Annex I

STUDY CONTRACT

CONTRACT No. XXXX/BXXXX.EEA.XXXXX

The European Environment Agency, hereinafter called "the Agency",
Whose official address and contact person are:

- Kongens Nytorv 6, DK-1050 Copenhagen K, Denmark,
- Jan-Erik Petersen, Project Manager

Which, for the purpose of the signature of this contract, is represented by [Mrs Jacqueline McGlade, Executive Director of the Agency] [or] **[**Mrs/Mr ……[Name of the signatory], …… [Position of the signatory] acting pursuant to a delegation of the Executive Director of the Agency] [Select the appropriate option],

Of the one part,

And …… [Name of the contractor]

Hereinafter referred to as "the contractor"

Whose official address is: ……

Whose bank account no is: ……

With …… ……[Name of establishment, city, bank identification code]

VAT registration number:…….

Represented by: ……..…..…..…..…. [Name of the signatory] , ……. ……[Position of the signatory],

Of the other part,

Have agreed as follows:

Article 1 – Subject

In the framework of this contract, the contractor hereby undertakes, subject to the conditions laid down in this contract and the annexes thereto, which form an integral part thereof, to perform the following tasks:

Assessing the impact of large-scale biofuel production on agricultural landuse, farmland habitats and related biodiversity

The description of work is set out in Annex I.

Article 2 – Duration

1. This contract shall enter into force from the date on which it has been signed by the contracting parties [and shall start to be carried out …… days after its date of entry into force] [Select and complete appropriate].

2. This contract [is awarded for a period of ……] [Months/years] [or] [shall expire on ……] [Date: day, month, year] [Select the appropriate option].

Article 3 - Financial provisions

1. [Select the appropriate option]

[Option 1]

In consideration of the services performed under this contract, the Agency shall pay to the contractor a sum of up to a maximum of EURO ……[Amount in figures] ([Amount in words] ……) (VAT [Included] [or] [Excluded] [Select the appropriate option]) covering all expenses incurred in the course of execution of this contract, including all travel [and subsistence] expenses.

[Option 2]

In consideration of the services performed under this contract, and up to a maximum of EURO …… [Amount in figures] the Agency shall pay to the contractor the sum of EURO ……[Amount in figures] (……[Amount in words]) (VAT [Included] [or] [Excluded] [Select the appropriate option]) for each day of work covering all expenses incurred in the course of execution of this contract, including all travel and subsistence expenses;

[Option 3]

In consideration of the services performed under this contract, and up to a maximum of EURO……[Amount in figures] the Agency shall pay to the contractor:

a) The sum of EURO ……[Amount in figures] ([Amount in words] ……) (VAT [included] [or] [excluded] [Select the appropriate provision]) for each day of work.;

b) A sum of up to a maximum of EURO ……[Amount in figures] covering all travel ([and subsistence expenses] [Insert if necessary]) incurred in the course of execution of the contract.

[Option 4]

In consideration of the services performed under this contract, and up to a maximum of EURO ……[Amount in figures], the Agency shall pay to the contractor …… [To be completed].

2. Subject to the condition that they would not lead to exceed the maximum amount of the contract as mentioned above, unforeseen travel and subsistence expenses in connection with missions carried out at the specific request and with the prior written authorisation of the Agency shall be reimbursed to the contractor.

3. Payments shall be made as follows:

a) Concerning the sums agreed in paragraph 1**;**

[Select the appropriate option]]

[Option 1]

EURO ……[Amount in figures], payable within 30 calendar days upon receipt by the Agency of a request for pre-financing following the signature of the contract (… % [to be completed]) [Up to a maximum of 40 % of the total amount of the contract],

EURO ……[Amount in figures], payable within 30 calendar days upon approval by the Agency of [the …… interim] [or] [the final] report, subject to the acceptance of the invoice and, where appropriate, of the other documents accompanying the [interim] [or] [final] payment request [Select the appropriate options] (… % [to be completed]),

[Optional] **[**And EURO ……[Amount in figures] payable within 30 calendar days upon approval by the Agency of the final report, subject to the acceptance of the invoice and, where appropriate, of the other documents accompanying the final payment request (… % [to be completed])]

The time allowed for approval of the reports may not exceed [20 days][1] [or] [45 days][2] [or] [60 days][3] [select the right option] as from the date of their receipt by the Agency.

[Option 2]

……..……[Mention the period: monthly etc ….], within ……calendar days [to be completed][4]upon receipt by the Agency of an admissible payment

[1] In case of « straightforward contract" relating to the supply of goods or services.
[2] In case of other contracts.

[3] For contracts involving technical services which are particularly complex to evaluate.
[4] See footnote 1

request subject to the acceptance of the invoice and, where appropriate, of the other supporting documents.

b) Invoices shall indicate the contract number and shall be sent to the Agency at the address and to the contact person as referred above.

4. Payments shall be made to the contractor into the bank account mentioned above.

Article 4 – General conditions

This contract shall be governed by the General terms and conditions applicable to contracts awarded by the European Environment Agency as laid down in Annex II to this contract.

Article 5 – Administrative provisions

All communications, reports, and complaints concerning the performance of this contract shall be in written form and indicate its number as well as its subject, and shall be sent to the address of the interested contracting party and, where appropriate, to the contact person as mentioned above.

Article 6 – Taxation

1. The contractor shall have sole responsibility for compliance with the tax laws which apply to him.

2. The Agency is exempt from duties, levies and taxes, including value added tax, pursuant to Article 3 and 4 of the Protocol on the Privileges and Immunities of the European Communities and the Headquarters Agreement between the Agency and the Government of Denmark of 17 August 1995. The contractor shall accordingly complete the necessary formalities with the relevant authorities to ensure that the goods and services required for the performance of the contract are exempt from tax and customs charges, including VAT.

3. The VAT number of the Agency is: DK 18 13 98 39.

Article 7 – Annexes

1. The following are annexes to this contract:

[Select the appropriate ones]

[To be completed where appropriate]

- Annex I — Description of work
- Annex [II] — General terms and conditions applicable to contracts awarded by the Agency

- Annex… VAT exemption form
- Annex… Budget
- Annex… reimbursement of travel expenses
- Annex … ……

2. In case of conflict between provisions of the contract and those of the annexes, the provisions of the contract shall take precedence. In case of conflict between provisions of Annex II and the provisions of other annexes, those of Annex II shall take precedence.

[Optional] Article 8 - …….

[to be completed]

For the contractor:

[……]

Signed in duplicate in English
in …….. on ……..[Date]

For the Agency:

[Jacqueline McGlade
Executive Director]

[or]

[……]

[Select the appropriate option]

Signed in duplicate in English
in Copenhagen on ……..[Date]

ANNEX II

GENERAL TERMS & CONDITIONS APPLICABLE TO CONTRACTS (Framework contract-Service/Study contract-specific agreement) AWARDED BY THE EUROPEAN ENVIRONMENT AGENCY (Hereinafter "the Agency")

Article 1 - Performance of the contract

(1) The contract shall be performed in such a way as to exclude the possibility of the Contractor or his staff undertaking tasks under conditions identical to those governing the tasks entrusted to a member of the Agency's staff. The Contractor and his staff may not be members of the Agency's administrative structure.

(2) If the Contractor is a natural person, he shall be required to provide proof of his status either as a self-employed person or an employee for the duration of the contract. To this end, he shall provide the Agency with information about his occupation, in particular with regard to social security and VAT.

Article 2 - Secondary obligations of the Contractor

(1) The Contractor shall perform the contract according to the highest professional standards and in accordance with the principles of sound financial management. In performance of the contract, the Contractor is required, depending on the circumstances, to use only his own highly qualified, professional staff

(2) The Contractor shall not be in one of the following situations:
- Being bankrupt, wound up or have his/her business activities suspended;
- Have his/her affairs being administered by the court; have entered into an arrangement or similar measures with creditors or be the subject of any proceedings of that nature;
- Having been convicted of an offence with regard to his/her professional conduct by a judgement which is not open to appeal;
- Be guilty of grave professional misconduct;
- Having been subject of a judgment which has the force of "res judicata" for fraud, corruption, involvement in a criminal organisation or any other illegal activity detrimental to the Communities' financial interests;
- Having not fulfilled his/her obligations relating to the payment of social security contributions or taxes in accordance with the legal provisions of the country in which he/she is established or those of the country of the contracting authority or those where the contract is to be performed;
- Following another procurement procedure or grant award procedure financed by the Community budget, having been declared to be in serious breach of contract for failure to comply with their contractual obligations.

(3) The Contractor undertakes to provide the Agency with any information it may request for the management of the contract.

(4) In the event of termination of the contract for one of the reasons referred to in Article 7 of these terms and conditions, the Contractor shall undertake to send the Agency all information and documents in his possession concerning the tasks assigned to him.

Article 3 - Confidentiality

(1) The Contractor undertakes not to make use of and not to divulge to third parties any facts, information, knowledge, documents or other matters communicated to him or brought to his attention during the performance of the contract or any matter arising there-from. He shall continue to be bound by this undertaking after the expiry of the contract.

(2) If the Contractor uses his own staff in the performance of the contract, he shall obtain from each staff member a written undertaking that they will respect the confidentiality of any information brought to their attention during the performance of the work and that they will not divulge to third parties or use for their own benefit or that of any third party any document or information not available publicly, even after completion of their assignment. A copy of the undertaking shall be sent to the Agency.

(3) If the Contractor's staff are working at Agency premises, the Contractor shall replace, immediately, at the Agency's request and without compensation any person considered undesirable by the latter.

Article 4 - Permits and licences

The Contractor shall be solely responsible for taking the necessary steps to obtain any permit or licence required for the performance of the contract under the laws and regulations in force at the place where the tasks assigned to the Contractor are to be performed.

Article 5 - Spread of risk

The Contractor shall not be entitled to payment if he is prevented by force majeure from performing the tasks assigned to him. Part performance only of any such task shall result in part payment. Provided it is specified in the contract, the above provisions shall not affect the Contractor's entitlement to reimbursement of travel and subsistence expenses and of costs for the shipment of equipment incurred in the performance of the contract.

Article 6 - Liability of the contracting parties

(1) The Agency may not under any circumstances or for any reason whatsoever be held liable for damage sustained by the Contractor himself or by his staff during the performance of the contract. The Agency shall not accept any claim for compensation or repairs in respect of such damage.

(2) Except in case of force majeure, the Contractor shall be required to indemnify the Agency for any damage it may sustain during the performance, poor or otherwise, of the contract.

Article 7 - Termination of contract

(1) Each contracting party may, of his own volition and without being required to pay compensation, terminate the contract by serving formal notice two months in advance. If the contract is terminated by the Agency, the Contractor shall be entitled to payment for the part performance of the contract only.

(2) In the event of a serious failure by the Contractor to the Agency, duly noted by the Agency, to fulfil his obligations under the contract, the contract may be terminated at any time by registered letter without formal notice or payment of any compensation

whatsoever by the Agency. This provision shall not affect the application of Article 6(2) of these General Terms & Conditions.

(3) In the event of non performance of the contract by the Contractor, except for reasonable and justifiable technical or economic reasons, of any of his obligations, and after having given notice by registered mail requiring performance of the obligations concerned, the Agency may terminate the contract if the Contractor is still in breach of his obligations one month after receiving formal notice.

(4) In the event of circumstances, which are liable to prejudice or delay the performance of the contract, the Contractor shall forthwith inform the Agency, with the relevant details. The parties shall agree together on the measures to be taken. If no agreement can be reached, the Agency may terminate the contract without recourse to any legal proceedings, where no action is taken by the Contractor within one month of receiving formal notice by registered mail.

(5) The Agency may terminate the contract without notice if the Contractor is unable, through his own fault, to obtain any permit or licence required for the performance of the contract as referred to in Article 4 above.

(6) Without prejudice to the termination referred to in paragraphs 3 and 4 above, the Agency may require reimbursement of all or part of the amounts paid, having regard to the nature and the scale of the work carried out, before the date of termination of the contract.

Article 8 - Assignment and services to third parties

(1) The Contractor shall not assign the rights and obligations arising out of the contract in whole or in part or sub-contract any part of the contract to third parties without the prior and written approval of the Agency.

(2) Even where the Agency authorises the Contractor to sub-contract part or all of the work to third parties, he shall nonetheless remain bound by his obligations to the Agency under the contract.

(3) Save where the Agency expressly authorises an exception, the Contractor shall be required to include in any sub-contracts for all or part of the work such provisions as enable the Agency to enjoy the same rights and guarantees in relation to the sub-Contractors as it enjoys in relation to the Contractor himself.

Article 9 - Ownership

(1) Any result or patent obtained by the Contractor in the performance of the contract shall belong to the Agency, which may use them as it sees fit.

(2) Copyright and any other rights of ownership in respect of manuscripts or parts thereof shall belong exclusively to the Agency except where copyright or other property rights already exist.

(3) On the date of acceptance of the manuscripts and subject solely to the exception referred to in paragraph (2) above, all rights in respect of manuscripts, including amongst others the right to use, print, publish and sell all or part thereof in any manner and in any language whatsoever, shall be acquired by the Agency which may transfer all or part of such rights to third parties on its own terms.

(4) The Contractor shall specify any parts of manuscripts, including illustrations, maps and graphs, of which copyright or any other right of ownership already exists and hereby affirm that he has obtained permission to use such parts from the titular holder(s) of such rights or from his or their legal representatives. Any cost for which the Contractor may become liable for such permission shall be paid by him. Save as otherwise provided for in paragraph (2), the Contractor hereby affirms that he is entitled to transfer the copyright or other rights of ownership in respect of the subject matter of the manuscript.

(5) The Agency shall not be required to publish manuscripts or documents supplied in the performance of the contract. If it is decided not to publish the manuscripts or documents supplied, the Contractor shall not have them published elsewhere without the prior written approval of the Agency.

Article 10 – Payments

(1) Payments shall be made in euros (€).

(2) At the request of the Contractor, the Agency may pay him an advance of up to a maximum of 40% of the amount due on completion of the contract. Payment of the advance may be made conditional upon the furnishing by the Contractor of proof that he has lodged a deposit with his bank equal to the amount of the advance. The advance shall be deducted from subsequent payments in such a manner that it is fully recovered on exhaustion of the funds provided for such payments.

(3) In the event of termination of the contract under Article 7 of these General Terms & Conditions, no payment shall be due except for services actually rendered up to the date of termination. In such an event, the amount due shall be calculated after deducting any payments already made. If the payments made prior to termination exceed the sum finally due, the Contractor shall repay the additional amount to the Agency within 60 days of receipt of a request for repayment. If payment is not made within this period, the sum owed by the Contractor shall start to bear interest at the euro rate applied by the European Central Bank on the last day of the period allowed for repayment, as published in the C series of the Official Journal.

(4) Where appropriate, invoices shall be supported by original documents justifying the time spent by the Contractor to perform the tasks under the contract.

(5) Reimbursable travel and subsistence expenses shall be paid, where appropriate, on production of original supporting documents including receipts, used tickets and boarding pass.

(6) Payments shall be made within the time limit as specified in Article 3 of the contract and shall be deemed to have been made on the date on which the Agency's account is debited

(7) Where payments depend on approval of a report, the time limit for the payment shall not begin to run until the report has been approved. The report shall be deemed to have been approved implicitly once the time allowed for approval has expired without being suspended by means of a formal document sent by the Agency to the contractor.

(8) On expiry of the time limit for payment the Contractor may claim interest within two months of receiving the late payment. Interest shall be calculated at the rate applied by the European Central Bank to its most recent main refinancing operations (*"the reference rate"*) plus seven percentage points (*"the margin"*). The reference rate in

force on the first day of the month in which the payment is due shall apply. Such interest rate is published in the C series of the Official Journal of the European Communities. Interest shall be payable for the time elapsed between expiry of the payment deadline and the date of payment. Suspension of payment by the Agency may not be deemed to constitute late payment.

(9) However, the Agency may suspend the time limit for payment by informing the Contractor, at any time during the period referred to under (6), that the payment request cannot be met, either because the amount is not due or because the appropriate supporting documents have not been produced. The Agency shall notify the Contractor accordingly by registered letter with acknowledgement of receipt or equivalent. Suspension shall take effect from the date of dispatch of the letter. The remainder of the payment period shall begin to run again from the date when the properly formulated payment request is first registered.

(10) The Contractor, whose registered office or residence is situated within the territory of one of the Member countries of the Agency, shall indicate a banking institution on the territory of the country where his registered office or residence is situated for the payment of the sums due to him under the contract.

Article 11 – Audits and controls

The Agency and such persons who are authorised for this purpose by the Executive Director shall be entitled to carry out audits and controls, have access to all books, papers, records and files kept by the Contractor relating to expenditure incurred in performing the contract during the contractual period and for a period of five years after such period.

Article 12 - Provisions relating to taxation

(1) The amount of VAT shall not be included in the sums due to the Contractor except when the tasks envisaged with the present contract are not directly exonerated from VAT under the terms of the tax laws applicable to the Contractor.

(2) The Contractor shall be responsible for complying with the national tax laws applicable to him in respect of revenue received under the contract with the Agency.

(3) The Contractor shall, at the request of the Agency, make available to the latter all vouchers which it might require in order, where necessary, to apply for reimbursement by the fiscal authorities of levies and taxes which have been paid in execution of this contract, pursuant to Articles 3 and 4 of the Protocol on the Privileges and Immunities of the European Communities.

Article 13 – Applicable Law and Jurisdiction

(1) The contract shall be subject to Danish law.

(2) Any dispute between the Agency and the Contractor or any claim by one party against the other which cannot be settled amicably shall be brought before the Copenhagen courts exclusively, at the initiative of either party.

Article 14 – Amendments

Any amendment to the contract shall be the subject of an additional written agreement. Oral agreements shall not be binding on the contracting parties.

Call for tender EEA/EAS/03/004

IDENTIFICATION SHEET

Company name: _____

Address: _____

_____

Director: _____

Consultant(s): _____

VAT No: _____

E-mail: _____

Bank details:
Bank: _____
Address:

_____

Account No: _____

BIC code: _____

Signed by: _____

Company stamp:
(must be added)

ANNEX IV

REIMBURSEMENT OF TRAVEL EXPENSES

The reimbursement of travel & daily allowance expenses incurred under this contract is paid in euro (EUR) at the rate of exchange in force against the euro (EUR) for the month in which the liquidation is effected (rate applied by the European Central Bank). All claims must be in the currency in which they were paid.

a) Travel expenses

by train:	First class fare (used ticket with claim),
by air:	Economy class where available (used ticket with claim),
by car:	The equivalent of first class rail fare.

b) Visas

c) Daily allowance

The daily allowance is to include **all** expenses relating to:
- accommodation;
- meals;
- local transport including taxis.

d) Transfer of professional materials or non-accompanied luggage

Subject to prior approval by the Agency.

NOTES:

Taxis are not chargeable.

The daily allowances applicable for the whole duration of the contract are as follows (*):

Austria	:	EUR	122	Belgium	:	EUR	150
Bulgaria	:	EUR	197	Cyprus	:	EUR	110
Czech Rep	:	EUR	193	Estonia	:	EUR	159
Denmark	:	EUR	179	Finland	:	EUR	156
France	:	EUR	130	Germany	:	EUR	127
Greece	:	EUR	113	Hungary	:	EUR	168
Iceland	:	EUR	199	Ireland	:	EUR	165
Italy	:	EUR	130	Latvia	:	EUR	244
Lithuania	:	EUR	179	Liechtenstein	:	EUR	150
Luxembourg	:	EUR	143	Malta	:	EUR	175
Netherlands	:	EUR	148	Norway	:	EUR	180
Poland	:	EUR	270	Portugal	:	EUR	143
Romania	:	EUR	230	Slovak Rep	:	EUR	144
Slovenia	:	EUR	170	Spain	:	EUR	141
Sweden	:	EUR	157	Turkey	:	EUR	136
United Kingdom:		EUR	199				

(*) Rates are decreased with 25% when the mission exceeds 4 weeks.

Only 50% of the daily allowance is paid in case the night has not been spent at the place of mission.

EUROPEAN COMMUNITY CERTIFICATE

VAT AND EXCISE DUTY EXEMPTION

(Directive 77/388/EEC - Article 15 (10) and Directive 92/12/EEC - Article 23 (1))

Serial No. (optional)

1. ELIGIBLE INSTITUTION/INDIVIDUAL

Designation/name: **European Environment Agency**

Street and No. **Kongens Nytorv 6**

Postal code, place: **1050 Copenhagen K**

(Host) Member State: **Denmark**

2. COMPETENT AUTHORITY FOR ISSUING THE STAMP
(Name, address and telephone No.)

Ministry of Foreign Affairs

Protocol Department

DK-1448 Copenhagen K Tel.: **+45 33 92 00 00**

3. DECLARATION BY THE ELIGIBLE INSTITUTION OR PERSON

The eligible institution hereby declares

(a) that the goods and/or services set out in box 5 are intended [1]

☐ for the official use of

- ☐ a foreign diplomatic mission
- ☐ a foreign consular representation
- ☐ an international organisation
- ☐ an armed force of a State being a party to the North Atlantic Treaty (NATO)

☐ for the personal use of

- ☐ a member of a foreign diplomatic mission
- ☐ a member of a foreign consular representation
- ☐ a staff member of an international organisation

(designation of the institution (see box 4)

(b) that the goods and/or services described at box 5 comply with the conditions and limitations applicable to the exemption in the host Member State mentioned in box 1, and

(c) that the information above is furnished in good faith. The eligible institution or individual hereby undertakes to pay to the Member state from which the goods were dispatched or from which the goods and/or services were supplied, the VAT and/or excise duty which would be due if the goods and/or services did not comply with the conditions of exemption, or if the goods and/or services were not used in the manner intended.

Copenhagen,
Place, date

Name and status of signatory

Signature

4. STAMP OF THE INSTITUTION (in case of exemption for personal use)

Place, date

Stamp

Name and status of signatory

Signature

[1] Put a cross in the appropriate box

5. DESCRIPTION OF THE GOODS AND/OR SERVICES, FOR WHICH THE EXEMPTION FROM VAT AND/OR EXCISE DUTY IS REQUESTED

A. Information concerning the supplier/authorised warehouse keeper

(1) Name and address

(2) Member State

(3) VAT/excise number

B. Information concerning the goods and/or services

No.	Detailed description of goods and/or services [2] (or reference to the attached order form)	Quantity or Number	Value excluding VAT and/or excise duty		Currency
			Value per unit	Total value	
	Total amount				

6. CERTIFICATION BY THE COMPENENT AUTHORITY OR AUTHORITIES OF THE HOST MEMBER STATE

The consignment/supply of goods and/or services described in box 5 meets

☐ totally

☐ up to a quantity of (number)[3]

the conditions for exemption from VAT and/or excise duty.

Place, date

Stamp

Name and status of signatory (ies)

Signature (s)

7. PERMISSION TO DISPENSE WITH STAMP

By letter No (reference to file) of (date)

(designation of eligible institution) has been permitted by

to dispense with the stamp under box 6.

(designation of the competent authority in the host Member State)

Place, date

Stamp

Name and status of signatory

Signature

[2] Delete space not used: This obligation also applies if order forms are attached

[3] Goods and/or services not eligible should be deleted in box 5 or on the attached order form

Explanatory notes

1. For the supplier and/or the authorised warehouse keeper, this certificate serves as a supporting document for the tax exemption of the supplies of goods and services or the consignments of goods to eligible institutions/individuals referred to in Article 15 (10) of Directive 77/388/EEC and Article 23 (1) of Directive 92/12/EEC. Accordingly, one certificate shall be drawn up for each supplier/warehouse keeper. Moreover, the supplier/warehouse keeper is required to keep this certificate as part of his records in accordance with the legal provisions applicable in his Member State. In case a Member State does not grant a direct exemption for the supply of services and, therefore, proceeds to exempt the supply by reimbursing the tax to the beneficiary specified in box 1, this certificate should be attached to the request for reimbursement.

2.

a) The general specification of the paper to be used is as laid down in the Official Journal of the European Communities No C 164 of 1.7. 1989, p. 3.

The paper is to be white for all copies and should be 210 millimetres by 297 millimetres with a maximum tolerance of 5 millimetres less or 8 millimetres more with regard to their length.

For an exemption from excise duty the exemption certificate shall be drawn up in duplicate:

- one copy to be kept by the consignor
- one copy to accompany the administrative accompanying document

b) Any unused space in box 5.B. is to be crossed out so that nothing can be added.

c) The document must be completed legibly and in a manner that makes entries indelible. No measures or overwriting are permitted. It shall be completed in a language recognised by the host Member State.

d) If the description of the goods and/or services (box 5.B. of the certificate) refers to a purchase order form drawn up in a language other than a language recognized by the host Member State, a translation must be attached by the eligible institution/individual.

e) On the other hand, if the certificate is drawn up in a language other than a language recognized by the Member State of the supplier/warehouse keeper, a translation of the information concerning the goods and services in box 5.B must be attached by the eligible institution/individual.

f) A recognized language means one of the languages officially in use in the Member State or any other official language of the Community which the Member State declares can be used for this purpose.

3. By its declaration in box 3 of the certificate, the eligible institution/individual provides the information necessary for the evaluation of the request for exemption in the host Member State.

4. By its declaration in box 4 of the certificate, the institution confirms the details in boxes 1 and 3(a) of the document and certifies that the eligible individual is a staff member of the institution.

5.

a) The reference to the purchase order form (box 5.B. of the certificate) must contain at least the date and order number. The order form should contain all the elements that figure at box 5 of the certificate. If the certificate has to be stamped by the by the competent authority of the host Member State, the order form shall also be stamped.

b) The indication of the excise No as defined in Article 15(a), paragraph 2 (a), of Directive 92/12/EEC of the authorised warehouse keeper is optional; the VAT identification No must be indicated.

c) The currencies should be indicated by means of a three-letter code in conformity with the international ISOIDIS 4127 standard established by the International Standards Organisation [4].

6. The above mentioned declaration by the eligible institution/individual shall be authenticated at box 6 by the stamp(s) of the competent authorities of the host Member State. It is up to the competent tax authority to obtain such agreement.

7. To simplify the procedure, the competent authority can dispense with the obligation on the eligible institution to ask for the stamp in the case of exemption for official use. The eligible institution should mention this dispensation at box 7 of the certificate.

[4] As an indication, some codes relating to currencies currently used: BEF (Belgian franc), DEM (German mark), DKK (Danish kroner), ESP (Spanish peseta), FRF (French franc), GBP (Pound sterling), GRD (Greek drachma), IEP (Irish pound), ITL (Italian lire), LUF (Luxembourg franc) NLG (Dutch guilder), PTE (Portuguese escudo), ATS (Austrian schilling), FIM (Finnish mark), SEK (Swedish kroner), USD (United States dollar).

Annex VI

Declaration on Exclusion Criteria

The undersigned:
Name of the company/organisation:
Legal address:

Registration Number:
VAT number:

Declares on oath that the company/organisation mentioned above is not in any of the situations mentioned below:

They are bankrupt, being wound up or have suspended business activities, their affairs are being administered by the court, they have entered into an arrangement with creditors or similar measures or are the subject of any proceedings of that nature;
They have been convicted of an offence concerning their professional conduct by a judgement, which is not open to appeal;
They have been guilty of grave professional misconduct;
They have not fulfilled obligations relating to the payment of social security contributions or taxes;
They are guilty of serious misrepresentation in supplying the information required by the authorising department.

I the undersigned am aware that tenders may not be awarded to candidates who during the award procedure are guilty of misrepresentation in supplying, or fail to supply, the information requested by the authorising department.

Full Name: Date:
Signature:

Annex A

OECD WORKSHOP ON BIOMASS AND AGRICULTURE, JUNE 2003

A framework for evaluating the environmental impact of biofuel use

Jane Feehan and Jan-Erik Petersen, European Environment Agency, Copenhagen.

Abstract

With increasing emphasis on renewable energy, the role of biomass as an environmentally friendly energy source is becoming more important. Transport is a sector where other renewables will not play a major role in the foreseeable future, making the contribution of biomass and biofuels particularly significant. The issue of biofuel use in transport is one of the cross-sectoral themes that the EEA is planning to address during the coming years.

This paper summarises recent EU policy developments regarding biofuels. It then sets out a framework for evaluating the environmental impact of current biofuel use, drawing on existing studies and assessment approaches developed at the EEA and linking with the existing OECD agri-environment indicator structure. This framework is intended to facilitate more integrated, holistic thinking on how best to assess the impact of increased biomass production and use. It aims to set out the parameters of an ex-ante evaluation of measures to expand biomass production and use. Recent policy developments present a range of options for increasing biofuel use in the EU, and it is hoped that the framework will help to develop appropriate approaches for local and regional circumstances. To test our conceptual approach, the framework is applied to two different types of biofuel production. Lastly, the paper draws conclusions from the case study exercise about the usefulness of the assessment framework in evaluating the environmental implications of future biofuel development.

Keywords

Integrated environmental assessment, life cycle assessment, rapeseed, biodiesel, willow, combined heat and power (CHP[*]).

Introduction

There is now a renewed interest in the use of biomass for the efficient and clean production of heat and electricity and for the production of renewable transport fuels. Biomass from agricultural, forestry and waste sources provided over 63% of the EU's renewable energy in 1999, and it appears to be the renewable energy source with the highest potential to contribute to a future sustainable energy supply for the European Union (EEA, 2002a). In Finland, Sweden and Austria, it currently covers 23%, 18% and 12% of the primary energy demand (Groscurth *et al.*, 2000). Biomass is a particularly attractive option for a number of reasons.

[*] Acronyms used in the text are listed in the 'Acronym Glossary' at the end of the paper.

