 1999). The same is true with strategies that are being developed to foster sustainable consumption patterns (see chapter about instruments). They mostly ignore the specific situation of consumers as well as the different situation and motivations of different consumer groups. Moreover, they do not advocate gender-specific consumption patterns and female every-day lives that are made up of both household work *and* labour market work.

The debate about sustainable consumption patterns in general continues mostly to be gender blind. One example here is the Human Development Report for 1998 that was centred on consumption patterns. It focussed on both poverty and the environment, but it did not address gender differences explicitly (UNDP 1998).

The current discussion and state of the art on gender issues in sustainable consumption patterns has been summarised in a report to the CSD by Grover et al. (1999). Grover et al. argue that women represent the largest group of consumers world-wide (Beckmann 1997), although in industrialised countries gender categories of consumption (that is the attributed preferences of women and men for certain product groups, e.g. women: cosmetics, men: tools) are beginning to dissolve. Additionally, women have the most shaping power in the household sphere and can therefore have a great influence on consumption.

Indeed, there has been a lot of research about gender and consumption (e.g. Costa 1994, Firat 1994, Grazia/Furlough 1996, Horowitz/Mohun 1998, Lubar 1998, McDonald 1995), but it has not been linked to sustainability or environmental problems. On the other hand within the existing research on sustainable consumption, gender has not been addressed specifically, but it occurred that research projects on motivations or specific consumption behaviour (see chapter above) showed gender differences.

Research about sustainable consumption should integrate the different aspects of sustainability by integrating both the material base of consumption and the motivational factors for consumption. For doing the latter a focus on everyday-life and the specific situation of women is necessary, at the same time as differentiating between the situation of different social groups and life-styles.

An empirical study done by ISOE on “*Consumption styles in German households*” (Empacher et al. 2000) can be regarded as exemplary for integrating the every-day life situations of different groups into strategies for sustainable consumption. Building on the style-approach explained in the chapter above, ten different consumption styles were identified that based on a qualitative exploration within 100 German households. The different styles were identified with regard to their consumption orientations that were investigated before the background of their different social situation and lifestyles. Furthermore their actual consumption behaviour was examined with respect to identified indicators of household consumption. According to the aim of the study, that was to develop consumer communication strategies, these ten types were gathered within four *target groups*. Finally specific strategies to increase sustainable consumption according to their specific consumption orientations and situations were developed. *The study gives a deeper view of gender-specific needs and motivations. It shows that in many cases, women’s attitudes and orientations were more open to sustainable consumption strategies than those of men* (see chapter above). Two consumption styles could be identified that are completely opposite in their readiness to contribute to sustainable

consumption. The 'every-day creatives' are made up of people that spend much time on shaping their every-day life in a creative way, that is they produce a lot of things to satisfy their needs themselves. E.g. they like to cook fresh food, go to the market, buy second-hand goods and refurbish them etc. They value social relations, the environment and health. By contrast to this group there is the group of those who try to avoid reproductive every-day activities as much as they can. This group takes over any convenience products that are available and does not want to spend a single thought more than the essential about what to buy or how to get it. Indeed, the first group is made up of mostly women, whereas the second group consists of mostly men.

The survey also showed that the gendered distribution of tasks within the household was an important aspect for the readiness to take over sustainable consumption offers. In households where women were taking the burden of the housework, the child-care and additionally an employment, whereas men were not taking household responsibilities, there was clearly no space for sustainable consumption any more because women were simply overtaxed with the issue (and men thought it was a women's issue). However, in households that were trying to live gender equality, although they have a strict time regime, there is still space for sustainability concerns and moreover, men had taken over caring concerns as well and were more open for sustainable consumption offers (Empacher et al. 2000).

b) Sustainable Regional Development Strategies and Gender¹²

Since the Brundtland-Report (World Commission on Environment and Development 1987) and the Earth Summit in Rio 1992 there has been a lot of discussion about identifying perspectives for sustainability on different levels (international, national, regional, local). Local agenda processes, as it is described in chapter 4 on urban sustainability, is one part of this discussion. As opposed to this, the globalisation of the economic sphere is almost completed – enterprises are engaged in world wide networks; production and consumption is not bound to one single place (e.g. textiles go half around the globe until they are used). Concerning this tendency, there are winning regions possessing business location advantages. There are, however, also losing ones. The latter are often rural areas, with a high share of agriculture, often suffering from high unemployment (especially of higher educated persons), inadequate and insufficient infrastructure and lacking (foreign) investment. These obvious disparities can not be seen as (regionally) sustainable.