- It is widespread, diverse and renewable, contributing both to the security of energy supply and to the diversification of energy sources.
- It can produce a low-carbon source of electricity.
- Modern biomass conversion technologies have brought emissions down to very low levels.
- Energy plantations, if carefully planned and managed, can yield benefits such as watershed protection, habitat and amenity value and the rehabilitation of degraded areas.
- Biomass production can provide an alternative market for agricultural production, contributing to agricultural diversification and rural development.

Table 1 shows some of the main agricultural and forestry biomass resources, ranging from dedicated energy crops such as oil and starch crops, to secondary residues such as sawmill waste. Some crops, such as sugar beet, have a high energy yield per hectare but little use can be made of their by-products. Others, such as oilseed rape, have a lower energy yield per hectare but yield a number of useful by-products (high-protein animal feed, glycerine) that contribute to the overall energy balance.

Energy content is only one feature of these crops. Some can only be grown in rotation with other crops, may require more irrigation and chemical inputs than others, and some provide useful cover for wildlife. Some are being exported, while others are already being imported. A simple cost-benefit analysis does not capture the full range of costs and benefits that arise, and nor does a simple comparison between biomass fuels and their fossil alternatives. **An integrated framework for assessing the broader, cross-sectoral environmental impact of expanding biomass production and use is needed to ensure that all the important factors are taken into account**.

This paper attempts to set out such a framework. This framework is not intended to provide a blueprint for assessment, rather to facilitate more integrated, holistic thinking on the approach that is needed. It aims to set out the **parameters of an ex-ante evaluation** of measures to increase biofuel production and use in an environmentally-friendly way. We welcome feedback on the proposed framework and aim to improve it in the future.

Table 1

Agricultural and forestry biomass resources

Biomass type	*Source*
Dedicated crops	• Oil crops (rapeseed, sunflower, soya) • starch crops (sugar beet, sugar cane, wheat, barley) • short rotation forestry (willow, poplar) • high-yielding grasses (miscanthus, switchgrass)
Primary residues / by-products from agriculture and forestry	• Forestry (thinnings, felling residues) • Straw from cereal crops • Other agricultural residues
Secondary residues / by-products	• Manure, slurry (fermentation for biogas) • Sawmill waste • Sewage sludge • Non-agricultural sources (used cooking oil, organic solid waste)

Two uses of biomass: combined heat and power (CHP) and biofuels for transport

This paper examines two uses of biomass: the use of short-rotation coppicing of willow for combined heat and power production (CHP), and the use of oilseed rape for biodiesel generation.

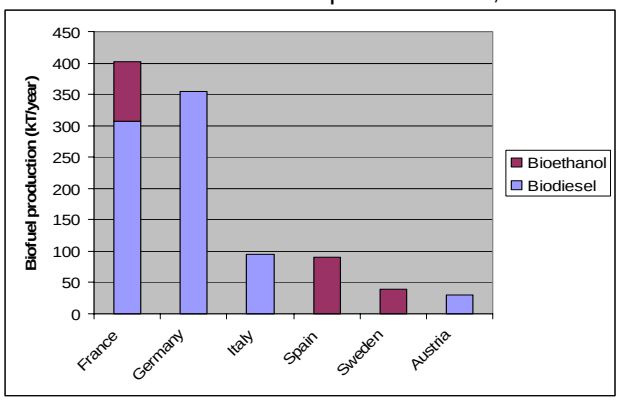
Bioelectricity represents about 1% of the electricity production capacity in OECD countries, with an installed capacity of about 18.4 GW. Most plants are of the **CHP** type, where heat is generally used for industrial purposes or district heating (Bauen *et al.*, in print). A well-developed bioelectricity sector depends on ready availability of a biomass feedstock, and most bioelectricity production in OECD countries is associated with forestry and wood processing industry activities. Some countries – Finland in particular – have considerable experience with co-firing biomass with fossil fuels and waste. For the OECD area, an ambitious but realistic target for bioelectricity by 2020 could consist of the exploitation of 25% of potentially harvestable residues from agriculture and forestry, and by dedicating 5% of the crop, forest and woodland area to biomass growth for energy (Bauen *et al*., in print).

Transport is a sector with limited renewable fuel options. Energy sources such as wind and solar power cannot be harnessed for transport in the foreseeable future, and so the EU's transport sector is set to increase the use of **biofuels** in the coming years. With transport's 98% dependence on oil, a shift towards biofuels offers some attractive advantages: a reduction in CO_2 emissions, a fostering of improved security of energy supply, a new path for the diversification of agriculture and a medium-term stepping stone to the more distant technology of hydrogen fuel cells. It has been suggested that wood crops converted to alcohol or hydrogen could in the long term satisfy most UK road transport fuel demand (Eyre *et al.*, 2002).

A recent Directive (2003/30/EC) on increasing the use of biofuels in the EU is promoting the use of biomass for transport fuel. Currently, almost all biofuel use in the EU is accounted for by six Member States (Figure 1), and much of this is biodiesel manufactured from rapeseed or sunflower oil. The Directive sets out a wide range of alternative fuel options to encourage a diversification of fuel supply. National targets for the use of biofuels are to be set across the EU, aiming towards the indicative goal of replacing 5.75% of all transport fossil fuels by 2010. Countries will be asked to report on the environmental impact of planned biofuel-encouraging measures, including factors such as land use, the degree of intensity of cultivation, the use of pesticides, the protection of watercourses and energy efficiency. Appropriate environmental measures will need to be taken to reduce the impact of biofuel crop cultivation. The overall goal is to expand the use of biofuels in a considered way on the basis of clear evidence of their environmental benefits, while taking into account competitiveness and security of supply. There is a need to develop complementarity between the different biofuel options available in the EU.

Figure 1

Use of biofuels for transport in the EU, 2001.



Source: The Altener (Alternative Energy) Programme, DG Energy and Transport

Current tools for conducting environmental assessment

Straightforward impact assessments are often partial, looking only at certain sets of impacts and making it more difficult for policy makers to assess trade-offs and to compare different scenarios when deciding on a specific course of action (Willis, 2002). Integrated environmental assessment (IEA) and life cycle analysis (LCA) attempt to overcome this limitation by including a broader set of impacts. Features of these tools are useful for assessing more comprehensively the environmental consequences of biomass production and use.

A current focus of work in the EEA is to develop expertise in **integrated environmental assessment** (IEA) in order to evaluate policy effectiveness. IEA is a process that requires a broad, systemic approach to building environmental knowledge, and it must be relevant and useful to policy development processes (Rothman and Robinson, 1996). Because of its integration of policy relevance with a multi-disciplinary approach, IEA is increasingly recognised as an important technique for managing the environmental impacts of human actions.

Integration is a continuous spectrum, and there are many ways to approach it. The most frequent way is so-called ***vertical integration***, which incorporates the whole causal chain of socioeconomic driving forces, pressures on the environment, the resulting state of the environment, the impacts and the required responses from policy and society. The DPSIR framework (Driving force, Pressure, State, Impact, Response), summarises this end-to-end cycle. This framework can facilitate a good understanding of the dynamics of the system, ensuring that the assessment is properly comprehensive and 'integrated'.

A second approach is ***horizontal integration***, which entails broadening the study across disciplines within a single link of the causal chain. To take environmental pressures as an example, we can distinguish between different types of pressures from different activities and sectors. Thus nutrient loading in water bodies arises from a variety of sources (agriculture, industrial activities, sewage treatment plants). To properly assess their combined pressure, a combination of agronomic, engineering and environmental knowledge is required. Combining vertical and horizontal integration is the main challenge of IEA (Vos, 2001).

Life cycle assessment is also known as 'life cycle analysis', 'life cycle approach' or 'cradle to grave analysis'. It is a system orientated approach estimating pollution potential, energy and resource usage associated with a product or operation throughout its life cycle (EEA, 1996). In general, 'life cycle thinking' can be a useful spur to creative thought on the wider dimensions of a problem (EEA, 1997). Among the newer concepts in LCA is 'life cycle management' (LCM), which is an integrated approach to minimising environmental burdens throughout the life cycle of a product, system or service.

A typical LCA study consists of the following stages:

1. Goal and scope definition.
2. A detailed life cycle inventory (LCI) analysis, with compilation of data both about energy and resource use and on emissions to the environment, throughout the life cycle.
3. An assessment of the potential impacts associated with the identified forms of resource use and environmental emissions.
4. The interpretation of the results from the previous phases of the study in relation to the objectives of the study.

Impact categories are discussed in some detail in Appendix 4.2 of the EEA (1997) publication 'Life Cycle Assessment (LCA). A guide to approaches, experiences and information sources (Environmental Issues Series No 6)'.

A framework for evaluating the environmental impact of current biofuel use

The production and use of biomass has cross-sectoral effects, touching on transport, energy, trade and agriculture. Different stages in the production chain – cultivation, fuel manufacture, use of by-products, CHP technology, transport use – have very different sets of environmental impacts.

The cultivation of biomass for energy has various potential impacts on soil, water, air and biodiversity. These impacts can be listed as follows.

- Biodiversity (changes in the use of chemical inputs, changes in crop rotations, possible arable conversion of grassland, potential creation of landscape elements)
- Soil (organic matter content, soil structure, nutrient content)
- Quality of water and watersheds
- Air and atmosphere (ozone, acidification, particulate emissions, greenhouse gases)
- Energy efficiency
- Human health (pollution of air and water, allergenic pollen from crops)
- Amenity value.

Each of these impact types needs to be assessed for the biomass type in question, and for each stage in the processing and refinement of that biomass type.

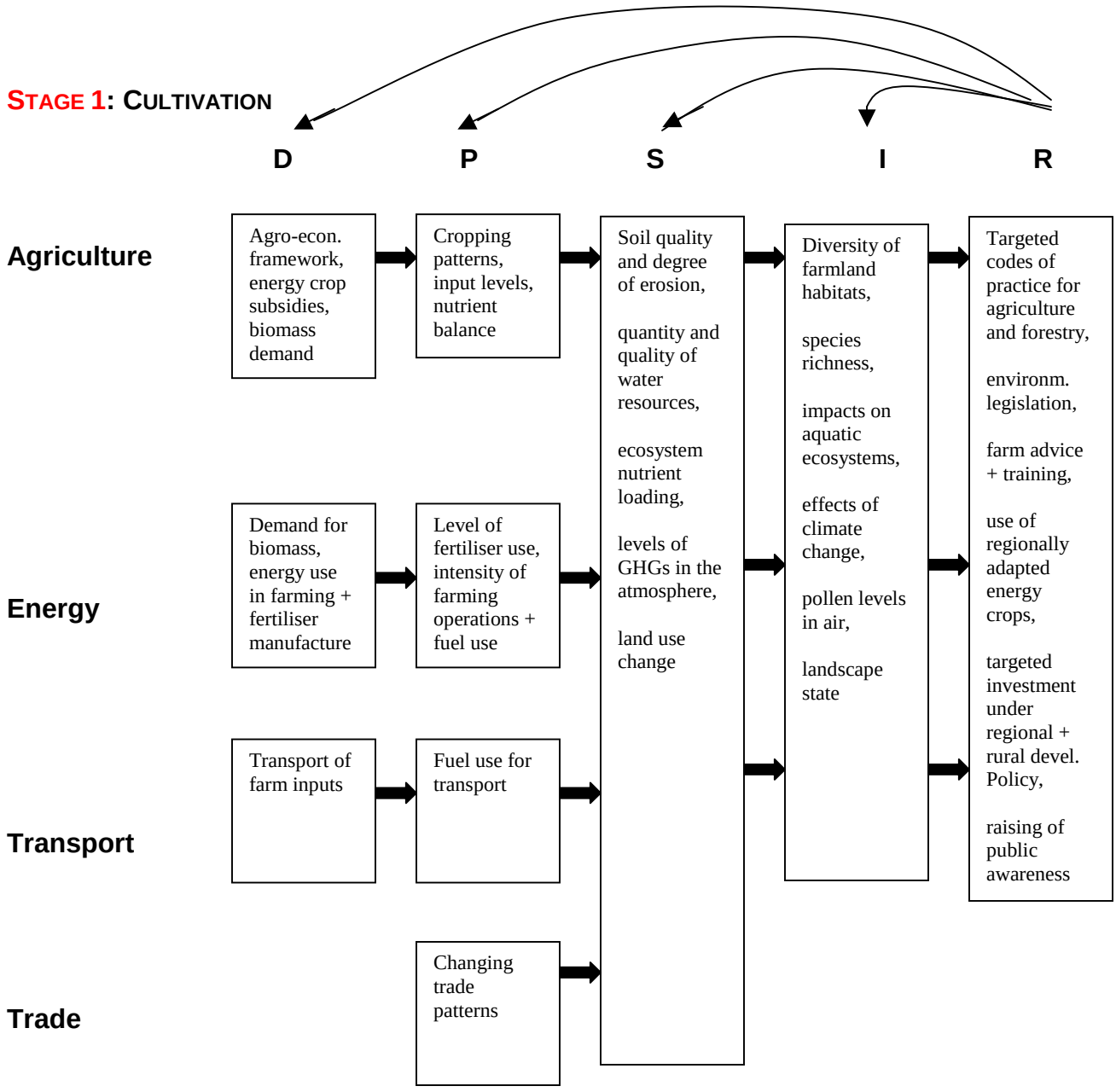
In developing an integrated framework for assessing the environmental impact of biofuel production and use, both horizontal and vertical integration are necessary to achieve effective evaluation. Stages of the production process should be considered one by one, and looked at from the point of view of parameters that affect the environmental outcomes: agriculture and land use, energy, transport and trade. Economic assessment – including cost-benefit analysis – is also important, but is beyond the scope of this paper.

At each stage of this multi-sectoral life-cycle assessment, the DPSIR cycle is kept in mind. This maintains a useful causal continuity throughout the framework. Instead of a list of factors, the framework retains a sense of the underlying reasons for, and possible responses to, each factor.

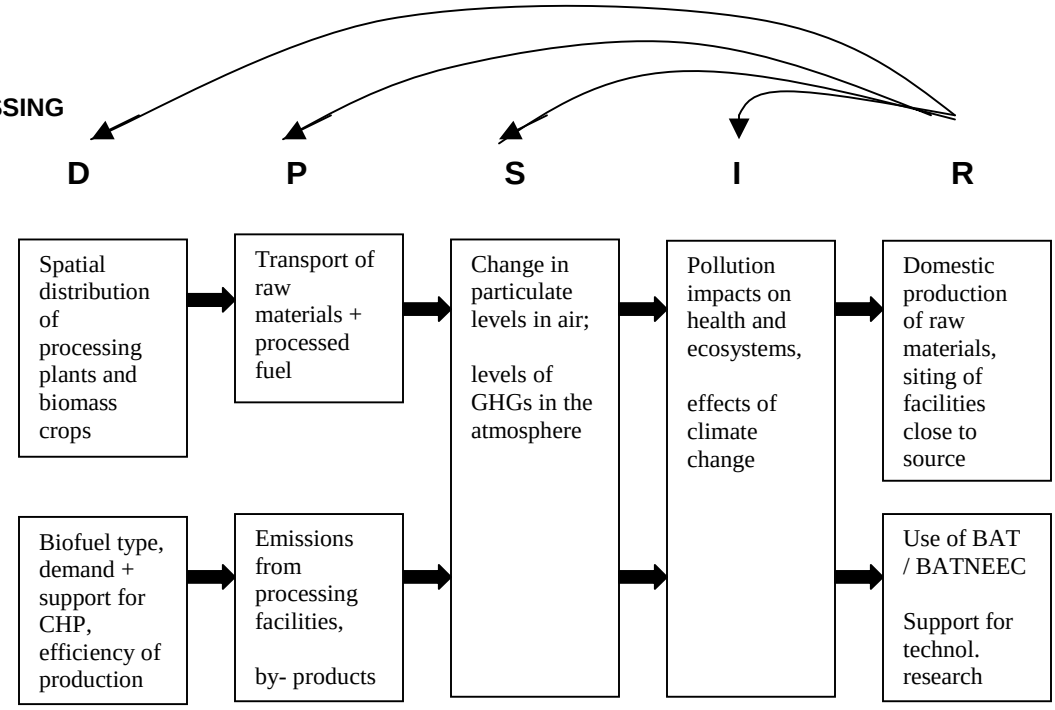
The evaluation framework is illustrated in Table 2.

Table 2

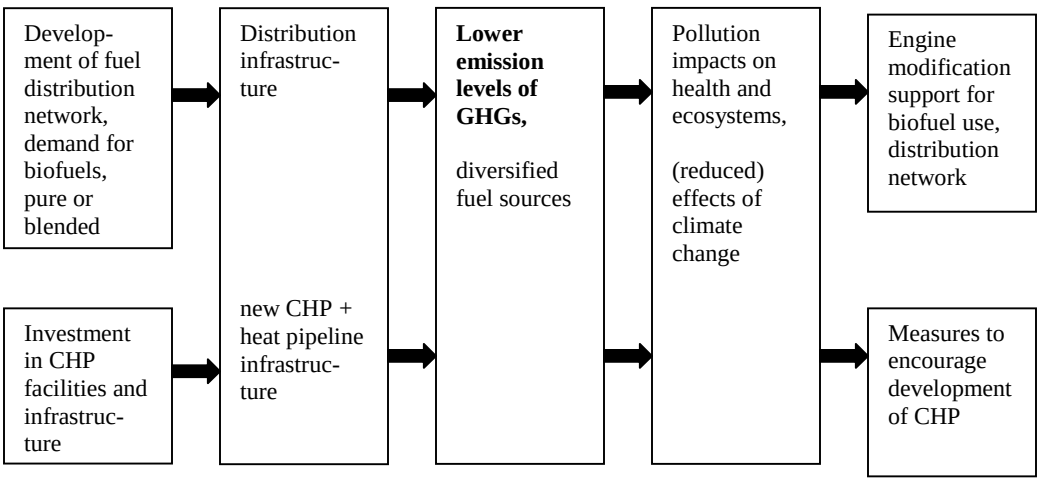
Framework for integrated evaluation of environmental impact of biomass production and use. The product life cycle is divided into three stages: cultivation, processing and end-product consumption. Individual factors may have negative or positive effects.



STAGE 2: PROCESSING



STAGE 3: END PRODUCTS: CONSUMPTION AND WASTE



Application of the framework

In order to test the framework, it will be applied to two different types of biomass use: biodiesel (FAME, fatty acid methyl ether) production from oilseed rape, and woody biomass use for CHP. These 'test runs' of the framework are not intended to be comprehensive: rather, they are intended to assess its usefulness, and to highlight key features of these two biomass use types. The examples chosen represent on the one hand a fairly well-developed approach to biofuel production for transport, and on the other hand a less well-developed approach for bio-energy generation. The first option can be easily integrated in current crop rotations, whereas the second option entails the introduction of new, long-term crops.

Biodiesel production from oilseed rape

Biodiesel can be produced from several raw materials: oilseed rape, sunflowers, soya, other oil crops, and non-agricultural sources of oil such as used cooking oil. In the EU, oilseed rape is the main agricultural raw material for biodiesel.

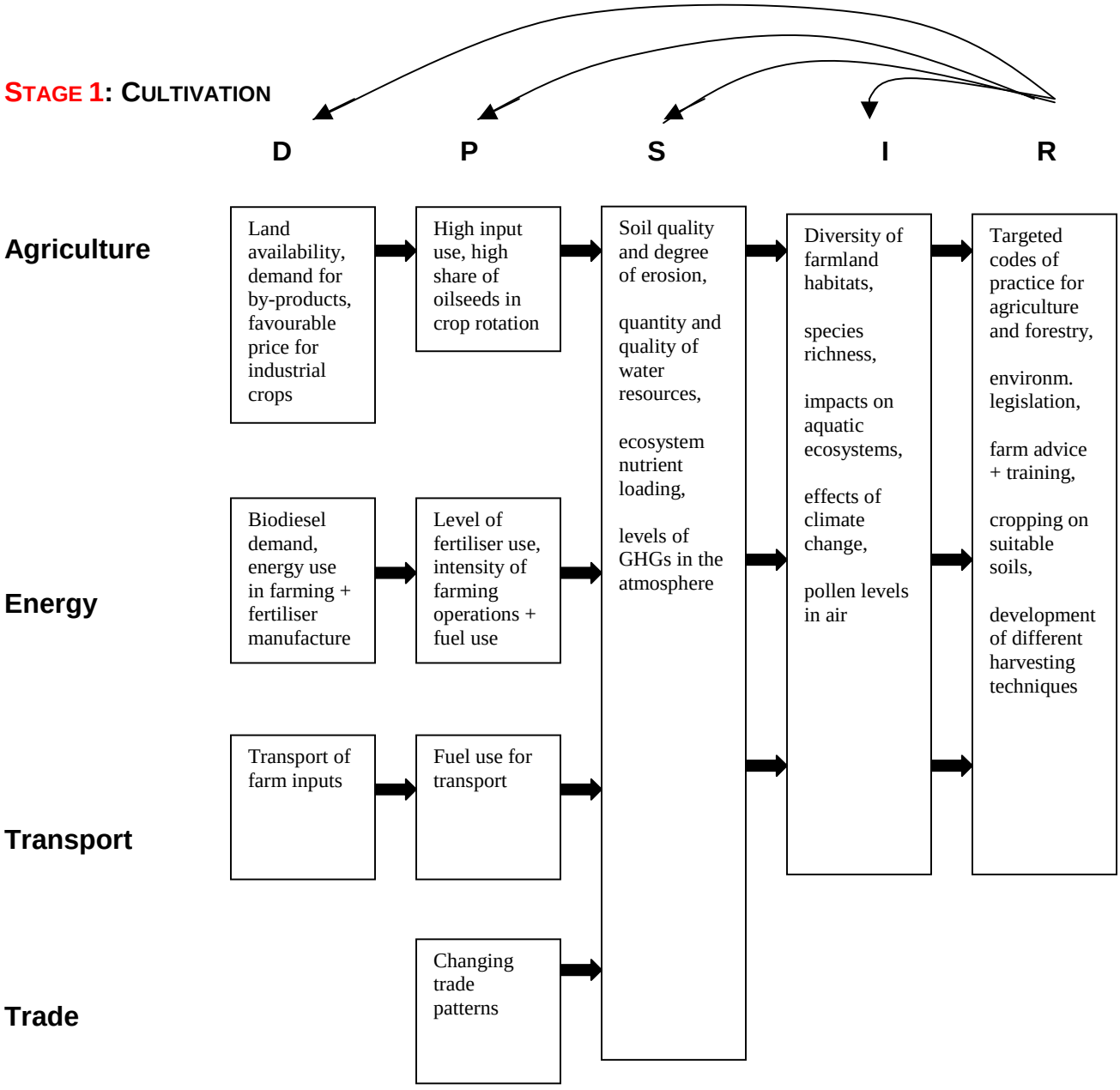
Oilseed rape is the agricultural crop that is most widely used for fuel production at present. Industrial oilseed rape was grown on approximately 2,900,000 ha in the EU-15 in 2002. Compared to bioethanol yield from starch crops, the biodiesel yield from oilseed rape is relatively low: one hectare of oilseed rape produces between 0.5 and 1.5 T/ha.

There are three main stages to the production process. Cultivation of the crop is followed by harvesting and pressing to obtain the oil. The high-protein cake that remains is a valuable animal feed. The oil is then esterified and purified to produce biodiesel. It may be blended with fossil diesel for use in unmodified engines – most current blends contain 5% biodiesel – or distributed in pure form for use in suitably adapted engines. Finally, the fuel needs to be transported to distribution points. In Germany over 900 filling stations offer pure biodiesel to supply a growing market that has been fostered by favourable taxation.

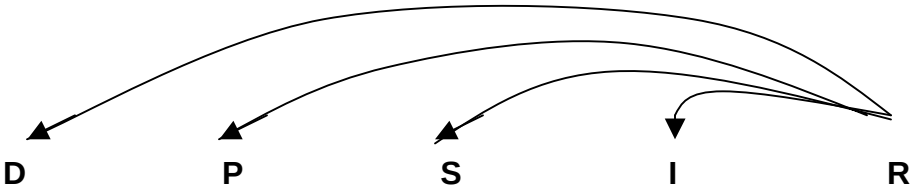
In accordance with the proposed framework, key features of this process are listed in Table 3.

Table 3

Assessing the environmental effects of biodiesel production from oilseed rape.



STAGE 2: PROCESSING



Transport	Location of processing plants versus main rapeseed areas	Transport of raw materials + processed fuel	Change in particulate levels in air; Levels of GHGs in atmosphere	Pollution impacts on health and ecosystems, effects of climate change	Domestic production of raw materials, siting of facilities close to source
Energy and Industry	Societal demand for biodiesel, efficiency of production	Emissions from processing facilities, by-products			Use of BAT / BATNEEC Support for technol. research

STAGE 3: END PRODUCTS: CONSUMPTION AND WASTE

Transport	Developmt. of fuel distribution network, biofuel tax exemption, pure or blended use	distribution infrastruc-ture	**Lower emission levels,** diversified fuel sources	Pollution impacts on health and ecosystems, (reduced) effects of climate change	Engine modification support for biofuel use, distribution network, raising of public awareness

STAGE 1: CULTIVATION (Land availability, input intensity and greenhouse gas balance)
At the cultivation stage, two aspects of particular importance are the high **fertiliser requirements** of oilseed rape, and the relatively low yield of biodiesel (FAME) per hectare (0.5-1.5 T Ha^{-1}). It is an intensive crop that is best cultivated in areas already dominated by high-input arable cropping, in order to avoid negative impacts in more extensive areas. The yield of biodiesel per hectare means that very large areas of land are required to produce significant quantities of fuel, substantially more than are required to produce some types of bioethanol (for petrol replacement). In countries that do not have a high proportion of arable area, **land availability** could therefore become a particularly important criterion in selecting approaches for biofuel production. Use of waste oil as a feedstock can help to boost the availability of feedstock materials for biodiesel production (Eibenstiner and Danner, 2000).

N_2O (nitrous oxide) is 300 times more potent as a greenhouse gas than CO_2, and it is released in significant quantities from cultivated fields, particularly with intensive fertiliser use. Oilseed rape has high fertiliser requirements, and is therefore associated with higher N_2O emissions. Projections for emissions from soils use the IPCC (Intergovernmental Panel on Climate Change) methodology which assumes that 1.25% of the nitrogen contained in mineral fertilisers is released directly as N_2O, with further quantities arising from volatisation and subsequent deposition of NH_3 and NOx from fertiliser application (EEA, 2002b), totalling approximately 10% of the N contained in the fertiliser (Wilson, pers. comm.). Excluding N_2O emissions data, FAME produces a greenhouse gas saving of 53%, but taking N_2O emissions (calculated using IPCC methods) into account the saving drops to approximately 10% for FAME (Concawe, 1995) (Table 1).

STAGE 2: PROCESSING (Use of by-products)
At the processing part of the production cycle, sale of **by-products** is particularly important to the economic balance of biodiesel. In fact, the high-protein animal feed produced from oilseed rape is more important than a by-product, because its importance as feed product has been boosted in the wake of the BSE crisis. Glycerine is also a by-product of biodiesel production. In the event of a large increase in production, there is a possibility of market-damaging overproduction of glycerine.

STAGE 3: END PRODUCTS: CONSUMPTION AND WASTE (Diesel market and introduction of biofuels)
Regarding use of and demand for end-products, diesel compression ignited (CI) engines are 15-20% more efficient than gasoline spark ignited (SI) engines, and so there is a strong demand for diesel in the EU market. Most diesel is produced from straightforward distillation, and a second fraction is obtained by cracking heavier hydrocarbons, a process which is much more expensive both in energy and economic terms. There is great interest in diesel substitutes, making the biodiesel market a promising one (albeit dependent on continuing government subsidies). If an increase in biodiesel were to incur a reduction of this second fraction, clear energy-saving gains would result.

The use of **pure biodiesel** avoids the environmentally damaging effects of the fossil diesel in biodiesel/diesel blends. However, it requires engine modifications and a separate distribution network, which are more easily achieved for captive fleets. Examples include buses in the German district of Heinsberg and in Kuala Lumpur, Malaysia (where biodiesel is manufactured from white palm oil), and garbage trucks, snow ploughs and refrigerator truck fleets in the US. In Germany over 900 filling stations offer pure biodiesel to supply a growing market that has been fostered by tax exemption for pure biodiesel.

Woody biomass used for CHP

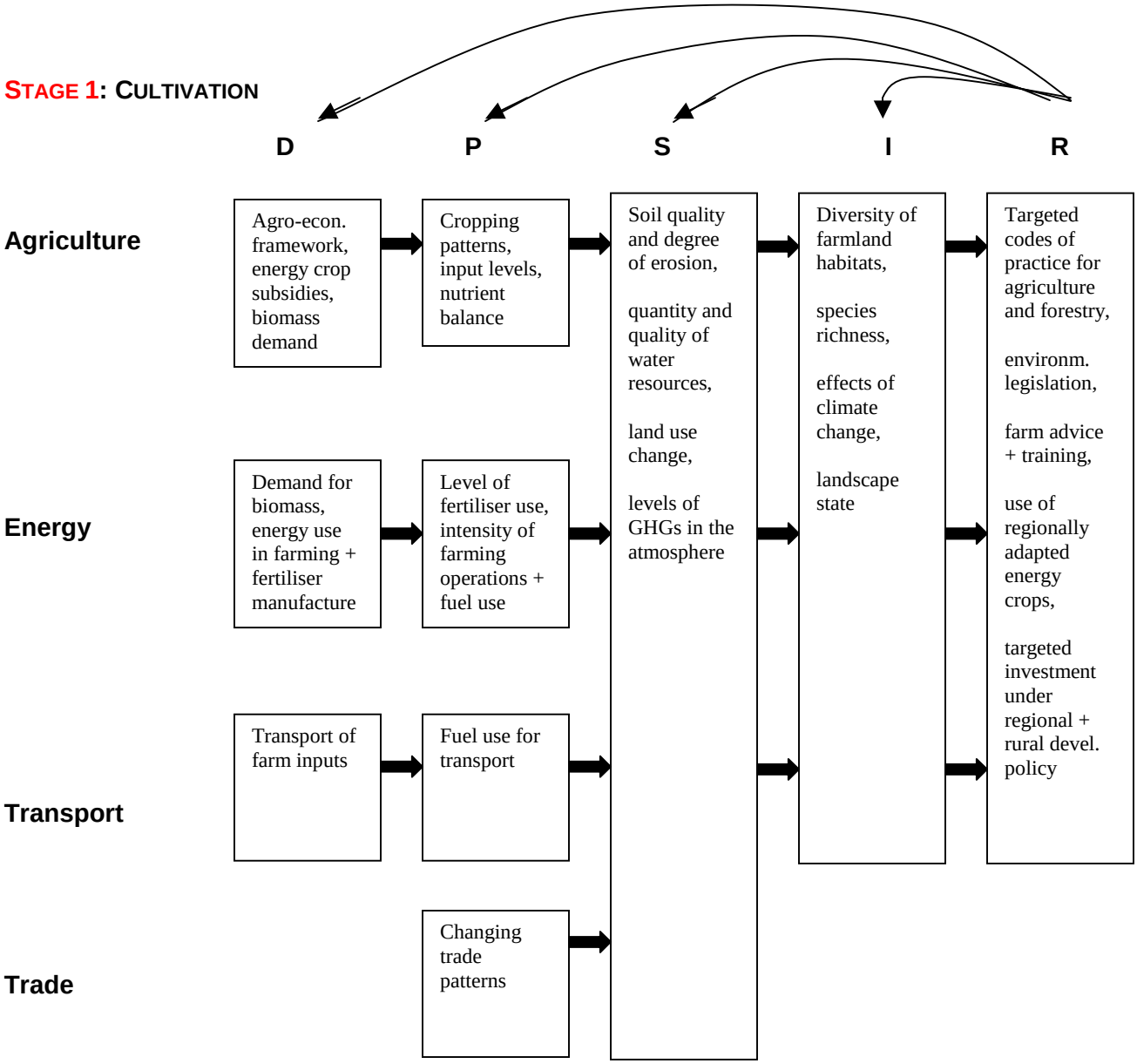
CHP (combined heat and power) or cogeneration is a highly efficient use of biomass that could contribute significantly to the economic viability of electricity from biomass. It is a particularly efficient form of energy generation: electricity is generated from steam or gas turbines fuelled by the biomass, and the 'waste' heat is used to heat water which is piped to households to provide heating. The use of woody biomass for CHP is a more straightforward process than the production of biodiesel. Feedstocks include woody biomass from SRC (short-rotation coppicing) of a variety of species including willow and poplar, wood from managed forests, forestry thinnings, sawmill waste and various agricultural wastes. In this paper dedicated short-rotation willow plantations on agricultural land will be considered. The main stages in the process are the cultivation of the trees, harvesting, transportation to the power plant, combustion and harnessing of the energy released.

Woody biomass production or SRC (short rotation coppicing) is particularly low in input requirements and has potential wildlife and amenity benefits. Because biomass is an ideal renewable fuel for energy and heat generation, these products have several outlets: CHP and liquid biofuel production when technology is further developed, together with several useful by-products.

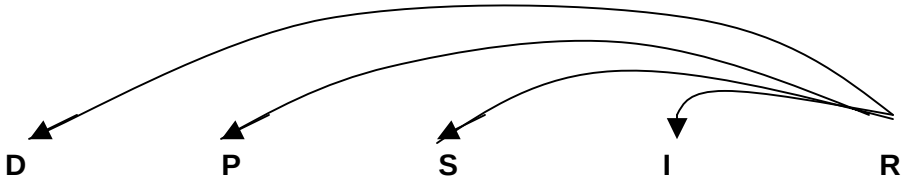
In accordance with the proposed framework, key features of this process are listed in Table 4.

Table 4

Assessing the environmental effects of combined heat and energy production (CHP) using willow biomass.



STAGE 2: PROCESSING



Transport

Location of processing plants versus SRC plantations	Transport of raw material	Change in particulate levels in air, levels of GHGs in the atmosphere	Pollution impacts on health and ecosystems, effects of climate change	Domestic production of raw materials, siting of facilities close to source

Energy and Industry

Demand + support for CHP, efficiency of production	Emissions from CHP plants, by- products			Use of BAT / BATNEEC Support for technol. research

STAGE 3: END PRODUCTS: CONSUMPTION AND WASTE

Energy

Investment in CHP facilities and infrastruc-ture	new CHP + heat pipeline infrastruc-ture **change in GHG emissions** **ash toxicity and disposal**	**Lower emission levels**, diversified energy sources	Pollution impacts on health and ecosystems, (reduced) effects of climate change	Measures to encourage development of CHP

STAGE 1: CULTIVATION (Effects on landscape, habitats and environmental resources)
The following recommendations for the planning and cultivation of short-rotation willow plantations illustrate key factors for the assessment of this stage (Perttu, 1999).

1. Plantations should be planned to suit the local landscape, preserving existing sensitive habitats. Small 'islands' around features such as open ditches, cairns etc. should be retained.
2. The coppice should be located close to existing forests to enlarge the continuous available habitat.
3. Variation in the landscape can be increased by planting several small stands which can be harvested in different years, rather than one large stand.
4. Several species and clones should be planted. This reduces the risk of damage from fungi, insects and frosts.
5. A higher proportion of male clones will favour early spring pollinators.
6. Weed control should be adjusted to need without overapplication of herbicides. In most cases, weed control is necessary during the establishment phase but can usually be avoided in a full-grown stand.
7. Fertiliser application should be adjusted to stand development, and minimised accordingly.

Willow has a pronounced capacity to take up nutrients and heavy metals, including cadmium; and willow stands have been shown to be adaptable as vegetation filters in order to purify water and soils. The purification efficiency of willow vegetation filters has been demonstrated in several countries, such as Sweden, Poland, Denmark and Estonia.

STAGE 2: PROCESSING (Technological aspects)
In the processing stages, use of BAT (best available technology or techniques) is particularly important in achieving the best environmental outcomes. Combustion technologies and co-firing with coal are commercial technologies on which the current bioelectricity industry is based. Gasification technologies are commercial in niche markets, and for specific feedstocks. Gasification could lead to more efficient and cleaner use of biomass for electricity production. Its demonstration and commercialisation using a wide range of biomass feedstocks could be very important for economically viable and environmentally sustainable bioelectricity production. Furthermore, biomass gasification can lead to future biomass facilities being integrated with advanced conversion technologies such as fuel cells and co-production of additional outputs, such as transport fuels (Bauen *et al*., in print).

STAGE 3: END PRODUCTS: CONSUMPTION AND WASTE (Policy responses and support)
As bioelectricity expands, the market pull for energy crops will need to come from the energy sector, but agricultural and forestry policy needs to provide the conditions for biomass feedstock to be delivered in an efficient and environmentally sound way.

An existing biomass industry base and a readily available biomass feedstock are strong factors behind the relatively more developed bioelectricity sector in some countries. Usually, however, the development of bioelectricity has also been a result of regulations favouring the input of bioelectricity into the electricity grid and policies supporting the price of bioelectricity, or due to taxes on the use of conventional fuels on environmental grounds. Therefore, a significant increase in bioelectricity use will require strong policy commitment and needs to be accompanied by regulations and guidelines that ensure its environmental sustainability.

For example in Austria, the Housing Promotion Act in the provincial governments provides financial support for renewable energies, particularly solar technologies and biomass boilers. Besides the Housing Promotion Act, special support for biomass, solar and heat pump systems are offered to the consumers by the provincial governments in the order of up to 20% of the investment costs.

Conclusions: Evaluation of assessment framework and biofuel options

Evaluating the framework

Existing environmental assessments of biomass and biofuels generally restrict themselves to partial evaluations of the effects of production and use of the fuels concerned. Agricultural and land use implications are often neglected, particularly in assessments of transport biofuel production where the focus is usually on the fuels themselves and comparisons with their fossil counterparts. The framework proposed in this paper addresses these gaps, pointing to the need for an integrated environmental assessment of each stage in the biomass product life cycle, while keeping a causal continuity throughout by bringing in the DPSIR approach. The framework is flexible: it does not have to be exhaustively completed, but it does provide a structure that facilitates a comprehensive analysis of the important elements of these complex product life histories. Other types of impact can be added to it as appropriate. In clarifying potential environmental impacts it helps to show trade-offs between different benefits and disadvantages of biofuel options. However, by itself it does not resolve the often difficult decisions that policy makers face in this context, including other important issues such as cost-effectiveness.

The two case studies show how aspects of the framework can be applied as part of a comprehensive approach to assessing the environmental impact of the fuels concerned. However, it should be said that applying the framework does require a more detailed quantitative approach than is provided here. Without such a real-life test its usefulness can ultimately not be judged. Further work needs to be done to compile relevant data and information and test the framework on that basis at regional or country level.

Comparison of biofuel options

If a given area of land is used to produce transport biofuels, the net greenhouse gas reduction would be much less than if that same area of land was used to grow biomass for energy generation such as CHP. This is because the production of transport biofuels involves energy-expensive processing to produce a high-specification product, and because most biofuel crops require high levels of nitrogen fertiliser, which is very energy-expensive to produce. Biomass crops for energy generation on the other hand do not need as much fertiliser, nor do they do not need much processing. It is a considerably more efficient production chain: after harvesting, the raw materials can be burned, or put through thermochemical conversion (charcoal-making) process. However, renewable options in the transport sector alone are limited. The many benefits of CHP do not address the very large – and rising – greenhouse gas output of this sector, and therein lies the justification for developing biofuels for transport.

There is a land-use trade-off between crops for transport biofuel manufacture, and crops for energy generation. The Biofuels Directive recognises this cross-sectoral trade-off: if a country sets targets for transportation biofuels that are lower than the indicative levels of 2% by 2005 and 5.75% by 2010, it can justify the shortfall by showing its progress in developing biomass for energy generation. Both biofuel options require significant public support for large-scale

production and use although the necessary price subsidisation of CHP energy compared to fossil fuel alternatives appears to be smaller than in the case of biodiesel (FAME).

The potential impact of short rotation coppice (mainly used for CHP at present) on agricultural landscapes and habitats appears more favourable than that of rapeseed production. This is due to the increase in landscape diversity and breeding habitats that such plantations provide in comparison to oilseed rape, which is already a widely grown crop. However, introduction of the latter in cereal-dominated crop rotations could also provide benefits for seed-eating birds (Anderson *et al*., 2003).

The overall effect of biofuel crops on farmland habitats and diversity depends on the present intensity of agricultural land use and cropping patterns as well as the specific characteristics of the individual crops for biomass production. These aspects are of particular interest to the EEA in the further development of environmental assessment frameworks for biofuel production.

Acronym Glossary

BAT:	Best available technology. Defined in the IPCC Directive as best available techniques, which is a broader definition including management practices
BATNEEC:	Best available technology not entailing excessive costs
CHP:	Combined heat and power
DPSIR cycle:	The causal cycle of driving forces, pressures, states, impacts, responses
GHG:	Greenhouse gas
IEA:	Integrated environmental assessment. Working definition of IEA used at the EEA: '*The interdisciplinary process of identification, analysis and appraisal of all the relevant natural and human processes and their interactions which determine both the current and future state of environmental quality, and resources, on appropriate spatial and temporal scales, thus facilitating the framing and implementation of policies and strategies*' (Thomas, 1995).
IPCC:	Intergovernmental panel on climate change
LCA:	Life cycle assessment/analysis
LCI:	Life cycle inventory
LCM:	Life cycle management
FAME:	Fatty acid methyl ether
SRC:	Short rotation coppicing

References

Anderson, G. Q. A., L.R. Haskins and S.H. Nelson (2003) *The effects of bioenergy crops on farmland birds in the UK – A review of current knowledge and future predictions*. Paper presented at the OECD Workshop on biomass and agriculture, Vienna, June 2003.

Bauen, A., J. Woods, J. and Hailes R. (in print) *Bioelectricity Vision: achieving 15% of electricity from biomass in OECD countries by 2020*. Report for WWF International. Imperial College London and E4tech (UK) Ltd.

Concawe report (2/95) on alternative fuels. Cited in Armstrong et al. (2002) *Energy and greenhouse gas balance of biofuels for Europe – an update.* Brussels: Concawe.

Directive 2003/30/EC of the European Parliament and of the Council of 8 May 2003 on the promotion of the use of biofuels or other renewable fuels for transport. *Official Journal* 17.5.2003 L 123/42.

EEA (1996) *Environmental Taxes Implementation and Environmental Effectiveness.* Environmental issues series No 1. Copenhagen: EEA.

EEA (1997) Life Cycle Assessment (LCA). *A guide to approaches, experiences and information sources*. Environmental Issues Series No 6. Copenhagen: EEA.

EEA (2002a) *Energy and environment in the European Union*. Environmental issue report No 31. Copenhagen: EEA.

EEA (2002b) *Analysis and comparison of national and EU-wide projections of greenhouse gas emissions*. Topic report No 1. Copenhagen: EEA.

Eibenstiner, F. and H. Danner (2000) Biodiesel in Europe. *System analysis non-technical-barriers*. SYsan IFA report.

Eyre N., M. Fergusson and R. Mills R. (2002) *Fuelling Road Transport. Implications for Energy Policy.* London: IEEP.

Groscurth, H-M. et al. (2000) Total costs and benefits of biomass in selected regions of the European Union. *Energy* 25, 1081-1095.

Perttu, K.L. (1999) Environmental and hygienic aspects of willow coppice in Sweden. *Biomass and Bioenergy* 16, 291-297.

Rothman and Robinson (1996) quoted in C. Gough (2000) Integrated Assessment at the European Environment Agency – historical and future perspectives. In: *Report of the Special Session of the European Forum for Integrated Environmental Assessment (EFIEA) at the EEA in Copenhagen*. Annex VI. November 2000. Copenhagen/Amsterdam: EEA/EFIEA.

Thomas, R. (1995) *A general strategy for integrated environmental assessment at the European Environment Agency.* Scoping study prepared by: National Institute of Public Health and Environment (RIVM), Bilthoven, The Netherlands.

Vos, H. (2001) *Integrated Environmental Assessment at the European Environment Agency. Taking stock and formulating next steps.* Draft paper. Copenhagen: EEA.

Willis, R. (2002) Communication from the Commission on impact assessment. Paper presented at an Environmental Evaluation Workshop, EEA, June 2002.

Wilson, D., Faculty of Agriculture, University College Dublin. Pers. comm. 27 Jan 2003.

Annex B

Scenario Analysis of Consequence of Renewable Energy Policies for Land Area Requirements for Biomass Production

By:

Peder Jensen

European Commission - DG JRC/IPTS

7. February 2003

Abstract:

This paper contains a short analysis of three targets of the Commission on use of renewable sources of energy. The conclusion is that it is possible to meet the targets, but that relatively large areas of land must be dedicated to the task. Because of some of the inherent uncertainties in a quick analysis it should be considered to develop scenarios for this field of a greater level of detail.

Introduction

Over the past years several targets have been set aiming at increasing the share of renewable sources being employed for energy production. There are multiple sources of renewables and there are therefore many ways to meet the targets. The aim of this paper is to develop scenarios for the consequences for land-use of meeting these targets via different combinations of renewable sources.

The following directives dealing with renewable energy are relevant in this context:

- ✓ *Draft Directive 2001/0265 (COD) of the European Parliament and of the Council on the promotion of the use of biofuels for transport, included in COM(2001) 547.*
  This draft directive includes a target of 5.75% (2010, measured on energy content basis) of all transport fuel (gasoline and diesel) sold in EU to be biofuel. Thus in reality the proposed directive deals with road transport, as both rail, inland waterways, maritime and aviation use other fuels.

- ✓ *Directive 2001/77/EC of the European Parliament and the Council on the promotion of the electricity produced from renewable energy sources in the international electricity market*
  This directive sets indicative targets (2010) for renewable share of electricity production on a member state basis. The combined target is 22.1% of electricity production.
  If the 10 Newly Associated Countries are included the combined EU25 target drops to 21% as a result of the negotiated targets being lower than the EU15 average.

- ✓ *Communication from the Commission. Energy for the Future: Renewable Sources of Energy. White Paper for a Community Strategy and Action Plan. COM(97)599*
  The White Paper includes an indicative objective of 12% of gross inland consumption to come from renewables by 2010.

As the different legal/policy documents do not refer to the same base there are some room for interpretation. The first two documents refer to final energy consumption in two sectors. The last refer to the gross inland consumption.

There are a number of sources of renewable energy of relevance:
- ✓ *Hydropower,* where some expansion of the small-scale hydropower capacity is expected.
- ✓ *Geothermal power,* where only modest expansion is expected.
- ✓ *Wind power,* where significant developments are expected
- ✓ *Photo voltaic,* which is only expected to generate a marginal contribution in 2010 perspective.
- ✓ *Biomass,* where significant developments are expected

Thus the two main sources of development to meet the targets set out in the directives are wind and biomass.

- ✓ Wind is well suited for electricity production, whereas it does not have much potential for the transport sector, apart from the part supplied to electric trains.
- ✓ Biomass is well suited for heat/power production as co-firing fuel in power plants or CHP installation. Additionally it can be used as raw material for production of liquid or gaseous fuels for transport.

Methodology

From a theoretical point of view (but not an economical) it is always possible to build more wind power generating capacity, e.g. offshore. Thus in the following the availability of land for production of biomass is seen as the limiting factor, as this is a limitation which cannot be circumvented by investment.

On the other hand biomass could be imported, e.g. from Russia, and as such increase the share of renewable sources employed. Such import would contribute to security of supply, reduction of CO2 emission and generate employment both in Russia and EU (as biomass production, conversion and consumption is more labour intensive than fossil energy use). This possibility is not covered by this analysis, but forms a "third option" to the focus on wind and to the focus on biomass.

As biomass is the only way to meet the biofuel directive this will be the point of departure. Based on available studies covering biofuel production in EU28 (to be published within 1Q-2003) the potential to meet the target will be assessed, and the consequences in terms of land use will be calculated. Depending on how the biofuel is produced a larger or smaller share of waste products may be available for heat production.

Meeting the renewable electricity directive will require a combination of wind and biomass. The analysis will as baseline take the standard projection for energy production and consumption in 2010 included in the POLES model. The consequences in terms of installed wind turbine capacity and land use for biomass production will be added to the figures found above.

Finally the result will be compared to the renewable energy directives target and needs for additional renewable shares calculated. Here residual biomass for heating purposes will play a role.

Baseline data

The baseline data set for energy production and consumption is primarily based on the Enerdata data set and the POLES energy market model.

2000		EU-15	NAC	Bg, Ro, Tr	EU-28
Gross Inland Consumption (Mtoe)		**1348.88**	**198.91**	**131.69**	**1679.48**
	Fossil fuel	1079.11	198.65	149.17	1426.93
	Nuclear	217.18	14.97	6.17	238.32
	Renewables	52.61	8.86	14.59	76.06
Electricity Generation (TWh)		**2384.77**	**378.97**	**249.30**	**3013.04**
	Fossil fuel	1185.05	191.08	124.76	1500.89
	Nuclear	858.61	173.84	71.76	1104.21
	Hydropower + geothermal	311.71	13.74	52.75	378.20
	Windpower	15.29	0.01	0.00	15.30
	Biomass	14.10	8.90	2.21	25.21
	Other renewables	0.01	0.00	0.00	0.01
Final Energy Demand (Mtoe)		**283.38**	**23.50**	**17.01**	**323.89**
	Road transport	246.20	20.96	14.56	281.72

The baseline projection for 2010 is based on the POLES energy market model. As the model has at present aggregated countries in a different manner than the one used here some approximations have been made. Therefore some figures may not correspond fully to other projections.

2010		EU-15	NAC	Bg, Ro, Tr	EU-28
Gross Inland Consumption (Mtoe)		**1385.64**	**219.91**	**165.30**	**1770.85**
Electricity Generation (TWh)		**2565.49**	**471.45**	**353.13**	**3390.07**
Final Energy Demand (Mtoe)		**309.70**	**28.36**	**21.26**	**359.32**
	Road transport	269.20	25.30	18.19	312.69

Biomass Production Potential

Biomass production include the following categories:

- ✓ Production of oilseeds with the aim of making plant oil, which can be converted to biodiesel. This process generates significant amounts of straw, which can be used as a co-firing fuel in heat and power production.
- ✓ Production of starch crops for conversion to ethanol or ETBE. This production will also generate significant amounts of straws and other waste, Which can be used for co-firing or converted into ethanol via other processes.
- ✓ Production of ligno-cellulose crops (fast growing trees, forest residues, etc.) for use as feed stock for ethanol production, F-T diesel production or as co-firing fuel in CHP installations.
- ✓ The use of waste such as household waste, animal manure, etc. for the production of biogas.

Each type of production has its advantages and drawbacks, which make certain types of production better suited for some areas than others.

The following table includes the most common crops and the average energy yields per hectare in terms of biofuel and additional biomass, which can typically be used for power and heat production.

	Transport fuel	Other energy products
Oilseeds for biodiesel		
Rape	45-50 GJ/ha [1]	40 GJ/ha [1]
Sun flower	27-30 GJ/ha [1]	quantity unknown
Starch crops for ethanol and bioETBE		
Sugar beet	133-157 GJ/ha [2]	limited [2]
Potato	96 GJ/ha [2]	limited [2]
Wheat	25-62 GJ/ha [2]	50-100 GJ/ha [2]
Ligno-cellulose crops		
Agricultural waste	1 GJ/t [2]	9-16 GJ/t [3]
Woody biomass[1]	55-77 GJ/ha [2][3][4]	110-165 GJ/ha [2][3][4]

In addition to the energy content each crop has other assets. Many plants yield different types of protein meal to be used as animal feed. Additionally some crops may yield better habitats for wild animals, may fit into crop rotation schemes, etc. It is therefore not possible simply to select the highest yielding crop as a mono crop. In stead there is a need to fit crops into a larger framework of agricultural economy and environmental concerns.

Available land

Production of energy crops will compete with other types of production for land, wherefore it makes sense to look at the land as the limiting factor. In theory all utilized agricultural land can be used for energy production, though competition with other uses including other crops of course sets a limit much lower.

All figures in mio. ha	EU-15	NAC	Bg, Ro, Tr	EU-28
Utilized agricultural area	130	38	59	227
Forest covered areas	87 (130)[2]	16 (24)	20 (31)	123
Total	217	54	79	350

[1] According to [2] the typical ethanol production from woody biomass is 5-7 GJ/t. According to [4] the average yield of wooded areas, including fast growing trees in Europe is 3-30 t/ha per year with an average of 11 t/ha per year. Finally according to [3] the total energy content of woody biomass is in the range of 15-22 GJ/t. Given the wide range of variation this issues warrant further analysis before solid conclusions can be drawn. The production of bio ethanol from woody biomass is still at an experimental stage, wherefore an immediate scaling up of production is not possible.

[2] According to [5] the total EU-15 forest area is around 130 Mha of which 87 Mha are exploitable on a commercial basis. For NAC such data does not exist, wherefore a similar fraction has been assumed.

Meeting the "Biofuel Directive" voluntary targets

The biofuel directive indicates a target of 5.75% of transport fuel by 2010 as the target for biomass based fuels in the road transport sector. This lead to the following targets:

	EU-15	EU-25	EU-28
2010 Consumption (Mtoe)	269.20	294.50	312.69
Biofuel target (Mtoe)	15.48	16.93	17.98
Biofuel target (PJ)	648	709	753

Meeting the targets can be done in many ways. In the following the consequence in terms of land area of a number of scenarios are calculated. Figures are in percentage of utilized agricultural area. Woody biomass may also be produced as forest residues. In this case, however, the yields would be much lower as a significant share of the biomass would be used for other purposes such as timber, chipboards, paper, etc.

	EU-15	EU-25	EU-28
100% rape seed	10.0 - 11.1	8.4 - 9.4	6.6 - 7.4
50% rape sees, 50% wheat	9.0 - 15.5	7.6 - 13.1	6.0 - 10.3
50% sugar beet, 50% wheat	5.6 - 11.8	4.7 - 10.0	3.7 - 7.9
50% sugar beet, 50% woody biomass	4.8 - 6.4	4.1 - 5.4	3.2 - 4.3
100% woody biomass	6.5 - 9.1	5.5 - 7.7	4.3 - 6.0

Thus meeting the targets in the directive will require between 4.8 and 15.5 % of all agricultural land in EU-15 dropping to between 4.1 and 13.1 % in EU-25. Each scenario will, however, generate a number of additional energy benefits to be taken into account. Figures are in PJ:

	EU-15	EU-25	EU-28
100% rape seed	547	599	636
50% rape sees, 50% wheat	729-1183	796-1294	846-1375
50% sugar beet, 50% wheat	455-909	497-995	528-1057
50% sugar beet, 50% woody biomass	555-833	608-912	695-968
100% woody biomass	1111-1666	1215-1823	1291-1936

Thus all the scenarios goes some way in meeting other objectives. Generally a combination of woody biomass and sugar beet would look favorable. However, it should be borne in mind that woody biomass as a fuel feedstock is still in the experimental stage. Additionally the lack of byproducts of sugar beets may cause the overall economy of the solution to be less favorable than it looks on a pure energy basis.

An ongoing study on potential for biofuel production in candidate countries (as they were when the study started) gives a slightly less optimistic picture, due to the fact that data shows that the average land quality in candidate countries is lower, wherefore average yields will be lower. According to this study it will take an area equal to or greater that the average set-aside land (10%) to meet the objective.

Meeting the "Renewable Electricity Directive" indicative targets

The renewable electricity directive sets an indicative target of 22.1% for renewable electricity. With the targets for NAC the overall target has dropped a bit. However, in the following the 22.1% will be used as the target.

	EU-15	EU-25	EU-28
Electricity generation 2010 (TWh)	2565.49	3036.86	3390.07
Renewable target of 22.1% (TWh)	566.97	671.15	749.21
Expected hydro+geo energy 2010[3] (TWh)	338.13	353.03	410.26
Rest renewable target to be covered (TWh)	228.84	318.12	338.95
Rest renewable target to be covered (PJ)	823	1145	1220
Transport biomass byproducts[4] (PJ)	182-666	199-729	211-774
To be covered by additional actions (PJ)	157-641	416-946	446-1009

The amount of electricity not covered by waste biomass from the transport sector may thus be covered either by wind or by additional biomass:

	EU-15	EU-25	EU-28
To be covered by additional actions (PJ)	157-641	416-946	446-1009
Wind baseline (PJ)[5]	200	200	200
Rest (PJ)	-43 - 441	216-746	246-809

Thus in the most optimistic scenario EU-15 has already met the target. In the pessimistic scenario another 441 PJ electricity is needed.

	EU-15	EU-25	EU-28
Rest (PJ)	-43 - 441	216-746	246-809
100% wind[6] (GW)	0 - 80	39-136	45-147
100% biomass[7] (Mha)	0-1.2	0.4-2.1	0.5-2.2

Thus meeting the objective of the directive would require up to around 1% additional land in EU-15. For EU-25 the figure could be up to around 1.5% additional land. Meeting the objective for EU-15 via extra wind power would require 20-30.000 of the largest generators on the market today (in addition to the strong growth predicted). For EU-25 the number would be significantly higher due to the lower expected production per generator in NAC.

---

[3] Based on POLES model with adaptations for the candidate countries not covered on a country by country basis in the model.

[4] Assuming an efficiency of 40% in conversion of biomass energy to electricity.

[5] The POLES model assumes a growth of around 300% for wind over the decade in EU-15. As wind power is practically non-existent in most NAC the baseline for these countries have been set to 0.

[6] Assuming the same average production as in Denmark (5.5 PJ/GW) is probably an error towards the optimistic side as more landlocked countries has lower wind potential. Therefore the estimates are on the low side.

[7] Assuming woody biomass.

Meeting the "Renewable Energy White Paper" indicative objectives

Finally meeting the target of 12% of gross inland consumption coming from renewable resources gives the following:

	EU-15	EU-25	EU-28
Gross inland consumption 2010 (Mtoe)	1385.64	1605.55	1770.85
12 % target (Mtoe)	166.28	192.67	212.50
Existing (2000) renewables (Mtoe)	52.61	61.47	76.06
Planned wind power (Mtoe)[8]	3.50	3.50	3.50
Energy "from biofuels directive" (Mtoe)	26.34 -55.27	28.80 -60.48	30.60 -64.22
Energy range bio/wind electricity[9] (Mtoe)	0 - 26.32	5.16 - 44.54	12.32 - 48.31
Needs to reach target (Mtoe)	**28.58 -83.83**	**22.68 -93.74**	**20.41 - 90.02**

If wind and hydro electricity are counted based on their substitution of fossil fuel for power production the calculation is somewhat more optimistic. In this case the target will be met for optimistic scenarios but not for the pessimistic ones.

The needs in the pessimistic scenario can be met either by installation of another 175GW of wind power capacity or application of around 7-13% of agricultural land in addition to what has already been used.

Conclusion

The conclusion is that it is possible to meet the requirements of all three directives within somewhat reasonable limits. The biofuels directive can be met within an area comparable to the present set aside land or smaller depending of crop composition. The renewable electricity directive is mostly covered by the additional biomass and planned wind power capacity. Finally the renewable energy targets can be met with application of more land.

In this analysis the use of woody waste from forests have not been included. It is assumed that this source of biomass may form either feedstock for ethanol production, when commercial methods become available or as fuel for CHP plants. This may significantly reduce the need for land. On the other hand is it to be expected that the energy density will be lower as part of the biomass is diverted for other purposes.

Further development of small hydropower, geothermal power and heat, photo voltaic, wave, etc. are to be expected. These are not covered by this analysis, which in this context will err on the pessimistic side.

---

[8] The expansion from 15.29 TWh to 55.95 TWh included in POLES for EU-15. Included on a 1 to 1 energy content basis.