But what is regional sustainability? The Brundtland-Commission and also the Rio Conference mainly focused on the global, ecological problems and social crisis. However, for the successful practical implementation of solutions, local and regional considerations concerning co-operations, alliances and utilisation of indigenous potentials of re-

12 In the following rural development is the main focus, because urban development and questions of the transition from town/city to surroundings and urban areas are described in chapter 4 on urban sustainability.

gions are necessary. For if the global point of view is maintained the disparities between flourishing metropolis and rural areas can not be offset. Regional Development includes various topics like development plans for land use, optimising of regional material flows, traffic planning, spatial planning as well as water and waste management. All these topics are also relevant for a regionally sustainable development strategy that focuses on:

- Administrative tasks: planning, policy- and decision-making on regional level
- Social Tasks: communication between stakeholders, key actors, social groups
- Ecological Tasks: reduction of material flows and prolongation of material cycles, less transport through short distances, protection of landscape and biodiversity etc.
- Human Resources: utilisation of potentials of people who live in the region (self-reliance, qualification)

Thus these tasks show that a *successful regional/rural development can no longer be simply a part of administration, because the bottom-up approach with participation and active integration of different social (focus) groups and actors could strengthen the identification of citizens with the implemented projects and their region. In the process of developing these participation models, women and their different needs should also be integrated, as well as those of other vulnerable groups such as children, elderly, pregnant women, chronic patients, disabled persons etc. The independence of regions could be strengthened through such integrative, participatory and active processes.*

The EU regional policy and EU research could support this development, with respect to the autonomy of the regions. For the future the EU faces two main challenges in rural areas: updating of the European model of agriculture and narrowing the gaps in wealth and economic prospects between regions. The latest document, Agenda 2000, agreed by European heads of state or government at the European Council in March 1999, focuses on these with respect to the association of Eastern European Countries.

The European initiative LEADER is the executive institution of Agenda 2000 for projects in the sector of rural development. Some of these also consider gender-differences, with stress on (un-)employment. In rural areas women are more often faced with unemployment than men, especially where traditional agricultural societies still predominate.¹³ The situation is more difficult for higher educated women because suitably paid jobs are rare. Additionally, insufficient transport services and possibilities for care of children and elderly restrict women's access to the labour market. However, it can be shown that rural women (especially in France and Ireland where suitable databases exist) have less free time than women living in urban areas. Furthermore, their possibility to participate in decision-making is deficient (Braithwaite 1996).

13 Only in a few regions such as England and Scotland is male unemployment higher because of the increasing growth of part-time and low-paid job offers in service sectors, which are primarily taken by women.

There are a lot of employment initiatives in various European regions. One example from Finland (Oulu) seems to be interesting. As a result of developing a joint service for children and elderly persons living at home, women, who formerly had to care for them, are no longer forced to work at home. On the other hand, new jobs (particularly for women) were created in the health sector (nursing).

Employment initiatives are not the only way to support rural life – especially in view of environmental *and* gender aspects. Alternative approaches to (spatial) planning could, in addition, bring new concepts and ideas into rural development. Spatial planning includes “the location of large employment, housing, shopping and recreational sites, infrastructure projects, roads, communications and energy networks and urban regeneration projects targeting towns and cities” (Reeves 2000:2).

As such, spatial planning predetermines environmental, social and economic impacts and is thus a key factor for the implementation of sustainable development – gender issues are seen as a part of those factors. ***The ministry of Environment in Norway published a ‘cookbook’ to introduce the Planning and Building Act, and to make local land use planning more accessible to women and more commonplace.*** In the foreword the Minister writes: “Planning can be complicated, and is often made more complicated than necessary for the express purpose of hindering broad participation. Those in power are not always interested in letting others take over their authority. But if we are to improve society, women must be allowed more control over the shaping of our society” (Ministry of Environment (Norway) 1994, cited in OECD 1995:69). This statement is very important, because many examples of planning processes show that planning done by men is often oriented towards the economic system – it assumes growth, competition, power, and image. While men frequently try to drive forward with polarisation and by building hierarchies women are more interested in change and flexibility, in taking responsibility for the needs of others and in bringing opposites together such as public – private, living – working etc. (Schäfer 1993).

Gender aspects in planning have been discussed now and then (e.g. Sandercock/Forsyth 1992, Moser 1993, Little 1994, Reeves 1998, for gender-oriented city planning see chapter 4.4). But with regard to environmental planning the first assessment of gender-oriented structure plans in spatial planning was done in the UK by Reeves (Reeves 2000). Reeves argues that gender roles are often reinforced by the environment and spatial relationships created by planning. Her project therefore focussed on the capacity of strategic agencies in the field of economic development, housing and transport to take a gendered approach to the spatial planning process. She assessed UK structure planning and transport planning authorities according to the following points:

- collection of gender-relevant statistics and information,
- involvement of men and women,
- gender sensitive policies,
- gearing up to incorporate gender,
- targeting policies to specific groups,

- level of gender awareness within strategic planning and transport organisations and
- barriers.

Her findings show that the great majority of authorities did not incorporate gender issues at all or only to a small extent, whereas at the same time the majority was convinced that their organisation had a good level of gender awareness. Reeves states that *there is still a need to identify what exactly has to be done to mainstream gender in structural planning (Reeves 2000). With respect to women and their different needs, EuroFEM developed a 'toolkit' showing how to integrate women into local and regional development* (Horelli et al. 1997).

10.3 Summary and Priority Issues

Including gender and environmental aspects in socio-economic research broadens the view towards a transdisciplinary sustainability research. Feminist theoretical approaches on ecological economics move in that direction. Building on the critique of the externalisation of both women and the environment in economic mainstream thinking, feminist approaches develop alternatives that include environmental, social and gender aspects in economic theory building. In this way other aspects of economic action come into view: the effects of economic action on both the environment and gender relations and the social embeddedness of economic behaviour. Most feminist approaches argue that the gender and environment question will not be solved within the limits of the market economy. Other forms of economy will have to come into view, such as subsistence economy, or economic activities will have to be centred again on the provision of basic needs.

Empirical findings of gender differences within environmental socio-economic research demonstrate that women show different environmental concerns, more awareness, more scepticism towards technology and more environmentally friendly behaviour because their specific situation and motivations tend to enable the acceptance of strategies for sustainability.

The gender dimension in research about environmental attitudes and behaviour has been put forward in a rather accidental manner, quasi as a by-product of empirical social environmental sciences. Research with a specific view on gender differences is largely missing, not because of lack of importance of the research questions, but because of the lack of funding provided for such research.

Additionally, there has been very little research about how these gender differences in attitudes could be addressed effectively for a transition towards sustainability. Environmental education and communication strategies continue mostly to be gender-blind and do not address women's specific needs and their situation.

But in view of the environmental awareness and behaviour of men, it seems to be a fact, that it is men who are the biggest polluters and that their behaviour represents the most important hindrances. So it is important to take a closer look at men and their behaviour and motivations and to develop environmental education and communication strategies aimed at their rationale.

Moreover, it can be shown that it is women that suffer most from the impacts of environmental change. On the one hand, they are more vulnerable to health impacts, because pregnancy and breast-feeding are periods where women are particularly sensitive, and they have the caring responsibility for the extremely vulnerable group of small children. On the other hand, women tend to be more poor and are more likely to be socially excluded in their specific social contexts and, consequently, are more exposed to environmental impacts. These differences in exposure to environmental burdens should be addressed politically and measures should be taken to integrate women's needs and that of vulnerable groups into prevention policies of environmental degradation in order to create 'environmental justice' for women and vulnerable groups.

A feminist critique of concepts and methodologies for a change towards sustainability centres on the following points:

- Existing concepts and methodologies are mostly gender-blind. Moreover, the point of view of the users or consumers is not even considered within most of these concepts.
- Women do not participate within the development of environmental policies and policy measures on a greater scale, not in technology development or product development. Concepts for their integration in these development processes are still largely missing.
- Different social groups and different life-styles face diverse conditions, not only regarding their objective situations, but also concerning their subjective points of view and motivations. Differences between these groups are still generally ignored when it comes to the development of strategies. If women are recognised as a specific target group, it is by addressing them as if one universal woman would exist, without taking into account different women with different backgrounds and needs or the needs of specific vulnerable groups.
- When policy measures or strategies for sustainable development are developed, everyday-life is not taken into account. The gender-specific division of labour within the household, routines, and the mutual organisation of household, labour market work and childcare are all part of women's specific situation in industrialised countries. Policy makers, but also actors that promote sustainability such as consumers' movements, ignore these specific aspects of women's lives. Hence, policies or suggestions for sustainable behaviour count on women's unpaid labour and time, thereby further increasing women's already heavy workloads.