[9] Wind electricity is included on a 1 to 1 energy content basis. Biomass energy included on an energy content basis.

References

[1] Techno-economic analysis of Bio-diesel production in the EU: a short summary for decision-makers. IPTS, 2002. EUR 20279.

[2] Techno-economic analysis of Bio-ethanol production in the EU: a short summary for decision-makers. IPTS, 2002. EUR 20280.

[3] Oak Ridge National Laboratory homepage on biofuels. http://bioenergy.ornl.gov/papers/misc/energy_conv.html

[4] Renewable Fuels for Cross Border Transportation. Draft report for DG ENV by a consortium led by German Aerospace Centre. 2003.

[5] COM(1998) 649. Communication from the Commission to the Council and the European Parliament on a Forestry Strategy for the European Union.

Annex C

Working document *Final draft technical report no xx*

EEA guidelines for geographic data and maps

Prepared by:
Arvid Lillethun
Sheila Cryan
Jan Bliki
Mette Palich Lund
Thor Jessen

May 2003

Project Manager:
Arvid Lillethun

European Environment Agency

Foreword

EEA has developed a set of guidelines for geographical data and maps. The GIS team at EEA, operational from 2002 onwards, co-ordinates the cross-cutting aspects of GIS, within the aim to harmonise spatial data handling by different topic areas. The terms of reference defines that an operational GIS activities should be established in-house, that the team should provide guidance for spatial data handling to all partners (ETCs, EIONET), and that quality control should be ensured on maps and other information based on spatial information. This technical report documents the work carried on guidance and tool development

EEA presented in May 2001 the report "Guidelines on EEA/ETC cooperation and working procedures – data management and geographical data supply". The new guidelines in this document will constitute a revised and extended part 2 of that document. This part dealt with geographical data supply from ETCs to the Agency. The revised and extended version covers geographical data handling, map standardization and the web map tool.

The EEA guidelines and accompanied map template, which were presented as draft versions at the Data Managers Workshop June 2002, has now been used by EEA and several of the ETCs for about one year. Similarly, the EEA web map tool was also introduced to the ETCs at the workshop, and has been used by many ETCs and EEA integrating maps into a variety of web pages and services. The experience gained through since the draft versions where introduced has lead to the creation of a first version of a separate EEA guideline document for geographical data and maps – this technical report.

In the process of developing the guidelines for standardizing map outputs, there has been contact with personnel responsible for main EEA reports, the topic team leaders and different ETCs. The guidelines on map templates have been presented to the Management Team at EEA.

The guidelines are as far as possible linked to standardisation agreements within the European Commission and also the initial work developed by INSPIRE – Infrastructure for Spatial information in Europe.

Data handling and information services are under rapid development. This affects development of guidelines. It is expected that development of different tools and information products will affect the recommendations for data handling and map productions, and that the guidelines thus also need revision from time to time. The current report documents the status in 2003. Users of the guidelines report will find updated information at the EEA web page:
http://www.eionet.eu.int/gis

Any reactions, comments and questions can be mailed to gis@EEA.eu.int.

Contents

1. Why guidelines are necessary

EEA is mandated by its Regulation to provide high quality information to support the environmental policy process and sustainable development and for the assessment of environmental achievements and outcomes (EEA Strategy). In this context, the EEA intends providing more and better quality geographical information. The work on the EEA Core set of indicators has highlighted the need for common routines and harmonization in order to obtain acceptable quality on the input data, thus facilitating quality assessments.

EEA has since 2001 worked on developing guidelines and tools with the aim:

- to standardize the handling of geographical data by considering the following aspects:
  - projections,
  - accuracy,
  - formats,
  - data structure,
  - quality control routines
- to standardize maps for printed reports and web applications in terms of
  - map extents
  - colours
  - creating generalized data and template files for use with Arc/Info
  - creating ready-to use maps for use with Adobe Illustrator
- to develop a web map tool to present simple statistical/ tabular data
- to review the use of spatial analysis as a methodological tool

The last years there have been major developments carried out both on standard issues, templates and tools, which is affecting GIS actions imposed by EEA.

1.1. ETC GIS actions and deliverables

The geographically related deliverables that are to flow from the European Topic Centers are several, and also input data are of several categories.

The handling of geographical data and products can be grouped into three;

- **input datato ETC:**
  - thematic data as originals, either captured by the ETC or delivered by other institutions and used in GIS-analysis and map production.
  - basic geographic data from EEA to be used in analysis and map production (EEA core data and EEA map data)
- **handling of data at ETC:**
  - different kinds of preparations of data
  - analysis of data resulting in statistics of new geographical data sets
  - map making
- **output data and products from ETC to EEA:**
  - the original data sets (GIS-data and attribute tables)

- o new attribute tables and statistical data
- o new geographical data sets, including valuable intermediate versions
- o illustration maps, including legends

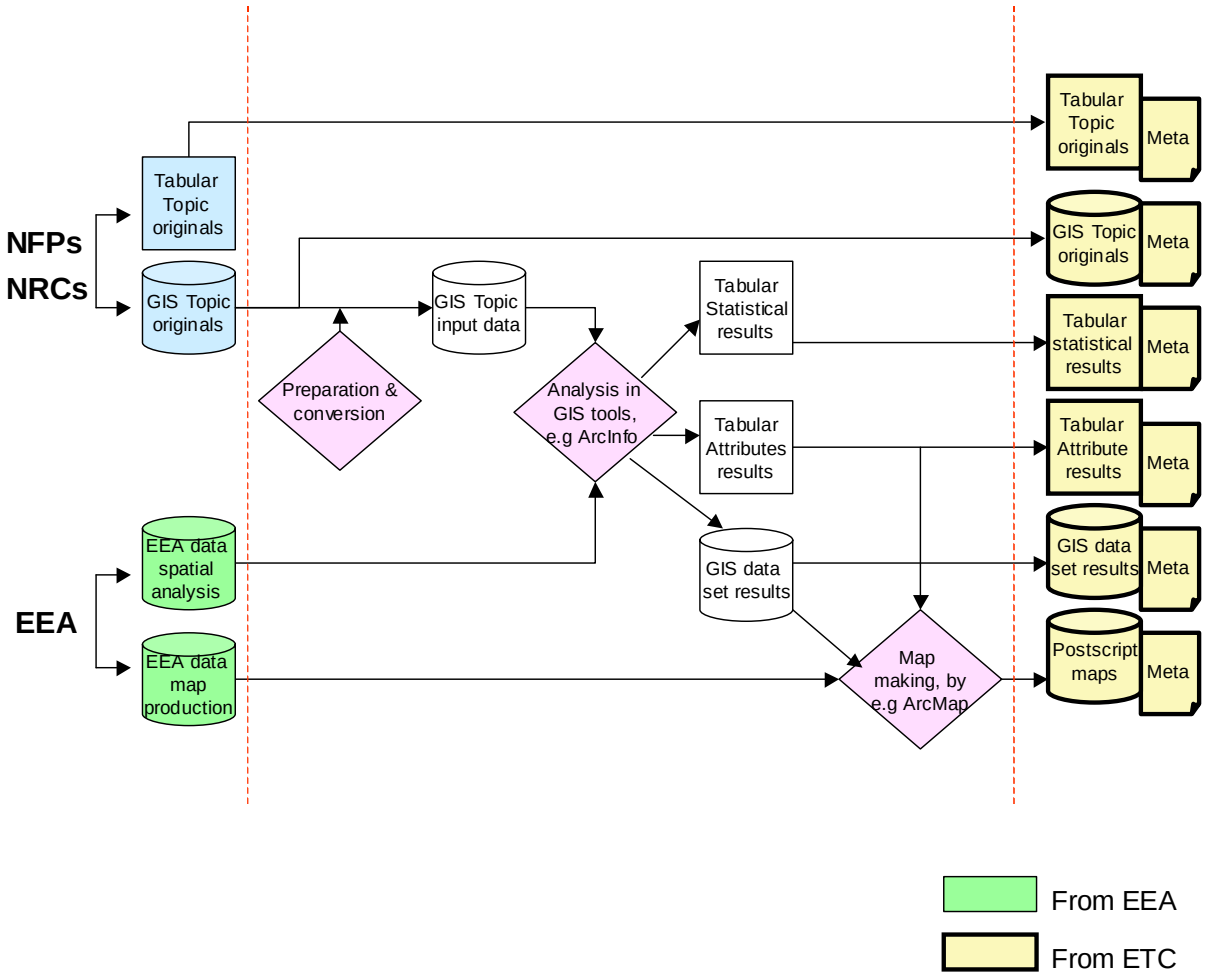


Figure 1: Production line for geographical analysis and map production by ETCs. Indication of input data, processes, intermediate products and deliverables from ETCs to EEA. The deliverables include different kinds of attribute files, geographical data sets and maps. Each of the deliverables should contain or be followed by a separate document on metadata. Metadata will be covered by the Reportnet project. Geographical metadata will be consistent with the specification from Reportnet.

The output categories outlined above are all geographical products. Maps and statistics are encapsulated into different kinds of end products; reports, indicator fact sheets etc. The report Towards sustainable publications? is a guide on how to reports are to be organized, styles and roles. Similarly, there is a guide to the organization and contents of the EEA Indicator Fact Sheets (EEA Indicator Fact Sheet Model version 23/05/2001).

1.2. Guidelines and templates on geographical data deliverables

EEA has produced a set of guidelines, example files and template files, and also supply with specially treated data for map making.

The material should make it easier to produce standardised geographic data and maps, make it possible to obtain the desired quality of the specified products and make data flow and treatment by EEA, ETCs and other institutions more effective.

The complexity of geographic products delivered to EEA varies significantly. Most are very simple, while some datasets are heavy and the result of long term mapping projects. Thus the guidelines describing how to provide high quality data also vary from simple instructions to complete technical reports. This report deals with the parts common to many products, data set specific specifications

The paper deals with the following issues:

Guidelines about data

- Attribute tables (with ID)
- Latitude/longitude point coordinates as table
- GIS vector and raster data
- Coordinate reference systems
- EEA-Spatial data infrastructure
- Identifying data – using the EEA data service

Guidelines about maps

- Illustration maps (Postscript)
- General map extents
- Web map tool

Guidelines about metadata

- Metadata

The guidelines document presents an overview and a "snapshot" by 2003. Some aspects of geographical data and information are under consideration in a wider context. EEA intends to align its requirements as far as possible with those of the European Commission and other international bodies. Changes at the international level and technical developments and decisions on procedures at EEA will lead to the need for revisions. Some issues will be revised at long intervals, others at shorter intervals. To get the latest versions, therefore, users should consult EEA documentation web pages for GIS at http://www.eionet.eu.int/gis or contact EEA gis@EEA.eu.int.

1.3. When to use the different guidelines, templates and data

The different guidelines will be used in different operations
- preparation of data for analysis
- handling projections
- define the structure of data
- defines the formats to be delivered
- define output sizes and cartography

Templates are files helping to create data according the specifications. There are template files to be used e.g. when
- filling in metadata
- creating views and making maps in GIS systems
- create maps in Postscript software

Two kinds of geographical data are supplied to the ETCs, to be used for separate actions
- EEA data for spatial analysis
- EEA data for map production

The following illustration shows that different documents, templates are geographic input-data are related to different actions and products to be handled by the ETCs.

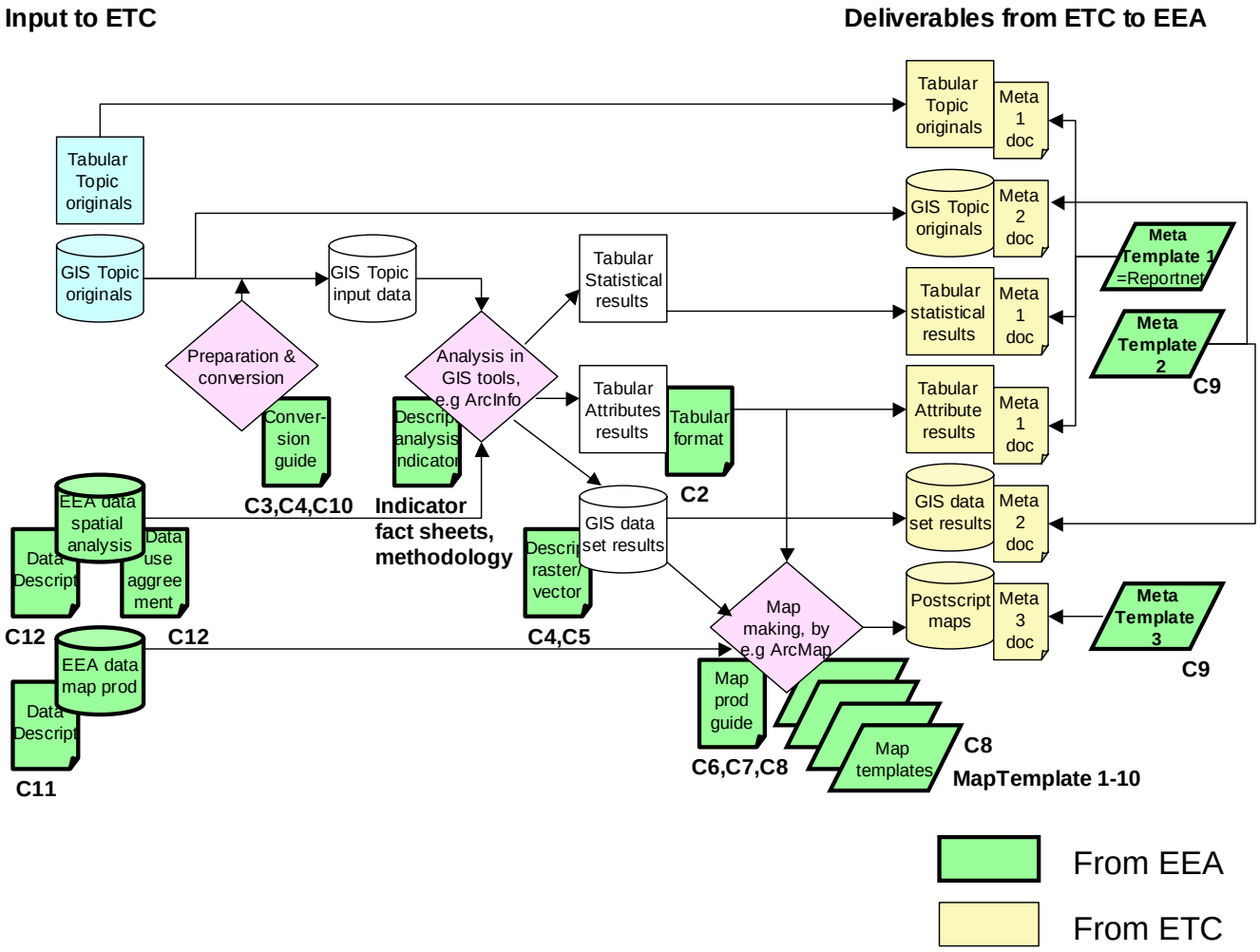


Figure 2: EEA provides guidelines, templates and data to be used for GIS analysis and map production by ETCs. The different help products are linked to different actions and products in the production line, here marked as documents and in green/with thick outline. For simple actions only a few guideline chapters need to be consulted. The Cx next to the document symbols are numbers referring to the different guideline chapters. The description of the analysis and methodology should in most cases be found in the fact sheets for indicators, as described in the document EEA Indicator Fact Sheet Model version 23/05/2001.

1.4. Requirements on GIS and map deliverables - overview

1.4.1. Requirements on metadata deliverables

EEA has defined a metadata standard to be used for geographical data and maps. Firstly, the standard include metadata that is to follow any kind of deliverables/ products. Secondly, important fields that are necessary to understand the contents of geographical data has been added. General metadata includes information such as title, keywords, thematic group, text description, description on anticipated use, brief overview of methodology, technical creator, ownership, distribution rights etc.

You can find the full guideline in chapter xx, and templates on http://eionet.eu.int/gis.

There are different levels of details, thus also different routines, depending on the kind of geographical data set/product.

- Tabular deliverables are treated through the system of Reportnet.
- Postscript files are to be followed by metadata according to Dublin Core, with some additional information. A template is available.
- GIS data, both vector and raster, are to be delivered with a selected set of metadata that following the ISO 199115 standard. In addition attributes and predefined codes should be defined separately. A template is available.
- In addition to these routines, it is envisaged to use of general systems of document information/metadata systems that are linked to existing software

Metadata may be changed by purpose when being evaluated at EEA or in the process of bringing data into the EEA Data Service.

1.4.2. Requirements on attribute data/tabular data deliverables

A large proportion of the geographical data delivered by countries and produced by the ETCs at present fall within this category. Typical deliverables are tabular data in Excel, Dbase, Access or other formats. We ca distinguish between two kinds of information:

- tables with attribute information linked to an area by the use of an identifier (id)
- information of point locations of specific objects or actions, e.g. monitoring sites, oil spill sites etc. Usually the geographical location is given in lat/long values

The requirements on such deliverables include

- Use of accepted and standard id's wherever possible
- Definition of all fields. The Reportnet Data Dictionary should if possible be used for this purpose.
- Definition of codes where appropriate. Commonly this will be codes as part of a predefined classification system. Where an externally defined classification system/nomenclature is use, a link to institution in charge of should be given.

- Quality control should be carried out, with special focus on scientific quality, codes/classes having exact spelling following specifications, and lat long values being checked if they fit intended location

You can find the full guideline in chapter 2, templates at http://eionet.eu.int/gis.

1.4.3. Requirements on GIS data -vector deliverables and products

Vector data are advanced GIS data where the data coordinates are defined in a geographical reference system, with features constructed according to specific regulations (topology) and with attributes linked to the different feature elements in the database. A set of different requirements are needed to handle such data effectively. You can find the full guideline and templates described in chapter 4 and at http://eionet.eu.int/gis. Underneath an overview of the contents/requirements:

- **Logical structure and topology**: The structure should follow the ArcInfo general structure on datasets, with geometry in coverages and attributes in info files. Arcinfo geometry files should contain tics. The files should be stored hierarchically and named as explained in the guideline document.
- **Projections**: **V**ector data (point, line and polygons) should be delivered in geographical coordinates (lat, long). For accurate data below 1: 100.000 other projections could be used. ETRS should be used as the coordinate reference system. When doing area and length measurements Lambert Azimuthal Equal Area projection should be used. These specifications follow European recommendations.
- **Accuracy**: The accuracy or scales are defined individually case by case. However, some general guidelines have been developed.
- **Delivery format:** The format should be ArcInfo Coverage packed as ArcInfo interchange format/export format (.e00) with the following components - xx. Simple point data can be delivered in tabular formats such as Dbase or Microsoft Excel.

1.4.4. Requirements on raster data deliverables and products

All deliveries of raster and vector data sets (including lat/long point data sets) should be accompanied by a set of simple raster illustration maps.These should be delivered as image files (BIL raster file) in 4 different resolutions. These raster illustrations provide web users with a quick and easy to use view of the geographical data contained in the data set. See chapter 5. Link to guideline on Circa: EIONET-CIRCLE - EIONET Information Management and Telecommunications.

1.4.5. Requirements on postscript maps

The guidelines on postscript maps deliverables include a series of specifications. In addition, a set of template files has been created to help make maps following the specifications. Some of the specifications also account for rasterised pictures of illustration maps in formats such as jpeg,

gif, bmp, TIF. See chapters 6, 7, 8, 11. Link to documents, templates and can be found at http://eionet.eu.int/gis , also linking further to the data specifically treated for map making found at the EEA data service http://dataservice.eea.eu.int/dataservice/ . The main issues are:

- **Standard map extents:** EEA has defined a set of maps with different predefined extents at the European level.
- **EEA Map data:** EEA has selected some generalised data that should be used as the general features - background map for all small scale maps.
- **ESRI ArcGIS Map templates:** These template files work with the EEA Map data, and make it easy to create the correct layers, layout and extents.
- **Adobe Illustrator Map templates**: Ready base maps in different standard map extents. Could be used for simple illustrations where you want to add simple information such as points or rough statistics. Using these templates is a shortcut not following a full GIS production line. File format. Adobe Illustator and EMF - enhanced meta file.
- **Standard map width, cartography and legend**: The EEA report layout make it necessary to standardise the width of the two separate elements - map and legend. They should follow the size of the columns. Guidelines about cartography include recommendations on colours of standard background layers, and symbols and text.
- **Projections:** The projection for most small scale maps should be Lambert Azimuthal Equal Area, with Azimuth placed 52 N. Central Meridian 20 E.
- **Delivery format:** The format should be Adobe Illustrator 8.0. The files should be layered.

1.5. Available geographic data for analysis and map making

The geographical data available for geographic analysis and map making to the ETCs are of different kinds, both concerning accuracy and topics. A series of thematic data sets is managed by EEA and a series of basic background data sets are available.

The full collection of data at EEA could be labelled **EEA GIS data**. Old and new versions are stored and managed at EEA. most of which is available in the EEA data service. It is possible to view information about most of the data sets at the EEA web site: http://dataservice.eea.eu.int/dataservice/. The EEA GIS data can be divided into two groups

- **EEA data for spatial analysis:** This is a selection of the full EEA GIS data collection and is intended to be used for geographical analysis and indicator development. The data are commonly too detailed for being used at maps in small scales. This selection also contain data from other sources, and the main part of the collection is the selected parts of the GISCO reference data that ETCs are eligible to receive.
- **EEA data for map production:** Data to be used for small scale maps. These are pre-processed and generalised data for simple presentations. The EEA map data are working together with the predefined ArcGIS template files generating a series of small scale maps with different extents.

Only the two latter selections of data are being delivered to the ETC. EEA may deliver specific data sets of the remaining data in the EEA GIS data at request.

1.6. Available guidelines and templates

The table underneath contains the title of all guidelines and templates, and shows for which actions or products the different documents/files are relevant. The guidelines are included as chapters in this document.

Guideline materiale for spatial data and maps Guideline chapter, tools and information material				Kind of deliverable/product to which material is relevant				
		tools/ templates	supplementary documents	Attribute tables without point location	Tables with lat/long values for locations	GIS vector data	GIS raster data (incl Natlan)	Postscript Illustation maps
Chap 2	Guidelines on attribute files, tables, incl example			x		(x)		
Chap 3	Guideline: location with latitude/ longitude				x	(x)		
	Lat/long example file		x		x	(x)		
Chap 4	Guideline vector and rater files					x		
Chap 5	Guideline raster file						x	
Chap 6	Guideline Postscript Illustration maps (AI/EPS)					(x)		x
	Postscript map colours		x			(x)		x
Chap 7	EEA Standard map extents							x
Chap 8	How to use map templates					(x)	(x)	x
	ArcInfo templates, mxt-files, 15 files, different map sizes					(x)	(x)	x
	Adobe templates: 15 files, different sizes							x
Chap 9	Metadata guidelines			x	x	x	x	x
	Metadata template: GIS data (vector/raster)					x		
	Metadata template: GIS data: Attribute documentation							x
	Metadata template: Postscript map products							x
Chap 10	About Projections				x	x	x	x
	What is ETRRS89? 10 - ETRS89 Ellipsoidal Coordinate Reference System (ETRS89) 10 ETRS89 Lambert Azimuthal Equal Area Coordinate Reference System (ETRS-LAEA) 10 ETRS89 Lambert Conformal Conic Coordinate Reference System (ETRS-LCC) 10 - ETRS89 Transverse Mercator Coordinate Reference System (ETRS-TMzn)				x	x	x	x
Chap 11	11 EEA Map data for small scale maps					x	x	x
	11 GISCO data for spatial analysis and map making					x	x	x

1.7. References and relevant links

Relevant data and information available on the Internet:

All EEA reports are available on the Internet,

- EEA website: http://www.eea.eu.int/ .
- EEA regions: http://dataservice.eea.eu.int/dataservice/geonotes.asp
- EEA map service: http://map.eea.eu.int/help

The following websites contain some of the reports mentioned in this reference list or other data/information:

- ISO documents on geographical information and metadata
- INSPIRE: Documents from the process of defining the content and functions of INSPIRE – The Environmental European Spatial Data Infrastructure. http://www.ec-gis.org/e-esdi/
- ETEMII: Documents from the European Territorial Management Information Infrastructure.

2. Attribute table deliverables

2.1. Introduction

All ETCs are required to organise the data to support EEA reporting in a structured way. Database systems are already in use or being developed in all ETCs to hold the tabular data, which is used for regular reporting (especially indicators) in an integrated way. However a significant amount of tabular data also exists in the form of spreadsheets. This document refers to the clean, quality-checked version of the data (reference data) to be delivered to the Agency and used as source data for indicator fact sheets or other analytical products.

2.2. Documentation

The documentation of tabular data is an on going process, which begins during the design stage of the product and is updated for each delivery to the Agency. The Reportnet Data Dictionary should be used by the ETC when defining a data set. There should be an interaction between EEA and the ETC is this work. Revison of definitions of a data set will usually be at an annual cycle.

The Agency policy is to make the data used for reporting available to the public by publishing it on the internet. The documentation must therefore be appropriate for internet dissemination.

The documentation takes place at various levels:

Table:	
Documentation type	*Update frequency*
Description	Design stage
Geographical Coverage	Update each release
Temporal Coverage	Update each release
Attribute Item:	
Documentation type	*Update frequency*
Attribute name	Design stage
Description (include link to website of classification or coding system used)	Design stage
Purpose	Design stage
Type	Design stage
Source (include link to supporting documents) EIONET Data flow Conversion routine Analytical process	 Change in data flow procedure Change in conversion routine Change in analytical process
Quality control	Change in quality control procedure
Quality statement	Update each release
Attribute Value (only if required by EEA Topic team)	
Documentation type	*Update frequency*
Reliabilty	Update each release

Many of the considerations outlined below should be taken into account at the design stage of a product whether database system or spreadsheet.

2.3. Thematic attributes

The thematic attributes should underpin environmental indicator based reporting. The selection of the thematic attributes whether in a database system or in a spreadsheet should be agreed with the topic team at EEA. The purpose of each attribute should be clear. The appropriate unit(s) of measurement should also be agreed.

2.3.1. Naming of data elements (attribute items)

Data handing requires abbreviated names to be assigned to data elements (attribute items). There are no EEA or EIONET standards although guideline documents exist for major deliverables. The Reportnet Data dictionary, which is under development, is to hold both definition of data elements common to different data set, see www.dd.eionet.eu.int. The tool should be used for defining data sets, its tables and the data elements (attribute items) used in each table. The GISCO Reference Database manual provides guidelines for item names in spatial datasets.

The dataset documentation must contain a description, which enables the EEA and other users not connected with the ETC to understand the attribute. This description should use standard terminology, if possible from GEMET http://www.eionet.eu.int/GEMET or from the EEA Glossary http://glossary.eea.eu.int/EEAGlossary/ as this facilitates translation into other languages. The EEA topic team should be contacted if important thematic terms are not present in these applications. The documentation function of the database handling software can be used to manage item descriptions in the case of databases. Figure 1 shows an example using MS Access. Additional worksheets should be used for documentation in the case of data delivered as a spreadsheet. Practical examples for documenting spreadsheets were developed by EEA in preparation for the SoE Report Environment in the European Union at the turn of the century (EU98)

Figure 1.

2.3.2. Source information

The source of each attribute should be clear. The underlying data flow should be stated in the documentation with references to any supporting guidelines or data exchange modules (DEM) used in the process. It should be possible for countries to understand how the data that they have reported is being handled at the European level.

In some cases, the ETC itself will be the source of an attribute item. The attribute maybe an output from a simple conversion process where the original units from national systems need to be converted to an agreed standard at European level. On the other hand, the attribute might be the result of a complex analytical procedure. The latter case is particularly true in the case of spatial data sets. As the Agency is moving toward a regular reporting system with stable data flows, the procedures used for conversion or for analysis should be well documented both for efficiency within the consortium and for the information of the Agency and other users. The methodological concept on which analytical procedures are based must be explained.

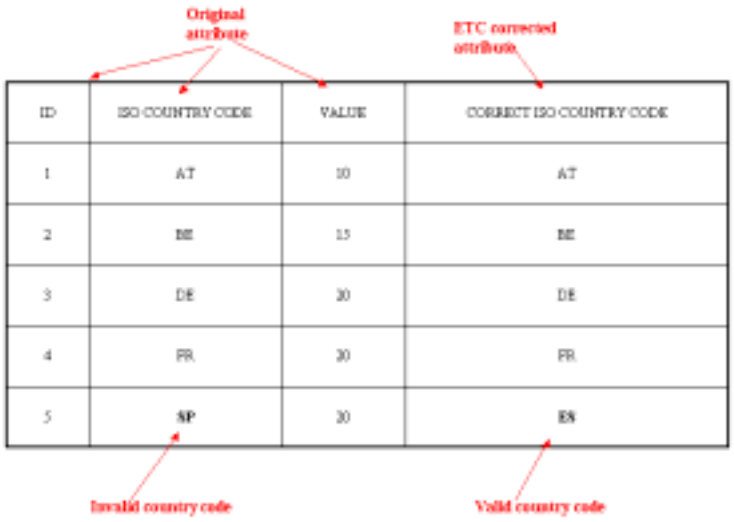
2.3.3. Attribute type

Information on the attribute type should describe the data format: integer, decimal, text.
This information will be the basis for quality control procedures and for IT applications in which the data set is used. The documentation function of the database handling software can be used to manage item type definitions in the case of databases.

2.3.4. Quality information - coded values

Many of the thematic attributes used by the Agency are related to classification systems.
It is important that the classification systems used (including the release version) are clearly identified in the documentation for the data set.

Figure xx: The table below shows a simple example.



Documented quality control procedures should be used by the ETC to check for invalid entries. The ETC should try to obtain a corrected version of the data from the National Reference Centre (NRC) or other external supplier. If this is not possible the ETC should use an attribute, which holds correct values and which will be used for processing. The feedback process to the original supplier is important for improving the quality of future deliveries.