Specific Priority Issues in the Field of Gender and Socio-economic Environmental Research

The priority issues integrating socio-economic aspects of environmental change with respect to gender are summed up here as three priority issues with several sub-points:

- 1. Integration of gender aspects in sustainability research in general:***
 - *Monitor the development of gender aspects within sustainability by enlarging gender-specific databases and creating gender-sensitive indicators*
 - *Development of bridging concepts for the integration of different sustainability aspects, including gender*
 - *Address possible conflicts between sustainability goals, e.g. between ecological sustainability and emancipation of women*
- 2. Enhancing the gender-relevant knowledge base for sustainable solutions:***
 - *Expanding knowledge about every-day life economy and household contexts (e.g. investigation of household routines and opportunities to change them)*
 - *Men/women and the environment: study gender-specific environmental motivation and behaviour (in different need areas) in more detail*
 - *Gender and environmental aspects of demographic changes*
- 3. Development of gender-sensitive strategies, methods and instruments for sustainability***
 - *Methods and concepts for the participation of women in technology, policy, instruments and product development*
 - *Methods and policy measures to consider gender differences of environmental impacts and address the needs of vulnerable groups*
 - *Gender impact assessment methods for environmental technologies and policies*
 - *Engendered environmental education and communication strategies*
 - *Work-extensive strategies for sustainable consumption, in order to not further increase women's workload*

11 Experts and Networks

11.1 Women and Environment/Sustainable Development

Networks:

- DIGMA: Database of Instruments for Gender Mainstreaming, Brussels, <http://www.amazone.be>
- FOPA Hamburg e.V. - HIC Women and Shelter Network; Hamburg, Germany,
- WIDE: Network Women in Development Europe, Brussels, Belgium, <http://www.eurosur.org/wide/porteng.htm>
- Gender Studies in Agriculture Group, Wageningen, The Netherlands, http://www.sls.wau.nl/crds/cent_gs.htm
- Women's Environmental Network, London, UK, <http://www.wen.org.uk>
- Women's Environmental Network (FrauenUmweltNetz), Frankfurt/M., <http://www.oneworldweb.de/FrauenUmweltNetz/index.htm>¹⁴
- WEDO (Women's Environment and Development Organization), www.wedo.org

11.2 Urban Sustainability

Experts:

Beccali, Bianca	Faculta di science politiche, Milano, Italy
Bimbi, Franca	Univesity of Padova, Department of Sociology, Italy
Breckner, Dr. Ingrid	TU Hamburg-Harburg, DFG "Raum und Geschlecht", Arbeitsbereich 1-06 Stadtebau II, Stadt- und Regionalsoziologie, Hamburg, Germany
Buschig, Prof. Sabine	Hochschule für bildende Künste, FB Architektur, FG Gebäudetechnik, Hamburg, Germany
Cugis, Alessandra de	Commune di Milano, Milano, Italy
Dandoulaki, Miranda	Earthquake Planning and Protection Organisation, Athens, Greece
Duchene, Chantal	Centre d'Etudes des Tranaports Urbains, France
Eberle, Uli	Oeko-Institut e.V. - Institute for applied Ecology, Freiburg, Germany http://www.oeko-institut.org
Friberg, Dr. Tora	University of Lund, Sweden
Hassler, Prof. Uta	Universität Dortmund, Lehrstuhl für Denkmalpflege und Bauforschung, Germany
Heiler, Ursula	Feministische Organisation von Planerinnen und Architektinnen (FOPA), Dortmund, Germany
Liesbeth, Ottes	NIROV/SEIROV, Diemen, The Netherlands
Maasberg, Ute	TU-Braunschweig, Department of Architecture, Germany
Mayerl, Roland	city & shelter, Brussels, City, Citizenship and Gender, Low Cost Housing, Belgium http://www.cityshelter.org
Mellor, Prof. Mary	University of Northumbria, Newcastle upon Tyne, UK
Modlich, Regula	Women Plan Toronto, Toronto/Ontario, Canada

14 For Experts of Gender and Environment in German-speaking countries cf. FrauenUmweltNetz (Hg.): Who is who, Initiativen und Expertinnen zu "Frauen und Umwelt", Frankfurt/M.

Paravicini, Prof. Ursula	Universität Hannover, Institute for Architecture and Planning Theory (IAP), Germany
Riedel, Christiane	Universität Hannover, Institute for Architecture and Planning Theory (IAP), Germany
Rodenstein, Prof. Marianne	Universität Frankfurt/Main, Department of Societal Sciences, Germany
Sassen, Prof. Saskia	University of Chicago, Department of Sociology, USA http://www.social-sciences.uchicago.edu/sociology
Schendelen, Maryca van	University of Amsterdam, Institute of Planning and Demography, The Netherlands
Spitzner, Meike	Wuppertalinstitut für Klima, Umwelt, Energie, Wuppertal, Germany
Vaiou, Dina	University of Athens, Dept. Urban and Regional Planning, Greece

Networks:

Arbeitskreis der Architektinnen der Architektenkammer Baden-Württemberg,
Architekturbüro Laufner und Ernst, Stuttgart, Germany
Association for City, Regional and State Planning (SRL) - Professional Group "Women in Planning" (Germany)
Cadre de Vie (France)
City & Shelter network
EuroFEM – Gender and Human Settlement
Feminist Organization of Planners and Architects - FOPA (Germany)
International Women`s University, <http://www.vifu.de/areas/city>
NFFG, Niedersächsischer Forschungsverbund für Frauen-/Geschlechterforschung in Naturwissenschaft, Technik und Medizin
NUT-Frauen in Naturwissenschaft u. Technik e.V. (Women in Natural and Technical Sciences), Berlin, Germany
Women and Transportation (UK)
Women in Movement (Germany)
Women`s Environmental Network, London, UK, <http://www.gn.apc.org/wen>
Women`s Design Centre (UK)

11.3 Global Change, Climate and Biodiversity

Experts:

Alber, Gotelind	Klimabündnis Frankfurt am Main, Germany
Becker, Prof. Dr. Egon	University of Frankfurt, Theory of Science and the Sociology of Higher Education at the Department of Educational Sciences, and co-founder of the Institute for Social-Ecological Research (ISOE) in Frankfurt, Germany

Bondeau, Dr. Alberte	Potsdam Institute for Climate Impact Research (PIK), Department Natural Systems, Remote Sensing, POEM Earth System Model, Germany
Gerlinger, Katrin	Potsdam Institute for Climate Impact Research (PIK), Department Social Systems, Germany
Goerg, Dr. Christoph	University of Frankfurt, Faculty of Sociology, Germany
Jaeger, Dr. Jill	International Human Dimensions Program on Global Environmental Change (IHDP), Executive Director, Directorate of the National Human Dimensions, Committees and Programs, Bonn, Germany
Matthes, Dr. Maite	University Hannover, Germany
Nöh, Ingrid	Umweltbundesamt (Federal Environmental Agency) Berlin, Germany
Howard-Borjas,	University of Wageningen, Chair of Gender Studies in
Prof. Dr. Patricia	Agriculture, Wageningen, Netherlands
Reusswig, Dr. Fritz	Potsdam Institute for Climate Impact Research (PIK), Germany
Seidl, Prof. Dr. Irm	University of Zurich, Institute for Environmental Sciences, Switzerland
Suplie, Jessica	Potsdam Institute for Climate Impact Research (PIK), Germany

Networks:

Diverse Women for Diversity, New Delhi, India, divwomen@ndf.vsnl.net.in

11.4 Sustainable Marine Ecosystems

Experts:

Augstein, Prof. Dr. Ernst	Alfred-Wegener-Institute for Polar and Marine Research, Bremerhaven, Germany
Cameron, Dr. Patricia	World Wide Fund for Nature (WWF), Germany
Coellio, M.P.	Independent Commission to the Oceans, Portugal
Fahrbach, Dr. Eberhard	Alfred-Wegener-Institute for Polar and Marine Research, Bremerhaven, Germany
Forbes, Prof. Dr. Valery	University Roskilde, Institut for biologi og kemi, Danmark
Forus, Ingebreth	Norwegian Oil- and Petrochemical Workers Union, Stavanger, Norway
Harms, Dr. Sabine	University of Kiel, Institute for Marine Research, Germany
Kortum, Prof. Dr. Gerhard	University of Kiel, Institute for Marine Research, Germany
Kridlo, Susanne	Deutsches Hygienemuseum, Leipzig, Germany
Lochte, Prof. Dr. Karin	Warnemünde – University Rostock, Institut für Ostseeforschung, Germany
Meyer, Dr. Ute	AK Meere – Forum Umwelt und Entwicklung, Germany
Otto, Dr. Sabine	World Wild Fund for Nature – Ocean Ecology, Germany
Püschel, P.	Greenpeace/Ocean Ecology, Germany