2.3.5. Quality information - numerical values

The ETC should also use documented procedures to identify invalid numerical entries. As in the case of invalid codes, efforts should be made to obtain corrected data from the original supplier. A simple example is a percentage value greater than 100. Thematic expertise can also be used to derive efficient ways of identifying improbably high or low values for thematic attributes. The meaning of a zero value should be clear: does it indicate a reported value or a missing value.

The procedure for handling known errors in the data should be agreed with the EEA topic team. Overwriting original data without documentation should be avoided, as this will create confusion when the data is disseminated and when it is used as an input to other products.

Potential solutions for error-handling are:

- A general statement in the table documentation on the quality of the attribute
- The use of a "comments/footnotes" attribute in the table
- The use of a data quality attribute such as that used to clarify 0 values in air emission inventories (see example)

Data Quality Attribute	Description
NO	Not occurring
NE	Not estimated
NA	Not available
IE	Included elsewhere
-	Zero emissions

2.4. Spatial Attributes

The spatial attributes provide the information about the location of the feature being reported. The geographical coordinates, which define the location, are usually managed separately from the thematic attributes. The relationship between the thematic and the spatial data is made through the unique identifier for each feature. The types of location handled in the EEA reporting system are:

- pre-defined areas such as countries, water catchments or biogeographic regions
- other areas such as nature reserves or soil units
- point locations such as monitoring stations

2.4.1. Pre Defined Areas

The pre-defined areas are large environmental or administrative units, which the Agency uses for reporting aggregated environmental information on a regular basis. The boundaries of these pre-defined areas, are usually managed by an external organisation. The relationship between the thematic and the spatial data is made through the unique identifier for each area assigned by the organisation responsible for maintaining the spatial data set. This is therefore analogous to using valid codes from a standard classification system.

The ETC Data Manager should check that the relevant standard, including the version, has been identified and used. When the standards are respected, the attribute data can be efficiently re-used for different products and the task of documentation is simplified. The most common

example of a unique identifier for a pre-defined area is the ISO 2-letter coding system for countries: http://www.iso.org/iso/en/prods-services/iso3166ma/02iso-3166-code-lists/list-en1.html

At a lower administrative level each country is divided into administrative units. The system used in Europe to identify each region is called NUTS – Nomenclature of territorial units for statistics. This is a hierarchical system with several levels. The most commonly used is level 0 – country level, level 2 and level 3, but for location of e.g. a monitoring site a reference to the municipality level – NUTS 5, may be requested. The official id-codes should be used when referencing a location to such a region, or when making tabular files with measured/statistical values to be used together with NUTS geometry files. EEA holds tables to be used for such purposes. Documentation, lists and maps are found at
http://europa.eu.int/comm/eurostat/ramon/nuts/splash_regions.html

Other main classifications are collected in Eurostat's Ramon database. Some defined data classifications are available in the EEA Data service and the EEA Reportnet Data Dictionary.

2.4.2. Other Area Locations

These areas may be discrete features such as lakes and protected nature areas or a continuous coverage such as land cover or soil units. The relationship between the thematic and the spatial data is again made through a unique identifier for each area.

The GIS application used to manage the spatial data will provide a function, which allocates unique identifiers to individual polygons. However it will be necessary to consider carefully at the design stage, the relationship between individual polygons and the reporting level required by the Agency. This will enable appropriate aggregation for continuous coverages and also in some cases for discrete features.

Figure 2.

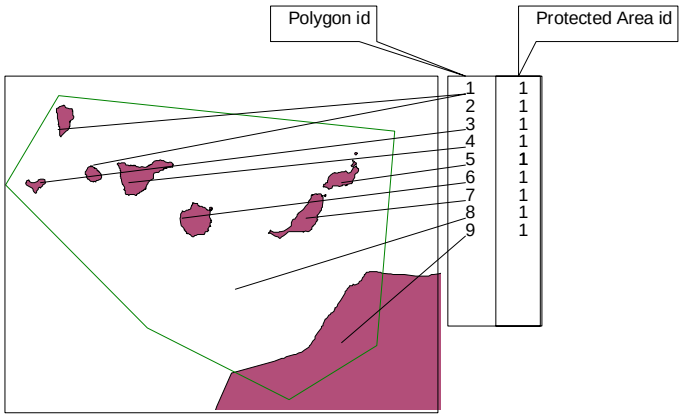


Figure 2 shows an example of the problem. The protected nature area to be reported includes several islands, which will be represented in the GIS system by a polygon for each island plus a

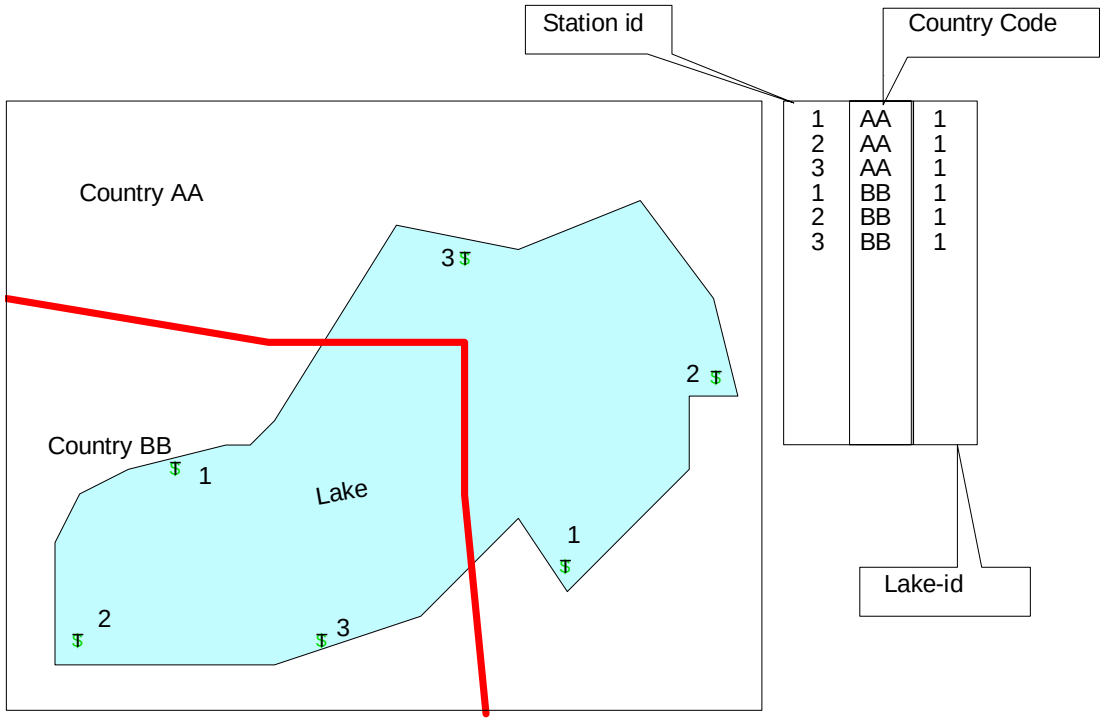
polygon for the water area. A separate Protected Area id must be maintained for correct reporting of the protected nature area.

2.4.3. Point Locations

The coordinates for point locations should always be provided to the Agency as decimal degrees of latitude and longitude. This permits the Agency to use a standard set of processing routines. A separate guidelines document has been prepared to illustrate the handling of these coordinates in a table.

However attention must also be paid to the relationship between the point location and the level of aggregation needed for reporting. For example, it must be possible to associate water quality monitoring stations with the water body being monitored. This is not always straightforward when the water body extends across national boundaries and/or changes its name. Figure 3 shows an example of monitoring stations on a transboundary lake. Aggregation by country and aggregation by water body (the lake) must both be foreseen at the design stage.

Figure 3



3. Working with point positions - latitude-longitude

3.1. Guidelines for working with point positions - latitude-longitude

EEA is receiving many geographical data. Most of them are tables with point positions for cities, water quality stations, waste treatment sites, oil spill sites etc. Commonly EEA finds incorrect positions in the delivered files. If such problems are not identified early in the map production or analysis chain, it may cause problems and an unnecessary workload.

Underneath you find some practical guidelines on how to make a file contain proper point position data. The examples are linked to files in tabular format.

3.2. Values given in lat/long

Deliveries of data/ tables containing point locations should always be given in LAT/LONG, decimal degrees.

3.3. Number of decimals

Number of decimals should correspond to the level of accuracy in the registration.
- When using degrees and minutes, the number of decimals should be 2 at a minimum.
- When using both degrees, minutes and seconds, the number of decimals should be 4 at a minimum.

3.4. Conversion from deg, min, sec to decimal degrees lat/long

If registration is done in degree, minutes and seconds (deg, min, sec) , the data should be delivered as they are. But in addition they should be converted to LAT/LONG values.

YEAR	TONNES	LATDEG	LATMIN	LATNS	LONGDEG	LONGMIN	LONGEW	LAT	LONG
1970	20000	41	19	N	21	58	W	41,32	-21,97

Here its only given degrees and minutes, which is less accurate than the version underneath. The conversion to LAT/LONG is done by leaving degrees as they are, adding as decimals the min,sec by taking the min,sec value and dividing by 60.

Positions given in deg, min and sec relate to origo. The location value is linked with directions; north (N) - south (S) and east (E) - west (W). When converting the values from latdeg/longdeg to LAT/LONG,

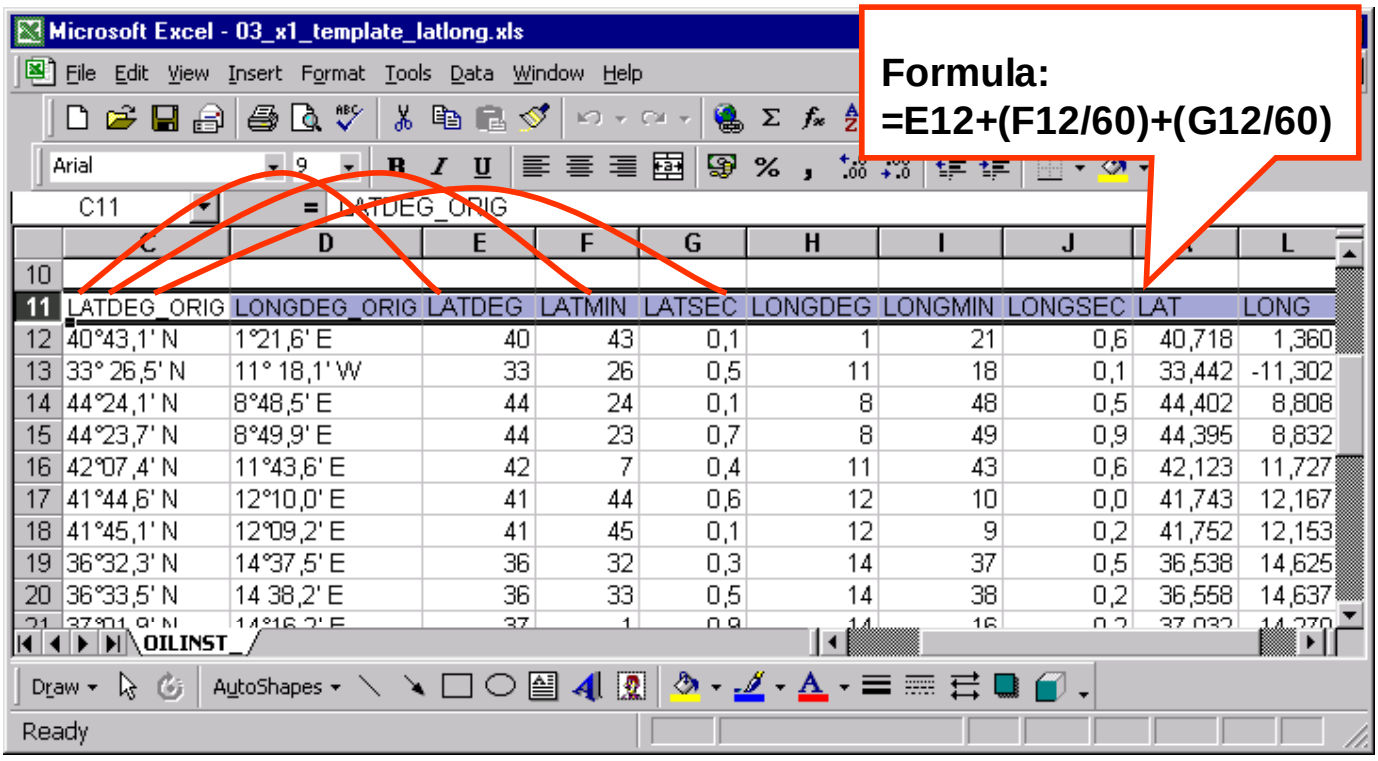
N gives positive value
S negative
E positive
W negative

LATDEG	LONGDEG	LATDEG	LATMIN	LATSEC	LONGDEG	LONGMIN	LONGSEC	LAT	LONG
40°43,1' N	1°21,6' E	40	43	0,1	1	21	0,6	40,718	1,360
44°24,1' N	8°48,5' E	44	24	0,1	8	48	0,5	44,402	8,808
44°24,1' N	8°48,5' W	44	24	0,1	8	48	0,5	44,402	- 8,808

Be aware that west values should give negative LONG values

3.5. Template file

The file **template_latlong.xls** can be downloaded at http://eionet.eu.int/gis This file contain a functions which changes values given in latdeg latmin to LAT/LONG. If you are familiar with functions, and use the fill down function, you can convert a column of values quickly.



1. Delete the data from row 13 downwards, and paste your own data in column C and D
2. The positions must be split into three columns, deg, min and sec in separate columns (Can be done by making each row a plain text file and import it in Excel.)

3. The formula in LAT and LONG (row 10) are used to convert the values of the new columns to decimal degree values. Use Edit, Fill, Down
4. All new values should be copied and pasted, using Edit, Paste special, Values
5. All LONG values marked as West (W) values in the original data (column D) must be negative. Add a minus sign to the number in row J.
6. Delete row 1-10 and save.

3.6. Reference system – simple guidance

For most of the registrations EEA handles the accuracy on location is medium to low. thus it is not very important to mark which reference system it is made in. Thus

3.7. Reference system – for the more advanced user

Point data collected are often provided as Latitude and Longitude, it is important to stress that this is not enough to put a place accurately on the earth's surface: the coordinate reference system used has to be recorded as well.

Usually Latitude and Longitude are taken from paper maps, which have been drawn using a coordinate system; the datum component of a coordinate system is usually specified in the map's legend, and it is this component that has to be put in metadata.

To clarify the matter further: to locate a point which lays in a 3-dimensional space (as every point on Earth do) you need 3 parameters, hence, Latitude and Longitude (2 numbers) are not enough. The 3rd component is given by the datum (which includes the used ellipsoid), this datum specifies the geographical shape (an ellipsoid or a sphere) on which the point lays: equipped with Latitude, Longitude and Datum, the point can properly be put on the Earth's surface.

4. GIS-data: vector and raster data deliverables

GIS-data, which are all data stored in a GIS format and has geographical referencing linked to a coordinate reference system, is being used different operations, both for assessments and the production of illustration maps. GIS-data does not include maps pasted/stored in files without a reference system these being labelled postscript maps (Postscript files: Adobe Illustator, EPS, WMF, EMF, PDF), and treated in chapter 5.

EEA receives data from three main sources

- the countries answering to reporting obligations in the context of EIONET, delivered through Reportnet
- the ETCs merging national data to new European data sets and carry out assessments resulting in new GIS-data
- External organisations where being used by EEA to deliver reference data or other thematic data needed in spatial assessment and map production

This guideline chapter addresses some central issues for how EEA and it's related organisations should treat the GIS-data, partly before they are delivered and partly in the assessment and production process.

4.1. Quality and quality control

It is essential that the data delivered to EEA is homogenous and of general good quality. Product specifications should, whenever available, be followed. There exist guidelines documents concerning priority data flows, and definitions of for certain data exist also in the Reportnet Data Dictionary. The quality control should include

- for attribute data, that the values and codes is within the range defined in guidelines documents
- for id's, checking that they are in accordance with standards
- for geometry, either being, points, lines or polygons, have an acceptable structure and topology; polygons being closed, sliver polygons removed or reclassified, lines forming networks linked properly to the nodes
- geometry accuracy, coordinate reference system, projection and file format according to specifications
- metadata is filled in, including aspects of accuracy, coordinate system, methodology, and source

Quality control should be carried out carried out before delivery of the final draft to the Agency. In the flow of data from ETCs to EEA, it is important that the ETC data manager is aware of the quality control procedures and ensure that they are posted to Circa in the ETC Consortium Interest Group, even if a partner organisation is responsible for the production task.

4.2. Projection and Scale

The projection and scale of a vector data set are fixed at the stage of product specification. Unless the Agency has provided written specifications to the contrary, vector data sets should use the national boundaries and coastline from the GISCO Reference Database at the specified scale as a template. This practice ensures that EEA datasets are compatible with each other and with the GISCO Reference Database. The GISCO Reference Database is distributed to ETCs by EEA under the licensing agreement between Eurostat and EEA.

4.3. Resolution and generalisation

The resolution and generalisation of a data set should be stated as clearly as possible. These characteristics are important for usage of the data set, in particular when the data set is an input to geographical analysis and area measurements.

4.3.1. Resolution

The required resolution should be stated in the product specifications. The resolution is given in meters. The resolution is related to the scale in which the data are to be used.

1: 10.000	ca. 4 meters
1: 50.000	ca. 15 meters
1: 100.000	30-50 meters
1: 1 million	300-500 meters
1: 10 million	3000-5000 meters

The GISCO reference database has the following resolution
1 million: 500 m
3 million: 1500 m
10 million: 5000 m
20 million: 8000 m

4.3.2. Minimum mapping size of a mapped area

Minimum mapping size of a mapped area is related to the resolution. The lower level for CORINE Land Cover (CLC90) is 25 ha (250,000 m^2) for mapping at 1: 100.000.
In the GISCO database they have used the following limits in their generalisation from 1: 1 million to smaller scales:

3 mill: All areas smaller than 2 250 000 m^2 (225 ha) eliminated
10 mill: All areas smaller than 25 000 000 m^2 (2500 ha) eliminated
20 mill: All areas smaller than 100 000 000 m^2 (10000 ha) eliminated

4.3.3. Generalisation of lines/vectors

GISCO has stated the following factors/parameters to be used in generalising the NUTS boundaries with the function *Bendsimplify* in Arc/Info:

3 mill: weed tolerance 1500 m

10 mill: weed tolerance 4500 m
20 mill: weed tolerance 8000 m

4.4. Geometric quality representation and topology

A short description of the geometric quality of the data set should be provided. If the original data has been converted from national systems, the conversion process should be documented. Any available information concerning the geometric quality of original national data should be maintained either as an attribute in the vector data set or as part of the written documentation/ metadata.

4.5. Thematic quality

A short description of the quality of the thematic attributes contained in the data set should be provided. It should be clear which attributes are original data (supplied by countries or third-party organisations) and which are attributes created by the ETC. The latter are often needed for the purpose of harmonisation of measurement units.

4.6. Naming of files and attributes

Naming of files and attributes should normally follow the style recommended by the GISCO Database manual. If this is not considered practical, then an alternative proposal should be made to the responsible person in the EEA Topic Team with a copy to the EEA GIS Team. These guidelines will be modified to follow any recommendations on naming practices within EIONET made by Reportnet group.

4.7. Recommended formats for geographical data sets

Geographical data sets can either be vector data, raster data or tabular data. EEA gives in the following chapter recommendations on the data formats for each of these data categories. The guidelines are relevant for EEA in its internal data handling and dissemination, ETCs, national organisations delivering data to EEA through EIONET data flows or other external contractors.

The given recommendations gives guidance to the delivery of data. If EEA receives data in the recommended formats this eases the handling of the data, and makes it possible to use specific tools for effective metadata production. EEA also offers tools for cooperating partners tailored to some of the defined formats. EEA is following the Commission decision to use ESRI products and formats whereever possible, and brings these views futher in the following recommendations. However, if an institution is not able to follow the recommended formats, EEA accepts to recieve a long range of formats if not specific format specifications are given in contracts.

In addition to format recommendations, EEA require certain metadata for all geodata deliverables. Any dataset should be followed by general metadata, and include detailed description of geographic reference system. If possible ESRI projection (*.prj) file should be supplied. Metadata issues is treated futher in chapter XX.

4.7.1. Raster formats:

Raster datasets can be delivered as one band or a collection of bands for each image (scene). If several images are supplied in a dataset, the delivery should include a raster catalog. A raster catalog is a table with columns IMAGE, XMIN, YMIN, XMAX, and YMAX. Any table format is accepted.

If a raster dataset is created on basis of a vector dataset, the vector dataset should be delivered with the raster dataset.

Name	Short name	Recom-mended	Comments	Advantage	Disadvantage
IMAGINE Image	**IMG**	**Yes**	**- Preferred by EEA**	**- High compression ratio without data loss** **- Supports any color depth** **- Detailed header information**	
Geographic Tag Image File Format	GeoTIFF	Yes	- Must include GeoTIFF tags in header	- Supported by most GIS, image and remote sensing tools	
ArcSDE Raster	SDERaster	No		- Easy and fast ESRI ArcSDE export/import	- Only useful for users with ArcSDE
MrSID		No	- Use only compression level 1:10	- High compression ratio	- Only 32 bit color - Manipulates data
Band Interleaved by Line, Band Interleaved by Pixel, Band SeQuential	BIL, BIP, BSQ	No	- Must include header file (*.hdr) and colormap file (*.clr)	- Supported by most remote sensing tools	- Various none compatible versions used - Missing some information's about the used geographic reference system
ESRI GRID	GRID	No	- Must include colormap file (*.clr)	- Old accepted format - Contains both bands and catalogs	- Uses folder structure - Unreliable

4.7.2. Vector formats:

If a vector dataset is extracted from a database, the extraction process steps should be described in metadata.

Format name	Short name	Recom-mended	Comments	Advantage	Disadvantage
Shapefile	**SHP**	**Yes**	**- Preferred by EEA**	**- Compatible with most GIS software**	**- Datasets having several types of shapes (feature classes) or several tables needs more than one shapefile/tablefile. - Cannot keep relations between feature classes within the dataset.**
ESRI Coverage	COV	No	- Delivered with the coverage folder structure fully intact	- Supports topology	- Disk folder structure - Only supported by ESRI - Many versions - Discontinued
ArcInfo export interchange file	E00	No	- For export between old ESRI ArcInfo systems		- None generic format - Designed for old ESRI systems
Drawing interchange files	DXF	No	- AutoCAD format		- Made for CAD drawings
AutoCAD drawing files	DWG	No			
MicroStation design files	DGN	No	- Old Microsstation format		
Vector Product Format	VPF	No	- A coverage format	- Supports topology	

4.7.3. Table formats

Datasets, which only include point shapes, may be delivered as a table with an X and Y coordinate.

Format name	Short name	Recom-mended	Comments	Advantage	Disadvantage
Access Database	**MDB**	**Yes**		**Stores multiple tables as a relational database**	**- Each table as one file**
dBASE5	**DBF**	**Yes**	**- Only point shapes**	**- Easy to use - Accepted by all systems**	**- Each table as one file**
Microsoft Excel	XLS	No	- Only point shapes	- Easy to use - Accepted by many systems	- Each table as one file - conversion to other format needed to use in ArcGIS
Comma separated text file	TXT	No	- Only point shapes	- Accepted by all systems	- Characters might be read different depending of system
VPF table	VPF	No			- Only supported by GIS systems

4.7.4. Database formats

It is recommended that you consult with the EEA GIS operations, before submitting a full or an extract of a database.

Format name	Short name	Recom-mended	Comments	Advantage	Disadvantage
ESRI Personal Geodatabase (Microsoft Access)	**MDB**	**Yes**	**- Preferred by EEA**	**- Supports topology and feature relations**	**- Does not support raster**
Standard Microsoft Access	MDB	Yes	- Only points - Uses an OLE DB connection	- No need of a GIS system	- Only supported by Windows systems
ESRI multiuser geodatabase	SDE	No	- EEA only reads SQLserver	- Handles huge amounts of data	- Complex and need lots of documentation describing database

4.7.5. Annotation formats

Format name	Shortname	Recom-mended	Comments	Advantage	Disadvantage
Personal geodatabase annotations	**MDB**	**Yes**	**Created with ArcMap**	**- Integrated with other formats** **- Easy to work with**	
Annotation Coverage	COV	No	COGO		- Old format - Difficult to work with

4.7.6. GeoService formats

EEA accept that geographical datasets are made available to the EEA as Internet geoservices. EEA accepts datasets delivered as OGC Web Map Service 1.1 and OGC Web Feature Service 1.0. Please contact EEA GIS operations group for further information (gis@eea.eu.int).

5. Coordinate reference systems and projections

5.1. The background and focus of the specification

This chapter describes the EEA standardisation of coordinate reference systems and projection for the storage and treatment of geographic databases and map display. This is a follow up of the European Commission decisions from 2003 to use specific coordinate reference systems and projections. Producers and users of spatial data and maps should be aware that different assessment operations require different projections and that maps should have a projection defined by EEA. Using defined standards has made it possible to develop templates and efficient tools for data handling, and will reduce the burden of documentation both for EEA and its cooperating partners.

There are several reasons why EEA finds it necessary to develop specifications in this field:

- The lack of documentation and skills in the field of transformations and projections causes frustrations, inefficient handling of geographical data, un-accurate data and analysis results.
- A variety of different projections are being used among the EEA, different topic centres and country institutions, but the documentations about the use is limited.
- Some European topic centres and projects experience severe problems when joining data from different countries. EEA is cooperating with more than 30 countries. In order to streamline the data flow from these countries we need to standardise in the field of coordinate reference systems and projections.
- It is foreseen that EEA will use spatial assessments more actively in the coming years, making it important to follow guiding principles for the best possible use of the data available.

5.2. The European initiative and recommendations

The experiences linked to EEA activities is typical also for other agencies working with many partners and with partners covering large areas. This resulted in an initiative from the European Commission. The aim has been to develop Pan-European standards for coordinate systems and some recommended projections, to be applied by National Mapping Agencies, The European Commission and other agencies treating geographical information.

The work has been carried out by an expert group of the cartographic projections workshop. Active institutions have been Eurogeographics and experts from national mapping agencies, JRC, Eurostat/GISCO and others. Their recommendations where released in November 2001, and approved by COGI (Commission Inter Service Group on Geographical Information) in 2003 for use within the Commission services. INSPIRE has through working groups recommended the use in a wider user community.

5.3. EEA general guidelines on coordinate reference system

The recommendations by the European Commission and the wider European initiatives should as far as possible be followed by EEA.

5.3.1. A common European Coordinate Reference System – ETRS89

Different workshops and expert group contributions prepared the ground for the definition of the common European Coordinate Reference System (CRS) and its use for geo-referencing of the data of the European Commission (EC) and for future specifications of the products to be delivered to the EC, within projects, contracts etc, and the promotion of the wider use within all member states.

The name of the coordinate reference system is **ETRS89.** The European Terrestrial Reference System 1989 (ETRS89) is the geodetic datum for pan-European spatial data collection, storage and analysis. This is based on the GRS80 ellipsoid and is the basis for a coordinate reference system using ellipsoidal coordinates. The ETRS89 Ellipsoidal Coordinate Reference System (ETRS89) is recommended to express and to store positions, as far as possible.

- **EEA and the topic centres should use the ETRS89 as the common coordinate reference system for storage of data and as a basis for defined projections to be used in analysis and map production. Data delivered to EEA, in particular data with European coverage, should use the ETRS89 as the coordinate reference system.**

- **National data delivered should also use ETRS89 or coordinate reference systems easily transformable to ETRS89. If the national/ local coordinate system is not found in commonly accessible documentation, the delivery institution should add a documentation following the ISO19111 referred to underneath.**

The description and definition of ETRS89 is based on the convention of ISO 19111 *Spatial referencing by coordinates* standard. For further documentation on ETRS89, see http://crs.ifag.de/ and www.EIONET.eu.int/gis.

5.3.2. Conversion from national coordinate reference systems

At the national level a series of different coordinate reference systems are used. It is essential that conversion is done with care, not loosing significant accuracy. Therefore, proper transformation routines have to be used.

The European initiative on coordinate reference systems provide information also about the national level: The National Mapping Agencies (NMA) or comparable Institutions / Organisations provide the information for the descriptions of the national coordinate reference systems and for transformation parameters between the national coordinate reference systems and the European coordinate reference system ETRS89. For more information, see the web site http://crs.ifag.de/

- **EEA recommends that transformation between national and the European coordinate reference system is being done by using the agreed transformation parameters for the different countries, see the link above.**

EEA may have the possibility of assisting such transformations on demand.

5.4. EEA recommendations - specific projections for different purposes and products

The guidelines underneath are relevant for any organisation involved in handling GIS data to be delivered to EEA or in treatment of such data on behalf of EEA, e.g. the topic centre and country institutions. The projection guidelines are also relevant to EEA's own data use and management.

The European commission recommends 4 different systems/ projections to be used on different products and activities, all based on the ETRS89 datum. The choice depend upon scale, data quality (raster/vector) and purpose of work. EEA is using this as a basis for it's recommendations.

EEA recommends the use of three of the options:

- **Lat-long: ETRS89** - No projection – un-projected, geographical coordinates, to be used for storage and expression of positions, mostly vector data.
- **Lambert Azimuthal Equal Area, (ETRS_LAEA)** For storing raster data, for statistical analysis and for map display purposes
- **Universal Transersal Mercator projection (ETRS_TMzn or UTM).** To be used in large-scale mapping and storage of large scale data. Allowing different zones to be used.

See www.EIONET.eu.int/gis for detailed definition documents. It does not seem as one of the 4 proposed option promoted by the European Commission, the Lambert Conformal Conical projection, is relevant to EEA, as no products or activities at the EEA make it necessary to use this projection.

Coordinate Reference System/ Projection	Name and definition	Types of coordinates	Datum	When to be used – purpose	EEA use
ETRS89	**European terrestrial reference system:** Ellipsoidal, geographical coordinates lat/ long	Geographical coordinates	ETRS89	storage and expression of positions - vector data - tabular data – point locations	Yes
ETRS-LAEA	**Lambert Azimuthal Equal Area**, Latitude of origin: 52 North Longitude of origin (Central Meridian): 20 East *	Map Projection	ETRS89	- map display - spatial analysis - storing raster data	Yes
ETRS-LCC	**Lambert Conformal Conical projection** Latitude of origin (Parallels) at 35N and 65 N Longitude of origin (Central meridian/ 10E	Map Projection	ETRS89	- small-scale mapping 1:500.000 – 1:1 mill - storing raster data	No
ETRS-TMzn (UTM)	**Universal Transversal Mercator** Different zones can be used	Map Projection	ETRS89	- large-scale mapping 1: 10.000 - 1:499.999	Yes

* The Longitude of Origin – the east west centre line of the map- is for the Lambert Azimuthal Equal Area projection promoted by the EC defined as longitude 10 Eeat. This is the centre of EU15. EEA handles 31 member countries and maps usually cover areas eastward including Turkey, at some occasions further west into the Atlantic Ocean and eastward to Ural Mountains. For EEA purposes it has been found that the use of the Lambert Azimuthal Equal Area projection (52N) with central meridian at 20 E will be a better standard solution. The recommendation therefore is to use the projection with this minor adjustment.

In the further treatment of the matter it is necessary to distinguish between mapping, storage of geographic data, spatial analysis and map display.

Mapping/ Data acquisition: EEA is not organising many true mapping projects – projects including field survey, image interpretation or other mapping techniques. Major projects, such as CORINE Land Cover (CLC), have separate specifications for how to carry out the mapping. General guidelines are:

- to use the ETRS89 datum in all mapping projects
- to use the ETRS-TMzn projection with a suitable zone or a local projection well documented, as is commonly being done for CLC
- for point data, such as the mapping or recording of monitoring site locations, lat-long values referring to ETRS89

Reporting, storage and dissemination of GIS data: EEA is organising many data flows, some of which include GIS data. Country organisations compile GIS data using inputs from other organisations and report these to EEA using Reportnet tools. EEA and its topic centres are involved in merging national data into European datasets, and carries out spatial assessments creating new GIS data sets. EEA store and disseminates all these kinds of data. EEA has joint guidelines for handling of all these kinds of GIS data

- to use the ETRS89 datum
- to report, store and disseminate **vector data** un-projected, including polygon data (e.g. watersheds), line data (e.g. rivers) and point data (e.g. towns, houses) and grid data (population grid, regular point grid). There are two main exceptions
    - vector data only intended to be used in production of small scale maps for reports, it is recommended to use ETRS-LAEA, 52N, 20 E
    - large scale vector data (Scale > 1:500.000), mapped in the countries using ETRS-TMzn or a well documented local projection, should be reported and stored in this format
- to report, store and disseminate **raster data** in the following way
    - Country-wise raster data or data with other regional split-up, use produced ETRS-TMzn or a well documented local projection (e.g. Image 2000).
    - European coverage or raster data, use ETRS-LAEA, 52N, 20 E (e.g. CLC 2000 raster data merged as European dataset, elevation).

Measurements and spatial analysis: It is important for use a projection suited for the purpose.

- For European-wide measurements/analysis EEA recommends to use ETRS-LAEA, 52N, 20 E. as this projection is a area-true projection. To be used in combination of layers, measurement of areas and distances, and in sampling processes for statistical purposes.

Maps in reports, fact sheets and on web: EEA has decided upon some common projections to be used for all map presentations in main reports, fact sheets and at the EEA web pages, including the ETC and EIONET web pages. Different projections were compared, leading to the following recommendations. All template files for maps delivered by EEA to the producers are based on these specifications.

- For **maps with European-wide coverage** or more limited coverage such as the European sea catchments, the seas or other major regions: use ETRS-LAEA, 52N, 20 E.
- Exceptions are wide **Eurasian** maps using ETRS-LAEA, 52N, 65 E, **world** maps using Times 10 E (VGS84) and maps showing **local** examples, where the preferred projection is ETRS-TMzn.
- EEA should be contacted by the producer when a map producer is intending to use other projections than the recommended ones.

5.5. Available documents and files for working with projections

EEA has developed templates files for map production based on the recommendations above. See chapter xx7. The documentation about the coordinate reference systems can be found at www.eionet.eu.int/gis and http://crs.ifag.de/. For other work on projections, EEA is releasing different kinds of files.

5.5.1. prj. files

When using the general predefined projection files in ArcGIS software, be aware that the ETRS89 option in ArcInfo prj-file is called ETRF89.

In ArcInfo it is possible to copy in your most used projections. Place .prj files in the directory of projections. .prj-files for the most common projections used by EEA is available at EEA data service at http://dataservice.eionet.eu.int/dataservice/metadetails.asp?id=587

- ETRS-LAEA.prj (48N_9E) (Commonly used by EUROSTAT/ GISCO)
- ETRS-LAEA5210.prj
- ETRS-LAEA5220.prj (Standard for EEA)
- ETRS-LAEA5265.prj (EEA Eurasia maps)

When placed in the correct directory these projections will be available as an option under predefined projections in ArcGIS 8.x. The .prj-files should be placed in arcexe82/Coordinate Systems/Projected Coordinate Systems/Continental/Europe

5.5.2. Shape files and coverages as template files

If you are to choose coordinate system and projection in ArcInfo 8.x, it is also possible to activate the information in already existing files with the correct projection. This is a helpful and easy to use tool. It is especially helpful when defining and changing projections in ArcToolbox. EEA is offering such coverages to ease transformations and definitions of files not containing details on coordinate system/projection.

6. Postscript maps – specification & templates

The wide variety of information products produced by EEA commonly contain map presentations, commonly resulting from spatial assessments/ indicator work. In order to facilitate efficient production of the maps and to generate harmonised presentations, EEA has developed a set of specifications for maps and accompanying legends. The maps. The chapter focuses on maps being produced for reports, but much of the information is also relevant as specifications for maps being produced for the web. EEA and the topic centres are expected frequent users of the map specifications.

6.1. Standard size for postscript maps (in reports)

EEA has a standard layout for printed reports. Each page is built up of columns of 33 mm; between each column there is a 4 mm space. Concerning indicator fact sheets, there exist other and less strict templates. Maps produced for fact sheets should as far as possible follow the specifications as for printed reports.

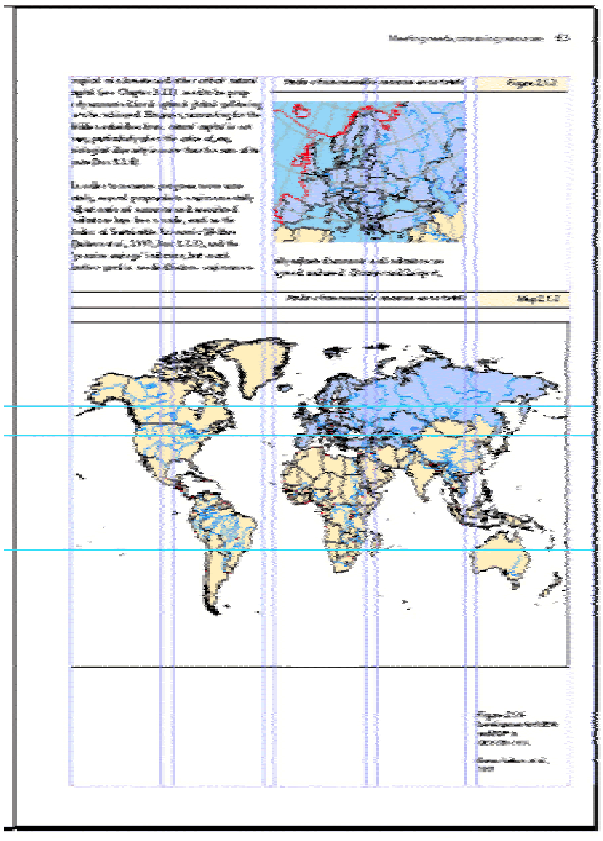


Figure 1: Dummy example of page with maps following the EEA layout norm.

- Postscript maps should have a size compatible with the EEA layout norm: Accepted widths are:
  - 33 mm
  - 70 mm
  - 107 mm
  - 144 mm
  - 181 mm
- EEA will sometimes use and require maps covering two pages, with maximum width 402 mm.
- If EEA has not specified the width of the map, the map should be made with the width 144 mm, and in addition the legend at the side with a width of 33 mm. It will then be possible to scale it according to the final use in the reports.
- All EEA postscript template maps follow the width (and height) prescriptions.
- All EEA ArcGIS (8.x) template files (drawing instruction files) follow the width (and height) prescriptions

6.2. Standard map projections

The map data and template files available from EEA, both the GIS data (Shape format) and the postscript versions (Adobe Illustrator) follow the prescribed projections. See chapter xx7 for details about the map extents and their projection, chapter xx8 for how to use the template files and chapter xx5 for details about projections and reference systems.

6.3. Map extents for postscript maps & other final version maps

EEA has defined a series of standard map extents as a basis for illustrations in reports and on the web. Use of a set of standard map extents makes map making easier and more effective, makes it possible to tailor map data and template files and makes it possible to get harmonised outputs that fit to the general EEA standard layout of reports.

These map extents, being defined in detail in chapter 7, should be used when producing maps for reports, and should also be used when presenting maps on the EEA web pages. The series of map extents are defined according to **east-west** coverage. Each of the map types can have 4 different versions, depending on **north-south** extent. There are at present 7 map series with different east-west coverage, but only 2-3 of these are frequently used.

See the presentation in chapter 7 for a detailed description and definition of all the map extents, with illustrations and coordinate definitions. The ArcGIS template files (drawing instructions) are based on these standard map extent definitions. See chapter 8.

6.4. Scales of postscript maps

EEA does not focus on certain scales for the maps presented in reports. The scaling of maps in order to provide one of the standard layout widths will probably not result in a rounded map scale. EEA finds this of low importance for the small scale maps.

The map producer should make the map following them standard map extents outlined above. These can be presented in different scales.

The focus therefore should be to focus on the size of the maps as it is planned in the reports where it is to be used. Then the map producer should follow the standards for width of maps in reports and choose one of these. See chapter 6.1.

6.5. Level of generalisation

Different generalisation of elements, rivers, coastline, land surface, etc are available from EEA.

- EEA GIS data (core data) are environmental data and some general features are not specifically selected for illustration map purposes. The data are primarily for producing environmental indicators.
- For most of the basic features data the GISCO reference database are delivered in three or four different levels of generalisation (Scale 1, 3, 10 and 20 mill). If a data set is available at different scales, the data with the smallest scale should be used for illustration maps.
- Some data sets have fixed generalisation. Data sets with polygons cut along the coast with a certain coastline will remain with this coastline.
- EEA has put together a selection of generalised data sets which are well adapted to illustration maps in small scales. ETC's and others producing maps on behalf of EEA should, if not anything is specified by EEA, use this selection. The data are labelled EEA map data. The data are GIS data and has been the basis for Postscript map template files. EEA's ArcGIS templates are based on the use of these GIS data sets. The generalised EEAMapdata are presented in a separate paper f:/gisdata/gisguide/EEAmapdata.doc

6.6. Standard elements/features in maps

The maps EEA are using in reports are usually very simplified. Therefore the maps delivered to EEA should contain few elements in the small-scale maps.

- few general elements/ background features
- few topic issues per map – usually one issue is enough, or a comparison between two. EEA has experienced that many maps are overcrowded.

The features delivered from EEA to be used in map production are all based on a level of generalisation in the databases comparable to 1:40 mill in scale or even lower.

Needed features for rough maps to reports/web covering the whole Europe and local case studies maps:

EEA mapdata	Filename	Size – width 33-107 mm	Size – width 144-181 mm	Larger scale case maps 1 mill for printing in reports (A4 size or less)
Background polygon	01_background_prj			
Land (terrestrial) polygon	02_landsurface	x	x	x
Countries polygon	03_countries	x	x	x
Sea surface	04_oceansurface	x	x	x
NUTS 2 regions	05a_regionsnuts2		x	x
NUTS 3 regions	05b_regionsnuts3		x	x
Lake, large	06a_lakelarge	x	x	x
Lake, medium	06b_lakemedium		x	x
Lake, small	06c_lakesmall			(x)
River, major (Eurasia)	07_river			x
River, large	07a_riverlarge	x	x	x
River, medium	07b_rivermedium		x	x
Country boundaries, terrestrial	08a_countryborder		x	x
Country boundaries, marine	08b_marineborder		x	x
Arctic circle and tropics	09_parallels		x	x
Lat long every 10°	10a_latlong10			x
Lat long every 5°	10b_latlong5		x	
Coastline	12_coastline		x	x
Cities	20_cities		x	x
Capitals	21_capitals		x	x

The table above gives a generalised picture of which databases delivered from EEA that could be used in the different map sizes. A mark is only a rough indication of the features that should be included in the map.

6.7. Standard layer orders

The layers of the map as they come from the GIS system should be reflected as layers in the postcript file. Text should be placed in separate layers, according to the feature they are naming.

Each layer name should be named in English language. If all standard layers are in use the following layer order is prescribed. Adjustments might be needed.

Feature/ map element	Layer order
Frame	1
Text	
Thematic text	2
country names	3
towns	4
seas/lakes	5
Grid numbers	6
Points	
Thematic point data	7
Cities	8
Lines	
Thematic boundaries/ line data	9
Coast/ sea shoreline	10
Roads	11
Rail	12
Country boundaries	13
Rivers, large	14
Rivers, medium	15
Lake/shoreline	16
Gridnet (lat/long)	17
Surface/area	
Lake/river surface	18
Thematic area/polygon data	19
Outside data coverage area	20
Land surface- outside data coverage	21
Land surface	22
Sea surface	23

6.8. Colour and graphics definitions

EEA has defined graphic layout (colour/line size) for selected features that are repeatedly being used on maps. The specifications underneath are defined to fit the needs when being used as originals for use in reports, fact sheets. EEA has also defined suitable colour schemes for web.

6.8.1. Colour and graphics for background layers

We distinguish between surface/area features, line features, point features and text. Areas outside the data coverage should have a separate colour. Areas within the coverage area but with mission values should have another colour.

Feature/ map element	Colour CMYK Bio/Dobris+3	Size/ Width , pt	Font/ line type/ fill type
Surface/area			
Land surface	0-5-25-0		fill/ no line
Land surface – missing values/no data	0-0-0-0		fill/ no line
Land surface- outside data coverage	0-0-0-10		fill/ no line
Sea surface	20-5-0-0		fill/ no line
Lake/river surface	20-5-0-0		fill/ no line
Lines			
Coast/ sea shoreline	50-20-0-0	0,3	line
Rivers, large	50-20-0-0	0,3	line
Rivers, medium	50-20-0-0	0,3	line
Lake/shoreline	50-20-0-0	0,3	line
Country boundaries	0-0-0-60	0,4	line
Thematic boundaries	no line		
Frame	0-0-0-100	0,6	line
Gridnet (lat/long)	100-30-0-0	0,28	line
Roads	0-100-100-0	0,3	line
Rail	0-0-0-100	0,3	line
Points			
Capitals	0-100-100-0	0,6 mm	
Cities	0-0-0-100	0,4 mm	
Text			
country names	0-0-0-100		Avenir
towns	0-0-0-100		Avenir
seas/lakes	0-0-0-60		Avenir
Grid numbers	100-30-0-0	5 pt	Avenir light

For ArcGIS-users: The colours are used in the template files produced by EEA. When adding new layers/ data sets to a production, use of .lyr files brings in pre-defined colours, use of .shp-files does not.

6.8.2. Colour and graphics for thematic information – use of common colour scales

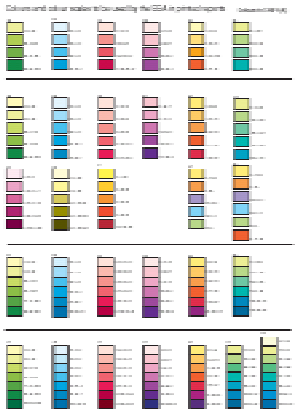
In general it is difficult to define common guidelines for the variety of thematic information to be presented on maps. However, some guidance can be given for maps intended for paper presentations:

- When using statistical or ordinal division of data, EEA has some recommended colours scales. These may be used when arranging data according to relative value or other ordinal value. There is a sub-division according to basic colour and also the number of classes, 3, 4, 5, 6 or 7. Both colours and greyscale. Please http://eionet.eu.int/gis where files with the exact definitions of colours can be found.
- When presentations of distribution areas there should only be colour on the area itself. Try to avoid using a separate colour for the outline/boundary of each of the areas, the maps get cleaner without these boundary lines.

Similarly, EEA has some specifications for colours to be used for web maps. Screens show the colours differently compared to paper. Separate web-safe colours defined in a html-code is used.

The EEA web map system is based on these colour schemes. Please see http://map2.eea.eu.int/help/map/predefshade.asp

A



B

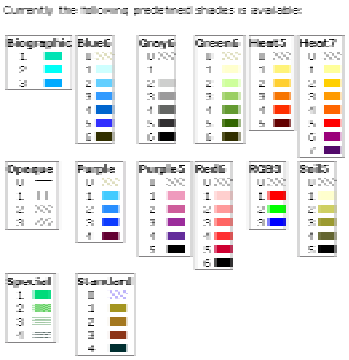


Figure xx: EEA has guiding principles for colouring of maps, based on some predefined colour scales, one for maps in reports (A) and one for web presentations (B).

6.8.3. Colour systems – CMYK, RGB, HTML

The colours are given in 3 different "languages",

- CMYK: for printing purposes
- RGB: for screen purposes
- HTML: used for web applications

The colours defined in the different systems may not be translated directly. CMYK has a limited colours spectrum compared to the other systems, especially in bright colours. If you have defined colours in RGB on the screen the system might give you an in-correct colour as CMYK. This might also be the case in sending maps to a printer; different colours might change the valeur significantly. In order to make colour versions able to be copied without being re-made for black and white, the colour (darkness) have been looked at especially when selecting the colours.

6.9. Legend

A map will commonly have a legend. The Adobe Illustrator file with the map should preferably, therefore, also contain the legend with the layout planned to be used in the report. The legend should not be ovelayed "on top of" the map, but outside the frame of the map.

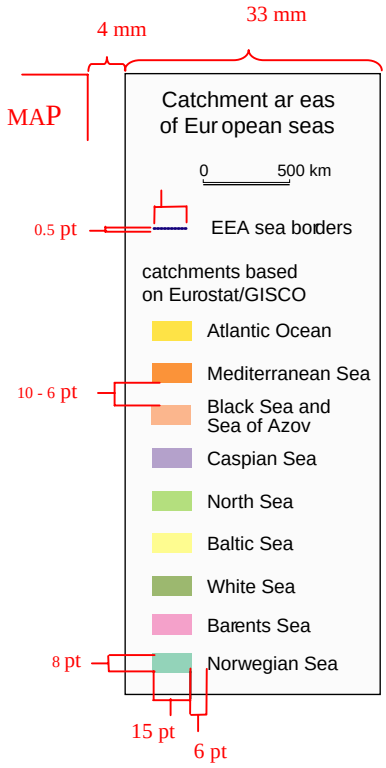
The norms for the legend are as follows

Width: 33 mm will be preferable for most cases. See example to the right. Aslo 77, 107, 144 or 181 mm will be possible sizes for legends. Maps covering the width of the page, could have legends with the same width (181mm)

Fonts: Font type should be AvenirTrue and AvenirBold. Usually AvenirTrue will be used for both ordinary text and the heading.

Font size: Font size should not be under 5 pt and not over 11 pt. In the example Heading is 8 pt, category text is 7 pt, and scale bar text is 6 pt. Text should be black.

Line spacing/distance (leading): The spacing could usually be somewhat larger than the font size. In the example the heading has font size 8 pt, the leading is 9,5 pt. The category text is 7 pt, while the leading here is 8,5 pt.



6.10. Text – translation implications

Guiding principles

- Text should be place on separate layers.
- Text should be defined as text with the prescribed fonts and sizes. See section 6.8 underneath for font specifications.
- Text should not be outlined.
- Text that needs translations should be in black or grey. Other text, such as numbers or id's on locations could have other colours.

6.11. Map templates in ArcGIS

EEA has developed map template files for ArcGIS 8.x that works together with the selected data for map production, in the form of ArcMap 8.x map templates (.mxt). See chapter 8. Export of postscript maps can be made from the GIS system. For producers using other software the frames for each map extent should be used together with the map data to create the map illustrations.

6.12. Map templates in Adobe Illustrator format

In quite some cases there is an interest only to mark objects on simple maps. In such cases it is not necessary to be linked to a GIS database and use ArcInfo or any other GIS-tool. One could instead edit directly in ready made postcript baseline maps. EEA is offering such ready maps: Adobe Illustrator Template files with different map extents. The maps follow the specifications given for such map deliveries as defined by EEA.

When producing, delivering and storing postscript maps using this method, it will still be important for EEA to get and store GIS compatible data related to the presentation for later production. ETC and other producers of maps should provide such data files, e.g. thematic tables with lat/long values for point locations.

7. Map extents to be used by EEA

EEA has developed a set of defined map extents to cover all "standard" needs at EEA. The map extents have been used in Environmental Signals reports and the Europe's environment: The third assessment (Kiev-report), and is expected to be used in all EEA publications and information material.

7.1. Map extents - north, south east, west

When defining map extents (north-south, east-west) the following aspects have been considered;

- to cover the needs for standard maps in the foreseen reports, roughly covering some 70-80% of the total needs. There will always be additional maps in other sizes and formats
- the ability to reuse and mix data from different productions. In earlier productions it has been difficult to use map components and reuse them in a map based on another production, as map extents and projections have varied.
- reusability also requires a standard reference coordinate system and projection. Most of the maps are based on one projection: Lambert Azimuthal Equal Area projection, 52N, 20 E. Some maps extending outside Europe use other parameters and projections.
- Harmonic picture of map (visual)
- Sizes that fits report layout/standards

7.2. Map extents – a full series

The series of map extents are defined according to **east-west** coverage.

- Map Extent1 EU15+EFTA:
- Map Extent 2 EU15+EFTA+Central and Eastern Europe(CEE), EEA coverage
- Map Extent 3 EU15+EFTA+CEE+Caspian Sea
- Map Extent 4 EU15+EFTA+CEE+Caspian Sea+Canary Islands
- Map Extent 5 EU15+EFTA+CEE+Aral Sea+North Atlantic+North Pole
- Map Extent 6 EU15+EFTA+CEE+EECCA, narrow (full Russia)
- Map Extent 6a EU15+EFTA+CEE+EECCA (Russia partly),
- Map Extent 7 EU15+EFTA+CEE+EECCA, wide (full Russia)
- Map Extent 8 World
- Map Extent 9a Countries of Mediterranean Sea region
- Map Extent 9b Mediterranean Sea

Each of the map types 1, 2, 3, 4, 6 and 6a can have 4 different versions, depending on **north-south** extent.

- Core
- Core + North Extension
- Core + South Extension
- Core + North and south Extensions

Map 8 can have 2 different versions concerning north-south extent.

- Core
- Core + Antarctica

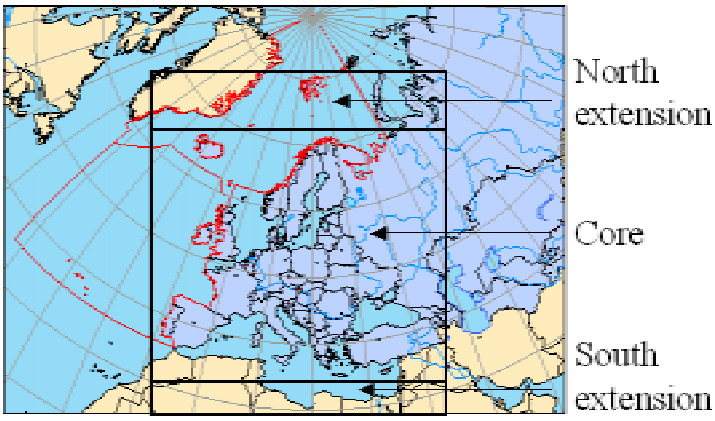


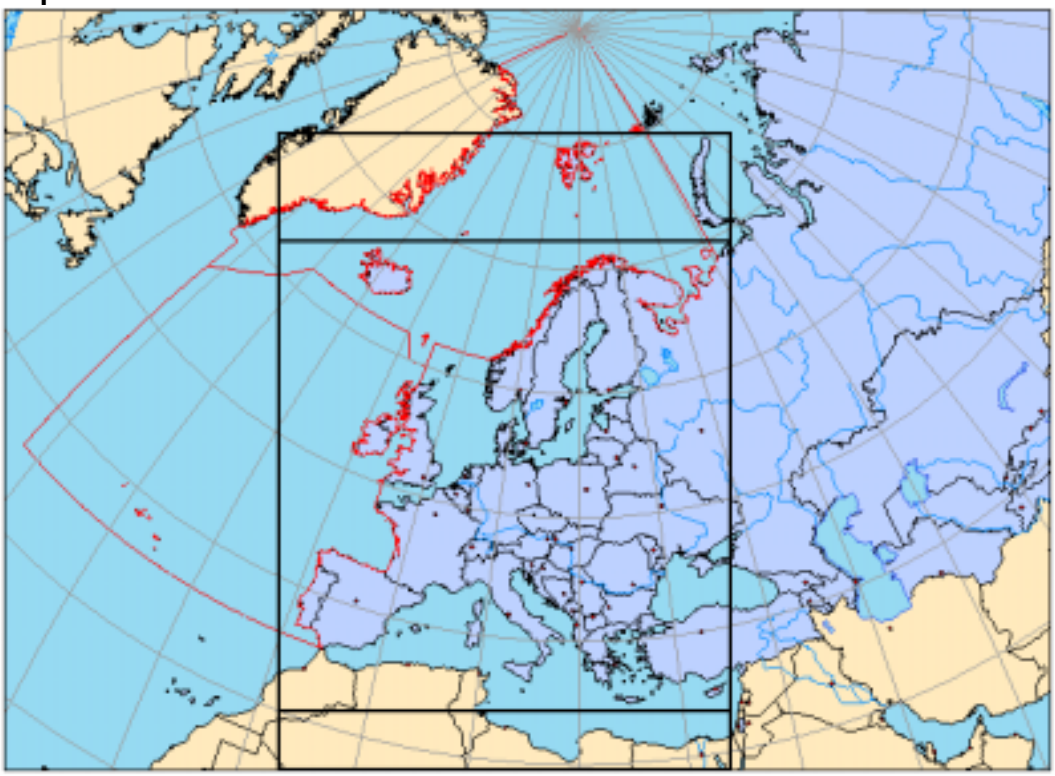
Figure: Example of a map extent and its possible extensions to the north and south.Each map number/series refer to an extent in east-west direction.

7.3. Map extents – illustrations of EEA map extent series

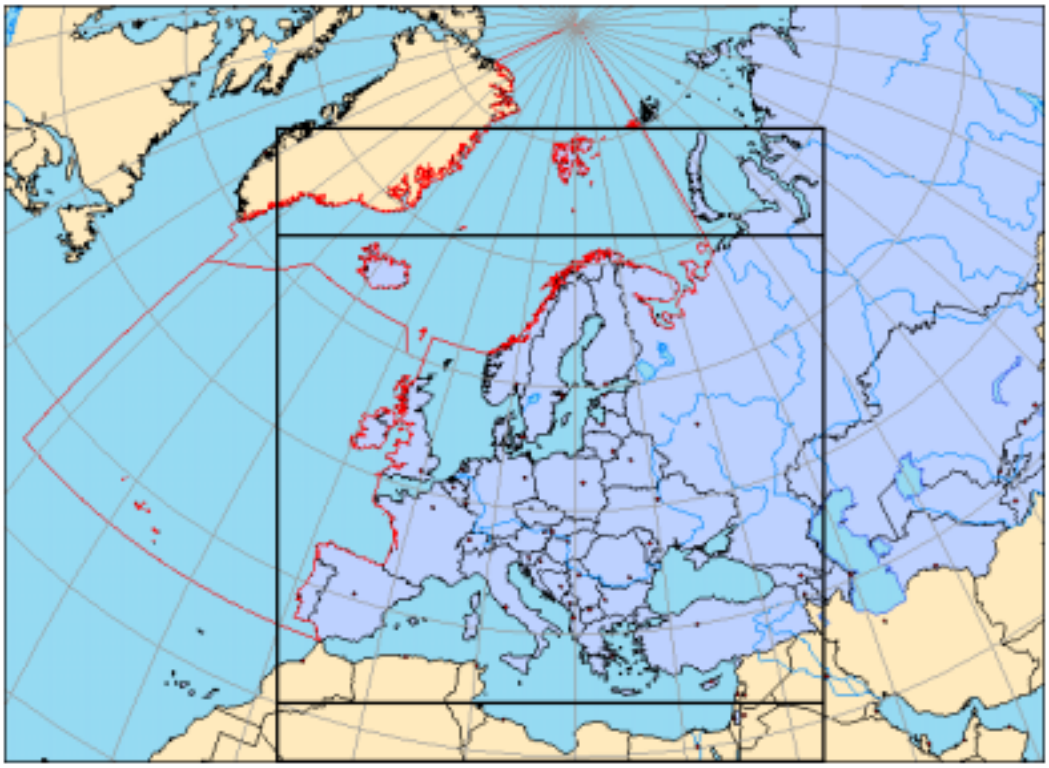
The following pages presents the series of agreed map extents. The frame mark core, and north and south extensions on a larger map.