Ritterhof, Jürgen	Aktionskonferenz Nordsee e.V., Germany
Stüben, Prof. Dr. Doris	University Karlsruhe, Institut für Petrographie und Geochemie, Germany
Wessel, Dr. Daisy	Wissenschaftsrat, Bonn, Germany
Willers, Peter	Aktionskonferenz Nordsee e.V., Germany
Ziebarth, Nadja	Frauen in Naturwissenschaft und Technik, Bremen, Germany

11.5 Sustainable Management and Quality of Water

Experts:

Bouayad-Agha, Malia	World Water Vision Unit/UNESCO, Paris, France
Chancellor, Felicity	International Development Department Water Management Group, Wallingford, United Kindom
Davis, Dr. Joan	Eidgenössische Anstalt für Wasserversorgung, Abwasserreinigung und Gewässerschutz (EAWAG), Dübendorf, Switzerland
Lewan, Prof. Dr. Lillemor	Faculty of Science, Biology, Environmental Sciences, Lund University, Sweden
Telkëve, Dr. Maria	Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ), Eschborn, Germany

11.6 Natural and Technological Hazards

Experts:

Enarson, Dr. Elaine	American sociologist, ample work on women and gender relations in disasters, Federal Emergency Management Administration (FEMA), course developer and external consultant with the ILO on crisis and reconstruction.
Fordham, Maureen	Anglia Polytechnic University, Cambridge

Networks:

- Disaster and Social Crisis Network: Part of the European Sociological Association, <http://www.anglia.ac.uk/geography/d&scrn>
- Gender and Disaster Network, www.anglia.ac.uk/geography/gdn

11.7 Earth Observation Technologies

Experts:

Hanneke Gieske	president of GAIA (Network for Women in Earth Sciences)
Rainer Kalliany	Technical University Graz, Institute for computergraphics, Austria

*Networks:***GAIA**

Network for Women in Earth Sciences, Amsterdam, Netherlands

The main goal of the network is to advocate and promote a better position of women in the profession. It is linked to the Royal Geological and Mining Society of the Netherlands (KNGMG) and the Royal Geographical Society of the Netherlands (KNAG).

Lekstraat 75-3

NL – 1079 EM Amsterdam

Tel. 31-20-4044 846

11.8 Socio-Economic Aspects of Environmental Change in the Perspective of Sustainable Development

Experts:

Behringer, Jeanette

Swiss Federal Institute for Environmental Science and Technology (EAWAG), Dübendorf, Switzerland (research fields: sustainability, participation, environmental awareness, gender-specific life-styles)

Biesecker,
Prof. Dr. Adelheid

Professor of Economy at the University of Bremen, Germany, Institute for Economy and Social Behaviour (research fields: sustainability, economy and time)

Häußler, Angela

University of Gießen, Germany (research fields: home economics and sustainable development)

Hemmati, Dr. Minu

UNED-UK, London, Project Coordinator (Gender and Sustainable Consumption, Gender and Tourism); Co-facilitator of the CSD NGO Women's Caucus

Knobloch, Dr. Ulrike

University of St. Gallen, Institute for ethics in economy, Switzerland (research fields: consumption, sustainability, women in the economy, Vorsorgendes Wirtschaften)

Lindén, Prof. Anna-Lisa

University of Lund, Sweden, Department of Sociology (research fields: environmental awareness, travel and transport)

Lorek, Sylvia

Wuppertal-Institute for Climate, Environment and Energy, Germany (research fields: sustainable consumption)

Ransom, Pamela

Women's Environment and Development Organisation (WEDO), New York, USA; research fields: environmental health

Reeves, Dr. Dory

University of Strathclyde, Glasgow, Department of Environmental Planning (research fields: environmental planning, gender)

Röhr, Ulrike

Coordinator of Life e.V., FrauenUmweltNetz (Women Environment Network), Frankfurt

Scurell, Dr. Babette	Stiftung Bauhaus Dessau, Germany (research fields: sustainability, regional development, economy)
Walker-Leigh, Vanya	St. Julians, Malta, economist and journalist (fields of interest: gender, environment, agriculture)
Weller, Dr. Ines	Technical University of Berlin; Germany (research fields: feminist critique of natural sciences, gender and environment, women and textiles, chemistry and material flows)

12 Bibliography

12.1 General Remarks

The literature sources of the following bibliography are subdivided according to the contents of the presented thematical fields of gender and environment/gender and sustainability research. Titles can therefore appear in more than one of the sections. The numbers of the sections correspond to the numbers of chapters in this book.

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