The Powerpoint presentation at http://map.eea.eu.int/slides/powerpoint/frame.htm contain the same map extents, and examples where example maps of the different kinds are pasted in to dummy pages. This contains the map extents, but Legends are not shown. They will be places outside the maps.

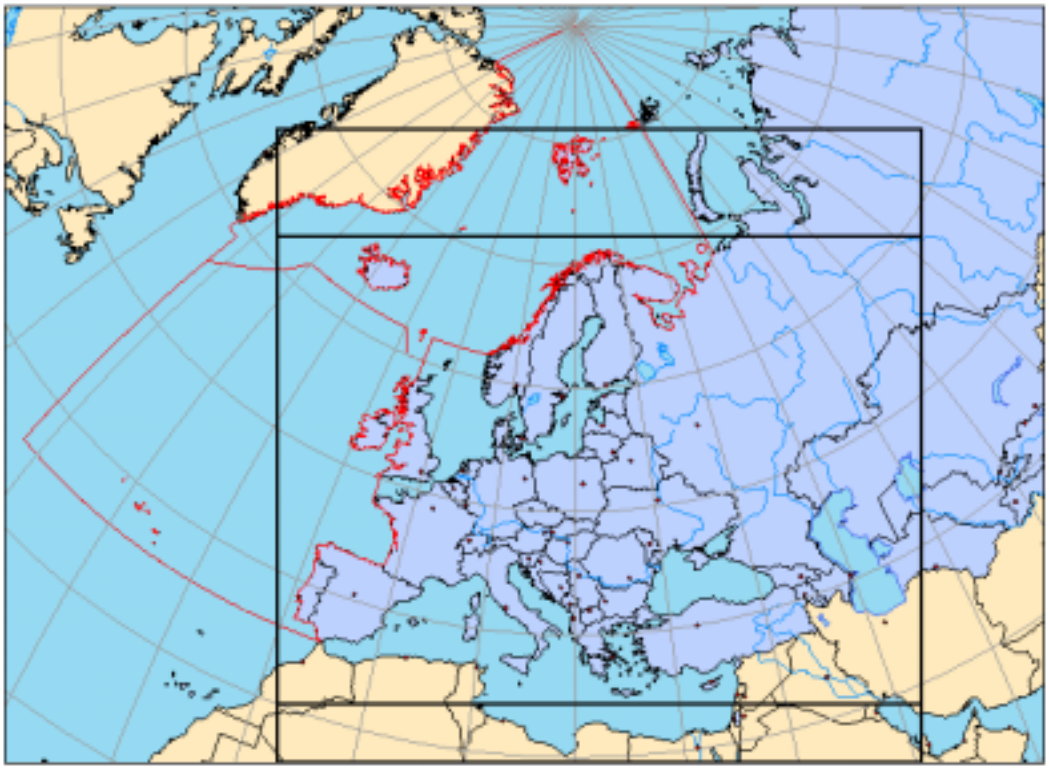
Map Extent 1: EU15+EFTA



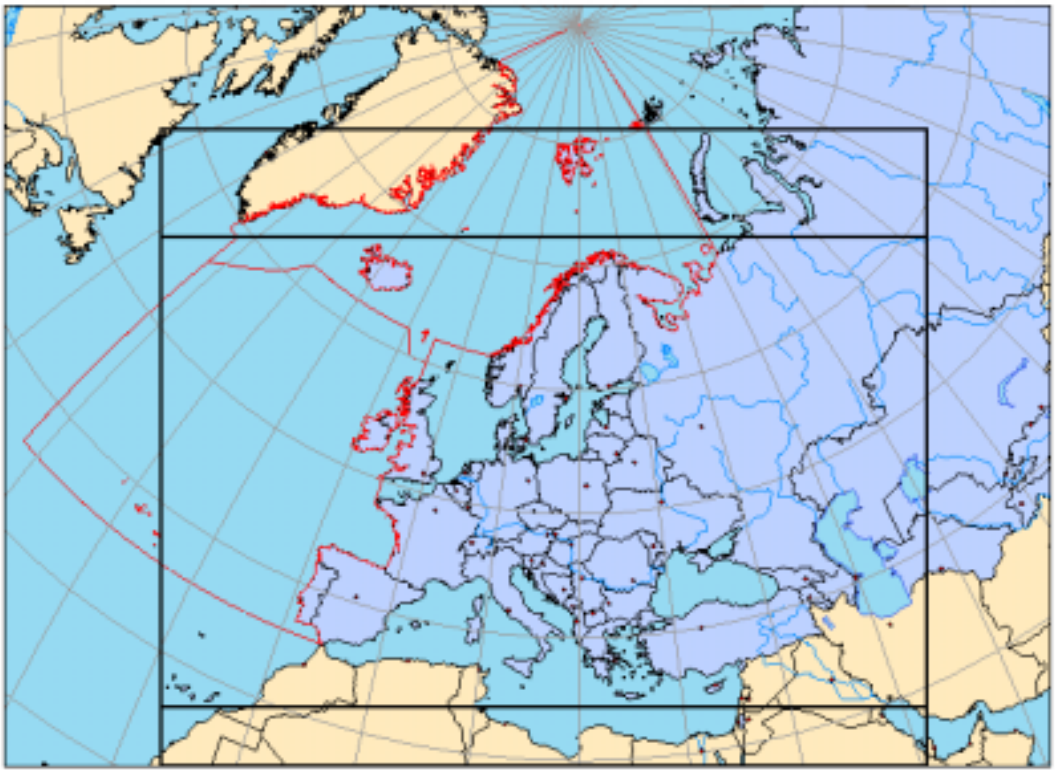
Map Extent 2: EU15+EFTA+Central and Eastern Europe(CEE), EEA coverage



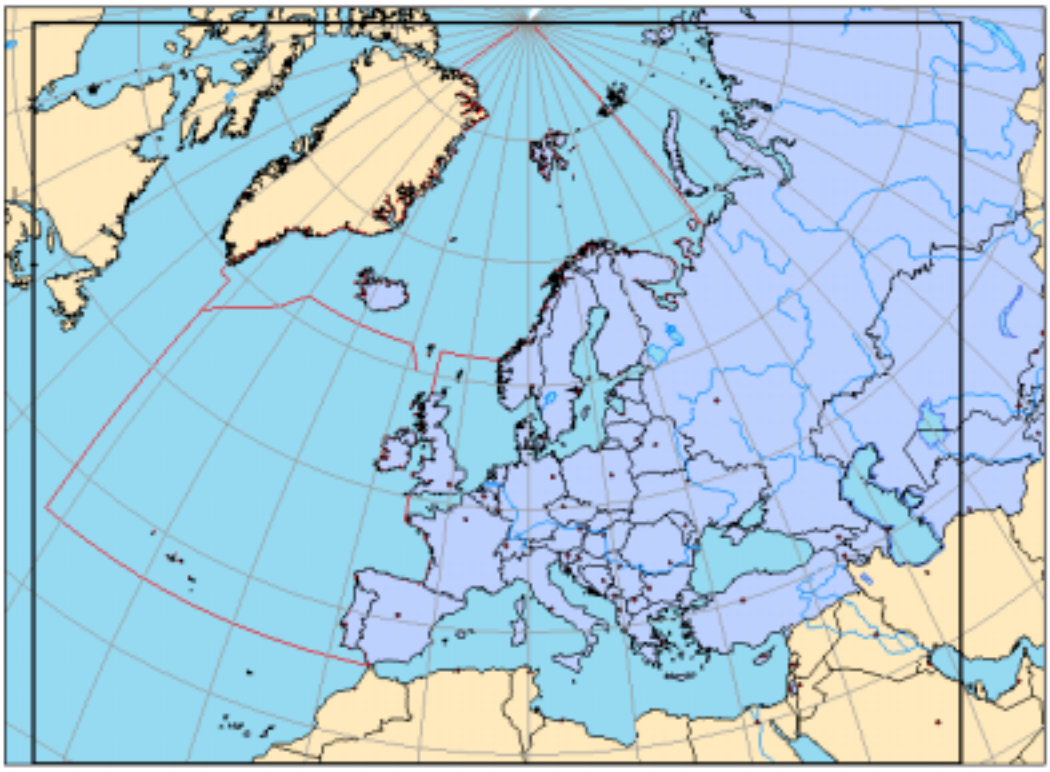
Map Extent 3: EU15+EFTA+CEE+Caspian Sea



Map Extent 4: EU15+EFTA+CEE+Caspian Sea+Canary Islands. Similar to map 3, but wider to the west.



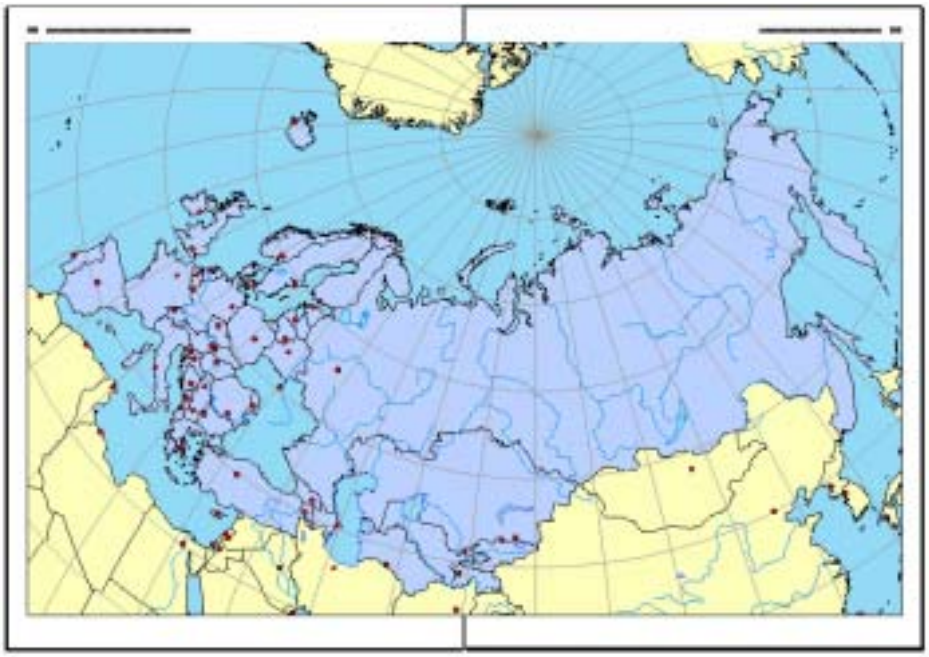
Map Extent 5: EU15+EFTA+CEE+Aral Sea+North Atlantic+North Pole



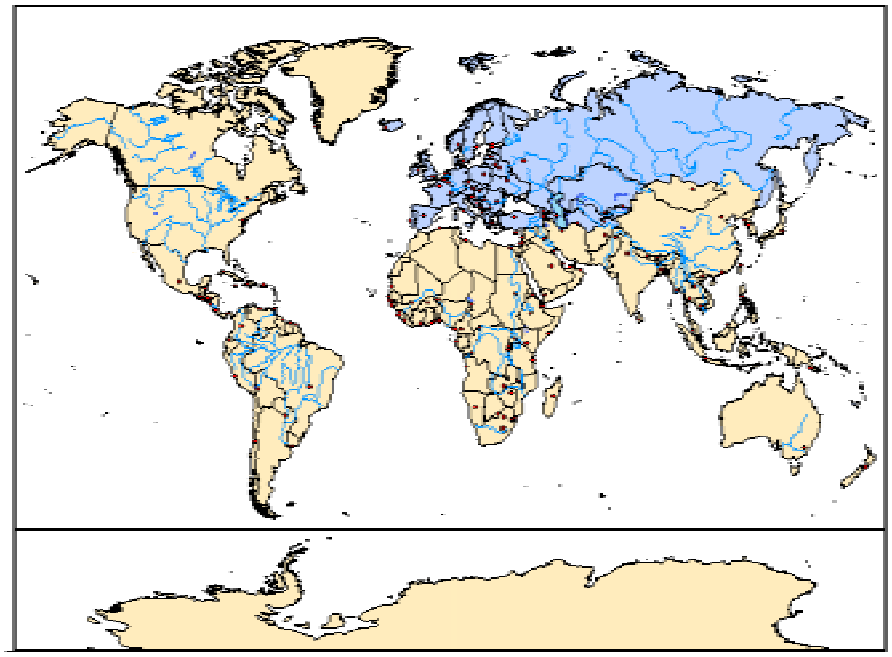
Map Extent 6a: EU15+EFTA+CEE+EECCA (only part of Russia)

Map Extent 6: EU15+EFTA+CEE+EECCA, narrow (full Russia)

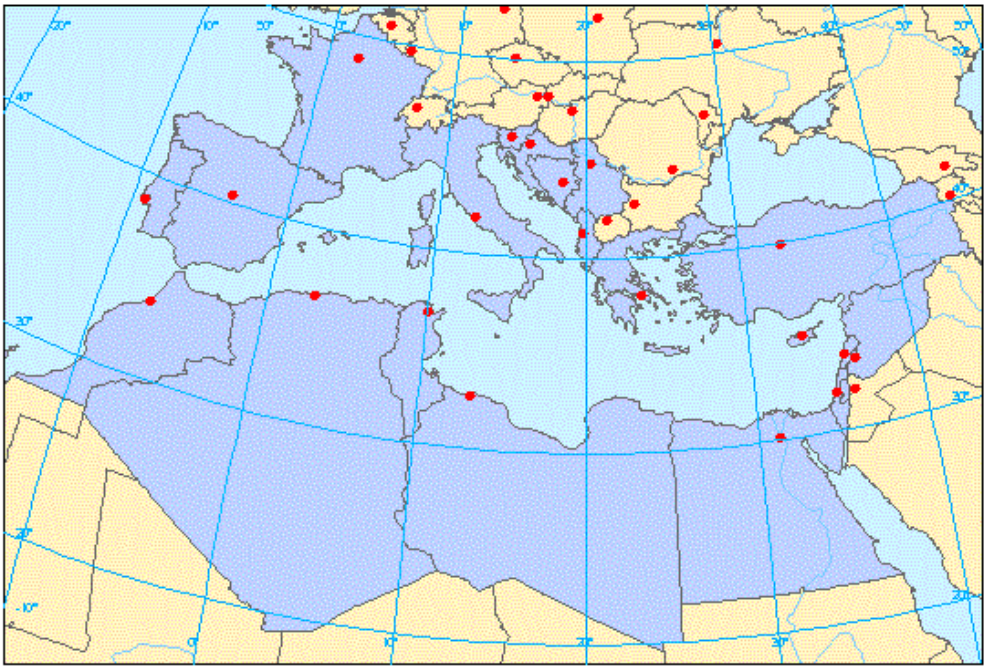
Map 7 : Europe and Central Asia. Covers the same area as Map 6. To be used on double pages



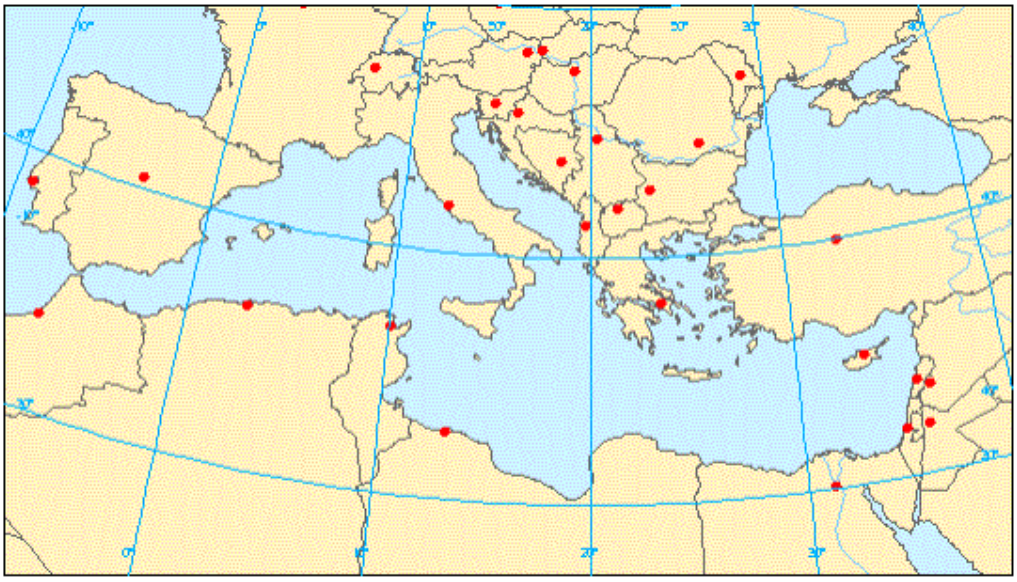
Map Extent 8: World



Map Extent 9a: Countries of Mediterranean Sea region



Map Extent 9b: Mediterranean Sea



7.4. Specification of map extents by coordinates

All values given in coordinates related to the projection specified

Map extent	Projection	NSmin	NSmax	EWmin	EWmax
Map 1c	LAEA-52N-20E	1250000	5500000	2400000	6450000
Map 1 c+s	LAEA-52N-20E	740000	5500000	2400000	6450000
Map 1 c+n	LAEA-52N-20E	1250000	6480000	2400000	6450000
Map 1 c+ns	LAEA-52N-20E	740000	6480000	2400000	6450000
Map 2 c	LAEA-52N-20E	1250000	5500000	2400000	7300000
Map 2 c+s	LAEA-52N-20E	740000	5500000	2400000	7300000
Map 2 c+n	LAEA-52N-20E	1250000	6480000	2400000	7300000
Map 2 c+ns	LAEA-52N-20E	740000	6480000	2400000	7300000
Map 3 c	LAEA-52N-20E	1250000	5500000	2400000	8200000
Map 3 c+s	LAEA-52N-20E	740000	5500000	2400000	8200000
Map 3 c+n	LAEA-52N-20E	1250000	6480000	2400000	8200000
Map 3 c+ns	LAEA-52N-20E	740000	6480000	2400000	8200000
Map 4 c	LAEA-52N-20E	1250000	5500000	1350000	8200000
Map 4 c+s	LAEA-52N-20E	740000	5500000	1350000	8200000
Map 4 c+n	LAEA-52N-20E	1250000	6480000	1350000	8200000
Map 4 c+ns	LAEA-52N-20E	740000	6480000	1350000	8200000
Map 5	LAEA-52N-20E	740000	7400000	0	8350000
Map 6	LAEA-52N-20E	740000	9950000	1950000	10400000
Map 6a c	LAEA-52N-20E	1250000	5500000	1950000	9600000
Map 6a c+s	LAEA-52N-20E	740000	5500000	1950000	9600000
Map 6a c+n	LAEA-52N-20E	1250000	6480000	1950000	9600000
Map 6a c+ns	LAEA-52N-20E	740000	6480000	1950000	9600000
Map 7	LAEA-52N-65E	1300000	8600000	-1000000	9900000
Map 8 c	Times10E	-6200000	10850000	-14500000	14500000
Map 8 c+s	Times10E	-10850000	10850000	-14500000	14500000
Map 9a	LAEA-52N-20E	-402000	3308000	1789000	7302000
Map 9b	LAEA-52N-20E	479000	3000000	2460000	6950000

- LAEA (Lambert Azimuthal Equal Area (ETRS89), 52N, 20E, false easting: 5071000, false northing: 3210000
- LAEA (Lambert Azimuthal Equal Area (ETRS89), 52N, 65E, false easting: 5071000, false northing: 3210000
- Times (WGS84), 10E, false easting: 0, false northing: 0

8. EEA Map templates - tools for easy map making

8.1. Why use a predefined map template?

EEA handles geographic data from many institutions and sources and presents them as maps in different publications and on the web. In 2001 EEA started standardizing the handling of this large body of data, and also started work on simplifying the production of maps. Map templates, being one of several developments in this respect, have become available and are now in frequent use by EEA. The templates and associated tools should be used by other producers delivering maps to EEA, e.g. the topic centres, as well.

A template is a predefined map. Extent, projection, and a number of features (data layers, e.g., country boundaries, lakes, rivers, etc.) are predefined and ready-to-access upon opening the template. A template file brings together the predefined set of data and presents it with the defined cartography.

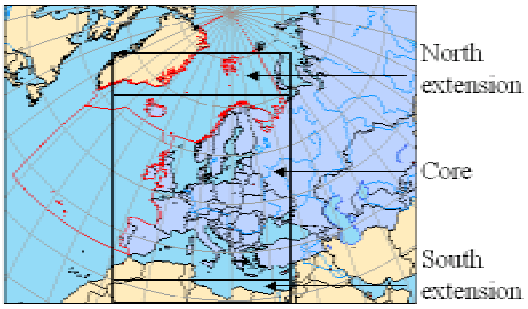
Specific map templates have been developed for small scale standard map presentations in printed reports and web applications. The use of templates will simplify map production as map extent, map projections, background features and colour schemes are defined beforehand in order to cover standard needs.

- **Whenever possible, the use of map templates is strongly recommended.**

In this way, map presented in reports and on the web will appear harmonic and fit the layout and in future, it will be possible to reuse and mix data from different productions. Additionally, individual users save time as there is no need to manually reproduce common parts of the maps.

8.2. Available templates from EEA, May 2003

EEA has developed template files for all the map extents defined by EEA, as presented in Chapter 7.



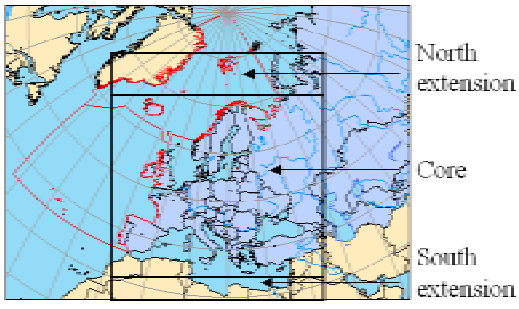


Figure X: The series of template files for ArcGIS makes the different producers of map able to produce maps with similar extents, background and layout. The files are possible to download from the EEA web pages. See http://www.EIONET.eu.int/gis
The different templates cover smaller or larger areas of Europe up to Ural, predefined for use in small scales ranging from 1:70.000.000 to 1:1.000.000. Some templates, as described earlier, cover wider areas.

There is one template file for each map extent. This means there are several templates for each of the map number/series, as each series can have up to 4 different versions, concerning north-south coverage. Underneath is given an example for map series 1.

Map 2	**EEA area: EU15+EFTA+CEE**	Template filename
	Core	map_2c.mxt
	Core + North Extension	map_2c_n.mxt
	Core + South Extension	map_2c_s.mxt
	Core + North and South Extentions	map_2c_ns.mxt

8.3. ArcInfo template files and user of other softwares

The Commission has decided to use ESRI products in their services- EEA is following this recommendation. Non-ArcGIS user may use the standard EEA Map data files, the map frame files and the layout definitions found in this document. If other software systems allow, the ArcGIS .mxt-files can be used as well.

At present (May 2003) the templates are made for ArcGIS (ArcView/ArcInfo 8.x) with the use of lyr-files for colour and symbol definitions.

When creating a map for publication through EEA, you first open the lyr-file and get up a standard map. You then add your thematic data layer(s) to the map template and save it as a map document (see below). ArcGIS (8.x) has two kinds of maps: map documents (.mxd) and map templates (.mxt). The following text is about the use of .mxt-files.

- **Extent:** Different series of map extents for use in reports have been defined. Each series is a group of map extents with the same east-west extent, each map within the series has different north-south extent. See separate document presenting the map extents. Separate data sets (Shape files) for the frame of all extents are available. See chapter 7.4xx for coordinates of extents and list of extent/frame files.

- **Standardised data layers:** EEA has developed a set of generalised data sets to be used for small scale maps, which work together with the ArcGIS 8.x template files. It is also possible to use them in other software, together with the frame of extent files. See chapter 8.5xx.

- **Projections:** For all maps and map covering the whole or part of the Pan-Europe area, the Lambert Azimuthal Equal Area projection has been used, Latitude of origin (Azimuth) at 52 North, Longitude of origin (Central Meridian) 20 East. See chapter 7.4xx and 10xx for details.

- **Cartography and size :** A set of cartographic features have been defined. See chapter on Postscript maps. The preferable size of figures is 144 mm.

8.4. Standard data layers for map templates

The templates contain a set of standard data layers, being commonly used background layers needed in visualisation, in addition to some administrative region data needed to create statistical (choroplet) maps. The following data layers are available.

EEA Series of map data sets - layers	Size – width 33-107 mm	Size – width 144-181 mm
21_capitals		x
20_cities		x
12_coastline	x	x
10a_latlong10	x	x
10b_latlong5		
09a_polar circle/tropic of cancer		x
08a_countryborder		x
08b_marineborder		x
07_river	x	x
07a_riverlarge	x	x
07b_rivermedium		x
06a_lakelarge	x	x
06b_lakemedium		x
06c_lakesmall		
05a_regionsnuts2		
05b_regionsnuts3		
04_ oceansurface	x	x
03_countries	x	x
02_landsurface	x	x
01_background_prj	x	x

Further, a graticule with lat/long numbering is defined as graphics in Data Frame Properties > Grid tab.

The data layers used in the templates are simplified with the aim of exclusive use for small scale figures in reports or on the web. The features delivered from the EEA to be used in map production are based on a level of generalisation in the databases comparable to a scale of 1:40.000.000 (40 mill) or even lower. Accordingly, maps based on these data should be used with care when reproduced in magnified versions, i.e. posters.

Most data layers were modified and generalised from more detailed data to suit the aims of the templates. Examples of modification was generalisation of lines, dissolving of polygons, removal of small polygons and reclassification of code lists. The source of the map data and the procedures of modification are defined in metadata attached to each of files representing thematic data layers.

8.5. Quick-guide to the use of ArcGIS 8.x template files

1) In ArcCatalog (or other file manager) navigate to C:\Arcgis\Arcexe81\Bin\Templates and create a new folder called,-e.g., EEAtemplates. Download the files you need. There are two options:
    - Download/ copy templates adapted to ArcMap 8.x from the folder EEA_8x if you use ArcInfo/ArcView 8.x
    - Download/ copy templates adapted to earlier versions of ESRI GIS from the folder EEA_3x if you use an earlier version of the software.

2) Copy and paste the data layers from EEAmapdata in a suitable folder. The folder may be placed anywhere on your computer or on a network.

3) Open ArcGIS.

3) If you get the dialog 'Start using ArcGIS with' tick 'A template'. The you are ready to continue. If no, go to File > New.

4) In the 'New' dialog, choose a suitable template from 'EEAtemplates' tab. Make sure that 'Create New Document' is ticked in the lower left corner.

5) The first time you open a template, all data layer names in the 'Table of Contents' appear grey and with a red exclamation mark, and you must establish the connection between the template and the data layers. Right-click on one of the greyed data layers, go to Data > Set data source, and browse to the same data layer in the folder where you placed the data in step 2). As all data layers are located in the same folder, all layers in the template should now be connected.

6) Go to File > Add data and browse to find your own data layers. Turn off unnecessary data layers that came with the map template.

7) Modify the legend

8) Save your map: File > Save. Make sure that the file type is .mxd (map document). (This should be the default option).

9) Export to postscript format (e.g., eps) is often required. Go to File > Export and in the export dialog choose format (eps). Resolution of the output is set in Options. 300 dpi is usually sufficient in vector maps and 600 dpi in maps with raster. It is recommended to examine the output file in Adobe or other image editing software to see that the resulting map is satisfactory.

NOTE: If you regret your choice of map template while working with your map, you can change the template on the fly. On the Layout Toolbar (you must be in Layout View) click the 'Change layout' button. You will be able to pick and choose from the available map templates.

8.6. Use of Frame shape files (extent of each map template) for ArcView and other software users

Frame files are used by the ArcGIS 8.x templates. For users of other GIS software or earlier versions of ArcInfo it is recommended to use the frame files by importing them manually into the GIS system. Similarly the different map data can be imported. This facilitates the use of the background data for the templates also in other GIS-systems.

Map name = template name	File name for the frame files
Map 1c	Frame1c
Map 1 c+s	Frame1c_s
Map 1 c+n	Frame1c_n
Map 1 c+ns	Frame1c_ns
Map 2 c	Frame2c
Map 2 c+s	Frame2c_s
Map 2 c+n	Frame2c_n
Map 2 c+ns	Frame2c_ns
Map 3 c	Frame3c
Map 3 c+s	Frame3c_s
Map 3 c+n	Frame3c_n
Map 3 c+ns	Frame3c_ns
Map 4 c	Frame4c
Map 4 c+s	Frame4c_s
Map 4 c+n	Frame4c_n
Map 4 c+ns	Frame4c_ns
Map 5	Frame5
Map 6	Frame6
Map 6 c	Frame6ac
Map 6 c+s	Frame6ac_s
Map 6 c+n	Frame6ac_n
Map 6 c+ns	Frame6ac_ns
Map 7	Frame7
Map 8	Frame8
Map 8c+s	Frame8c_s
Map 9a	Frame9a
Map 9b	Frame9b

The frame shape files are available on the data service See http://www.EIONET.eu.int/gis

9. Metadata for geographical data

9.1. Requirements on GIS and map deliverables

Metadata (information about a data file/data set) should follow any geographically related deliverable to the EEA, including tabular data, GIS-data, and postscript data. The metadata should always follow a geographically related deliverable from data-producer, via EEA to an end-user.

EEA has developed specifications, guidelines and tools for dealing with the handling of metadata. Data producers are responsible for delivering true and well-formed metadata according to specifications. EEA is responsible of validating received metadata and the main data files as well, and make the metadata and data available (if conditions allow). End products are published trough the EEA Dataservice.

The following metadata guidelines and accompanying tools for dealing with metadata are relevant for EEA, the ETCs, national institutions and other external partners delivering geodata to EEA.

9.2. EEA standard for metadata

EEA has developed a metadata standard for geographic data. The standard called European Environment Agency – Metadata Standard for Geographic Information (EEA-MSGI), is a profile of ISO19115 standard for geographic metadata. EEA-MSGI is defined as a set of metadata for discovery and quick understanding of geographic data.

Some of the main aspects covered in a metadata set are; name of data, description of data, corrdinate reference system, source and methodology, including version of specification the compilation is based, responsible party, ownership, user rights.

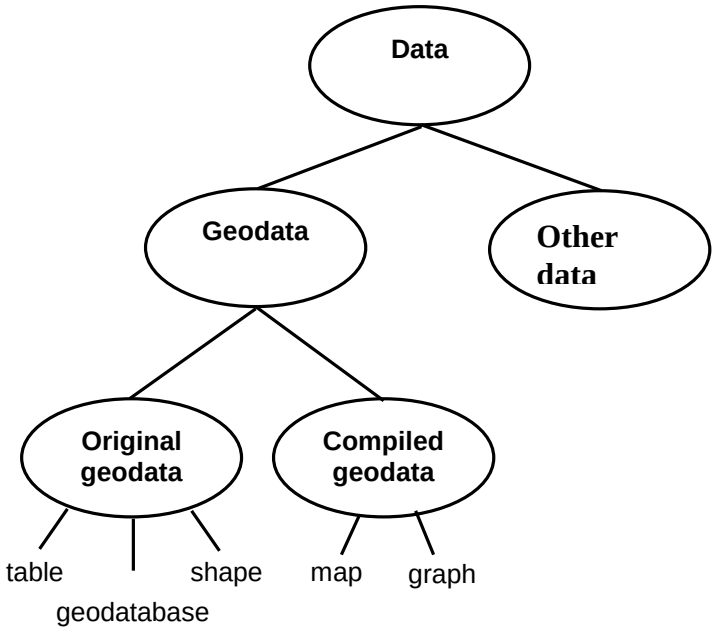
EEA-MSGI is designed to meet future needs and demands for interoperability of metadata. Metadata will become a key component for the coming EEA Spatial Data Infrastructure (EEA-SDI), the node linking EEA to other European infrastructures, such as INSPIRE (Infrastructure for spatial information in Europe) and the broader EEIS (European Environment Information system).

9.3. Different metadata requirements for different kinds of geodata

EEA splits geographically related deliverables (geodata) into two groups.

- Original geodata e.g. tables, geodatasets and geodatabases (GIS-data).
- Compiled geodata, usually termed maps

Figure xx: Different kinds of geodata, original geodata and maps



9.3.1. Metadata for original geodata (tables, geodatasets, geodatabases)

Original geodata is stored in formats such as commonly know GIS data formats such as shape file, Arc Coverage, Geodatabase, SDE database, geotiff file, imagine-file and vpf, or other files which can contain e.g point information such as xls, dBASE file, access database, text files.

Table is considered geodata if is has a spatial reference (attribute) or trough other table(s) can acquire a spatial reference e.g. place name or shape.

Original geodata should always use the EEA-MSGI.

9.3.2. Metadata for compiled geodata (maps and graphs)

Compiled geodata is stored in formats such as: postscript file, ESRI map document (mxd) file, tif file, jpeg file and gif file.

Compiled geodata should use the *EEA Dublin Core+ metadata form for maps and graphs*. When an extension of EEA-MSGI for maps and graphs is ready, this extension should be used instead.

9.4. Using EEA Metadata Editor for ArcCatalog

Using the ArcCatalog data explorer in the ArcView 8/9, ArcEditor 8/9 or ArcInfo 8/9 software package, you have the possibility to use the EEA metadata editor. A metadata

editor designed specific for EEA-MSGI. The editor provides an easy way to edit and visualise metadata.

9.4.1. Installing editor

You can find an EEA Metadata Editor installation zip file at http://eionet.eea.eu.int/gis. Follow instructions document in the installation manual.

9.4.2. Using editor

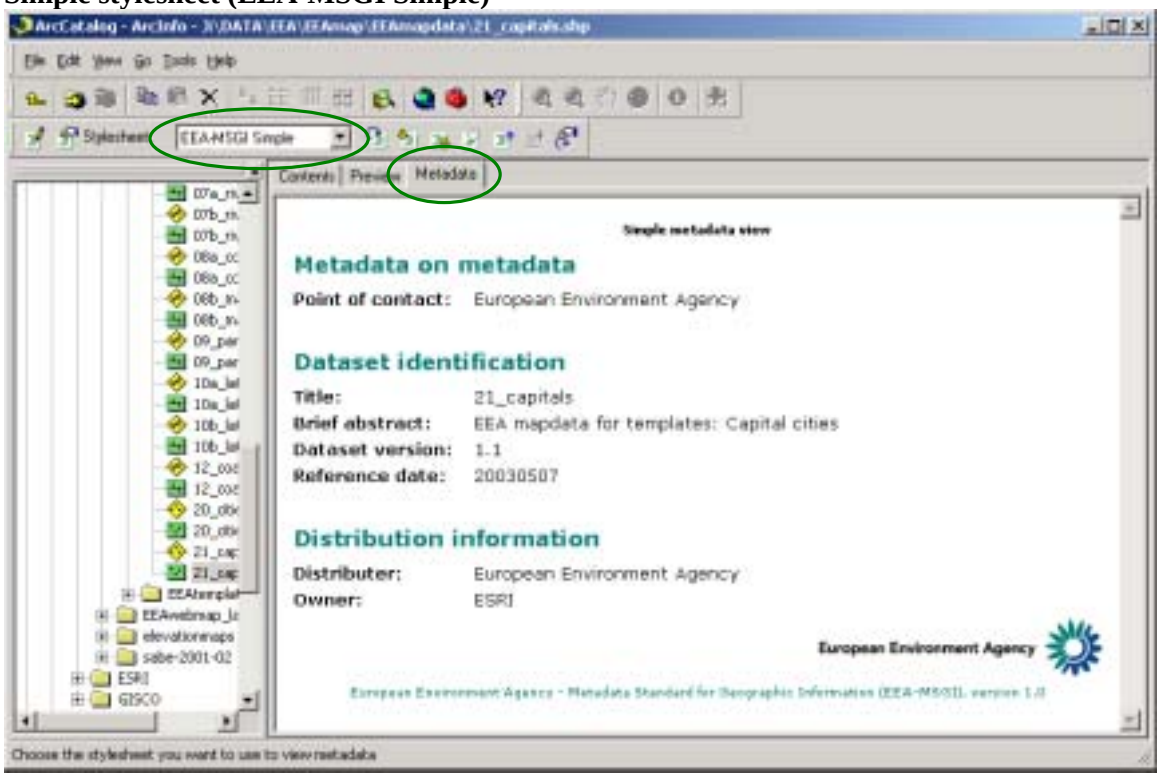
When using ArcEditor with EEA Metadata Editor installed you have the possibility to view, browse and edit metadata according to ISO19115 and EEA-MSGI. The editor is used the same way as the editors supplied by ESRI. Please consult ArcEditor user manual for more information about metadata editors.

The editor works on any file format accepted by ArcCatalog including geodatabases.

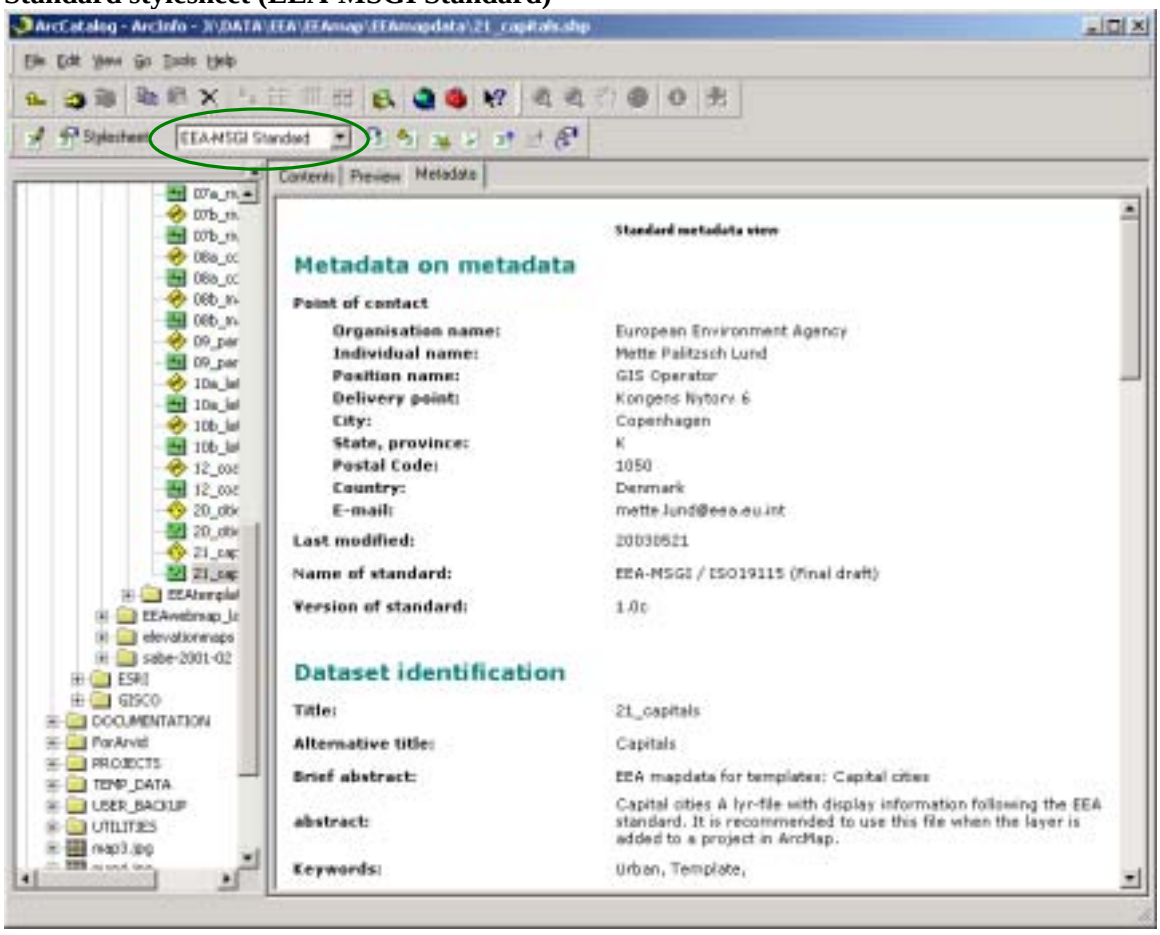
Viewing metadata

The editor provides two new metadata stylesheets (metadata views). A stylesheet for identifying a dataset called **EEA-MSGI Simple**. Second is a stylesheet for viewing all EEA-MSGI metadata information's called **EEA-MSGI Standard**. Change the view of metadata in the metadata toolbar available when metadata tab is selected.

Simple stylesheet (EEA-MSGI Simple)



Standard stylesheet (EEA-MSGI Standard)



Editing metadata

To add or edit metadata to a dataset; select the dataset; click metadata tab; press the Metadata Edit button.

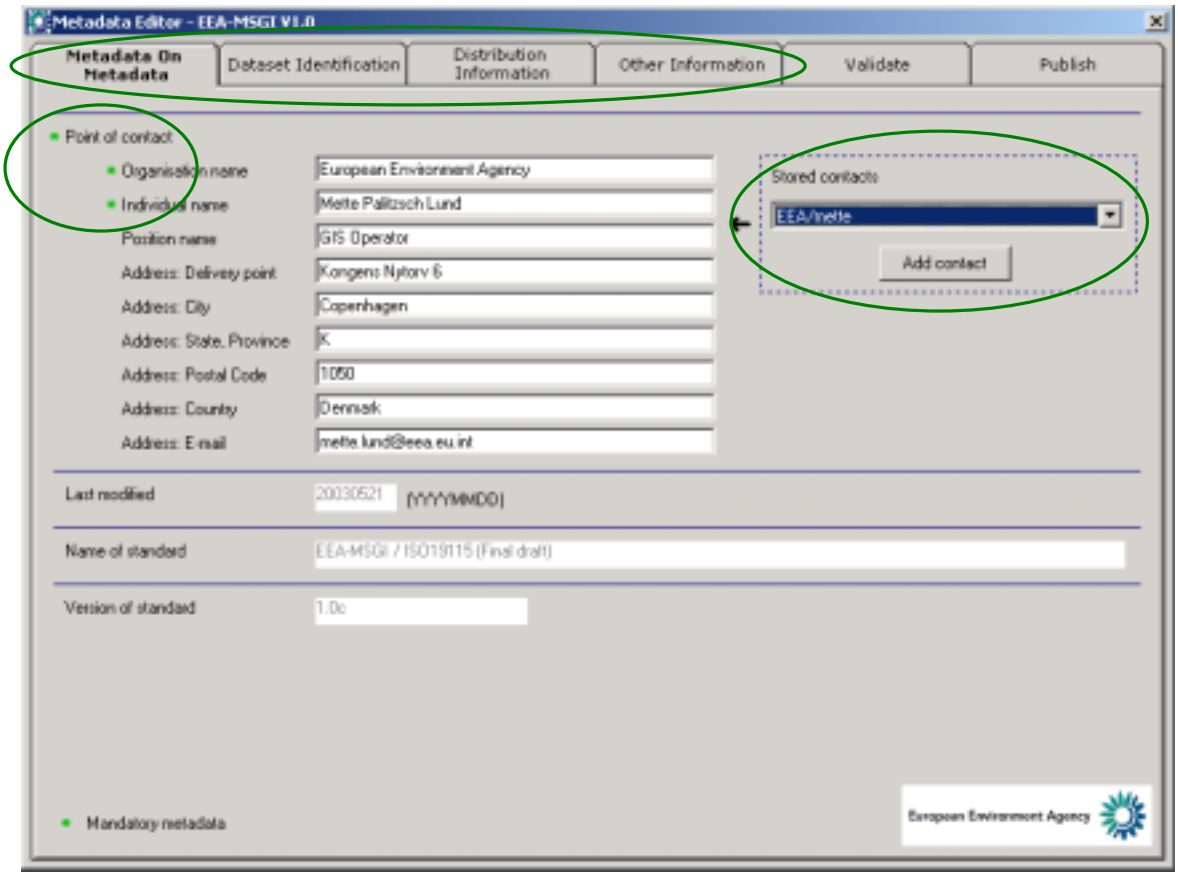
The editor splits metadata into four groups, *Metadata On Metadata*, *Data Identification*; *Distribution Information* and *Other Information*. You navigate between these groups using the tab page.

Metadata information marked with a green star (*). These metadata are mandatory.

The editor uses a database for storing often-used addresses on contacts. You can edit this database if you have Access installed on your computer.

Other metadata elements such as file format and geographic reference system are automatically synchronised with the metadata.

See EEA Metadata Editor user manual for further information.



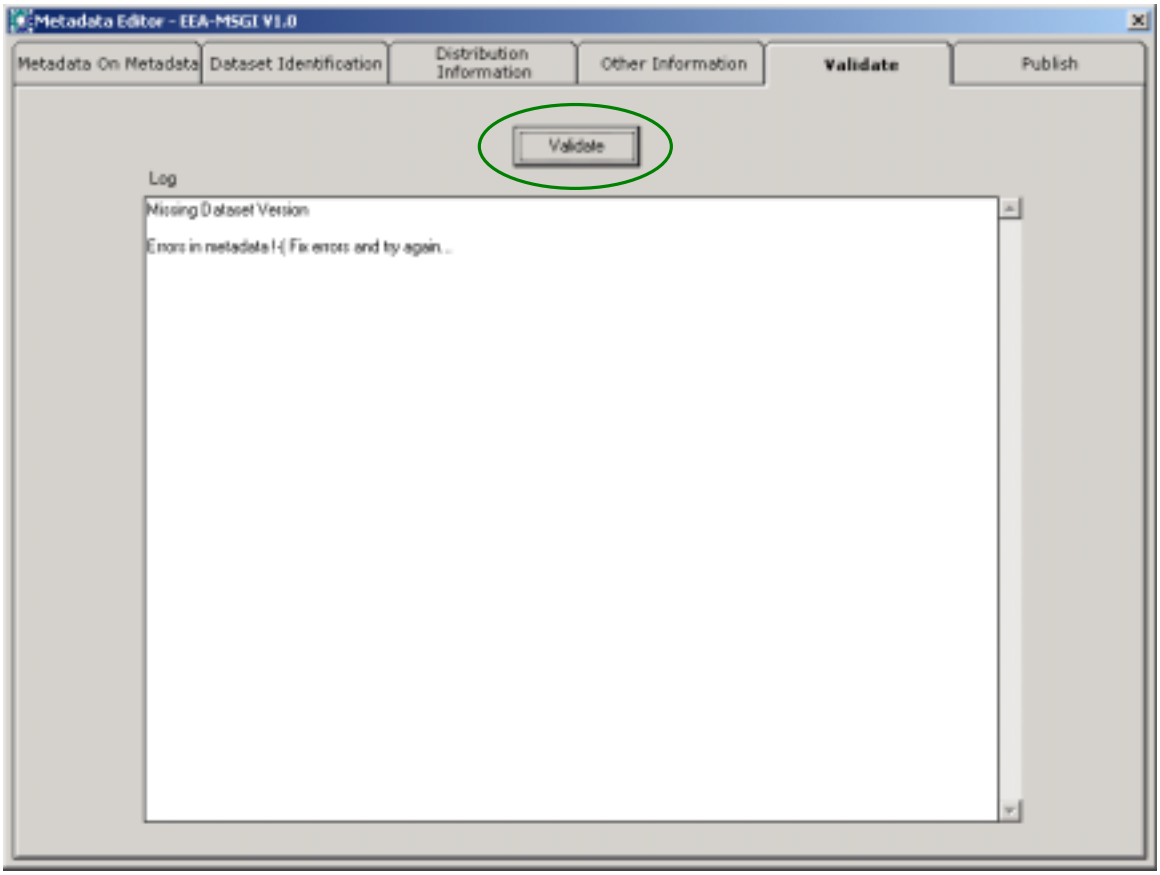
Validating metadata

Before submitting metadata with a dataset you should make sure you have provided all the metadata needed.

This is done in two steps:

1) Select the *Validate* tab. Press *Validate* and a validation log tells you which metadata is missing or wrong formatted. If error is listed in log, fix the error and try again.
2) When the validation is happy ☺, you can close the editor and metadata will automatically be stored correctly. Select the EEA-MSGI Standard stylesheet and check that you have remembered all the textual information you need to describe the dataset.

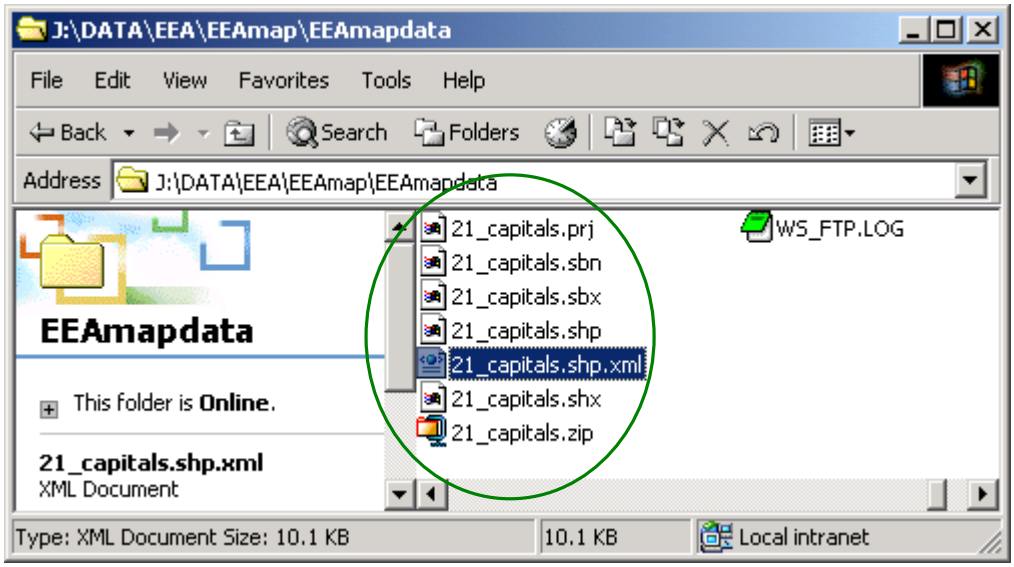
The validation tool validates other metadata elements not present in the editor. These elements are synchronised automatically. Such as file format and geographic reference system metadata is present.



9.4.3. Submitting metadata

To submit metadata with a dataset you have to know where the metadata is stored.

When dataset is submitted to the EEA as files like shape files, dbf files or coverage, metadata are stored in XML files. When submitting datasets stored as files remember to include the xml file as well as the projection file (prj) in delivery zip file.



When submitting a database or geodatabase metadata information are stored inside the database. Please contact EEA GIS operations (email: thor.jessen@eea.eu.int) before submitting a database.

9.5. Using EEA spatial data metadata information form

When submitting original geodata, not using the EEA metadata editor, the *EEA spatial data metadata information form* should be used. It's a word document and latest version can be found at http://eionet.eea.eu.int/gis. You need to fill in metadata from word and validate entries.

9.5.1. Mandatory metadata

Mandatory metadata elements are marked with a green star (*).

9.5.2. Submitting form

Add the filled form document to you dataset delivery file package. The package should be compressed as a zip file before submitting to the EEA.

When EEA receive the form, it will be validated and converted to an ISO 19115 XML.

9.6. Using EEA Dublin Core+ metadata form

Maps and graphs can be stored as postscript, images or application project file.

Find the latest version of the *EEA Dublin Core+ metadata form for graphs and maps* at http://eionet.eea.eu.int/gis.

9.6.1. Submitting form

Add the filled form document to you dataset delivery file package. The package should be compressed as a zip file before submitting to the EEA.

10. EEA Data for maps at small scales

10.1. EEA Standard Small Scale Mapping Data - a subset

EEA has created a set of basic data that can be used in map production.

This is a new selection of GIS-data to cover the needs for general elements in maps in small scales. These are the simplified maps that are used in many EEA. The data are labelled EEA Standard Mapping Data (EEA data – map production).

The major data source of basic features that has and will be distributed to ETC's and other map producers is the GISCO reference data base. In addition EEA delivered environmental data sets developed under the Agency work programme. Both these data sources primarily cover the needs when working with analysis, such as in developing environmental indicators. The data are were not well suited for map production organised by EEA for several reasons;

- Many of the GISCO data sets do not have the extent needed for maps to be produced by EEA.
- Many of the GISCO data sets are not well suited to map production in the scales used by EEA. The reports usually require maps of Europe at very small scales (e.g. 1: 40 mill). The GISCO data sets are too detailed for small scale maps. The most generalised versions are 1: 20 mill, but even these data are too detailed for simple maps. Generalised lines are needed for such scales.
- The present data structure has been difficult to use
- For several hierarchical data sets it has been necessary to select only the most important parts, the most simple lines. The operations were complicated.
- For several data sets from GISCO there are strict restrictions in distribution and use, making effective map production difficult.

10.2. EEA Standard Small Scale Map Data - layers

The data sets cover most needs for EEA's small scale maps and should be used by ETC's and external consultants for map production on small scale mapping wherever possible.

EEA Standard Small Scale Mapping Data		
Name data set	**File name**	**Type**
General		
Land surface	landsurf	poly
Sea surface	seasurf	poly
Countries	country	poly
Coast line	coastl	line
Boundaries		
Country boundaries - terrestrial	country_l	line

Country boundaries - sea	country_s	line
Water features		
riverl, large	river_l	line
riverm, medium	river_m	line
rivers, small	river_s	line
lakel, large	lake_l	line
lakem, medium	lake_m	line
lakes, small	lake_s	line
Population features		
Cities, capitals	capital	point
Cities, according to size	city	point
Grids		
Grid-30. lat long every 30	grid30	line
Grid-20 lat long every 20	grid20	line
Grid-10 lat long every 10	grid10	line
Place names		
Country names	namecou	poly
Sea names	namesea	poly
Capital city names	namecap	poly

10.3. EEA Standard Small Scale Map Data - technical issues

- The datasets are placed in a folder called EEA Standard Small Scale Mapping Data, which is one of the folders within EEA core data.
- The data have been generalised to fit to maps in scale 1:25 – 1:60 million. The scale interval is the most relevant for small scale maps to be used by EEA in reports and on the web.
- EEA Standard Small Scale Mapping Data is based on data distributed by ESRI or on data provided to EEA by GRID Warsaw.
- EEA Standard Small Scale Mapping Data is in ArcInfo Shape format
- EEA Standard Small Scale Mapping Data is in the coordinate system and projection, which should be used in maps in reports and on the web. The coordinate system is ETRS89 and the projection is Lambert Azimuthal Equal Area, 52N, Central Meridian 20E. (For more information, see guideline material on projections.
- The geographical area covered is wide enough for most map extents defined for use by EEA, and with the specified projection to be used on EEA maps. (For more information, See section on map extents),

10.4. EEA Standard Small Scale Map Data - user regulations

- EEA Standard Small Scale Mapping Data can be used without reference to any source as they are small scale widely distributed data.

11. The EEA web map tool

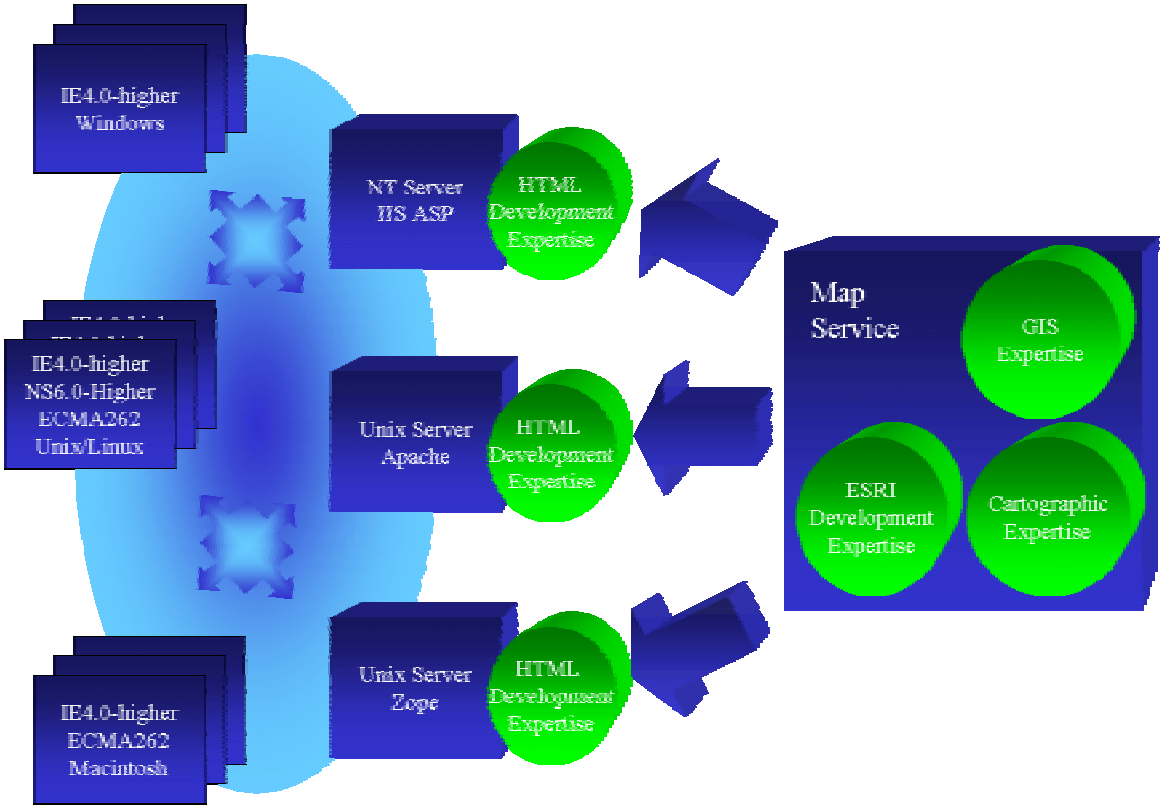
EEA has developed a web map tool making the production of simple web maps easy. The map service is an Internet based tool that provides you with European maps - European maps where you can control what is to be represented. The tool is based on the use of generalised data placed centrally at EEA. Users can connect tabular/ attribute information to the spatial data or bring in their own geographical data.

With the development of the web map tool map production by EEA, the ETCs and other organisations being part of the EIONET have two main options in map production
- to use the EEA web map tool
- to use the ordinary GIS system, with the EEA templates (e.g. ArcInfo)

The different tools will be used for different purposes. The web map primary focus is to make web maps, maps having the link to the environmental data. Any update on environmental data will result in updated maps. The web map tool will soon also allow
- to make powerpoint maps
- to do different kinds of quality checks

The map service developments started in January 2002 and continued growing until now. The reason for developing the map service is the fact that EEA has a lot of web servers, each dealing with there own information but on different platforms and software backgrounds. There are Unix and NT servers as operating systems. Main software used include IIS, Apache, ASP, Visual basic, Java, Zope, SQL-server, MySql, CGI.

Many of these sites could benefit by showing maps as a representation of there content. To handle geographic data needs specialized knowledge, not only on developments or visualization but also when preparing the geographic data and representation. The EEA Map service centralizes the expensive developments, commercial costs of used datasets and depends on centrally located GIS competence. Flexibility is maintained in the system, so all web-servers can express there information as defined and brings the map fast into the web pages.



The web site-developers can focus much more to the data content while EEA only needs to maintain one GIS infrastructure. Also new functionalities in the Map service will give direct benefit to all websites using the Map service.

The EEA web map system is under development. Information about the developments and documentation on the different functionalities can be found on http://map.eea.eu.int/help. Contact person is Jan Bliki.